Hospital for Special Surgery
Acquisition & Installation of an MRI in Stamford
Table of Contents

Hospital for Special Surgery
Acquisition & Installation of an MRI in Stamford
Application Checklist

Instructions:

1. **Please check each box below, as appropriate; and**
2. **The completed checklist *must* be submitted as the first page of the CON application.**

x **Attached is the CON application filing fee in the form of a certified, cashier or business check made out to the "Treasurer State of Connecticut" in the amount of $500.**

For OHCA Use Only:

Docket No.: 12-31780 **Check No.:** 858956
OHCA Verified by: [signature] **Date:** 8/13/12

x **Attached is evidence demonstrating that public notice has been published in a suitable newspaper that relates to the location of the proposal, 3 days in a row, at least 20 days prior to the submission of the CON application to OHCA. (*OHCA requests that the Applicant fax a courtesy copy to OHCA (860) 428-7053, at the time of the publication)***

x **Attached is a paginated hard copy of the CON application including a completed affidavit, signed and notarized by the appropriate individuals.**

x **Attached are completed Financial Attachments I and II.**

x **Submission includes one (1) original and four (4) hard copies with each set placed in 3-ring binders.**

Note: A CON application may be filed with OHCA electronically through email, if the total number of pages submitted is 50 pages or less. In this case, the CON Application must be emailed to ohca@ct.gov.

Important: For CON applications(less than 50 pages) filed electronically through email, the singed affidavit and the check in the amount of $500 must be delivered to OHCA in hardcopy.

x **The following have been submitted on a CD**

1. **A scanned copy of each submission in its entirety, including all attachments in Adobe (.pdf) format.**
2. **An electronic copy of the documents in MS Word and MS Excel as appropriate.**

THIS DOCUMENT CONTAINS ULTRAVIOLET FIBERS AND A WATERMARK ON THE BACK.

HOSPITAL FOR SPECIAL SURGERY

535 East 70th Street, New York, NY 10021

JPMorgan Chase Bank, N.A.
Syracuse, NY

1-2
210

CHECK NUMBER 858956

CHECK DATE 07/10/12

AMOUNT

$ *******500.00

FIVE HUNDRED AND 00/100--

PAY TO THE ORDER OF: TREASURER, STATE OF CT

AUTHORIZED SIGNATURES

⑈0000858956⑈ ⑆021000021⑆ 611⑉260298⑈

THE HOSPITAL FOR SPECIAL SURGERY 535 East 70th Street• New York, New York 10021

INVOICE NO.	INVOICE DATE	PO NUMBER	INVOICE AMT	DISCOUNT AMT	NET AMOUNT
10862	07/03/12	STAMFORD MRI CON APPLICATION FILING FEE CHECK REQUEST # 10862	500.00	0.00	500.00

VENDOR NO.	VENDOR NAME	CHECK NO.	CHECK DATE	TOTAL
999000691	TREASURER, STATE OF CT	858956	07/10/12	500.00

The ADVOCATE

HOSPITAL FOR SPECIAL SURGERY
535 EAST 70TH STREET
NEW YORK NY 10021

THE ADVOCATE
9 Riverbend Drive South
Building 9A
P.O. Box 4910
Stamford, CT 06907-0910
Telephone: 203-330-6208
Fax: 203-384-1158
Legal.notices@scni.com

LEGAL NOTICE

New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery is applying for a Certificate of Need pursuant to section 19a-638 of the general statutes. The proposal is for the acquisition of a 1.5 Tesla Magnetic Resonance Imaging Scanner to be located at 1 Blachley Road, Stamford, CT 06902 in a limited service outpatient radiology satellite center intended to serve patients of the applicant's physicians. The total capital expenditure for the project is $3,200,000

THE ADVOCATE
CERTIFICATE OF PUBLICATION

I, Alan O'Hansen[signature]
Being duly sworn, depose and say that I am a Representative in the employ of SOUTHERN CONNECTICUT NEWSPAPERS, INC., Publisher of *The Advocate* and *Greenwich Time*, that a LEGAL NOTICE as stated below was published in THE ADVOCATE.

Subscribed and sworn to before me on this 8.th Day of August, A.D. 2012.

Pamela E. Caluori[signature]
Pamela Caluori/Notary Public

My commission expires on January 2013

PO Number

Publication

Stamford Advocate

Ad Number	Ad Caption
0001778176-01	LEGAL NOTICE New York Socl

Publication Schedule

6/26/2012, 6/27/2012, 6/28/2012

AFFIDAVIT

Applicant: New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("Hospital for Special Surgery" or "HSS")

Project Title: Acquisition and installation of an MRI in Stamford

I, Louis A. Shapiro, President & CEO
(Individual's Name) (Position Title – CEO or CFO)

of Hospital for Special Surgery being duly sworn, depose and state that
(Hospital or Facility Name)

Hospital for Special Surgery's information submitted in this Certificate of
(Hospital or Facility Name)

Need Application is accurate and correct to the best of my knowledge.

Signature: [signature] Date: 8-9-12

Subscribed and sworn to before me on 8/9/12

Notary Public/Commissioner of Superior Court

My commission expires: Francine Gonzalez

FRANCINE GONZALEZ
Notary Public, State of New York
No. 01GO6060038
Qualified in Dutchess County
Commission Expires June 11, 2015

State of Connecticut
Office of Health Care Access
Certificate of Need Application

Instructions: Please complete all sections of the Certificate of Need ("CON") application. If any section or question is not relevant to your project, a response of "Not Applicable" may be deemed an acceptable answer. If there is more than one applicant, identify the name and all contact information for each applicant. OHCA will assign a Docket Number to the CON application once the application is received by OHCA.

Docket Number:	**TBD**
Applicant:	**New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery**
Contact Person:	**Stacey L. Malakoff**
Contact Person's Title:	**Executive Vice President/CFO**
Contact Person's Address:	**535 East 70th Street New York, NY 10021**
Contact Person's Phone Number:	**(212) 606-1239**
Contact Person's Fax Number:	**(212) 774-2620**
Contact Person's Email Address:	**MalakoffS@hss.edu**
Project Town:	**Stamford**
Project Name:	**Acquisition and installation of an MRI in Stamford**
Statute Reference:	**Section 19a-638, C.G.S.**
Estimated Total Capital Expenditure:	**$3,245,583**

1. Project Description: Acquisition of Equipment

    a. Please provide a narrative detailing the proposal.

In an effort to better serve its patients, the New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("HSS" or the "Hospital"), located at 535 East 70th Street, New York, New York 10021, is submitting this Certificate of Need ("CON") application for approval to purchase a 1.5 Tesla Magnetic Resonance Imaging ("MRI") unit, as well as perform related renovations to accommodate the new machine at 1 Blachley Road, Stamford, Connecticut.

HSS currently provides physician services, diagnostic x-ray and fluoroscopic guidance imaging services at 143 Sound Beach Avenue, in Old Greenwich. HSS has obtained a determination letter from OHCA that no CON is required for the Hospital to conduct these services. HSS plans to relocate and expand these services to the above address in Stamford. This will enable more of our current Connecticut and Westchester patients to see their doctors and receive services closer to home.

HSS is ranked #1 in the nation for Orthopedics and #3 for Rheumatology by U.S.News and World Report in its 2012 "Best Hospitals" issue marking the 22nd consecutive year that HSS has been among the top ranked Hospitals in these fields. A key ingredient to the quality of care that HSS patients receive is the musculoskeletal imaging and magnetic resonance imaging performed at HSS. MRI is an essential diagnostic tool for HSS's physicians. HSS has developed proprietary protocols for MRI scans which then are further customized to meet the needs and

specifications of each patient and their physician. This allows each physician to maximize the usefulness of the MRI as a tool for diagnosis and development of a treatment plan. HSS has also developed proprietary new applications for MRI for musculoskeletal conditions, and is one of the world's leading institutions in musculoskeletal MRI innovations. In order to take advantage of these protocols and applications, the majority of HSS physicians prefer to have an HSS MRI.

HSS is seeking to locate an MRI in Stamford to provide better access to its proprietary and customized MRI scans for its many patients in Connecticut and nearby Westchester who currently travel to HSS's location in Manhattan to receive MRIs. Such patients currently receive approximately 3,250 MRI scans annually at HSS's locations in Manhattan, where HSS operates ten MRIs at two locations pursuant to CONs issued by New York State. The proposal will not impact the volumes of current Connecticut MRI providers because (i) HSS will be using its Stamford-based MRI to service its own patients who are now being served in Manhattan, (ii) such patients will almost immediately fill the capacity of the proposed Stamford MRI, and (iii) HSS's Stamford based MRI will not be marketed to non-HSS physicians or their patients. This proposal, if granted, will free up capacity at HSS's Manhattan locations and alleviate current issues with MRI backlog. A similar proposal with similar objectives for an MRI at a satellite facility in Long Island has been approved by New York State.

b. Provide letters that have been received in support of the proposal.

Attachment I contains letters of support for the project.

c. Provide the Manufacturer, Model, Number of slices/tesla strength of the proposed scanner (as appropriate to each piece of equipment).

The proposed MRI unit would be a GE Discovery MR450w 1.5 Tesla 32 channel model.

d. List each of the Applicant's sites and the imaging modalities and other services currently offered by location.

While the Hospital is currently licensed to operate eleven MRIs in New York, it operates no MRI imaging sites in Connecticut and this proposed MRI acquisition would be the first outside of the State of New York. The current MRI sites are the Main Hospital (535 East 70th Street, New York, NY 10021), a satellite Manhattan site (429 East 75th Street, New York, NY 10021) and a Long Island site (333 Earle Ovington Blvd, Uniondale, NY 11553) approved but not yet operational. Of the Hospital's 11 MRI units, three are 3.0 tesla units and the remaining eight are 1.5 tesla units. All HSS MRI units are closed units.

Background on the Hospital

Founded in 1863, HSS is a musculoskeletal specialty hospital predominantly focused on Orthopedics, Rheumatology, Rehabilitation and Pain Management of related disorders. HSS is a not-for-profit, acute care, academic medical center located on the Upper East Side of Manhattan whose mission is to provide the highest quality patient care, improve mobility, and enhance the quality of life for all and to advance the science of orthopedic surgery, rheumatology, and their related disciplines through research and education. Recognized as a leader in Orthopedics and

Rheumatology around the world, HSS has been among the top ranked hospitals for orthopedics and rheumatology in *U.S.News & World Report* in its "Best Hospitals" issue for 22 consecutive years. Most recently for the 2012 rankings, HSS ranked first in the nation in orthopedics and third in rheumatology. HSS has earned a 3rd Magnet Nursing Designation by the American Nurses Credentialing Center, and HSS is one of 27 organizations world-wide to receive a Gallup best workplace award in 2012 in recognition of its extraordinary ability to create an engaged workplace culture. HSS is the only hospital in New York State with infection rates significantly lower than the state average for hip replacements for three consecutive years (2008 – 2010; most recently available data) and ranks in the 99th percentile on the Press Ganey survey in "likelihood to recommend the Hospital to others." The HSS Department of Orthopedics serves as the Department of Orthopedics for Weill Cornell Medical College and all other members of the HSS medical staff serve as faculty at the Medical College in disciplines such as medicine, anesthesiology, radiology, neurology, and pathology. Members of HSS's medical staff serve as team physicians for major professional sports teams, including the New York Giants, New York Mets, New York Knicks, New York Liberty, and the New York Red Bulls, as well as the athletic programs of several local colleges. During 2011, HSS performed over 25,000 surgeries and had over 300,000 outpatient visits for non-surgical services such as radiology (diagnostic and interventional), rehabilitation, neurology, and laboratory.

Many of the patients treated by HSS and its medical staff require diagnostic imaging services. MRI is an integral component of HSS's Department of Radiology

and Imaging, which also provides diagnostic and treatment services in X-Ray, Computerized Tomography and Ultrasound.

HSS's Education Division trains over 115 residents and fellows, along with approximately 200 residents and fellows that rotate to HSS from other institutions in the U.S. and abroad as well as over 250 medical, physical therapy, nursing and public health and health care administration students. The active Alumni Association (consisting of graduates from HSS programs) spans the globe with over 1,100 members located in 47 U.S. states and 33 foreign countries.

HSS's Research Division occupies an influential position in the world of musculoskeletal science. Based on a solid foundation built on significant musculoskeletal patient volume, excellent clinical care, and a strong team of scientists and clinicians, its major goal is to translate research and discoveries into new technologies that improve patient care and outcomes.

Patients seek the internationally recognized and specialized care of HSS from a broad geographic service area. Percentage of volume by region is summarized in the table below.

	Inpatients		Ambulatory Surgery	
	2011	2010	2011	2010
Manhattan	15%	15%	28%	30%
Other NYC Boroughs	18%	19%	17%	17%
Long Island	18%	18%	14%	13%
Fairfield CT/Lower Hudson Valley	15%	16%	16%	15%
Northern NJ	19%	18%	16%	15%
All other (domestic and international)	15%	14%	9%	10%

HSS Volume Growth

Illustrated below is the five-year growth from 2007 to 2011 for inpatient, ambulatory surgery and MRI volume, as well as six months year-to-date actual for 2012 compared to the same period in 2011.

	Full Year		First Six Months		Growth- 2007 to 2011		
	2007	**2011**	**2011**	**2012**	**Total**	**Annual**	**Increase 2011 - 2012**
HSS Totals:							
Admissions	10,509	13,311	6,835	7,162	26.7%	6.1%	4.8%
Ambulatory Surgeries	16,594	20,043	10,131	10,897	20.8%	4.8%	7.6%
MRI Scans	19,623	28,316	14,015	15,901	44.3%	9.6%	13.5%
All of Connecticut & Westchester within 15 miles of Stamford:							
Admissions	898	1,235	630	615	37.5%	8.3%	(2.4%)
Ambulatory Surgery	1,731	2,089	1,052	1,114	20.7%	4.8%	5.9%
MRI Scans	1,747	2,887	1,409	1,625	65.3%	13.4%	15.3%

This volume growth has been achieved throughout HSS's broad geographic service area and has been driven by many factors, including:

- ✓ **Continued and growing acceptance of joint replacement, spine surgery, sports medicine, and other Orthopedic procedures due to new technologies and capabilities, superior devices and implants, high success rates, and quick recovery periods**
- ✓ **The general aging of the population is a favorable demographic trend for the overall growth of Orthopedics and Rheumatology**

- ✓ **A growing number of younger individuals are electing to have Orthopedic procedures in order to maintain their active lifestyles**
- ✓ **The number of revision surgeries to replace implants that have reached the end of their useful life is expected to increase significantly due to the significant growth in primarily joint replacements since 1980, and longer life expectancies**

To accommodate this growth and demand, HSS has expanded its number of beds, operating rooms, MRIs and other patient care services. Since the end of 2007, the number of operating rooms has grown from 27 to 35, the number of inpatient beds has increased from 162 to 205, and the number of MRIs has increased from 7 to 11.

Demand for HSS's services is expected to continue to increase over the remainder of the decade (4% - 5% annual growth projected), continuing to create patient care capacity challenges. A key component to HSS's strategic plan is developing offsite locations to enable HSS patients in the applicable communities near the site to see their doctors and receive services closer to home.

2. Clear Public Need

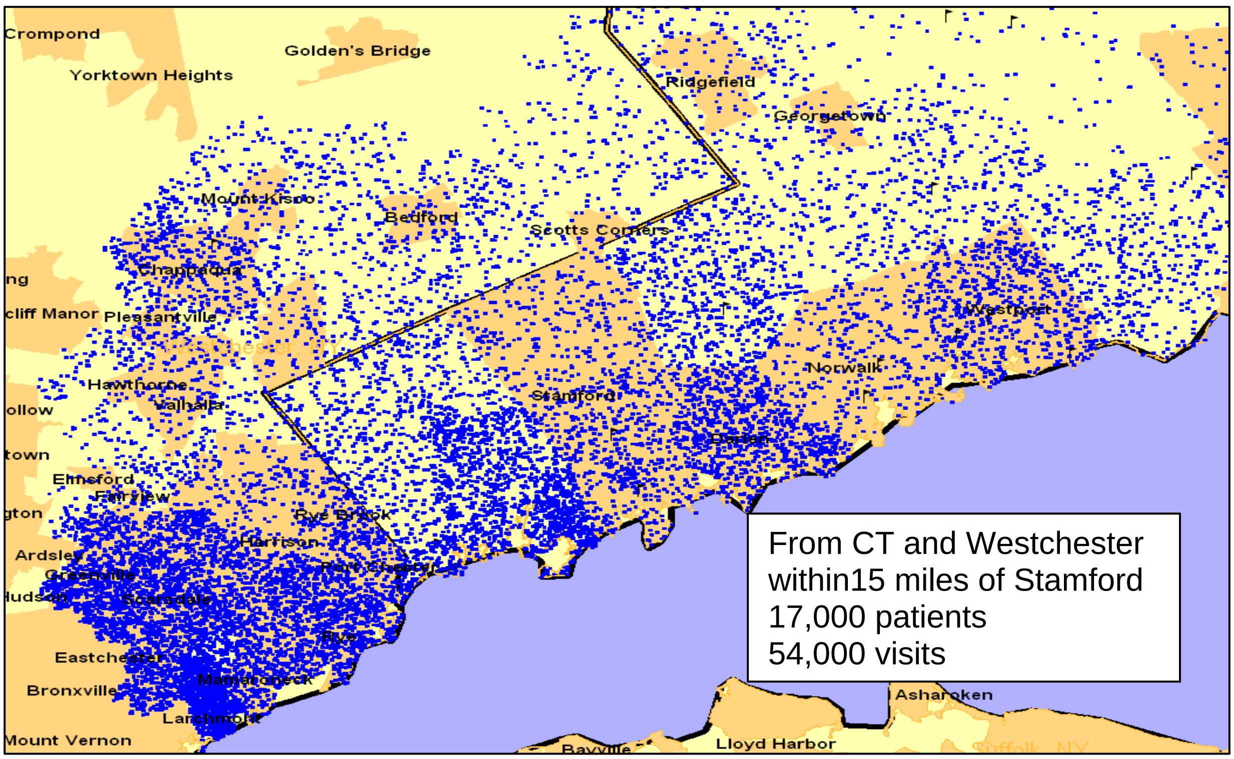
a. Explain why there is a clear public need for the proposed equipment. Provide evidence that demonstrates this need.

It is important to note that this proposal primarily involves a shift of location for MRI scans currently performed on patients residing in Connecticut and Westchester at HSS's main campus in Manhattan. The proposed site provides a convenient location in closer proximity to the homes of these patients. This decanting of MRI volume will in turn free up needed capacity in Manhattan. The proposed MRI unit will be utilized by HSS physicians on their patients from Connecticut and nearby towns in New York State who would otherwise travel to New York City to obtain their MRI scans at HSS in Manhattan. These scans are read by HSS radiologists and the referring physicians would continue to rely on the HSS Department of Radiology and Imaging's specialization in orthopedic-focused scans that limit the use of contrast injections and provide a high level of specialized sequences, improving both conservative and surgical planning and overall patient outcomes. Historical information summarized below indicates sufficient need for an HSS MRI in Connecticut to accommodate HSS patients in Connecticut and Westchester county currently receiving their MRI scans in New York City. The new MRI unit is expected to be utilized at full capacity almost immediately based on this historical volume alone.

The determination of need and projected volume for the proposed MRI service involved 1) identification of the patient service area, and 2) current MRI utilization within the service area by the applicable HSS physician population.

HSS Serving Patients in Connecticut and Westchester County (within 15 miles of Stamford)

For the three-year period from 2009 to 2011, nearly 17,000 residents (9,000 from Connecticut) had approximately 54,000 encounters at HSS in NYC (29,000 for Connecticut residents). Each point on the scatter chart below represents one of these residents.



In addition, HSS's offsite location in Old Greenwich had over 7,000 MD visits and 2,600 x-ray exams in 2011. Finally, for fiscal year 2011, HSS surgeons performed approximately 3,700 surgical procedures on residents of Connecticut and eastern Westchester County at the main campus in New York City.

Service Area Determination

As the proposed MRI unit in Connecticut is new to HSS, there is no historical patient service area. A patient origin analysis was done for 2011 and year-to-date 2012 (for the six months ending June 30, 2012) for MRI volume from HSS patients who reside in lower Connecticut and the eastern portion of Westchester County (Attachment II). From this analysis, a proposed service area was derived. These towns are in closest proximity to the proposed location of the MRI unit in Stamford. Illustrated below are HSS historical MRI volumes from the proposed service area towns, along with the aggregate patient origin volume for other communities in Connecticut and New York (within 15 miles of Stamford).

Town	2011	YTD June 2012	Projected 2012
Stamford	144	67	134
Greenwich	454	243	486
Darien	174	68	136
New Canaan	109	70	140
Subtotal- Conn. portion of proposed service area	881	448	896
Scarsdale	229	114	228
Rye	217	110	220
Mamaroneck	219	144	288
Subtotal- NY portion of proposed service area	665	368	736
Total proposed service area	1,546	816	1,632
Other Conn (statewide)	725	465	930
Other NY (within 15 miles)	616	344	688
Total HSS MRI volume- Conn and eastern Westchester County	2,887	1,625	3,250
Percent increase- 2011 to 2012			12.6%

Projected 2012 volume by town represents YTD 6/30/12 actual plus projected volume for July 2012 to December 2012. As shown in the above table, over 1,600 scans are projected for 2012 to be done at HSS's Manhattan campus on patients from the proposed service area and an additional approximately 1,700 scans are projected to come from the remainder of the State of Connecticut and neighboring New York towns near the proposed service area (and within a 15 mile driving distance to the proposed MRI location).

Maximum capacity of the proposed MRI (2,540 scans) would not be able to fully accommodate the 3,250 scans projected in 2012 for the service area. A portion of this volume would still be performed in Manhattan for two main reasons:

- **Patient preference (e.g., the patient is employed in New York City and it is more convenient to have the scan performed during work hours); and**
- **The patient's physician office visit is at the Hospital's main campus and an MRI is ordered and performed during that same visit.**

The total population for the above proposed service area is approximately 350,000 as discussed in further detail in 2.c.ii below and shown in detail in Attachment III. While this population is expected to have minimal growth through 2015 in total, the cohorts of ages 45 to 64 are projected to increase nearly 4% while the cohort of ages 65 and older are expected to increase nearly 11%. These cohorts are the more prevalent demographic for orthopedic care and thus MRI utilization for musculoskeletal conditions.

An evaluation was next done on the optimal operating time and overall expected capacity of the proposed MRI. The Hospital has recently been given CON approval for its first MRI located outside of Manhattan in Long Island, NY. This site is expected to open during the first quarter of 2013. Like the proposed unit, this Long Island-based MRI will be part of an HSS satellite office that will also include HSS-affiliated physicians, diagnostic x-ray and fluoroscopic guidance imaging services. The operating model to be adopted for that location is similar to the proposed Stamford site. It was determined that a 10-hour day, five days a week would be the most appropriate for this outpatient radiology satellite location, consistent with the hours when HSS physicians and nursing staff will be present at the site. Based on historical information and the utilization of HSS's existing MRIs the assumed average number of scans performed is one (1) per hour. This reflects an average scan time that is longer than many MRI scans due to the sophisticated protocols utilized by HSS which require more time than the average procedure at a typical general MRI facility.

MRI Machine Capacity

Days per week- Monday to Friday	**5**
Hours per day- 8am to 6pm	**10**
Business days per year	**254**
Hours per year	**2,540**
Scans per hour	**1.0**
Scans per year at capacity	**2,540**

The total business days per year exclude weekends and holidays and represent the days the MRI will be in operation.

HSS MRI Service Differentiation

Given the Hospital's specialization in musculoskeletal conditions, and its leadership in research and innovation in respect of the diagnosis and treatment of these conditions, heavy emphasis has been placed by the Hospital in developing proprietary and innovative protocols for its MRI service. These in turn have been customized for the needs of each HSS referring physician. Furthermore, HSS's radiologists are specialists in musculoskeletal MRI, as HSS focuses solely on orthopedics and rheumatology and requires that its radiologists have completed a musculoskeletal imaging fellowship, typically the fellowship offered by HSS. HSS's musculoskeletal radiology fellows will have already done substantial research and achieved top ratings in their residency programs before being accepted into the HSS fellowship program.

HSS physicians rely upon the HSS MRI protocols and quality to ensure accurate diagnosis, efficient treatment plans and ultimately superior patient outcomes. Following are some examples:

- **Dedicated cartilage-sensitive imaging is performed on ALL joints in three planes.**
- **Dedicated coils are used for specific parts to obtain the best images.**
- **MR utilizes high matrix imaging/thin slice imaging.**
- **Scans are normally checked prior to the patient leaving the facility to ensure diagnostic quality. A musculoskeletal MRI radiologist is available at all times when scanning is being conducted to review or assist with the scan. After such review, additional sequences may be performed in order to**

achieve the required imaging results without the necessity of the patient returning for another visit.

- **HSS functions as a GE Luminary site for testing coils and protocols for optimal musculoskeletal imaging.**
- **There are no intra-articular injections and limited use of contrast injections for increased patient safety. This is based on high resolution non-contrast techniques developed by HSS. This enables reproducible, accurate assessment of the rotator cuff, capsule and labrum in the shoulder, the cartilage and labrum in the hip, cartilage and meniscus in the knee (both native and repaired), and the cartilage in the ankle, wrist and elbow.**
- **The customized MRI protocols provide each surgeon with sufficient information to identify all issues to be operated upon prior to surgery, and to limit the need for diagnostic surgery.**
- **HSS has developed a series of proprietary and prototype means for early detection of osteoarthritis, determination of timing of treatment and assessing surgical cartilage repair. Post operative MRI assessment of cartilage and meniscal repair is accomplished using MRI rather than follow up surgery. A comprehensive research agreement with GE enables this capability at HSS, which is not otherwise available in the tri-state area.**
- **HSS has developed protocols for MRI assessment of arthroplasty, assessing bone loss following joint replacement and definition of regional adverse tissue reactions around implants, such as those seen following metal on metal hip arthroplasty.**

- **HSS is able to perform MRI scans on persons with pre-existing joint deformity as well as persons with orthopedic hardware. Some MRI sites decline such patients.**
- **Hollis G. Potter, MD, the Chief, Division of Magnetic Resonance Imaging for HSS, has specialized in Musculoskeletal MR Imaging since 1990. She has published 140 scientific articles and 51 book chapters. Several representative articles are attached. She has lectured extensively at scientific orthopedic and radiology meetings throughout the world. She is funded for MR research in both clinical and basic science projects. She is internationally recognized for her expertise in developing MR applications for orthopedic conditions. Dr. Potter's full CV is attached (Attachment V).**
- **Other HSS radiologists are also leaders in their fields. Additional CVs are attached (Attachment V).**
- **Reflecting HSS's leadership in development of MR applications for orthopedic conditions, HSS has received several NIH awards for advanced imaging development.**

b. Provide the utilization of existing health care facilities and health care services in the Applicant's service area.

The Hospital does not currently operate any MRIs in the service area defined above. As to utilization of MRIs currently located in the service area, see subsection (c)(iv) below.

Table 1: Existing Equipment Operated by the Applicant – N/A

Provider Name Street Address Town, Zip Code	Description of Service *	Hours/Days of Operation **	Utilization (2011) ***

* Include equipment strength (e.g. slices, tesla strength), whether the unit is open or closed (for MRI)
** Days of the week unit is operational, and start and end time for each day; and
*** Number of scans/exams performed on each unit for the most recent 12-month period (identify period).

c. Provide the following regarding the proposal's location:

i. The rationale for locating the proposed equipment at the proposed site;

HSS, in conjunction with the HSS physicians currently practicing at the Old Greenwich offsite location, plans to relocate and expand the services currently provided at its Old Greenwich office location to the Stamford site. This will enable more of our current Connecticut and Westchester patients to see their doctors and receive services closer to home. The Old Greenwich location has inadequate space for its current operation, and lacks secondary transportation options. The need exists to relocate to a location with improved accessibility and additional space. In addition to providing additional space, the Stamford location offers good proximity to major roads such as Interstate 95 and U.S. Route 1, is nearby to the Stamford train station with trains operated by Metro North and Amtrak, and is a convenient

location for HSS patients residing in lower Fairfield County, north of Fairfield County to the remainder of the State of Connecticut, and nearby New York State in the eastern part of Westchester County. The proposed location is in a facility that also houses Chelsea Piers, an entertainment and sports complex. Chelsea Piers originated on the west side of Manhattan and has branched out to this location in Connecticut.

ii. The population to be served, including specific evidence such as incidence, prevalence, or other demographic data that demonstrates need;

The Hospital intends to serve those patients that utilize HSS services in Manhattan and reside in Connecticut and the eastern part of Westchester County. The following table illustrates the proposed service area towns and population.

				Population Growth	
	2000 Census	2010 Census	2015 Projection	2000 to 2010	2010 to 2015
Stamford	116,837	122,643	123,710	5.0%	0.9%
Greenwich	61,360	61,171	61,783	-0.3%	1.0%
New Canaan	19,325	19,738	19,920	2.1%	0.9%
Darien	19,620	20,732	21,147	5.7%	2.0%
Subtotal Conn. Service Area	217,142	224,284	226,560	3.3%	1.0%
Scarsdale	38,485	39,129	39,520	1.7%	1.0%
Rye	53,084	54,890	55,988	3.4%	2.0%
Mamaroneck	36,392	36,674	36,975	0.8%	0.8%
Subtotal- NY Portion of Service Area	127,961	130,693	132,483	2.1%	1.4%
Total Service Area	345,103	354,977	359,043	2.9%	1.1%

The population of the proposed service area is approximately 350,000 and is projected to be relatively stable in the near future. While this population is expected to have minimal growth in the near future, the cohort of ages 45 to 64 is projected to increase nearly 4% while the cohort of ages 65 and older is expected to increase nearly 11%. These cohorts are the more prevalent demographic for orthopedic care and thus MRI utilization for musculoskeletal conditions.

iii. How and where the proposed patient population is currently being served;

The proposed patient population is currently being served by physicians affiliated with the Hospital and are currently receiving their MRI scans at the Hospital's main campus in Manhattan (3,250 scans projected for 2012).

iv. All existing providers (name, address) of the proposed service in the towns listed above and in nearby towns;

The following table illustrates the existing providers of MRI services in the Hospital's proposed service area.

Organization	*Location*	*Hours of Operation*	*Inpatient MRI Scans*	*Outpatient MRI Scans*	*Total MRI Scans*
Stamford Hospital					
Tully Health Center (Stamford Hosp. Satellite)	**Stamford**	**Mon-Fri 8am to 8pm Sat 8am to 4pm**	**Incl. in Stamford Hosp.**		
Darien Imaging Center (Stamford Hosp affiliate)	**Darien**	**Mon- Fri 7am to 4pm**	**Incl. in Stamford Hosp**		
Stamford Hospital (main hospital)	**Stamford**	**Mon-Fri 7am to 10 pm Sat-Sun 8am to 4pm**	**2,819**	**10,951**	**13,770**
Greenwich Hospital					
Greenwich Hospital Diagnostic Center (Greenwich Hosp. Satellite)	**Stamford**	**Mon-Fri 7:30am to 6pm**	**Incl. in Greenwich Hospital**		
Greenwich Hospital (main hospital)	**Greenwich**	**Mon-Fri 7:30am to 7pm Sat-Sun 7:30am to 5pm**	**1,240**	**7,386**	**8,626**
Advanced Radiology Consultants-Stamford	**Stamford**	**Mon-Sat 7am to 7pm Tues 7am to 11pm**	**not available**	**not available**	**not available**
Orthopedic & Neurosurgery Specialists	**Greenwich**	**not available**	**not available**	**not available**	**not available**
Rye Radiology Associates	**Port Chester, NY**	**not available**	**not available**	**not available**	**not available**

Source- Most recent available Hospital Annual Filings to OHCA (2011) and CON filings to OHCA

v. The effect of the proposal on existing providers; and

This proposal will have minimal impact on existing MRI service providers located in Connecticut. This proposal is intended to serve HSS patients who reside in Connecticut and eastern Westchester County currently traveling to HSS's Manhattan locations for MRI services. HSS will not market the service to non-HSS physicians nor will the site have the capacity to accommodate such volume. In addition, as with our sites in New York, only Orthopedic MRI will be performed. The information available and shown in the above table suggests there is sufficient utilization of the current MRIs located in the proposed service area. There is a small portion of MRI scans ordered by HSS-affiliated physicians that are performed at Connecticut MRI locations and this is expected to continue or possibly even grow.

vi. If the proposal involves a new site of service, identify the service area towns and the basis for their selection.

As shown above, the proposed service area is the Connecticut towns of Stamford, Greenwich, Darien and New Canaan, along with the New York towns of Rye, Scarsdale, and Mamaroneck. These towns were selected based on the Hospital's historical patient origin for MRI services in lower Fairfield County and the eastern part of Westchester County in New York and their proximity to the proposed site in Stamford. The site will also serve HSS patients from the remainder of the state of Connecticut, as well as other New York State towns within 15 miles of the Stamford site.

d. Explain why the proposal will not result in an unnecessary duplication of existing or approved health care services.

The proposed service will not duplicate any MRI services currently provided in Connecticut but will accommodate HSS's Connecticut and Westchester patients who currently travel to Manhattan to receive HSS's unique and specialized MRI services.

3. Actual and Projected Volume

a. Complete the following tables for the past three fiscal years ("FY"), current fiscal year ("CFY"), and first three projected FYs of the proposal, for each of the Applicant's existing and proposed pieces of equipment (of the type proposed, at the proposed location only). In Table 2a, report the units of service by piece of equipment, and in Table 2b, report the units of service by type of exam (e.g. if specializing in orthopedic, neurosurgery, or if there are scans that can be performed on the proposed scanner that the Applicant is unable to perform on its existing scanners).

Table 2a: Historical, Current, and Projected Volume, by Equipment Unit

	Actual Volume (Last 3 Completed FYs)			**CFY Volume ***	**Projected Volume (First 3 Full Operational FYs)****		
	FY ****	FY ****	FY ****	FY ***	**FY 2014**	**FY 2015**	**FY 2016**
Scanner***							
MRI	**n/a**	**n/a**	**n/a**	**n/a**	**2,175**	**2,540**	**2,540**
Total					**2,175**	**2,540**	**2,540**

* For periods greater than 6 months, report annualized volume, identifying the number of actual months covered and the method of annualizing. For periods less than six months, report actual volume and identify the period covered.
** If the first year of the proposal is only a partial year, provide the first partial year and then the first three full Fys. Add columns as necessary.
*** Identify each scanner separately and add lines as necessary. Also break out inpatient/outpatient/ED .
**** Fill in years. In a footnote, identify the period covered by the Applicant's FY (e.g. July 1-June 30, calendar year, etc.).

Table 2b: Historical, Current, and Projected Volume, by Type of Scan/Exam

	Actual Volume (Last 3 Completed FYs)			**CFY Volume***	**Projected Volume (First 3 Full Operational FYs)****		
	FY ****	FY ****	FY ****	FY ****	FY 2014	FY 2015	FY 2016
Service type***							
Orthopedics					**2,175**	**2,540**	**2,540**
Total					**2,175**	**2,540**	**2,540**

* For periods greater than 6 months, report annualized volume, identifying the number of actual months covered and the method of annualizing. For periods less than six months, report actual volume and identify the period covered.
** If the first year of the proposal is only a partial year, provide the first partial year and then the first three full FYs. Add columns as necessary.
*** Identify each type of scan/exam (e.g. orthopedic, neurosurgery or if there are scans/exams that can be performed on the proposed piece of equipment that the Applicant is unable to perform on its existing equipment) and add lines as necessary.
**** Fill in years. In a footnote, identify the period covered by the Applicant's FY (e.g. July 1-June 30, calendar year, etc.).

b. Provide a breakdown, by town, of the volumes provided in Table 2a for the most recently completed full FY.

Not applicable.

c. Describe existing referral patterns in the area to be served by the proposal.

The Hospital currently has seventeen members of the HSS medical staff seeing patients at the Greenwich office location (16 on a part time basis). These physicians will be relocating to the proposed Stamford location containing the MRI unit. The majority of the patients currently seen at the Old Greenwich location are referred to HSS's Manhattan location for MRIs (approximately 800 projected for 2012). These patients are expected to be referred to the Stamford site MRI when operational. There are a small number of MRI scans that are referred to Connecticut MRI locations. These referrals are expected to continue or possibly even grow. A significant portion of the remaining 2,450 scans projected in 2012 for patients residing in Connecticut or eastern Westchester County are expected to be referred to the Stamford site.

d. Explain how the existing referral patterns will be affected by the proposal.

The existing referral patterns should not change due to this proposal since this MRI service will not be marketed to non-HSS physicians or their patients. Members of the HSS medical staff already refer their patients to HSS for MRIs due to the high quality of the MRI image, the limited need for contrast, the avoidance of intra-articular injections, and the multitude of sequences that provide more enhanced detail than a typical MRI unit. As referrals to the proposed MRI facility would be the result of shift of current scanning volume from Manhattan to Stamford, there would be no effect on existing referral patterns resulting from this proposal. HSS

physicians currently located in Old Greenwich and expected to relocate to Stamford as well as HSS physicians located in Manhattan seeing patients residing in the proposed service area are providing their patients the convenience and opportunity to receive their scans closer to their residences instead of at HSS in NYC. In addition, HSS physicians have expressed an interest in utilizing office visit time in Stamford once it opens and provides its full range of radiological services including MRI. HSS will not be marketing the MRI at this site to non-HSS physicians or their patients nor would there even be capacity to accommodate such volume as HSS's existing MRI volume is expected to fully utilize the unit.

e. Explain any increases and/or decreases in volume seen in the tables above.

The changes in volume seen in the above table represent a shift of MRI scans currently provided at the Hospital's main campus that would be performed at the proposed Connecticut location. This volume represents referrals from HSS physicians of patients residing in Connecticut and eastern Westchester. These patients currently come to New York for their MRI but would use the proposed MRI once operational.

f. Provide a detailed explanation of all assumptions used in the derivation/ calculation of the projected volume by scanner and scan type.

It is assumed that the commencement of operations of the proposed MRI unit is January 1, 2014 which is the commencement of the Hospital's fiscal year 2014. By the second full year of operation, it is expected that the MRI unit will be operating at full capacity.

Projected Stamford MRI volumes for 2014 – 2016 are as follows:

	2014	2015	2016
Projected 2012 MRI Volume in NYC – Greenwich Office Patients	800	800	800
Projected 2012 MRI Volume in NYC – Other HSS Patients	2,450	2,450	2,450
Total Projected 2012	3,250	3,250	3,250
Less: Volume Remaining in NYC (a)	(1,075)	(710)	(710)
Projected at Stamford	2,175	2,540	2,540

(a) Represents estimate for patients receiving their MRI on the same day they see their MD in Manhattan, patients for which it is more convenient to receive MRI in Manhattan (due to proximity to workplace, etc.) or patients not able to be accommodated at Stamford due to capacity constraints.

g. Provide a copy of any articles, studies, or reports that support the need to acquire the proposed scanner, along with a brief explanation regarding the relevance of the selected articles.

See Attachment IV for selected articles.

4. **Quality Measures**

   a. Submit a list of all key professional, administrative, clinical, and direct service personnel related to the proposal. Attach a copy of their Curriculum Vitae.

      i. **Louis A. Shapiro – President/CEO**
      ii. **Stacey L. Malakoff – Executive VP/CFO**
      iii. **Lisa A. Goldstein – Executive VP/COO**
      iv. **Ralph Bianco – Vice President, Operations**
      v. **Hollis G. Potter, MD – Chief, Division of Magnetic Resonance Imaging**
      vi. **Jo A. Hannafin, MD, PhD – Attending Orthopedic Surgeon, Orthopedic Director, Women's Sports Medicine Center, Professor of Orthopedic Surgery, Weill Medical College of Cornell University**

      See Attachment V for CVs/Bio's for the above listed individuals.

   b. Explain how the proposal contributes to the quality of health care delivery in the region**.**

As noted previously, approximately 3,250 MRI scans are projected in 2012 at HSS's Manhattan location on patients traveling from the State of Connecticut and nearby eastern Westchester County. The proposal would bring HSS's unique and specialized MRI service to the region and provide better convenience and access for many of these patients.

The Radiology department at HSS includes 15 Board-certified radiologists specializing in musculoskeletal imaging, including 5 radiologists dedicated to musculoskeletal MRI. The MRI department at HSS has worked on several proprietary and prototype pulse sequences that enable early detection of osteoarthritis. Using MRI as a non-invasive means by which to assess cartilage tissue integrity and ultrastructure, HSS MRI radiologists are able to diagnose

osteoarthritis at a much earlier time compared with traditional imaging techniques. These techniques have a direct impact on patient management, helping to optimize timing of surgical procedures such as meniscal transplantation or osteotomy that are aimed at delaying the progression of osteoarthritis. In the setting of surgical cartilage repair, these advanced MR techniques provide an objective assessment of the repaired tissue, obviating the need for invasive, second-look arthroscopy and surgical biopsy with violation of the repair site. Not only has this had a direct impact on our local patients but also provides important research standards for the orthopaedic community. HSS has been the recipient of several NIH awards based on the background and expertise of its Department of Radiology in advanced imaging.

HSS's Radiologists have validated high resolution noncontrast techniques that obviate the need for intra-articular contrast agents, enabling reproducible, accurate assessment of the rotator cuff, capsule and labrum in the shoulder, the cartilage and labrum in the hip, cartilage and meniscus in the knee (both native and repaired), and the cartilage in the ankle, wrist and elbow. These data are published in the peer-reviewed orthopaedic literature. Every patient scanned in an HSS MRI facility receives cartilage-sensitive pulse sequencing in three planes, often enabling critical clinical decisions that alter management, be it conservative or surgical.

HSS has further established the market for MRI of arthroplasty, having shown MRI to be the most accurate noninvasive means by which to assess bone loss following joint replacement as well as definition of regional adverse tissue reactions

around implants, such as those seen following metal-on-metal hip arthroplasty. HSS can also assess the rotator cuff following shoulder arthroplasty as well as synovitis or inflammatory reaction around knee implants.

5. Organizational and Financial Information

a. Identify the Applicant's ownership type(s) (e.g. Corporation, PC, LLC, etc.).

New York State Not-for-Profit Corporation

b. Does the Applicant have non-profit status?
☒ Yes (Provide documentation) ☐ No

See Attachment VI for documentation of HSS's non-profit status.

c. Provide a copy of the State of Connecticut, Department of Public Health license(s) currently held by the Applicant and indicate any additional licensure categories being sought in relation to the proposal.

N/A

d. Financial Statements

v. <u>If the Applicant is a Connecticut hospital:</u> Pursuant to Section 19a-644, C.G.S., each hospital licensed by the Department of Public Health is required to file with OHCA copies of the hospital's audited financial statements. If the hospital has filed its most recently completed fiscal year audited financial statements, the hospital may reference that filing for this proposal.

N/A

vi. <u>If the Applicant is not a Connecticut hospital (other health care facilities):</u> Audited financial statements for the most recently completed fiscal year. If audited financial statements do not exist, in lieu of audited financial statements, provide other financial documentation (e.g. unaudited balance sheet, statement of operations, tax return, or other set of books.)

Attachment VII contains the most recent audited financial statements for the Hospital as of its fiscal year ended 12/31/2011.

e. Submit a final version of all capital expenditures/costs as follows:

Table 3: Proposed Capital Expenditures/Costs

Medical Equipment Purchase	$
Imaging Equipment Purchase – **See Attachment VIII for quote**	**1,800,000**
Non-Medical Equipment Purchase	
Land/Building Purchase *	
Construction/Renovation ** **- See Attachment IX for details**	**1,445,583**
Other Non-Construction (Specify)	
Total Capital Expenditure (TCE)	**$ 3,245,583**
Medical Equipment Lease (Fair Market Value) ***	$
Imaging Equipment Lease (Fair Market Value) ***	
Non-Medical Equipment Lease (Fair Market Value) ***	
Fair Market Value of Space ***	
Total Capital Cost (TCC)	**$**
Total Project Cost (TCE + TCC)	**$ 3,245,583**
Capitalized Financing Costs (Informational Purpose Only)	
Total Capital Expenditure with Cap. Fin. Costs	**$ 3,245,583**

* If the proposal involves a land/building purchase, attach a real estate property appraisal including the amount; the useful life of the building; and a schedule of depreciation.
** If the proposal involves construction/renovations, attach a description of the proposed building work, including the gross square feet; existing and proposed floor plans; commencement date for the construction/ renovation; completion date of the construction/renovation; and commencement of operations date.
*** If the proposal involves a capital or operating equipment lease and/or purchase, attach a vendor quote or invoice; schedule of depreciation; useful life of the equipment; and anticipated residual value at the end of the lease or loan term.

f. List all funding or financing sources for the proposal and the dollar amount of each. Provide applicable details such as interest rate; term; monthly payment; pledges and funds received to date; letter of interest or approval from a lending institution.

The proposed project will be funded from Hospital operations.

g. Demonstrate how this proposal will affect the financial strength of the state's health care system.

The proposal will enhance the financial strength of the State's health care system as it allows better coordination of care in a more appropriate setting closer to the patient allowing for a more efficient delivery of radiological information.

6. Patient Population Mix: Current and Projected

a. Provide the current and projected patient population mix (based on the number of patients, not based on revenue) with the CON proposal for the proposed program.

The projected patient population mix is presented below and is based on HSS's overall MRI volume payer mix.

Table 4: Patient Population Mix

	Current** FY ***	Year 1 FY 2014	Year 2 FY 2015	Year 3 FY 2016
Medicare*		**18.1%**	**18.1%**	**18.1%**
Medicaid*		**2.1%**	**2.1%**	**2.1%**
CHAMPUS & TriCare		**0.0%**	**0.0%**	**0.0%**
Total Government		**20.2%**	**20.2%**	**20.2%**
Commercial Insurers*		**74.7%**	**74.7%**	**74.7%**
Uninsured		**1.4%**	**1.4%**	**1.4%**
Workers Compensation		**3.7%**	**3.7%**	**3.7%**
Total Non-Government		**79.8%**	**79.8%**	**79.8%**
Total Payer Mix	**Not applicable**	**100.0%**	**100.0%**	**100.0%**

* Includes managed care activity.
** New programs may leave the "current" column blank.
*** Fill in years. Ensure the period covered by this table corresponds to the period covered in the projections provided.

b. Provide the basis for/assumptions used to project the patient population mix.

The projected payer mix for the proposed MRI unit is based on the overall HSS MRI payer mix as it is assumed the mix of patients seen at the Stamford location would approximate the current outpatient mix of patients seen by HSS as a whole. It is further assumed that no material change in payer mix would occur during the first three years of operation.

7. Financial Attachments I & II

a. Provide a summary of revenue, expense, and volume statistics, without the CON project, incremental to the CON project, and with the CON project. **Complete Financial Attachment I.** (Note that the actual results for the fiscal year reported in the first column must agree with the Applicant's audited financial statements.) The projections must include the first three full fiscal years of the project.

See Attachment X

b. Provide a three year projection of incremental revenue, expense, and volume statistics attributable to the proposal by payer. **Complete Financial Attachment II.** The projections must include the first three full fiscal years of the project.

See Attachment X

c. Provide the assumptions utilized in developing **both Financial Attachments I and II** (e.g., full-time equivalents, volume statistics, other expenses, revenue and expense % increases, project commencement of operation date, etc.).

See Attachment X

d. Provide documentation or the basis to support the proposed rates for each of the FYs as reported in Financial Attachment II. Provide a copy of the rate schedule for the proposed service(s).

See Attachment X

e. Provide the minimum number of units required to show an incremental gain from operations for each fiscal year.

A minimum of approximately 900 MRI scans are required in each year for the program to show an incremental gain.

f. Explain any projected incremental losses from operations contained in the financial projections that result from the implementation and operation of the CON proposal.

N/A

g. Describe how this proposal is cost effective.

This proposal is cost effective since it will allow residents of Connecticut and eastern Westchester County to access healthcare services closer to home thereby eliminating the expense and inconvenience of traveling to NYC for their care. In addition, since space cost is significantly lower in Stamford than it is in Manhattan, costs per scan will be lower at the Stamford location than in Manhattan.

Hospital for Special Surgery

Acquisition and Installation of an MRI in Stamford

Attachments

Moran Towing Corporation
50 Locust Avenue
New Canaan, CT 06840-4737

moran

Paul R. Tregurtha
Chairman & CEO
Tel: 203-442-2801
Fax: 203-442-2807

July 26, 2012

Lisa A. Davis
Deputy Commissioner
Connecticut Dept. of Public Health
Office of Health Care Access
410 Capital Avenue
Hartford, CT 06134

Dear Commissioner Davis,

I am writing in support of Hospital for Special Surgery's application to expand the services it currently provides to the residents of Connecticut. HSS has a site in Greenwich with physician offices and X-ray and is looking to transition this site to the new Chelsea Piers complex in Stamford. At this time patients in need of magnetic imaging services (MRI) must travel into Manhattan.

Each year, HSS performs over 3,300 MRIs at its main campus facility in New York City for Connecticut patients and residents living within 15 miles of Stamford. Having an MRI at the Chelsea Piers site is an essential service for HSS physicians who seek to provide the most convenient, efficient, and innovative café to their patients.

I strongly urge the Office of Health Care Access to approve HSS's proposal to install an MRI in Stamford and enable patients to receive the best possible care closer to home. Thank you very much for your consideration.

Sincerely,

Paul Tregurtha

Paul R. Tregurtha

PRT:jae

cc: Louis A. Shapiro
President & CEO, Hospital for Special Surgery ✓

Paul Tudor Jones II
Co-Chairman and Chief Investment Officer

TUDOR
INVESTMENT CORPORATION

Ms. Lisa A. Davis
Deputy Commissioner
Connecticut Dept. of Public Health
Office of Health Care Access
410 Capitol Avenue
Hartford, CT 06134

Dear Commissioner Davis:

I am writing in support of Hospital for Special Surgery's application to expand the services it currently provides to the residents of Connecticut. HSS has a site in Greenwich with physician offices and X-ray and is looking to transition this site to the new Chelsea Piers complex in Stamford. At this time patients in need of magnetic resonance imaging services (MRIs) must travel into Manhattan.

Each year, HSS performs over 3,300 MRIs at its main campus facility in New York City for Connecticut patients and residents living within 15 miles of Stamford. Having an MRI at the Chelsea Piers site is an essential service for HSS physicians who seek to provide the most convenient, efficient, and innovative care to their patients.

I strongly urge the Office of Health Care Access to approve HSS's proposal to install an MRI in Stamford and enable patients to receive the best possible care closer to home. Thank you very much for your consideration.

Sincerely,

Paul Tudor Jones II
Co-Chairman and Chief Investment Officer

cc: Louis A. Shapiro
President & CEO, Hospital for Special Surgery

PETER L. MALKIN

40 WEST ELM STREET
APT. 5J-L
GREENWICH, CT 06830

July 30, 2012

Lisa A. Davis
Deputy Commissioner
Connecticut Dept. of Public Health
Office of Health Care Access
410 Capitol Avenue
Hartford, CT 06134

Dear Commissioner Davis,

I am writing in support of Hospital for Special Surgery's application to expand the services it currently provides to the residents of Connecticut. HSS has a site in Greenwich with physician offices and X-ray and is looking to transition this site to the new Chelsea Piers complex in Stamford. At this time patients in need of magnetic resonance imaging services (MRIs) must travel into Manhattan.

Each year, HSS performs over 3,300 MRIs at its main campus facility in New York City for Connecticut patients and residents living within 15 miles of Stamford. Having an MRI at the Chelsea Piers site is an essential service for HSS physicians who seek to provide the most convenient, efficient, and innovative care to their patients.

I strongly urge the Office of Health Care Access to approve HSS's proposal to install an MRI in Stamford and enable patients to receive the best possible care closer to home. Thank you very much for your consideration.

Sincerely,

Peter L. Malkin
Chairman
Malkin Properties of Connecticut, Inc.

cc: Louis A. Shapiro
President & CEO, Hospital for Special Surgery

Dr. Leon Root
Hospital for Special Surgery

Hospital For Special Surgery
Attachment II
Patient Origin-MRI Volume- 2011 and 2012
State of Conn and 15 Mile Radius of Stamford (Excluding Long Island)

Zip Code	City	State	Actual 2011	YTD June 2012	Projected Actual 2012
10804	New Rochelle	NY	52	36	72
10607	White Plains	NY	10	6	12
10606	White Plains	NY	8	8	16
10605	White Plains	NY	67	28	56
10604	West Harrison	NY	8	4	8
10603	White Plains	NY	11	14	28
10601	White Plains	NY	19	7	14
10595	Valhalla	NY	3	6	12
10594	Thornwood	NY	10	4	8
10590	South Salem	NY	19	9	18
10583	Scarsdale	NY	229	114	228
10580	Rye	NY	174	84	168
10577	Purchase	NY	35	16	32
10576	Pound Ridge	NY	24	22	44
10573	Port Chester	NY	43	26	52
10570	Pleasantville	NY	30	21	42
10549	Mount Kisco	NY	51	22	44
10543	Mamaroneck	NY	56	33	66
10538	Larchmont	NY	163	111	222
10532	Hawthorne	NY	9	5	10
10530	Hartsdale	NY	20	15	30
10528	Harrison	NY	52	31	62
10523	Elmsford	NY	5	2	4
10514	Chappaqua	NY	75	44	88
10507	Bedford Hills	NY	6	5	10
10506	Bedford	NY	47	21	42
10504	Armonk	NY	55	18	36
06907	Stamford	CT	11	5	10
06906	Stamford	CT	2	3	6
06905	Stamford	CT	33	11	22
06903	Stamford	CT	32	23	46
06902	Stamford	CT	54	24	48
06901	Stamford	CT	12	1	2
06897	Wilton	CT	51	35	70
06896	Redding	CT	7	9	18
06890	SOUTHPORT	CT	12	9	18
06883	Weston	CT	54	26	52
06881	Westport	CT	2		0
06880	Westport	CT	120	80	160
06878	Riverside	CT	64	44	88
06877	Ridgefield	CT	32	35	70
06876	Redding Ridge	CT			0
06875	Redding Center	CT	1		0
06870	Old Greenwich	CT	43	20	40
06855	Norwalk	CT	11	4	8
06854	Norwalk	CT	4	1	2
06853	Norwalk	CT	10	6	12
06851	Norwalk	CT	16	13	26
06850	Norwalk	CT	18	7	14
06842	New Canaan	CT			0

Hospital For Special Surgery
Attachment II
Patient Origin-MRI Volume- 2011 and 2012
State of Conn and 15 Mile Radius of Stamford (Excluding Long Island)

Zip Code	City	State	Actual 2011	YTD June 2012	Projected Actual 2012
06840	New Canaan	CT	109	70	140
06838	GREENS FARMS	CT		1	2
06836	Greenwich	CT		1	2
06831	Greenwich	CT	143	69	138
06830	Greenwich	CT	181	100	200
06825	FAIRFIELD	CT	10	7	14
06824	FAIRFIELD	CT	48	41	82
06820	Darien	CT	174	68	136
06812	New Fairfield	CT	14	6	12
06811	Danbury	CT	8	5	10
06810	Danbury	CT	9	5	10
06807	Cos Cob	CT	23	9	18
06804	Brookfield	CT	7	11	22
06801	Bethel	CT	5	4	8
06798	Woodbury	CT	5	8	16
06796	West Cornwall	CT			0
06795	Watertown	CT	2		0
06794	Washington Depot	CT	2	4	8
06793	Washington	CT	1	1	2
06790	Torrington	CT	1		0
06787	Thomaston	CT			0
06785	South Kent	CT	1	2	4
06784	Sherman	CT	2	5	10
06783	Roxbury	CT		2	4
06777	New Preston Marble Dale	CT	4		0
06776	New Milford	CT	4	1	2
06770	Naugatuck	CT			0
06762	Middlebury	CT	3		0
06759	Litchfield	CT	4	2	4
06757	Kent	CT			0
06756	Goshen	CT		1	2
06754	Cornwall Bridge	CT			0
06753	Cornwall	CT			0
06752	Bridgewater	CT	1	1	2
06751	Bethlehem	CT		1	2
06716	Wolcott	CT	4	2	4
06712	Prospect	CT	2		0
06708	Waterbury	CT	1	2	4
06706	Waterbury	CT			0
06705	Waterbury	CT	1		0
06704	Waterbury	CT	1		0
06615	Stratford	CT	6	1	2
06614	Stratford	CT	4	1	2
06612	Easton	CT	3	1	2
06611	Trumbull	CT	16	13	26
06610	Bridgeport	CT	1		0
06606	Bridgeport	CT	4		0
06605	Bridgeport	CT	2		0
06604	Bridgeport	CT	2	1	2
06530	New Haven	CT	1		0

Hospital For Special Surgery
Attachment II
Patient Origin-MRI Volume- 2011 and 2012
State of Conn and 15 Mile Radius of Stamford (Excluding Long Island)

Zip Code	City	State	Actual 2011	YTD June 2012	Projected Actual 2012
06525	Woodbridge	CT	7	4	8
06524	Bethany	CT		1	2
06518	Hamden	CT	1		0
06517	Hamden	CT		2	4
06516	West Haven	CT	3	4	8
06515	New Haven	CT	1	2	4
06514	Hamden	CT			0
06513	New Haven	CT			0
06512	East Haven	CT	4		0
06511	New Haven	CT	3	1	2
06510	New Haven	CT		1	2
06498	Westbrook	CT	1		0
06492	Wallingford	CT	3	1	2
06490	SOUTHPORT	CT	2		0
06489	Southington	CT			0
06488	Southbury	CT	4	3	6
06484	Shelton	CT	15	8	16
06483	Seymour	CT		4	8
06482	Sandy Hook	CT	8	2	4
06480	Portland	CT			0
06478	Oxford	CT	9		0
06477	Orange	CT	2		0
06475	Old Saybrook	CT	2	2	4
06473	North Haven	CT			0
06470	Newtown	CT	11	5	10
06469	Moodus	CT			0
06468	Monroe	CT	9	5	10
06460	Milford	CT	8	6	12
06457	Middletown	CT	4	1	2
06450	Meriden	CT			0
06447	Marlborough	CT	1		0
06443	Madison	CT	7	3	6
06442	Ivoryton	CT	1	1	2
06441	Higganum	CT			0
06439	Hadlyme	CT	1	2	4
06438	Haddam	CT	1		0
06437	Guilford	CT	4	2	4
06430	FAIRFIELD	CT	5		0
06426	Essex	CT	1		0
06423	East Haddam	CT			0
06422	Durham	CT	1		0
06420	Salem	CT	1		0
06419	Killingworth	CT			0
06418	Derby	CT	3	1	2
06417	Deep River	CT	1		0
06415	Colchester	CT		1	2
06413	Clinton	CT		2	4
06410	Cheshire	CT	3	2	4
06405	Branford	CT	6	5	10
06404	Botsford	CT		1	2

Hospital For Special Surgery
Attachment II
Patient Origin-MRI Volume- 2011 and 2012
State of Conn and 15 Mile Radius of Stamford (Excluding Long Island)

Zip Code	City	State	Actual 2011	YTD June 2012	Projected Actual 2012
06403	Beacon Falls	CT		1	2
06401	Ansonia	CT	1	1	2
06385	Waterford	CT	4	2	4
06378	Stonington	CT	2		0
06371	Old Lyme	CT	3	6	12
06360	Norwich	CT		1	2
06357	Niantic	CT			0
06355	Mystic	CT	3	1	2
06351	Jewett City	CT	1	1	2
06340	Groton	CT	4	2	4
06339	Ledyard	CT		3	6
06335	Gales Ferry	CT	1		0
06320	New London	CT	2		0
06281	Woodstock	CT	1		0
06268	Storrs Mansfield	CT		1	2
06255	North Grosvenordale	CT		1	2
06250	Mansfield Center	CT		2	4
06249	Lebanon	CT			0
06237	Columbia	CT	1		0
06119	West Hartford	CT			0
06118	East Hartford	CT			0
06117	West Hartford	CT	3		0
06114	Hartford	CT	1		0
06111	Newington	CT		1	2
06109	Wethersfield	CT	1		0
06108	East Hartford	CT			0
06107	West Hartford	CT	1		0
06103	Hartford	CT	1	2	4
06098	Winsted	CT		1	2
06096	Windsor Locks	CT		1	2
06092	West Simsbury	CT	1		0
06085	Unionville	CT	2		0
06084	Tolland	CT		1	2
06076	Stafford Springs	CT	1		0
06074	South Windsor	CT	1	1	2
06071	Somers	CT			0
06070	Simsbury	CT	3	1	2
06069	Sharon	CT	5	2	4
06068	Salisbury	CT	2		0
06067	Rocky Hill	CT	1		0
06066	Vernon Rockville	CT	1		0
06063	Barkhamsted	CT			0
06062	Plainville	CT		1	2
06058	Norfolk	CT			0
06057	New Hartford	CT			0
06052	New Britain	CT	1		0
06045	Manchester	CT	3		0
06039	Lakeville	CT	5		0
06037	Berlin	CT		1	2
06035	Granby	CT	2	2	4

Hospital For Special Surgery
Attachment II
Patient Origin-MRI Volume- 2011 and 2012
State of Conn and 15 Mile Radius of Stamford (Excluding Long Island)

Zip Code	City	State	Actual 2011	YTD June 2012	Projected Actual 2012
06033	Glastonbury	CT	2		0
06032	Farmington	CT	2		0
06030	Farmington	CT			0
06029	Ellington	CT	1	1	2
06023	East Berlin	CT			0
06021	Colebrook	CT			0
06019	Canton	CT	2		0
06016	Broad Brook	CT		1	2
06013	Burlington	CT			0
06010	Bristol	CT	2		0
06002	Bloomfield	CT	1		0
06001	Avon	CT	7	1	2
Grand Total			**2,887**	**1,625**	3,250

Town	Actual 2011	YTD June 2012	Projected Actual 2012
Stamford	144	67	134
Greenwich	454	243	486
Darien	174	68	136
New Canaan	109	70	140
Subtotal- Conn portion of proposed service area	881	448	896
Scarsdale	229	114	228
Rye	217	110	220
Mamaroneck	219	144	288
Subtotal- NY portion of proposed service area	665	368	736
Total proposed service area	1,546	816	1,632
Other Conn (statewide)	725	465	930
Other NY (within 15 miles)	616	344	688
Total HSS volume- Conn and eastern Westchester County	2,887	1,625	3,250
percent increase- 2011 to 2012			12.6%

Hospital For Special Surgery
Attachment III
Population Summary

	2000 Census	2010 Census	2015 Projection	Population Growth 2000 to 2010	Population Growth 2010 to 2015
Stamford	116,837	122,643	123,710	5.0%	0.9%
Greenwich	61,360	61,171	61,783	-0.3%	1.0%
New Canaan	19,325	19,738	19,920	2.1%	0.9%
Darien	19,620	20,732	21,147	5.7%	2.0%
Subtotal Conn Service Area	217,142	224,284	226,560	3.3%	1.0%
Scarsdale	38,485	39,129	39,520	1.7%	1.0%
Rye	53,084	54,890	55,988	3.4%	2.0%
Marmaroneck	36,392	36,674	36,975	0.8%	0.8%
Subtotal- NY Portion of Service Area	127,961	130,693	132,483	2.1%	1.4%
Total Service Area	345,103	354,977	359,043	2.9%	1.1%
Aged 45-64	81,657	100,382	104,372	22.9%	4.0%
Aged 65 and over	49,342	50,191	55,672	1.7%	10.9%

Source- Caritas

Cartilage Injury After Acute, Isolated Anterior Cruciate Ligament Tear : Immediate and Longitudinal Effect With Clinical/MRI Follow-up

Hollis G. Potter, Sapna K. Jain, Yan Ma, Brandon R. Black, Sebastian Fung and Stephen Lyman

Am J Sports Med 2012 40: 276 originally published online September 27, 2011
DOI: 10.1177/0363546511423380

Cartilage Injury After Acute, Isolated Anterior Cruciate Ligament Tear

Immediate and Longitudinal Effect With Clinical/MRI Follow-up

Hollis G. Potter,*† MD, Sapna K. Jain,† MD, Yan Ma,‡ PhD,
Brandon R. Black,† MD, Sebastian Fung,† MD, and Stephen Lyman,‡ PhD
Investigation performed at the Hospital for Special Surgery, New York, New York

Background: Anterior cruciate ligament (ACL) tears have been implicated in the development of osteoarthritis. Limited data exist on longitudinal follow-up of isolated ACL injury.

Hypotheses: All isolated ACL tears are associated with some degree of cartilage injury that will deteriorate over time. There is a threshold of magnetic resonance imaging (MRI)–detectable cartilage injury that will correlate with adverse change in subjective patient-reported outcome measures.

Study Design: Cohort study, Level of evidence, 2.

Methods: The authors conducted a prospective, observational analysis of 42 knees in 40 patients with acute, isolated ACL injury (14 treated nonoperatively, 28 by reconstruction) with imaging at the time of injury and yearly follow-up for a maximum of 11 years. Morphologic MRI and quantitative T2 mapping was performed with validated outcome measures.

Results: All patients sustained chondral damage at initial injury. The adjusted risk of cartilage loss doubled from year 1 for the lateral compartment and medial femoral condyle (MFC) and tripled for the patella. By years 7 to 11, the risk for the lateral femoral condyle was 50 times baseline, 30 times for the patella, and 19 times for the MFC. There was increased risk of cartilage degeneration over the medial tibial plateau (MTP) (P = .047; odds ratio = 6.23; 95% confidence interval [CI], 1.03-37.90) and patella (P = .032; odds ratio = 4.88; 95% CI, 1.14-20.80) in nonsurgical patients compared with surgically treated patients. Size of the bone-marrow edema pattern was associated with cartilage degeneration from baseline to year 3 (P = .001 to .039). Each increase in the MFC Outerbridge score resulted in a 13-point decrease in the International Knee Documentation Committee subjective knee score (P = .0002). Each increase in the MTP resulted in a 2.4-point decrease in the activity rating scale (P = .002).

Conclusion: All patients with acute, traumatic ACL disruption sustained a chondral injury at the time of initial impact with subsequent longitudinal chondral degradation in compartments unaffected by the initial ''bone bruise,'' a process that is accelerated at 5 to 7 years' follow-up.

Keywords: anterior cruciate ligament; magnetic resonance imaging; cartilage; T2 mapping

The anterior cruciate ligament (ACL) is recognized as an important stabilizer of the knee that is commonly injured, with an estimated yearly incidence as high as 0.8 per 1000.[1] Anterior cruciate ligament tears have been implicated in the development of osteoarthritis (OA), with a natural history involving progressive loss of the articular cartilage in the face of recurrent instability.[14,45] The potential mechanisms and/or risk factors for OA in the ACL-deficient knee are multifactorial and include changes in gait mechanism, age at time of injury, the presence of meniscal or cartilage injury, instability, return to a high level of physical activity, and biologic factors such as activation of cytokine and protease cascades in the joint itself that increase the catabolism of chondrocytes.[1,7,8,19,36,39] Prior studies have reported variable occurrences of OA (40%-90%) 5-15 years after ACL injury.[2,8,18,34] This variability in reported occurrence of post-traumatic OA is likely related to study design, with differing lengths of follow-up obtained and scoring systems used for radiographic diagnosis of OA. The type of treatment also influences the progression or delay of OA, with prior studies demonstrating osteoarthritic changes at 10 to 15 years'

*Address correspondence to Hollis G. Potter, MD, Department of MRI, Hospital for Special Surgery, 535 East 70th St, New York, NY 10021 (e-mail: potterh@hss.edu).

†Department of MRI, Hospital for Special Surgery, New York, New York.

‡Department of Epidemiology and Biostatistics, Hospital for Special Surgery, New York, New York.

One or more of the authors has declared the following potential conflict of interest or source of funding: Funding for MRI examinations was provided by the Hospital for Special Surgery MRI research fund.

The American Journal of Sports Medicine, Vol. 40, No. 2
DOI: 10.1177/0363546511423380

follow-up after injury. No study to date has conclusively shown that ACL reconstruction protects the knee from the development of OA.[9,12,17,25,29,32,35]

While previous studies have assessed the biologic and clinical relevance of cartilage injuries sustained during ACL disruption, these data are often intermixed with concomitant meniscal and multiple ligament injuries.[1,41] The incidence of medial meniscal tears at the time of ACL rupture varies from 25% to 45%; and for the lateral meniscus, from 31% to 65%.[10,18,22,37,46] Meniscal tears as well as posterolateral corner injuries sustained at the time of injury have an increased risk of developing OA, thereby confounding the evaluation of isolated ACL injury and postreconstruction effects.[37]

Magnetic resonance imaging is an accurate, noninvasive means by which to assess the magnitude of cartilage injury, provided that pulse sequences used have been previously validated via a suitable standard.[38] The advent of more recent quantitative magnetic resonance pulse sequences has provided a means by which to assess matrix depletion in the traumatically injured knee. T2 mapping has been shown to correlate to collagen orientation using polarized light microscopy as the standard and may be performed at the time of morphologic assessment of the knee to evaluate associated cartilage matrix changes.[24,47]

The purposes of this longitudinal, observational study are 3-fold: to stratify the magnitude of cartilage injury sustained during an acute, isolated, ACL tear; to prospectively and longitudinally follow patients who underwent ACL reconstruction versus those treated nonoperatively over time; and, finally, to correlate the MRI findings with standardized clinical outcome measurements. Our hypotheses were that all isolated ACL tears are associated with some degree of articular cartilage injury that is detectable on MRI with appropriate pulse sequencing, and that the integrity of articular cartilage will deteriorate over time after the initial injury. We further hypothesized that there would be a threshold of MRI-detectable cartilage injury that would correlate with adverse change in subjective functional patient-reported outcome measures.

MATERIALS AND METHODS

Study Participants

This study was designed as a prospective, longitudinal, pragmatic cohort MRI study and was conducted after study protocols and procedures were approved by our Institutional Review Board. All 40 participants provided informed consent. The enrollment period ran from February 1994 to March 2005 and patients were recruited at the time of initial MRI evaluation for acute ACL tear. The study was conceived as a pragmatic prospective cohort study, with the plan being to invite patients to return for yearly MRI but with the understanding that these likely young, healthy, mobile patients would not realistically be expected to return every single year. Patients were followed yearly with a maximum 11-year follow-up. The Appendix (available online at http://ajs.sagepub.com/supplemental/) graphically displays the follow-up patterns of the cohort. All 42 knees (40 patients) enrolled had at least 1 follow-up visit, while 22 contributed multiple follow-up visits and 7 patients contributed at least 3 follow-up visits (see online Appendix).

Inclusion criteria included acute full-thickness ACL disruption by MRI and clinical examination, a time between initial injury and MRI of 8 weeks or less, and age at the initial injury less than or equal to 55 years. Exclusion criteria included grade 2 or higher clinical assessment of a concomitant medial collateral ligament or posterior cruciate ligament tear, any posterolateral corner injury requiring treatment, preexisting modified Outerbridge grade 3 or higher femorotibial or patellofemoral cartilage loss, and intrasubstance meniscal tear, including horizontal, vertical, or complex tears.[38] Isolated fascicle disruption of the lateral meniscus was not a criterion for exclusion, provided it did not require primary meniscal repair. Patients were censored from additional follow-up if they experienced an additional injury to the study knee requiring orthopaedic consultation; as of the last follow-up, no patients encountered this issue. The decision to treat the patients with surgical reconstruction or nonoperative management was based on the patient's individual activity profile but not upon age, degree of instability, or MRI results, given the lack of associated meniscal tears or preexisting OA.

Clinical Assessment

At the time of baseline imaging and all follow-up visits, all patients completed validated patient-reported outcome measures. The subjective questionnaires included the Medical Outcomes Study Short Form-36 (SF-36), the subjective knee score from the International Knee Documentation Committee (IKDC), and the Activity of Daily Living (ADL) and Activity Rating Scale (ARS) scores.[20,21,33,44] While the SF-36 scale is designed for broad use in a variety of medical conditions, the IKDC, ADL, and ARS scales are joint-specific instruments.

Magnetic Resonance Image Acquisition

Each participant underwent MRI of the signal knee (as defined above) at baseline and, when possible, at yearly intervals. Time from initial injury to MRI was less than or equal to 8 weeks.

The MRI evaluation was performed utilizing a standard clinical 1.5-T MRI unit (Signa LX or HDX 1.5 T, GE Healthcare, Waukesha, Wisconsin). All images were performed with a standardized quadrature or 8-channel knee coil (Invivo Inc, Gainesville, Florida). The MRI pulse sequences at the time of initial evaluation included a standardized cartilage-sensitive protocol using a moderate echo time (TE), fast spin-echo (FSE) technique, with repetition time (TR) 3500 to 6500 milliseconds; TE, 28 to 36 milliseconds (effective); and matrix 512 × 384 (sagittal), 512 × 256 to 288 (coronal), and 512 × 256 to 288 (axial) at 2 excitations. Standardized FSE cartilage imaging provided an in-plane resolution of 253-312 × 338-416 microns.

Additional sagittal frequency selective fat-suppression pulse sequence was performed with a TR of 4000 to 6000 milliseconds; TE, 40 to 50 milliseconds (effective); and matrix 256 × 224, at 2 excitations. Slice thickness for the sagittal non–fat suppression was 3.5 mm with no gap and for the fat suppression was 4.0 mm with no gap; coronal images were obtained with a 3.5-mm slice thickness without gap, as were the axials.

Follow-up MRI examination also included the above pulse sequences as well as quantitative T2 mapping in the sagittal plane using a multislice, multiecho modified CPMG (Carr, Purcell, Meiboom, Gill) pulse sequence that utilizes interleaved slices and tailored refocusing pulses to minimize contribution from stimulated echoes.[31] Quantitative MRI sequences were performed in the sagittal plane with a TR of 1000 milliseconds, 8 echo samples ranging between 8 and 64 milliseconds, with a matrix of 256 × 256, slice thickness of 2 mm/0 gap, and a receiver bandwidth of 31.25 kHz. The T2 mapping sequence was limited to the lateral compartment in the sagittal plane, at the site of the initial bone bruise, given the constraints of the software available at the time of initial patient entry and the efforts to keep the MRI examination within clinically acceptable time constraints.

After image acquisition, data sets were analyzed on a pixel-by-pixel basis with a 2-parameter weighted least-squares fit (Functool 3.1, GE Healthcare), assuming a monoexponential decay. Quantitative T2 values were calculated by taking the natural logarithm of the signal decay curve in a selected region of interest (ROI). Standardized size and anatomic location ROIs obtained for quantitative T2 mapping included deep and superficial halves of the lateral tibial plateau, lateral femoral condyle, and patella. Care was taken to not include the subchondral plate or synovial fluid, and caution was also exercised to avoid sampling at the magic angle.

Magnetic Resonance Image Interpretation

All magnetic resonance images were evaluated by a senior, board-certified musculoskeletal radiologist with over 15 years' experience in MRI interpretation; quantitative T2 maps were assessed by the senior MRI radiologist and a board-certified musculoskeletal MRI radiology fellow with at least 4 years of experience. The radiologists were blinded to the time of the interval follow-up but were aware that it was a follow-up examination after ACL tear. The magnetic resonance images were scrutinized for modified Outerbridge assessment of the lateral tibial plateau, lateral femoral condyle, medial femoral condyle, medial tibial plateau, trochlea, and patella. The modified Outerbridge score was denoted as follows: 0, intact cartilage with normal signal; 1, increased signal intensity with no loss of cartilage thickness; 2, loss of cartilage thickness affecting less than 50% of the cartilage thickness; 3, loss of greater than 50% of the cartilage thickness without exposed bone; and 4, full-thickness cartilage loss with exposed bone.[38] Bone-marrow edema pattern was assessed and quantified as absent, mild (<1 cm^2), or severe (>1 cm^2), over both the femoral condyles and the tibial plateaus. The subchondral plate was also evaluated as normal, depressed, or proud, as were the plateaus and the condyles. Osteophytes were assessed over the condyles and plateaus as absent, small (<2 mm), or large (≥ 2 mm). Sclerosis was scored as absent, mild (<1 cm^2), or severe (≥ 1 cm^2).

Statistical Analysis

Descriptive statistics were calculated as follows: continuous variables are presented as mean ± standard deviation (SD) and categorical variables are described as frequencies and percentages. Comparisons between groups were made by applying nonparametric Mann-Whitney *U* or Kruskal-Wallis tests as appropriate or parametric independent-samples *t* tests or 1-way analysis of variance according to the distribution of the data. Multinomial logistic regression analysis with inference based on the generalized estimating equations method was conducted to identify the changes in ordinal outcomes over time while adjusting for age, sex, and type of surgery. In the regression analysis for each individual predictor, odds ratios, 95% confidence intervals (CIs), and *P* values were calculated. The method allows for time variant outcomes and provides simultaneous estimates of the effect of time and other predictors on the outcome. A sensitivity analysis was also performed (not presented), removing the 7 patients who had only baseline and 1-year follow-up time points, but this analysis did not appreciably alter the results. All statistical analyses were performed using SAS version 9.2 (SAS Institute, Cary, North Carolina).

RESULTS

Forty patients were enrolled (24 women, 16 men), with a mean age of 37.2 years at the time of injury (range, 15-53 years) (Table 1). Two patients had both knees included, which were injured at 3-year time intervals. Mechanism of injury was low velocity, noncontact in 35 knees; high velocity, contact in 6 knees; and high velocity, noncontact in 1 knee. Fourteen knees were treated nonsurgically and 28 underwent ACL reconstruction (using autologous patellar tendon [n = 20], autologous hamstring tendon [n = 5], and allograft Achilles tendon [n = 3]). The mean age of the surgical group was 35.1 years (SD, 8.2 years), and the mean age of the nonsurgical group was 41.5 years (SD, 9.7 years). All surgically treated patients underwent the standard postoperative rehabilitation protocol, and the nonoperatively treated patients underwent a standardized rehabilitation regimen.

No meniscal repair or partial meniscectomy was performed in the surgical group. At baseline, there were additional low-grade injuries noted on MRI: for the medial collateral ligament, 17 were intact, 17 knees had low-grade partial tears, and 8 had moderate partial tears that did not require surgical intervention; for the lateral collateral ligament, 35 were intact and 7 had low-grade partial tears; for the popliteus tendon, 40 were intact and 2 had low-grade partial tears. For the lateral meniscal fascicles, there were 16 torn, 13 partial tears, and 13 intact. Only 3 meniscocapsular separations of the medial meniscus were noted.

TABLE 1
Characteristics of ACL-Injured Patients at Baseline[a]

	All Knees (N = 42)	Surgery (n = 28)	No Surgery (n = 14)	*P* Value
Demographics				
Age (y) at injury, mean ± SD	37.2 ± 9.1	35.1 ± 8.2	41.5 ± 9.7	.030
Weeks to initial MRI, mean ± SD	2.4 ± 1.9	2.7 + 2.1	1.9 ± 1.3	.209
Female, no. (%)	24 (60.0)	14 (51.9)	10 (76.9)	.092
Noncontact, no. (%)	35 (83.3)	24 (85.7)	11 (78.6)	.596
High velocity, no. (%)	7 (16.7)	4 (14.3)	3 (21.4)	.668
Surgery type, n (%)				
Achilles tendon allograft		3 (10.7)		
Bone–patellar tendon–bone		20 (71.4)		
Hamstring tendon		5 (17.9)		
MRI findings, no. (%)				
Outerbridge LFC Cartilage Loss[b]	28 (66.7)	18 (64.3)	10 (71.4)	.738
Outerbridge LTP Cartilage Loss	37 (88.1)	24 (85.7)	13 (92.9)	.650
Outerbridge MFC Cartilage Loss	4 (10.0)	1 (3.6)	3 (21.4)	.100
Outerbridge MTP Cartilage Loss	1 (2.4)	0 (0.0)	1 (7.1)	.333
Outerbridge Patella Cartilage Loss	11 (2.62)	4 (14.3)	7 (50.0)	.024
Outerbridge Trochlea Cartilage Loss	4 (10.0)	1 (3.6)	3 (21.4)	.333
Bone-marrow edema in LFC	30 (71.4)	18 (64.3)	12 (85.7)	.277
Bone-marrow edema in LTP	36 (85.7)	24 (85.7)	12 (85.7)	.999
Patient-reported outcomes measures, mean ± SD				
IKDC score	36.8 ± 13.9	39.1 ± 22.8	34.5 ± 6.5	.809
Knee outcome survey ADL score	57.5 ± 21.8	68.8 ± 30.1	46.3 ± 3.5	.403
SF-36 physical component score	44.0 ± 8.6	50.4 ± 2.6	37.5 ± 7.1	.139
SF-36 mental component score	51.2 ± 11.2	56.3 ± 1.4	46.1 ± 16.5	.476
Marx activity score	11.3 ± 3.6	8.5 ± 0.7	14.0 ± 2.8	.116

[a]ACL, anterior cruciate ligament; SD, standard deviation; LFC, lateral femoral condyle; LTP, lateral tibial plateau; MFC, medial femoral condyle; MTP, medial tibial plateau; IKDC, International Knee Documentation Committee; ADL, Activity of Daily Living; SF-36, Short Form-36.
[b]For the purposes of this table, Outerbridge score of ≥2 was considered positive for baseline cartilage loss; 0-1 was considered negative for baseline cartilage loss.

Bone-Marrow Edema

In the lateral tibial plateau, the size of the bone-marrow edema pattern at baseline was significantly associated with increased cartilage loss at year 1 (*P* = .001), year 2 (*P* = .008), and year 3 (*P* = .039). In the lateral femoral condyle, the size of the bone-marrow edema pattern at baseline was significantly associated with increased cartilage loss at year 1 (*P* = .030) and year 2 (*P* = .025). No association between cartilage loss and baseline bone-marrow edema pattern was found at time points after 3 years. There was no statistically significant difference in the bone-marrow edema as a result of high- versus low-velocity injury, either on the femur (*P* = .678) or the tibia (*P* = .841).

Unrelated to mechanism of injury, bone-marrow edema pattern was more severe in the surgical group over the tibia (60.7% severe) compared with 14.2% in the nonsurgical group, but over time there was a mean rise in Outerbridge scores for all compartments. A notable increase occurred at the 5-year follow-up, particularly in the lateral femoral condyle, patella, and trochlea.

Cartilage Injury/Loss

At the time of initial injury, 42 patients (100%) sustained an MRI-detectable cartilage injury, most severely over the lateral tibial plateau (Figure 1 and Figure 2A). The initial mean Outerbridge score of the nonsurgical group of the lateral tibial plateau was 3.0 (SD, 0.9), and 3.0 (SD, 1.1) for the lateral tibial plateau in the surgical group. The second most common acute chondral injury was over the lateral femoral condyle, with a mean Outerbridge score of 1.8 in the nonsurgical group and 1.8 in the surgical group. To assess any baseline differences in the cartilage status between the nonoperatively treated cohort and the reconstructed cohort, we compared the baseline medial femorotibial and patellofemoral compartments that were unaffected by the initial bone bruise over the lateral compartment. Only the patellofemoral joint showed a greater baseline (but still mild) degree of cartilage loss (*P* = .024) in the nonoperatively treated group compared with the reconstructed group.

Adjusting for age, sex, and type of surgery, in a generalized estimating equations model, the risk of cartilage lost doubled from year 1 for the lateral femoral condyle, lateral tibial plateau, and medial femoral condyle, and tripled for the patella (Figure 3). Regardless of surgical intervention, by years 7 to 11 after injury, the risk of cartilage loss for lateral femoral condyle was 50 times that of baseline (95% CI, 10.3-242), 30 times that for the patella (95% CI, 7.8-115), and 19 times for the medial femoral condyle (95% CI, 4.6-79.9) (Figure 3).

Figure 1. Sagittal fat-suppressed T2-weighted (A) and sagittal non–fat suppressed intermediate echo time fast spin echo (B) MRI sequences demonstrate a bone-marrow edema pattern 2 days after anterior cruciate ligament tear (A), with depression of the far posterior margin of the lateral tibial plateau as well as focal violation of the cartilage (arrow on B).

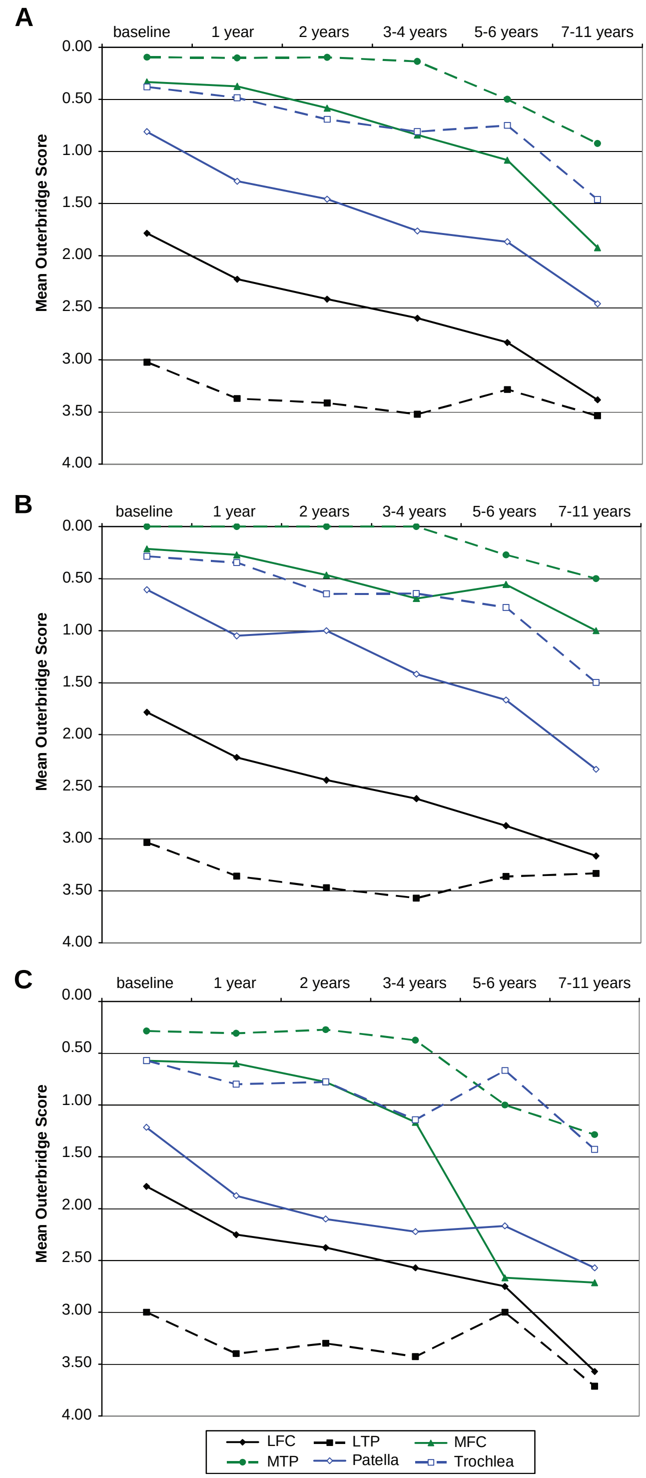


Figure 2. (A) Outerbridge scores over time (all patients); (B) Outerbridge scores over time (surgical cohort); (C) Outerbridge scores over time (nonsurgical cohort). LFC, lateral femoral condyle; LTP, lateral tibial plateau; MFC, medial femoral condyle; MTP, medial tibial plateau.

Adjusting for time, age, and sex and when comparing the nonsurgical patients with the surgical patients, the risk of cartilage loss over the medial tibial plateau was significant (P = .003). The nonsurgical group had statistically significant, higher odds ratio effect (5.9; 95% CI, 1.2-27.9) for cartilage loss over the medial tibial plateau, compared with the surgical group. The regression analysis adjusted for time also showed an increased risk of cartilage loss over the

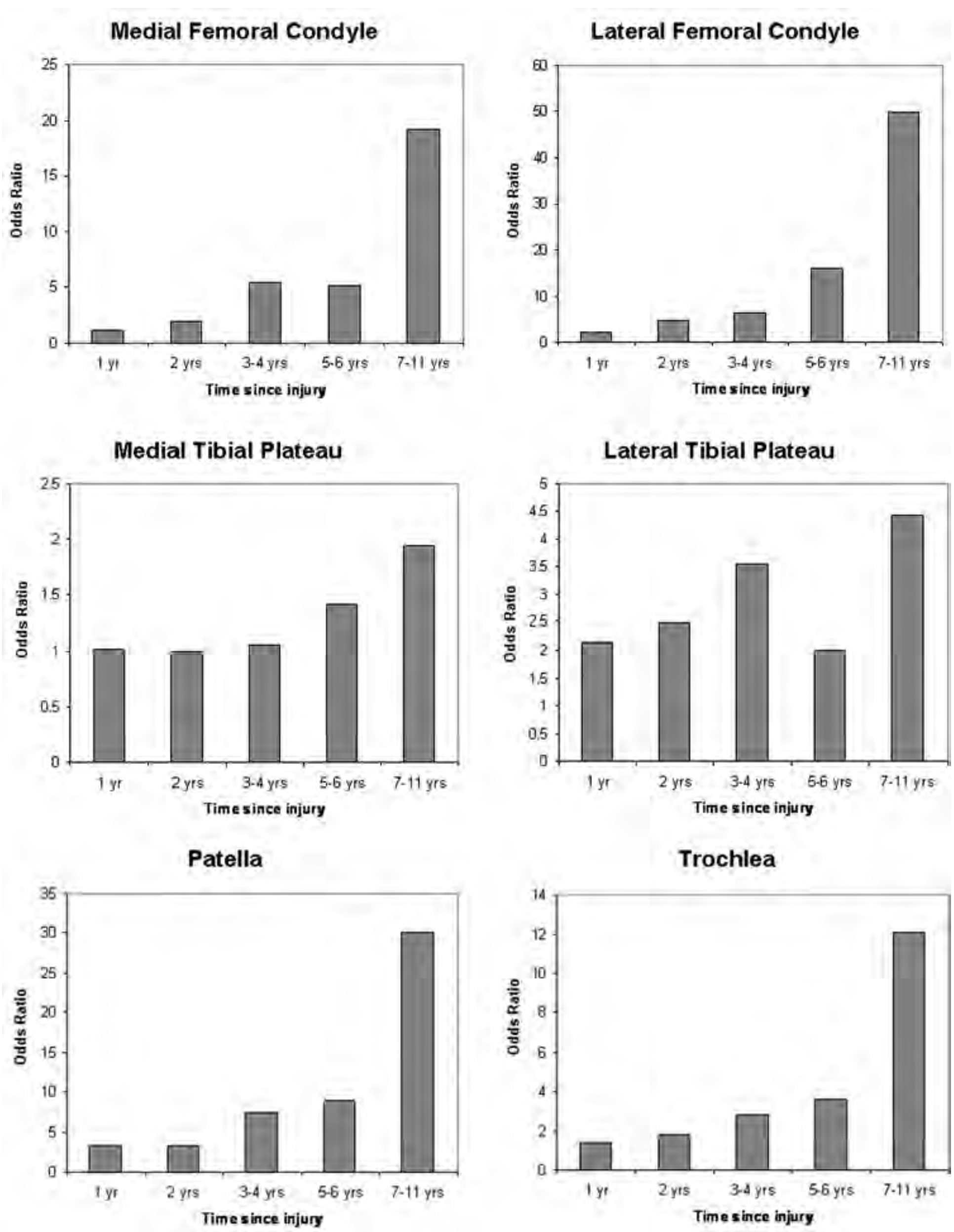


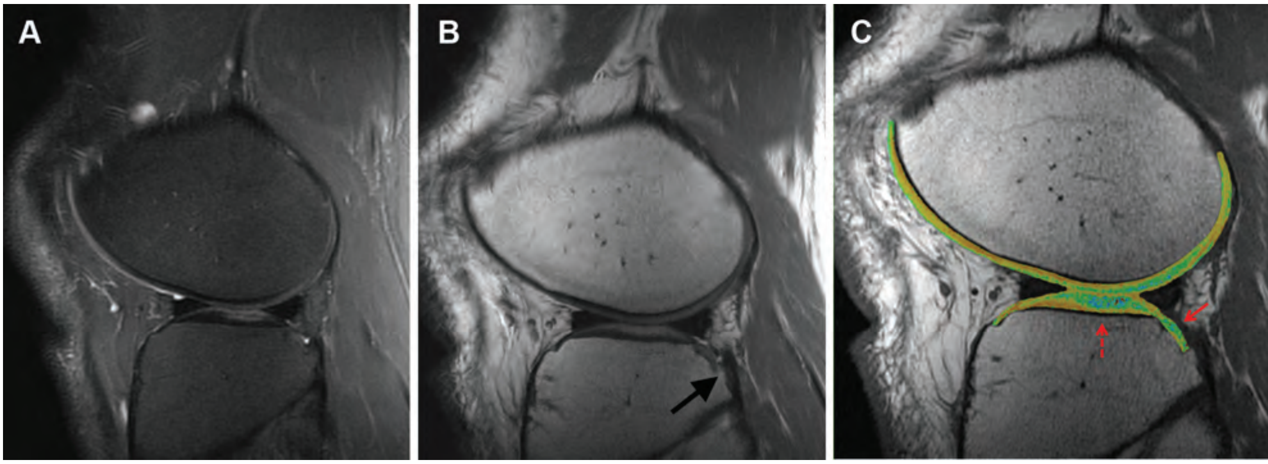
Figure 3. Odds ratios compared with baseline measurements (scales vary by table).

patella (P = .02; odds ratio, 4.9; 95% CI, 1.2-19.9), but when adjusted additionally for age and sex, this did not prove statistically significant (P = .15; odds ratio, 2.9; 95% CI, 0.7-12.4), although the odds ratio still suggested a nearly 3-fold increased likelihood of cartilage loss.

Progressive prolongation of T2 values compared with the values at year 1 were seen for both the lateral femoral condyle (P = .039) and the patella (superficial, P = .004; deep, P = .037) (Figures 4 and 5).

Clinical Scales

At 1-year follow-up, the mean ARS score was 8.5 ± 5.7 for the surgical group and 1.3 ± 1.5 for the nonsurgical group. The difference, however, was not significantly different between the groups (P = .056). In year 2, the mean ARS score was similar between the 2 groups (8.5 ± 6.1 nonsurgical vs 8.2 ± 5.6 for surgical). At year 3, a higher ARS score was found in the nonsurgical group (10.0 ± 4.9) versus the surgical group (5.6 ± 3.9), but this difference was not significant (P = .088). Each increase in the medial femoral condyle Outerbridge score resulted in a 13-point decrease in the IKDC (P = .0002). Each increase in the medial tibial plateau Outerbridge score resulted in a 2.4-point decrease in the ARS (P = .002). No significant differences were found for the knee outcomes survey ADL scores or for the SF-36 scores.



Figures 4. The same patient as in Figure 1, at 22 months after injury. (A) The fat-suppressed T2-weighted image demonstrates resolution of bone-marrow edema pattern. (B) The cartilage-sensitive sequence shows depression of the far posterolateral tibial plateau with cartilage loss. Focal proud bone formation is seen over the site of prior transchondral impaction (arrow). (C) Sagittal quantitative T2 relaxation time map of the lateral femorotibial joint cartilage, color-coded to reflect T2 values ranging from 10 milliseconds (orange) to 90 milliseconds (blue), shows prolongation of T2 relaxation times over the far posterolateral tibial plateau (solid arrow) as well as over the central lateral tibial plateau (dashed arrow), an area that was not involved by the initial ''bone bruise.''

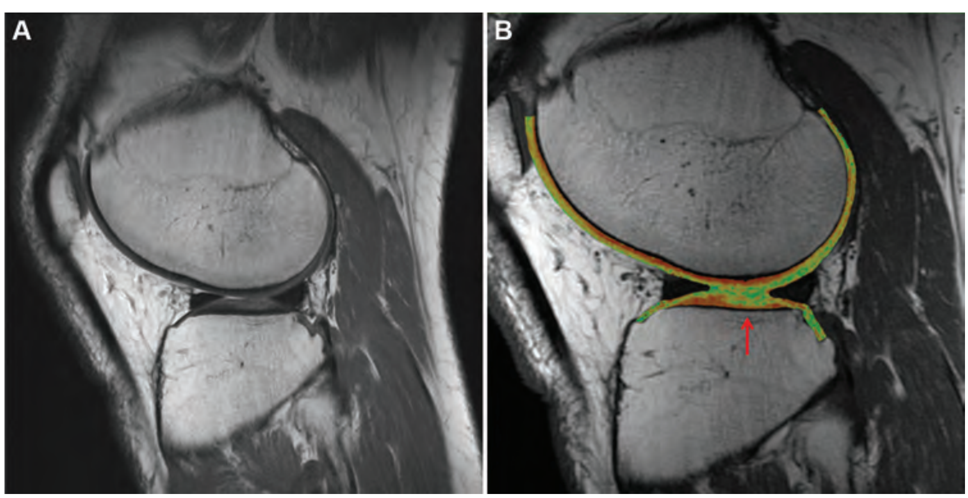


Figure 5. The same patient as in Figures 1 and 4, 4 years after injury. (A) Morphologic sequence demonstrates depression of the far posterolateral tibial plateau. (B) Sagittal quantitative T2 relaxation time map of the lateral femorotibial joint cartilage, color-coded to reflect T2 values ranging from 10 milliseconds (orange) to 90 milliseconds (blue), shows progressive prolongation of T2 relaxation times over the central lateral tibial plateau (red arrow) compared with the study at 22 months after injury.

DISCUSSION

The rationale for reconstructing the ACL is to restore the kinematics of the knee, treat symptomatic joint instability, and presumably to prevent the development of posttraumatic knee OA.[4,34] The prevention or delay of knee OA has, however, been debated, with several studies reporting malfunction and/or variable degrees of OA as sequelae of reconstruction.[9,17,25,32,35] Louboutin et al[30] found that at 20-year follow-up, the reported risk of developing OA was lower after ACL reconstruction (14%-26% with a normal medial meniscus, 37% with meniscectomy) compared with nonoperatively treated ACL insufficiency (60%-100%). Frobell et al[13] conducted a randomized, controlled trial of young (mean age, approximately 26 years) athletes with acute ACL injury who were treated with rehabilitation and early ACL reconstruction versus rehabilitation with the option of delayed reconstruction, and noted no significant differences between the 2 groups with regard to mean Knee Injury and Osteoarthritis Outcome Score or secondary outcome measures. Our data in an older cohort (mean age, approximately 37 years) suggest that there may be a chondroprotective effect for ACL reconstruction.

Proposed mechanisms for OA after reconstruction include alterations in gait mechanics, type of autograft, age at intervention, period between injury and surgery, activity level, residual instability, presence of irreparable meniscal tears or history of meniscectomy, and chondral lesions.[§] Among these, articular cartilage and meniscus status, a key secondary stabilizer of the knee, at the time of surgery are considered particularly important.[40] Ferretti et al[11] found that in knees with ACL injuries without meniscal tear or meniscal repair, reconstruction preserved the joint but not in cases where irreparable meniscal tears or meniscectomy occurred. No study has yet conclusively indicated that ACL reconstruction protects the knee from OA.[11] The current data suggest that the risk of OA progression was higher for nonoperatively treated patients, particularly over the medial tibial plateau and patella.

Our data demonstrated an initially higher (but not statistically significant) ARS in the reconstructed group, suggesting that these individuals placed greater demands on the knee; however, by year 3, the ARS was higher in the nonoperatively managed group (again, not significant). The wider SDs likely reflect the diversity of our patient population in both groups, which is not isolated to elite athletes but all patients presenting with acute ACL tears in the absence of preexisting OA. With regard to the IKDC scales (Figure 6), there appeared to be a delayed return to function in the nonoperatively treated group, but by 2 years their course appeared similar to the surgically treated group. This may reflect the expected greater motivation to higher function in those patients electing surgical management of ligament injuries.

Much of the controversy of the risk of OA after ACL tear has arisen because of limited documentation of the prevalence of cartilage lesions sustained during ACL tear. Limitations of radiography in the evaluation of early OA include 2-dimensionality, high precision error of measurement, and typical 1- to 2-year requirement to assess changes of degenerative joint disease resulting in imperfect correlation of radiographic findings with clinical symptoms.[5,15,16,28] We chose to prospectively follow patients with acute ACL injury with a standardized, cartilage-sensitive MRI evaluation, using a pulse sequence that has a reported accuracy of 92% based on arthroscopy as a standard in over 600 surfaces, with a high reproducibility, yielding a weighted kappa of 0.93.[38] Quantitative T2 techniques were also applied to measure collagen orientation changes within the cartilage.[24,47] The advent of improved MRI technology has resulted in the detection of a higher incidence of traumatic chondral injuries.

The current study establishes that patients with acute traumatic ACL disruption, in the absence of meniscal tear or preexisting moderate to severe cartilage loss, sustain a chondral injury that is detectable at the time of injury using appropriate MRI sequencing, and further,

§References 1, 3, 6, 8, 11, 25, 26, 36, 40, 43.

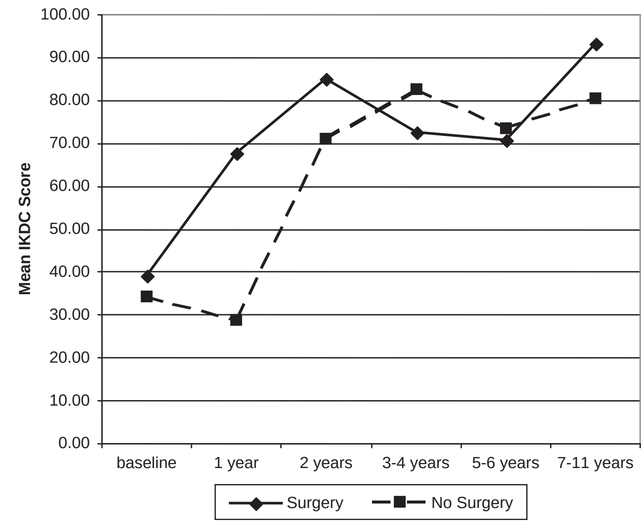


Figure 6. International Knee Documentation Committee (IKDC) scores over time.

that there is a longitudinal degradation over time that is accelerated at 5 to 7 years' follow-up. The most severe initial chondral injuries were noted over the lateral compartment, where the pivot shift and transchondral impaction occurs, yet the rate of progression was high for the medial compartment as well as the patellofemoral joint, suggesting an accelerated progression in the "natural" rate of chondral loss after ACL injury. Additional studies will hopefully elucidate the interactions between the damaged cartilage and the potential for progressive stiffening in the impacted subchondral bone, as the study of traumatically induced OA should ideally assess global joint integrity. This study has additionally demonstrated some statistically significant associations between the progression of cartilage loss and an adverse effect on subjective clinical outcome instruments of patient function. These data indicate that the cartilage injury at the time of ACL tear and resultant joint degeneration is a clinically relevant phenomenon. The degradation in compartments unaffected by the initial bone bruise also supports the notion that chondral injury sustained at the time of the transchondral fracture and pivot shift affects overall cartilage homeostasis, resulting in a global degradation in joint integrity. This is further supported by the prolongation of T2 relaxation times in areas that were not initially covered by the bone-marrow edema pattern (Figure 5).

Prior studies have shown significantly elevated quantitative T1ρ values, a marker of proteoglycan loss, of the posterolateral tibial cartilage in ACL-injured knees at baseline compared with normal controls that did not fully recover at 1-year follow-up.[27] Li et al[27] further demonstrated prolongation of T1ρ in the superficial layers in the medial compartments as well as T2 prolongation in the superficial margin of the medial femoral condyle but not in the deep layer of the compartments, indicating a preferential effect in the superficial portions of the articular surface. Tiderius et al[42] demonstrated depletion of proteoglycan, as measured by delayed gadolinium-enhanced MRI (dGEMRIC) index, over the bone-marrow lesions of the lateral femoral condyle in 15 of 24 patients after acute ACL injury. The investigators noted a similar effect in the medial femoral condyle that was unaffected by the initial transchondral fracture, further suggesting more globally altered cartilage homeostasis as a result of the injury.[42]

The finding of cartilage lesion(s) after all ACL tears differs from prior studies that reported a lower prevalence of articular cartilage injuries noted at arthroscopy.[41] This is likely attributable to the fact that many of the initial traumatic cartilage injuries were localized over the eccentric posterior margin of the lateral tibial plateau, an area that is not easily evaluated at arthroscopic inspection. Spindler et al[41] evaluated 54 patients with ACL tears at the time of surgery and noted that 25 of 54 (46%) had an articular cartilage lesion at arthroscopy, most commonly over the lateral femoral condyle, an area more easily evaluated at surgery compared with the far posterior margin of the plateau. Johnson et al[23] further evaluated a small cohort of 10 patients with acute ACL tear and subsequent biopsy of the lateral femoral condyle during ligament reconstruction and reported chondrocyte degeneration, depletion of extracellular matrix, osteocyte necrosis, and empty lacunae, indicative of depletion of matrix from both cartilage and bone. It is clear from both the data generated in this current study as well as previous studies that the bone "bruise" sustained during an acute ACL tear is a transchondral fracture of varying severity, and results in cartilage degradation over time.

A limitation of the current study is a lack of a representative control group of ACL-intact patients. This was intended as an observational, longitudinal analysis of patients with relatively intact cartilage and injury isolated to the ACL without concomitant meniscal tear requiring surgical intervention. It is conceivable that the rate of OA observed in this cohort may also be seen in the setting of cartilage degradation in the absence of ACL tears; however, the marked progression in arthritis at the 5-year interval would be unusual for an ACL-intact cohort, in the absence of any confounding variables that affect disease progression, such as meniscal tear. The lack of a control group reflects the challenges associated with long-term, longitudinal analysis of asymptomatic individuals. Additional limitations include the lack of ability to obtain quantitative data throughout the entire knee, limiting the longitudinal quantitative T2 analysis to the lateral compartment at the site of the bone bruise. This is because of restrictions of the software and time limitations at the initiation of this study.

Despite these limitations, the study clearly demonstrates that all ACL tears are associated with transchondral fractures of varying severity, resulting in a chondral injury that is detectable by standardized morphologic MRI assessment, with progression in cartilage degradation over time. This may have implications for potential chondroprotective intervention and/or alteration in rehabilitation regimens at the time of injury. These data help to improve the understanding of the pathogenesis of OA following ACL tear and provide imaging information that can guide the development of potential preventive and disease-modifying treatments.

ACKNOWLEDGMENT

The authors thank the following individuals for their support: Robert G. Marx, MD, Thomas L. Wickiewicz, MD, Jo A. Hannafin, MD, PhD, Wendy Brown, MD, Russell F. Warren, MD, and Scott A. Rodeo, MD.

REFERENCES

1. Ait Si Selmi T, Fithian D, Neyret P. The evolution of osteoarthritis in 103 patients with ACL reconstruction at 17 years follow-up. *Knee*. 2006;13(5):353-358.
2. Andersson C, Odensten M, Gillquist J. Knee function after surgical or nonsurgical treatment of acute rupture of the anterior cruciate ligament: a randomized study with a long-term follow-up period. *Clin Orthop Relat Res*. 1991;264:255-263.
3. Asano H, Muneta T, Ikeda H, et al. Arthroscopic evaluation of the articular cartilage after anterior cruciate ligament reconstruction: a short-term prospective study of 105 patients. *Arthroscopy*. 2004;20(5):474-481.
4. Brophy RH, Selby RM, Altchek DW. Anterior cruciate ligament revision: double-bundle augmentation of primary vertical graft. *Arthroscopy*. 2006;22(6):683.e1-e5.
5. Buckland-Wright JC: Quantitative radiography of osteoarthritis. *Ann Rheum Dis*. 1994;53(4):268-275.
6. Butler RJ, Minick KI, Ferber R, Underwood F. Gait mechanics after ACL reconstruction: implications for the early onset of knee osteoarthritis. *Br J Sports Med*. 2009;43(5):366-370.
7. Cameron M, Buchgraber A, Passler H, et al. The natural history of the anterior cruciate ligament-deficient knee: changes in synovial fluid cytokine and keratan sulfate concentrations. *Am J Sports Med*. 1997;25(6):751-754.
8. Cohen M, Amaro JT, Ejnisman B, et al. Anterior cruciate ligament reconstruction after 10 to 15 years: association between meniscectomy and osteoarthrosis. *Arthroscopy*. 2007;23(6):629-634.
9. Daniel DM, Stone ML, Dobson BE, Fithian DC, Rossman DJ, Kaufman KR. Fate of the ACL-injured patient: a prospective outcome study. *Am J Sports Med*. 1994;22(5):632-644.
10. DeHaven KE. Arthroscopy in the diagnosis and management of the anterior cruciate ligament deficient knee. *Clin Orthop Relat Res*. 1983;172:52-56.
11. Ferretti A, Conteduca F, De Carli A, Fontana M, Mariani PP. Osteoarthritis of the knee after ACL reconstruction. *Int Orthop*. 1991;15(4):367-371.
12. Fithian DC, Paxton EW, Stone ML, et al. Prospective trial of a treatment algorithm for the management of the anterior cruciate ligament-injured knee. *Am J Sports Med*. 2005;33(3):335-346.
13. Frobell RB, Roos EM, Roos HP, Ranstam J, Lohmander LS. A randomized trial of treatment for acute anterior cruciate ligament tears. *N Engl J Med*. 2010;363(4):331-342.
14. Gelber AC, Hochberg MC, Mead LA, Wang NY, Wigley FM, Klag MJ. Joint injury in young adults and risk for subsequent knee and hip osteoarthritis. *Ann Intern Med*. 2000;133(5):321-328.
15. Hannan MT, Felson DT, Pincus T. Analysis of the discordance between radiographic changes and knee pain in osteoarthritis of the knee. *J Rheumatol*. 2000;27(6):1513-1517.
16. Hayes CW, Jamadar DA, Welch GW, et al. Osteoarthritis of the knee: comparison of MR imaging findings with radiographic severity measurements and pain in middle-aged women. *Radiology*. 2005;237(3):998-1007.
17. Hertel P, Behrend H, Cierpinski T, Musahl V, Widjaja G. ACL reconstruction using bone-patellar tendon-bone press-fit fixation: 10-year clinical results. *Knee Surg Sports Traumatol Arthrosc*. 2005;13(4):248-255.
18. Indelicato PA, Bittar ES. A perspective of lesions associated with ACL insufficiency of the knee: a review of 100 cases. *Clin Orthop Relat Res*. 1985;198:77-80.

19. Irie K, Uchiyama E, Iwaso H. Intraarticular inflammatory cytokines in acute anterior cruciate ligament injured knee. *Knee*. 2003;10(1):93-96.
20. Irrgang JJ, Ho H, Harner CD, Fu FH. Use of the International Knee Documentation Committee guidelines to assess outcome following anterior cruciate ligament reconstruction. *Knee Surg Sports Traumatol Arthrosc*. 1998;6(2):107-114.
21. Irrgang JJ, Snyder-Mackler L, Wainner RS, Fu FH, Harner CD. Development of a patient-reported measure of function of the knee. *J Bone Joint Surg Am*. 1998;80(8):1132-1145.
22. Irvine GB, Glasgow MM. The natural history of the meniscus in anterior cruciate insufficiency: arthroscopic analysis. *J Bone Joint Surg Br*. 1992;74(3):403-405.
23. Johnson DL, Urban WP Jr, Caborn DN, Vanarthos WJ, Carlson CS. Articular cartilage changes seen with magnetic resonance imaging-detected bone bruises associated with acute anterior cruciate ligament rupture. *Am J Sports Med*. 1998;26(3):409-414.
24. Kelly BT, Potter HG, Deng XH, et al. Meniscal allograft transplantation in the sheep knee: evaluation of chondroprotective effects. *Am J Sports Med*. 2006;34(9):1464-1477.
25. Kessler MA, Behrend H, Henz S, Stutz G, Rukavina A, Kuster MS. Function, osteoarthritis and activity after ACL-rupture: 11 years follow-up results of conservative versus reconstructive treatment. *Knee Surg Sports Traumatol Arthrosc*. 2008;16(5):442-448.
26. Küllmer K, Letsch R, Turowski B. Which factors influence the progression of degenerative osteoarthritis after ACL surgery? *Knee Surg Sports Traumatol Arthrosc*. 1994;2(2):80-84.
27. Li X, Kuo D, Theologis A, et al. Cartilage in anterior cruciate ligament-reconstructed knees: MR imaging T1{rho} and T2–initial experience with 1-year follow-up. *Radiology*. 2011;258(2):505-514.
28. Link TM, Steinbach LS, Ghosh S, et al. Osteoarthritis: MR imaging findings in different stages of disease and correlation with clinical findings. *Radiology*. 2003;226(2):373-381.
29. Linko E, Harilainen A, Malmivaara A, Seitsalo S. Surgical versus conservative interventions for anterior cruciate ligament ruptures in adults. *Cochrane Database Syst Rev*. 2005;(2):CD001356.
30. Louboutin H, Debarge R, Richou J, et al. Osteoarthritis in patients with anterior cruciate ligament rupture: a review of risk factors. *Knee*. 2009;16(4):239-244.
31. Maier CF, Tan SG, Hariharan H, Potter HG. T2 quantitation of articular cartilage at 1.5 T. *J Magn Reson Imaging*. 2003;17(3):358-364.
32. Maletius W, Messner K. Eighteen- to twenty-four-year follow-up after complete rupture of the anterior cruciate ligament. *Am J Sports Med*.1999;27(6):711-717.
33. Marx RG, Stump TJ, Jones EC, Wickiewicz TL, Warren RF. Development and evaluation of an activity rating scale for disorders of the knee. *Am J Sports Med*. 2001;29(2):213-218.
34. McDaniel WJ Jr, Dameron TB Jr. The untreated anterior cruciate ligament rupture. *Clin Orthop Relat Res*. 1983;172:158-163.
35. Myklebust G, Holm I, Maehlum S, Engebretsen L, Bahr R. Clinical, functional, and radiologic outcome in team handball players 6 to 11 years after anterior cruciate ligament injury: a follow-up study. *Am J Sports Med*. 2003;31(6):981-989.
36. Neuman P, Englund M, Kostogiannis I, Fridén T, Roos H, Dahlberg LE. Prevalence of tibiofemoral osteoarthritis 15 years after nonoperative treatment of anterior cruciate ligament injury: a prospective cohort study. *Am J Sports Med*. 2008;36(9):1717-1725.
37. Noyes FR, Barber SD, Simon R. High tibial osteotomy and ligament reconstruction in varus angulated, anterior cruciate ligament-deficient knees: a two- to seven-year follow-up study. *Am J Sports Med*. 1993;21(1):2-12.
38. Potter HG, Linklater JM, Allen AA, Hannafin JA, Haas SB. Magnetic resonance imaging of articular cartilage in the knee: an evaluation with use of fast-spin-echo imaging. *J Bone Joint Surg Am*. 1998;80(9):1276-1284.
39. Sandy J. Proteolytic degradation of normal and osteoarthritic cartilage matrix. In: Brandt KD, Doherty M, Lohmander LS, eds. *Osteoarthritis*. 2nd ed. Oxford, UK: Oxford University Press; 2003:82-92.
40. Shelbourne KD, Gray T. Results of anterior cruciate ligament reconstruction based on meniscus and articular cartilage status at the time of surgery: five- to fifteen-year evaluations. *Am J Sports Med*. 2000;28(4):446-452.
41. Spindler KP, Schils JP, Bergfeld JA, et al. Prospective study of osseous, articular, and meniscal lesions in recent anterior cruciate ligament tears by magnetic resonance imaging and arthroscopy. *Am J Sports Med*. 1993;21(4):551-557.
42. Tiderius CJ, Olsson LE, Nyquist F, Dahlberg L. Cartilage glycosaminoglycan loss in the acute phase after an anterior cruciate ligament injury: delayed gadolinium-enhanced magnetic resonance imaging of cartilage and synovial fluid analysis. *Arthritis Rheum*. 2005;52(1):120-127.
43. Vairo GL, McBrier NM, Miller SJ, Buckley WE. Premature knee osteoarthritis after anterior cruciate ligament reconstruction dependent on autograft. *J Sport Rehabil*. 2010;19(1):86-97.
44. Ware JE Jr, Sherbourne CD. The MOS 36-item Short-Form health survey (SF-36): conceptual framework and item selection. *Med Care*. 1992;30:473-483.
45. Wilder FV, Hall BJ, Barrett JP Jr, Lemrow NB. History of acute knee injury and osteoarthritis of the knee: a prospective epidemiological assessment–the Clearwater Osteoarthritis Study. *Osteoarthritis Cartilage*. 2002;10(8):611-616.
46. Woods GW, Chapman DR. Repairable posterior meniscocapsular disruption in anterior cruciate ligament injuries. *Am J Sports Med*. 1984;12(5):381-385.
47. Xia Y, Moody JB, Burton-Wurster N, Lust G. Quantitative in situ correlation between microscopic MRI and polarized light microscopy studies of articular cartilage. *Osteoarthritis Cartilage*. 2001;9(5):393-406.

0363-5465/99/2727-0208$02.00/0
THE AMERICAN JOURNAL OF SPORTS MEDICINE, Vol. 27, No. 2

Noncontrast Magnetic Resonance Imaging of Superior Labral Lesions

102 Cases Confirmed at Arthroscopic Surgery

David A. Connell,* MD, Hollis G. Potter,*† MD, Thomas L. Wickiewicz,‡ MD, David W. Altchek,‡ MD, and Russell F. Warren,‡ MD

*From the *Department of Radiology and Imaging, and ‡Sports Medicine and Shoulder Service, Hospital for Special Surgery, New York, New York*

ABSTRACT

Previous studies report that noncontrast magnetic resonance imaging is limited in the evaluation of the superior glenoid labrum. From our magnetic resonance imaging database of 2552 patients, we prospectively identified 104 patients with superior labral lesions who subsequently went on to arthroscopic surgery. Magnetic resonance images were assessed to identify fraying, flap tears, bucket-handle tears, or displaced flap of fibrocartilage. The biceps tendon was also evaluated. Patients were categorized according to Snyder's classification, and the findings on the magnetic resonance images were correlated with surgical findings. One hundred of the 104 tears suspected on the images were confirmed at surgery. There were four false-positives and two false-negatives, the former reflecting one normal labrum, two meniscoid-type labra, and one sublabral foramen. With arthroscopic surgery as the standard, magnetic resonance imaging had a sensitivity of 98.0% (100 of 102), a specificity of 89.5% (34 of 38), and an accuracy of 95.7% (134 of 140) for detection of superior labral lesions. We concluded that high-resolution noncontrast magnetic resonance imaging can accurately diagnose superior labral lesions and aid in surgical management.

In 1990, Snyder et al.[20] identified an injury to the superior labrum that began posteriorly and extended anteriorly, stopping before or at the midglenoid notch and including the anchor of the biceps tendon to the labrum. They called this the SLAP (superior labrum anterior and posterior) lesion. The Snyder classification of SLAP lesions includes fraying (type I), tearing with detachment of the biceps anchor (type II), bucket-handle displacement with an intact biceps anchor (type III), and a bucket-handle fragment with the tear extending into the biceps tendon (type IV). Some SLAP lesions do not neatly fit into the original definition, and other classifications have been proposed.[14]

The originally proposed mechanism of SLAP injury was either a compressive force to the shoulder, usually due to falling on an outstretched palm with the shoulder in adduction and flexion on impact, or sudden contraction of the biceps tendon.[20] A subsequent study has shown that repetitive traction to the biceps tendon, as seen in throwing athletes, can also cause this labral injury.[2] Clinical symptoms include catching and pain, which are exacerbated by overhead activity.

Magnetic resonance imaging has been shown to be an accurate method for accurately evaluating the glenoid labrum. However, using either conventional or arthrographic MRI, imaging of the superior labrum has been fraught with error. Continuing advances in surface coil design, computer software, and image processing have resulted in the rapid acquisition of superior quality MR images of the shoulder, yielding increased diagnostic accuracy.

The purpose of this study was to show that noncontrast MRI can reliably diagnose SLAP lesions using sequences that are routinely employed for evaluation of the shoulder.

MATERIALS AND METHODS

Patient Population

From January 1994 through September 1997, 2552 patients with clinical suspicion of labral injury, rotator cuff lesions, impingement, or pain of unknown origin were referred by an orthopaedic surgeon for an MR examina-

† Address correspondence and reprint requests to Hollis G. Potter, MD, Chief, MRI Section, Department of Radiology, Hospital for Special Surgery, 535 E. 70th Street, New York, NY 10021.

No author or related institution has received any financial benefit from research in this study.

tion. A total of 104 patients with MR evidence of superior labral lesions were studied until and through the time of surgery. An additional 36 patients were assessed as having normal superior labra, but rotator cuff lesions. These 36 patients were also studied through the time of surgery to provide a comparative control population. The total study cohort was 140 patients.

The study population consisted of 103 men and 37 women with ages ranging from 15 to 72 years (mean, 35.4). There were 86 right shoulders and 54 left shoulders studied.

The majority (110 of 140) of patients provided a history of athletic participation, particularly baseball (31 patients), tennis (23 patients), and football (19 patients). There were 11 professional athletes included in the study. The interval between MRI and arthroscopic surgery of the shoulders was 1 to 219 days (mean, 43).

MRI Technique

The patients were examined with a 1.5-T superconducting magnet (Signa, GE Medical Systems, Milwaukee, Wisconsin). All patients were supine with the humerus in a neutral position. Either an anterior loop receive-only surface coil (Linear Shoulder Coil, Medical Advances, Milwaukee, Wisconsin) or phased array surface coil (Shoulder Array, Med Rad, Indianola, Pennsylvania) was placed anteriorly over the joint. With the aid of an axial localizing image, the following sequences were obtained:

- An oblique coronal fast spin echo, proton density weighted sequence; repetition time (TR)/echo time (TE), 3500–4000/32 msec (effective) along the axis of the supraspinatus muscle; 512 × 256 pixel or 512 × 384 pixel matrix; two signals acquired; 16-cm field of view; and 4-mm slice thickness with 0.5-mm interslice gap.
- Oblique coronal fast spin echo T2-weighted sequence; TR/TE, 3500/108 msec (effective); 256 × 224 pixel matrix; two signals acquired; 16-cm field of view; 4-mm slice thickness with a 0.5-mm interslice gap; and frequency-selective fat suppression (Chem Sat, GE Medical Systems).
- Axial multiplanar gradient echo T2-weighted sequence; TR/TE, 400/20 msec with a 20° flip angle; 256 × 256 pixel matrix; two signals acquired; 16-cm field of view; and 4-mm section thickness without an interslice gap.
- Axial fast spin echo proton density weighted; TR/TE, 4000/17–34 msec (effective); 512 × 256 pixel or 512 × 384 pixel matrix; two signals acquired; 15-cm field of view; and 3.5- to 4-mm slice thickness and no interslice gap.

The echo train length on all fast spin echo sequences was 8 to 12. Scan times varied according to the number of slices required to cover the region of interest, but ranged from 25 to 30 minutes.

The normal glenoid labrum is triangular in cross-section and has homogeneously low-intensity signal on all pulse sequences. It is attached to the glenoid rim at its base. To localize labral tears, the clock face was used as a reference point, and the superior labrum included the 11 o'clock through the 1 o'clock positions. For a tear to be considered a SLAP lesion, the abnormality needed to extend across the biceps anchor.

All examinations were interpreted by a senior musculoskeletal radiologist (HGP) after consensus review with two musculoskeletal fellows experienced in musculoskeletal MRI. The findings on physical examination were not available at the time of review. The labrum and the long head of the biceps tendon were evaluated with respect to signal intensity and morphologic characteristics. Labral lesions were characterized as either frayed, a flap tear, a bucket-handle tear, or a displaced flap of fibrocartilage. The long head of the biceps was followed to its origin from the supraglenoid tubercle, with attention paid to the fibers that blend with the superior labrum.[11] All superior labral lesions were confirmed in both the axial and oblique coronal planes. Superior labral tears were classified according to the classification by Snyder et al.[20]

A type I SLAP lesion was believed to be present on MRI if the superior labrum was hyperintense and had an irregular shape and if the biceps anchor was stable. The high-intensity signal in the labrum likely corresponds to mucoid eosinophilic degeneration.[13]

A type II SLAP lesion was believed to be present on MRI when a line of high-intensity signal was seen coursing across the base of the hyperintense labrum to the periphery. The long head of the biceps tendon had normal signal and shape and was attached to the avulsed labrum in these cases.

Type III SLAP lesions were characterized by a line of high-intensity signal coursing across the base of the hyperintense labrum but extending beyond the equator. This was thought to represent an undisplaced bucket-handle tear. If a discrete piece of fibrocartilage was identified within the joint capsule, this was thought to represent a displaced labral flap. The superior labrum was deficient and the biceps tendon could be followed to the supraglenoid tubercle.

A type IV SLAP lesion was thought to be present when a line of high-intensity signal was seen coursing across the base of the normally hypointense labrum to the periphery and extending beyond the equator with a deficient superior labrum. In addition, there was hyperintensity and splitting of the fibers of the biceps tendon.

All surgery was performed arthroscopically by one of seven surgeons. Review of labral lesions was undertaken by the attending surgeon using a combination of operative notes, arthroscopic pictures, and video recordings. The MR interpretation was available at the time of surgery.

RESULTS

At surgery, superior labral lesions were found in 102 of 140 patients. There were 33 type I SLAP lesions, 51 type II SLAP lesions, 7 type III SLAP lesions, and 5 type IV SLAP lesions. Six superior labral lesions did not specifically fit into any one category. This has been recognized before; Maffet et al.[14] found that 38% (32 of 84) of the patients in their study had significant findings that could not be classified.

There were 38 patients with normal glenoid labra at surgery. Included in this group were two meniscoid-type labra, one sublabral foramen, and one Buford complex. These were confirmed with direct visualization and probing at the time of surgery. The Buford complex was correctly interpreted on the MRI.

One hundred of the 102 superior labral tears seen at surgery were prospectively identified on the MRI scans. The two false-negative cases demonstrated a frayed superior labrum type I SLAP lesion and detachment of the posterosuperior labrum type II SLAP lesion at surgery. In addition, tears in four superior labra thought to be seen on the MRI scans were not confirmed at surgery. One patient was shown to have an intact superior labrum, two had meniscoid-type labra, and one had a sublabral foramen.

With arthroscopy as the standard, MRI had a sensitivity of 98.0% (100 of 102), specificity of 89.5% (34 of 38), and accuracy of 95.7% (134 of 140) for detection of a tear of the superior glenoid labrum.

Thirty-three type I SLAP lesions were confirmed at surgery with 30 cases identified on MRI. Two cases were prospectively read on MRI as having torn type II SLAP lesions, and one was read as having no lesion. There were also four cases interpreted on MRI as type I SLAP lesions that were regarded as type II SLAP lesions at surgery. There were five paralabral cysts decompressing into the adjacent soft tissues detected on MRI (Fig. 1). Four of the five cysts were seen in association with type I SLAP lesions, as confirmed at arthroscopic surgery.

Fifty-one type II SLAP lesions were identified at surgery, and MRI correctly identified a labral tear in 46 of the 51 cases (Figs. 2 and 3). Of the five cases not identified on MRI, four were misrepresented as fraying (type I), and one was misrepresented as normal.

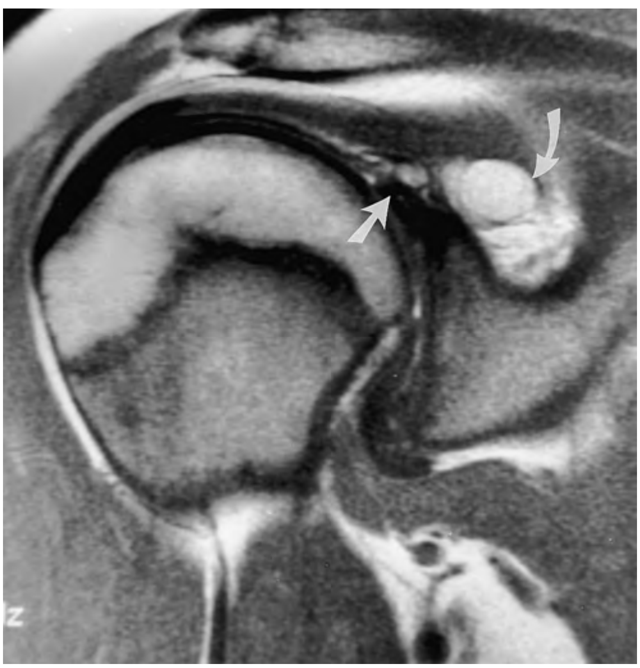


Figure 1. A type I SLAP lesion in an 18-year-old tennis player who had sudden onset of pain and clicking after an audible pop during a match. He had since complained of intermittent recurrent pain, particularly in the overhead position. Coronal images demonstrate a frayed, hyperintense superior labrum (short arrow) with decompression into a large paralabral cyst (curved arrow).

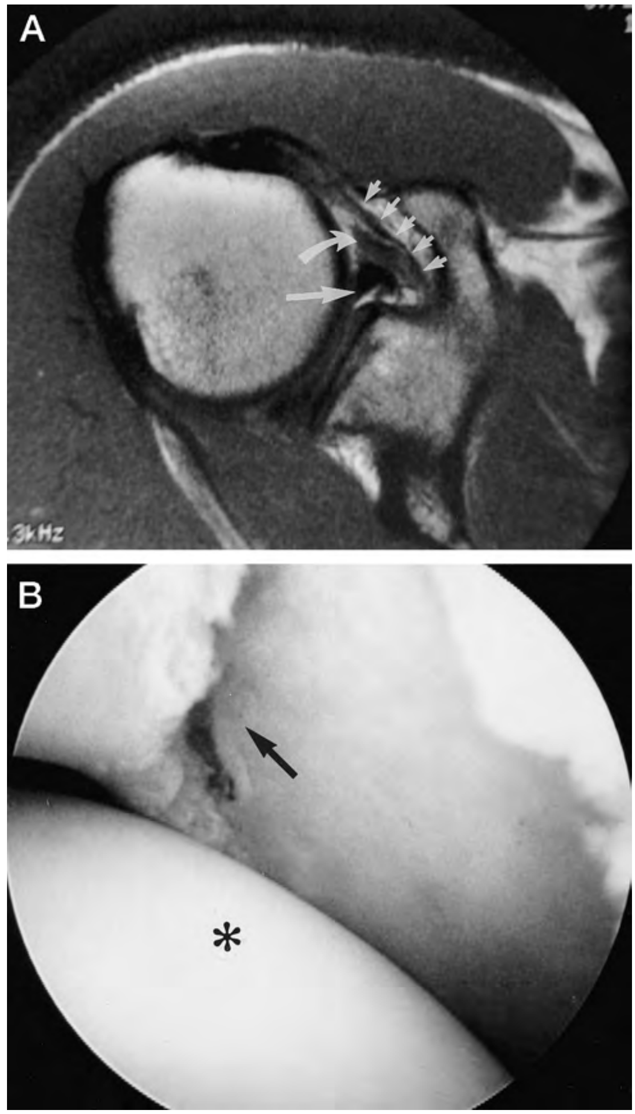


Figure 2. A, a type II SLAP lesion in a 33-year-old man who had a long history of right shoulder pain that was exacerbated by a recent skiing injury. The MR images demonstrate a tear of the anterosuperior labrum (straight arrow) at the insertion of the middle glenohumeral ligament (curved arrow). Note the frayed superior capsule (small arrows). B, arthroscopy confirmed a massive superior labral detachment (straight arrow) extending from the 8-o'clock position to the 4-o'clock position with the biceps tendon completely detached from the superior glenoid. Four bioabsorbable tacks were required to stabilize the lesion. The asterisk lies on the humeral head.

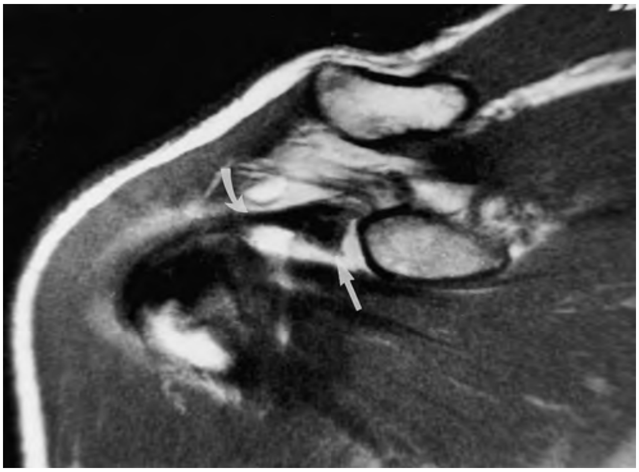


Figure 3. A type II SLAP lesion in a 46-year-old man high-level recreational tennis player who had shoulder pain. The coronal image demonstrates avulsion of the superior labrum from the glenoid (straight arrow). Note the retracted biceps tendon (curved arrow) attached to the avulsed labrum.

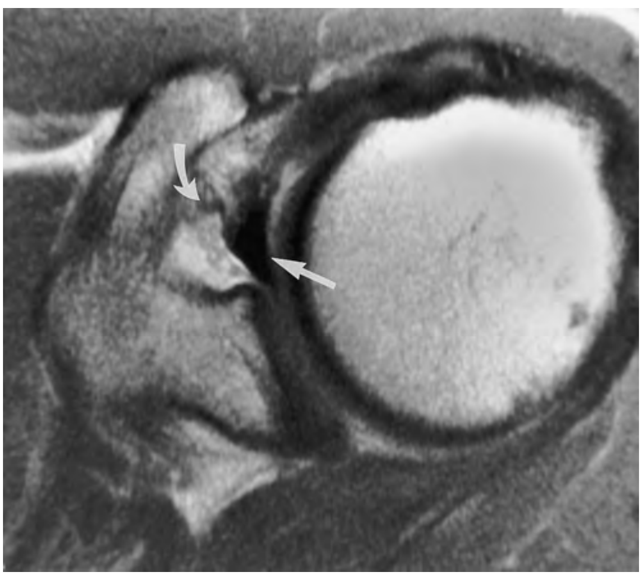


Figure 4. A type III SLAP lesion in a 24-year-old male patient who sustained a fall while skiing. He had since experienced pain during overhead activities. An axial image through the labrum demonstrates a detached labral fragment (straight arrow), as well as a frayed superior glenohumeral ligament (curved arrow).

Magnetic resonance imaging prospectively demonstrated four of seven type III lesions, three of which were displaced (Fig. 4). Three of the seven arthroscopically confirmed type III lesions were described on MRI as type II lesions.

Biceps hyperintensity and splitting of fibers, when seen in association with a tear coursing through the base of the superior labrum, was indicative of a type IV SLAP lesion

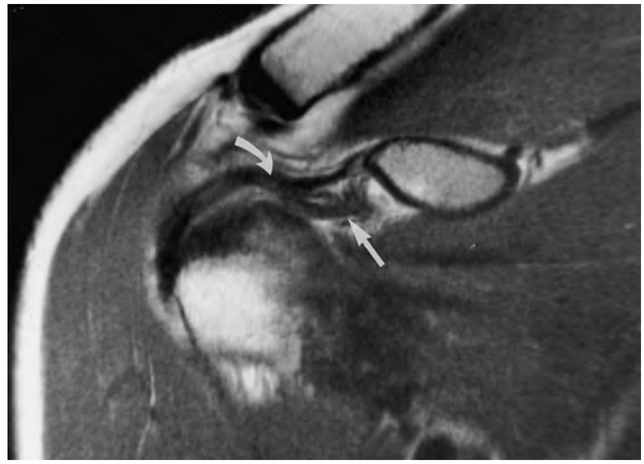


Figure 5. A type IV SLAP lesion in a 20-year-old baseball pitcher who had pain and discomfort related to throwing in the early acceleration phase. Far anterior coronal image demonstrates the displaced superior labral flap (straight arrow) with tearing and fraying of the biceps tendon (curved arrow).

(Fig. 5), and this was noted on MRI for all five type IV cases subsequent to arthroscopic confirmation.

DISCUSSION

Superior and inferior labral morphology are distinctly different. The superior labrum tends to be loosely attached, more mobile and meniscal in appearance than the inferior labrum, which is firmly continuous with the articular cartilage. It has been suggested that the superior labrum may act as a mobile extension at the glenoid surface rather than as a stabilizing bumper restricting translation.[4] Hence, a mobile and loosely attached superior labrum should not be considered abnormal unless there is definitive tearing or detachment. Furthermore, the superior and anterosuperior labrum have diminished vascularity relative to the inferior labrum.[4] This poor blood supply may account for superior labral degeneration with increasing age and explain its vulnerability for disruption.

Histologic examination of the glenoid labrum shows that it is composed of poorly vascularized, moderately dense bundles of fibrocartilage.[5] Eosinophilic degeneration is a common finding, and intralabral ossification has been described.[13] There is a thin zone of transitional fibrocartilage sitting between the labrum and articular cartilage, as first described by Moseley and Övergaard.[17] This transitional zone is continuous with the adjacent hyaline articular cartilage and may only be a few cells in width.[6] This transitional zone is accentuated on gradient echo MRI[15] and has been misinterpreted in the past as either a sublabral tear or a sublabral foramen. Furthermore, gradient-echo techniques are limited by their sensitivity to field inhomogeneities, including orthopaedic hardware, arthroscopic metallic debris, and paramagnetic agents such as hemoglobin-degradation products. This ar-

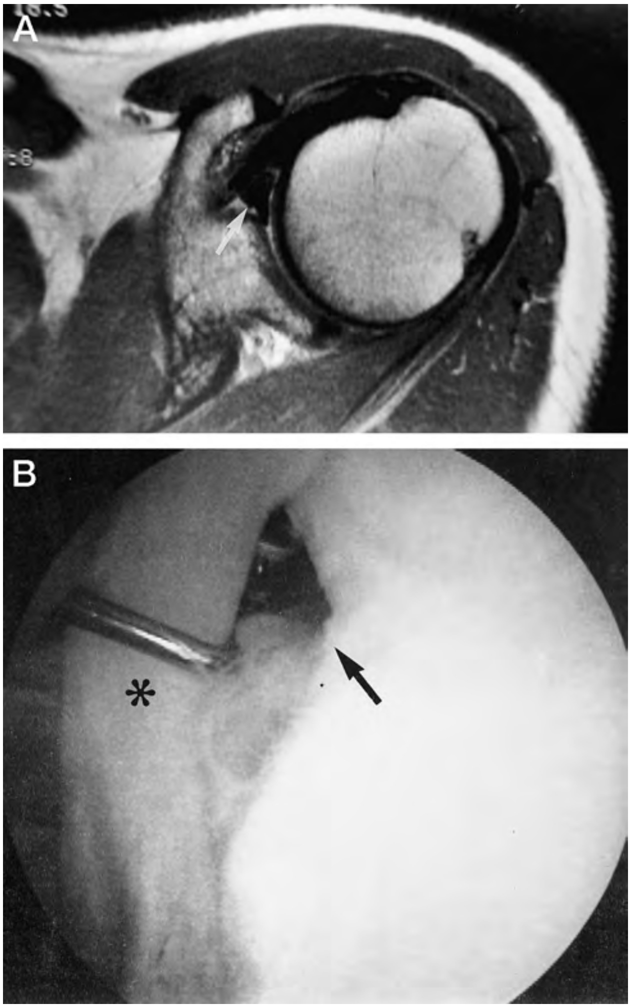


Figure 6. A, sublabral foramen in a 53-year-old patient who presented with anterior shoulder pain. Axial images demonstrate a line of high-intensity signal at the base of the anterosuperior labrum (arrow), which was prospectively interpreted as a superior labral tear. B, arthroscopic examination demonstrates a sublabral foramen (straight arrow) with smooth edges and no synovial injection. The anterosuperior labrum (asterisk) was freely lifted from the labral base, creating a foramen. This was one of the false-positives interpreted in our study cohort.

tifact limits the use of gradient echo techniques in the postoperative setting.

Early studies suggested that unenhanced MRI is limited in its ability to depict tears of the superior labrum,[8,12,19] with sensitivity for detecting tears ranging from 75% to 88%, and these sensitivities were relatively poor compared with studies of anterior labral tears (95% to 100%),[7,10,12,16] although the sample sizes were small. In response, several investigators have advocated MR arthrography using both saline and gadolinium as contrast agents to improve accuracy by distending the joint and allowing fluid to undermine tears.[3,18,22] However, intra-articular injection of contrast is time consuming, expensive, has yet to meet with US Food and Drug Administration approval, and removes the noninvasive advantage of MRI. Furthermore, the distension of the joint with intra-articular contrast distorts the native anatomic relationships of the labral-capsular complex and is not part of routine imaging of the shoulder joint.

This study involves, to our knowledge, the largest reported series of superior labral tears prospectively identified on MRI with subsequent arthroscopic correlation. This is also the first reported series using a phased array surface coil and 512 × 256 or 384 pixel imaging matrix, and attention should be drawn to these technical aspects. The use of a phased array surface coil design increases the signal-to-noise ratio by virtue of several receiver coils working in concert to receive signal and promote field homogeneity. The matrix of 512 × 256 or 384 pixels yields a smaller pixel size, which translates into superior spatial resolution, enhancing the conspicuity of subtle labral fraying and detachment. The fast spin echo imaging technique decreases imaging time and is invaluable in the postoperative setting because of the reduction in metallic artifact.

We have specifically chosen TR and TE values to take advantage of the magnetization-transfer effect that will optimize soft tissue contrast and provide good contrast between native joint fluid and fibrocartilage. Native fluid undermines a torn labrum and is seen as a line of high-intensity signal between the glenoid and torn fibrocartilage. Using our technique, sensitivity is high (98.0%) but specificity comparatively low (89.0%), mostly because of labral variations. The overall accuracy in identifying SLAP lesions was 134 of 140 (95.7%). Magnetic resonance imaging was less successful in classifying SLAP lesions into the four subcategories, particularly in its ability to discriminate between type II and type III lesions. Identification of SLAP subcategories will augment surgical planning, as type I and III SLAP lesions are commonly debrided, while type II and IV lesions require stabilization of the biceps anchor/labral complex.[1,9] As MRI resolution and technique continue to improve, accuracy should improve with respect to these subcategories.

Labral variants pose a problem to accurate labral interpretation. The meniscoid-type superior labrum may be misinterpreted as a type II SLAP lesion, and this was the source of two false-positives in our study. The meniscoid variant maintains a firm, focal attachment and has a normal biceps insertion. Wide separation of the superior labrum from the glenoid rim, frayed labrum with increased signal intensity, and the presence of adjacent capsular injury aid in the discrimination between the meniscoid variant and type II SLAP lesions.

Likewise, an anatomically thickened or band-like middle glenohumeral ligament in association with a deficient anterosuperior labrum, that is, a Buford complex, can simulate a detached anterior labrum.[21] However, the middle glenohumeral ligament is normally seen as a distinct structure adjacent to the anterior labrum and can be followed from its insertion site on the labrum to where it blends with the anterior capsule and attaches onto the humerus.

Another potential source of interpretive error is the sublabral foramen (Fig. 6). This entity is found within the anterosuperior labrum, but tends to be located more anteriorly as opposed to the more superior position of the SLAP lesion. In addition, the shape and signal of the separated fibrocartilage are preserved in the setting of anatomic variation without injury. The normal sublabral foramen does not usually extend below the level of the coracoid process. The orientation and extent of the increased signal, whether it crosses the biceps anchor, and whether there is concomitant injury to the capsule help to discriminate a tear from a sublabral foramen.

In a retrospective review of more than 700 shoulder arthroscopies by Snyder et al.,[20] 3.9% of patients were found to have SLAP lesions, suggesting that this is a relatively uncommon lesion. The lesion seemed to be confined to the athletic population. We identified 102 surgically confirmed SLAP lesions from our MRI database (102 of 2552, or 4.0%). The purpose of the current study was not to report the prevalence of SLAP lesions in our patient population but rather to assess the accuracy of our MRI technique in detecting these lesions. The high incidence of labral abnormality seen in predominantly young athletic patients selected out by clinical assessment and then included in our study introduces an inherent referral bias. All the referring surgeons in our study are sports medicine specialists who treat a large number of athletes who are prone to injury of the superior labrum, such as those who play baseball, tennis, and football. The prevalence of SLAP lesions seen at our institution is probably greater than in the normal population.

Advances in surface coil and software design have allowed for high-resolution imaging with improved soft tissue contrast that aids in labral visualization. By taking advantage of this technology, noncontrast MRI can accurately detect superior labral tears and readily identify those patients who may benefit from surgery.

ACKNOWLEDGMENTS

The authors acknowledge the contribution of case material by Jo A. Hannafin, MD, PhD, Answorth A. Allen, MD, Stephen J. O'Brien, MD, James Linklater, MD, and Edward V. Craig, MD.

REFERENCES

1. Andrews JR, Carson WG Jr: The arthroscopic treatment of glenoid labrum tears in the throwing athlete. *Orthop Trans 8:* 44, 1984
2. Andrews JR, Carson WG Jr, McLeod WD: Glenoid labral tears related to the long head of the biceps. *Am J Sports Med 13:* 337–341, 1985
3. Chandnani VP, Yeager TD, DeBerardino TD, et al: Glenoid labral tears: Prospective evaluation with MR imaging, MR arthrography, and CT arthrography. *AJR Am J Roentgenol 161:* 1229–1235, 1993
4. Cooper DE, Arnoczky SP, O'Brien SJ, et al: Anatomy, histology and vascularity of the glenoid labrum: An anatomical study. *J Bone Joint Surg 74A:* 46–52, 1992
5. DePalma A, Gallery G, Bennett G: Variational anatomy and degenerative lesions of the shoulder joint. *Instr Course Lect 6:* 225–281, 1949
6. Detrisac DA, Johnson LL: *Arthroscopic Shoulder Anatomy: Pathologic and Surgical Implications.* Thorofare, NJ, Slack, 1987
7. Gusmer PB, Potter HG, Schatz JA, et al: Labral injuries: Accuracy of detection with unenhanced MR imaging of the shoulder. *Radiology 200:* 519–524, 1996
8. Hodler J, Kursunoglu-Brahme S, Flannigan B, et al: Injuries of the superior portion of the glenoid labrum involving the insertion of the biceps tendon: MR imaging in nine cases. *AJR Am J Roentgenol 159:* 565–568, 1992
9. Hunter JC, Blatz DJ, Escobedo EM: SLAP lesions of the glenoid labrum: CT arthrographic and arthroscopic correlation. *Radiology 184:* 513–518, 1992
10. Iannotti JP, Zlatkin MB, Esterhai JL, et al: Magnetic resonance imaging of the shoulder: Sensitivity, specificity, and predictive value. *J Bone Joint Surg 73A:* 17–29, 1991
11. Kreitner KF, Botchen K, Rude J, et al: Superior labrum and labral-bicipital complex: MR imaging with pathologic-anatomic and histologic correlation. *AJR Am J Roentgenol 170:* 599–605, 1998
12. Legan JM, Burkhard TK, Gaft WB, et al: Tears of the glenoid labrum: MR imaging of 88 arthroscopically confirmed cases. *Radiology 183:* 35–37, 1992
13. Loredo R, Longo C, Salonen D, et al: Glenoid labrum: MR imaging with histologic correlation. *Radiology 196:* 33–41, 1995
14. Maffet MW, Gartsman GM, Moseley B: Superior labrum-biceps tendon complex lesions of the shoulder. *Am J Sports Med 23:* 93–98, 1995
15. McCauley TR, Pope CE, Jokl P: Normal and abnormal glenoid labrum: Assessment with multiplanar gradient-echo MR imaging. *Radiology 183:* 35–37, 1992
16. Monu JUV, Pope TL Jr, Chabon SJ, et al: MR diagnosis of superior labral anterior posterior (SLAP) injuries of the glenoid labrum: Value of routine imaging without intraarticular injection of contrast material. *AJR Am J Roentgenol 163:* 1425–1429, 1994
17. Moseley HF, Övergaard B: The anterior capsular mechanism in recurrent anterior dislocation of the shoulder. Morphological and clinical studies with special reference to the glenoid labrum and the gleno-humeral ligaments. *J Bone Joint Surg 44B:* 913–927, 1962
18. Palmer WE, Caslowitz PL: Anterior shoulder instability: Diagnostic criteria determined from prospective analysis of 121 MR arthrograms. *Radiology 197:* 819–825, 1995
19. Smith DK, Chopp TM, Aufdemorte TB, et al: Sublabral recess of the superior glenoid labrum: Study of cadavers with conventional nonenhanced MR imaging, MR arthrography, anatomic dissection, and limited histologic examination. *Radiology 201:* 251–256, 1996
20. Snyder SJ, Karzel RP, Del Pizzo W, et al: SLAP lesions of the shoulder. *Arthroscopy 6:* 274–279, 1990
21. Tirman PFJ, Feller JF, Palmer WE, et al: The Buford complex—a variation of normal shoulder anatomy: MR arthrographic imaging features. *AJR Am J Roentgenol 166:* 869–873, 1996
22. Tirman PFJ, Stauffer AE, Crues JV III, et al: Saline magnetic resonance arthrography in the evaluation of glenohumeral instability. *Arthroscopy 9:* 550–559, 1993

Meniscal Allograft Transplantation in the Sheep Knee

Evaluation of Chondroprotective Effects

Bryan T. Kelly,*† MD, Hollis G. Potter,† MD, Xiang-Hua Deng,† MD, Andrew D. Pearle,† MD, A. Simon Turner,‡ BVSc, MS, Russell F. Warren,† MD, and Scott A. Rodeo,† MD
From the †Hospital for Special Surgery, New York, New York, and ‡Colorado State University, Fort Collins, Colorado

Background: Early protection of articular cartilage, before degenerative changes appear on radiographs, should result in better long-term results, but scientific evidence regarding the effectiveness of meniscal transplantation is lacking.

Purpose: To assess the chondroprotective effects of a new meniscal allograft transplantation animal model and evaluate a magnetic resonance imaging parameter, T2 mapping, in articular cartilage after meniscectomy and meniscal transplantation.

Study Design: Controlled laboratory study.

Methods: Forty-five skeletally mature sheep were placed into 3 surgical groups: lateral meniscectomy (n = 24), meniscal allograft transplant (n = 17), and sham (n = 4). Animals were sacrificed at 2, 4, or 12 months. Cartilage was assessed by gross inspection, magnetic resonance imaging, T2 mapping, biomechanical testing, and semiquantitative histologic analysis.

Results: There were no differences between the sham operation and nonoperated control limbs. Compared with control limbs, meniscectomy resulted in significant increases in cartilage degeneration by all objective criteria ($P < .01$). Compared with meniscectomy, meniscal allograft transplantation resulted in significant decreases in cartilage degeneration ($P < .02$). There were significant correlations between T2-mapping data and all other traditional outcomes measures ($P < .05$, $r^2 = 0.37\text{-}0.67$). Compared with the nonoperated control limbs, allograft transplants demonstrated no significant differences at 2 months in any category, except magnetic resonance imaging data. By 4 months, nonoperated control limbs demonstrated significantly less wear compared to allograft limbs in all categories except modified Mankin scores.

Conclusion: This model demonstrated significant chondroprotection compared with meniscectomy but demonstrated more cartilage wear at 4 months compared to control limbs. A high degree of allograft cell viability and vascular ingrowth was seen in allograft explants. T2 mapping may provide an accurate noninvasive measure of early cartilage degeneration after meniscectomy, as well as cartilage protection after meniscal allograft transplantation.

Clinical Relevance: This study establishes a reliable animal model for meniscal allograft transplantation and provides evidence for the utility of T2 mapping at clinically relevant magnetic resonance imaging field strengths for evaluation of early cartilage degeneration.

Keywords: meniscus; allograft; transplantation; T2 mapping; cartilage

Meniscal transplantation has become a viable surgical option for patients with symptomatic meniscal deficiency. It is thought that the predictable long-term development of osteoarthritic degeneration in patients subjected to total meniscectomy can be decreased if the joint is protected by a meniscal substitute. Unfortunately, scientific evidence regarding the effectiveness of this surgical intervention is lacking. There has been limited long-term clinical investigation on the success of meniscal allografts.[13-15,28,33] Furthermore, animal studies have demonstrated varying results, and to date, a reliable animal model has not been developed.[7,10,16,31]

Although the optimal timing for meniscal allograft transplantation has not been well defined, it has become evident that surgical intervention must be performed before the development of advanced joint degeneration. The results of this procedure are suboptimal if transplantation is delayed

*Address correspondence to Bryan T. Kelly, MD, Hospital for Special Surgery, 535 East 70th Street, New York, NY 10021 (e-mail: kellyb@hss.edu).

Presented at the 51st annual meeting of the Orthopaedic Research Society in Washington, DC.

No potential conflict of interest declared.

The American Journal of Sports Medicine, Vol. 34, No. 9
DOI: 10.1177/0363546506287365

until advanced changes on radiographs are present.[28] The ability to better identify early signs of articular degeneration in a noninvasive manner would improve our ability to recommend reconstructive procedures in a timely fashion.

Our primary hypothesis was that a more anatomically based meniscal allograft transplantation procedure would be effective in reducing the degree of joint degeneration compared with meniscectomy as demonstrated by MRI, T2 mapping, biomechanical testing, and histologic analysis. Our secondary hypothesis was that measurements of T2 relaxation time could be used as a noninvasive measure of early cartilage degeneration in the postmeniscectomy model and that it could be used to monitor cartilage protection in the meniscal allograft transplantation model. Thus, the purposes of this study were (1) to assess the chondroprotective effects of meniscal allograft transplantation in the sheep postmeniscectomy model and (2) to evaluate the utility of T2 relaxation time mapping as a noninvasive measure of early articular cartilage degeneration.

MATERIALS AND METHODS

After Institutional Animal Care and Use Committee approval was obtained, 45 skeletally mature Columbian X Rambouillet ewes weighing approximately 70 to 80 kg were allocated for use. On arrival at the Colorado State University Veterinary Teaching Hospital, the sheep were placed in the large-animal research barn. They were dewormed and ear tagged for identification. Physical examination was performed, and only healthy animals with no clinically evident medical or orthopaedic problems were selected for the study.

Thirty nonstudy animals were allocated for meniscal allograft donation. These animals had been involved in unrelated research involving the spine or cranium and were scheduled for sacrifice on the day before meniscal allograft transplantation. During the harvest procedure, the entire lateral meniscus, including the full length of the anterior and posterior meniscal ligaments with a small amount of associated bone, was aseptically removed from the donor knees and stored in an antibiotic/nutrient medium according to the guidelines of the American Association of Tissue Banks.[12] All donor knee menisci were size matched by the weight of the sheep as well as precise intraoperative measurements of length, width, and height of the meniscus. The allografts were stored in the antibiotic/nutrient medium for a maximum of 48 hours before transplantation. The animals had a high degree of genetic similarity, thus decreasing the risk for rejection of the tissue transplant.

STUDY GROUPS

The animals were randomly assigned to 1 of 3 groups. Four animals underwent a sham operation involving exposure of the lateral joint with a release and repair of the lateral collateral ligament and popliteus insertion. Twenty-four animals underwent a lateral meniscectomy after exposure of the lateral compartment. Seventeen animals underwent lateral meniscal allograft transplantation immediately after meniscectomy with size-matched donor menisci. For the sham and the meniscectomy groups, half of the animals were sacrificed at 2 months, and the other half were sacrificed at 4 months. For the meniscal allograft transplantation group, 8 were sacrificed at 2 months, 8 were sacrificed at 4 months, and the final animal was sacrificed at 1 year.

SURGICAL INTERVENTIONS

Meniscectomy

Before surgery, 10 sheep cadaveric knees were dissected to better define the surgical anatomy (Figure 1).[1] A lateral incision was made over the lateral collateral ligament of the knee joint. The femoral attachment of the lateral collateral ligament and popliteus insertion site was elevated using an osteotome along with a small wedge of bone. The lateral collateral ligament and popliteus were then reflected distally to expose the entire lateral meniscus. Varus stress was applied to the knee joint to fully expose the meniscus. The peripheral rim of the meniscus was dissected sharply from the capsule, dividing the coronary ligament. The anterior and posterior horn attachments of the meniscus were then detached, and the meniscus was removed from the knee. Special care was taken to avoid any articular cartilage damage during the lateral meniscectomy. With detachment of the anterior meniscotibial ligament attachment, special care was taken to preserve the tibial insertion of the ACL, which lies in close proximity. With detachment of the posterior meniscofemoral ligament, the popliteal artery was carefully retracted to avoid vascular injury. The osseous femoral attachment of the lateral collateral ligament and popliteus was then reattached to the femur using a 4.0-mm cancellous bone screw. After thorough irrigation of the joint with saline solution, the joint capsule, overlying fascia of the tensor fascia lata, subcutaneous tissues, and skin were closed in layers.

Allograft Transplantation

Before the transplant procedure was performed in live animals, 10 sheep cadaveric knees were dissected. A surgical procedure was developed using anatomical placement of the anterior meniscotibial and posterior meniscofemoral attachment sites (Figure 1) with fixation through bone tunnels. At the start of the transplant procedure, lateral meniscectomies were performed using the technique described above. The previously harvested menisci for transplantation were then washed thoroughly with normal saline solution before transplantation. Accurate size matching was performed using 5 measurements: length from anterior horn to the posterior horn; width at the anterior horn, posterior horn, and central meniscus; and central height. The allograft meniscus was then prepared for transplantation by placing No. 2 Fiberwire (Arthrex, Naples, Fla) Krackow stitches through the anterior and posterior meniscal ligaments. The anterior meniscotibial attachment site was then exposed, and a drill tunnel was made entering at the anatomical insertion site and exiting the tibia on the medial side of the knee. The posterior meniscofemoral attachment site was then palpated, and a second

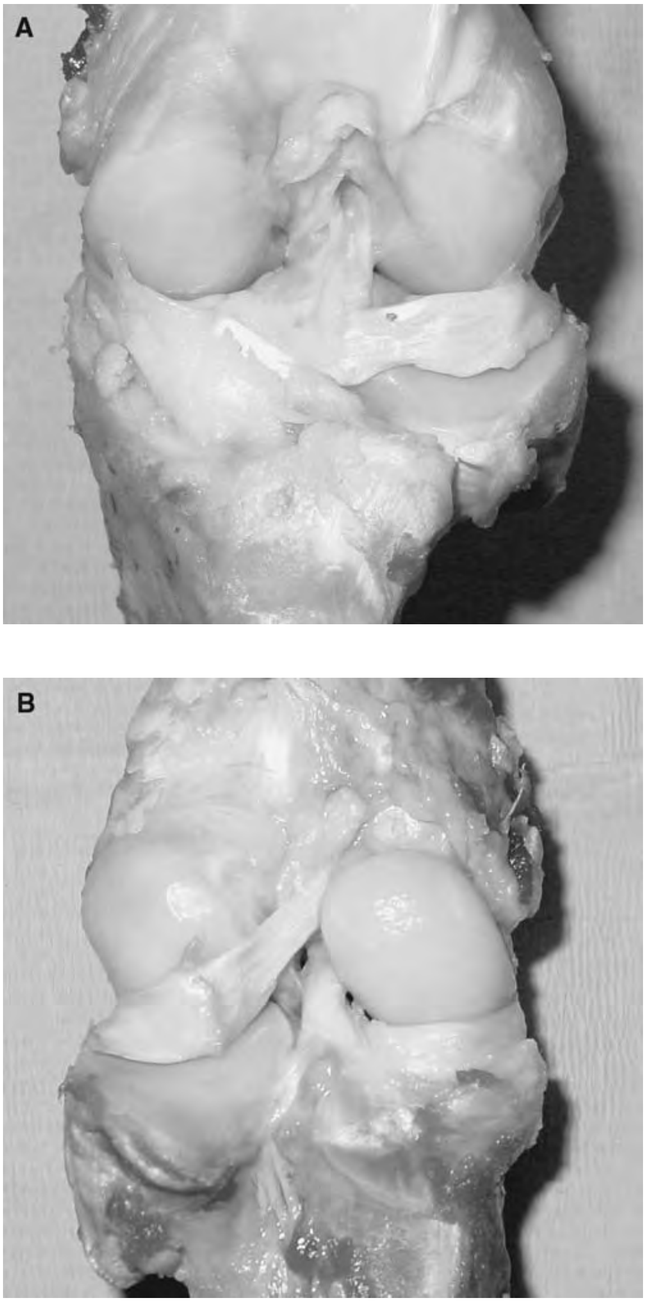


Figure 1. Normal anterior tibial (A) and posterior femoral (B) meniscal attachment sites.

drill tunnel was made entering the anatomical insertion site on the posterior aspect of the medial femoral condyle and exiting the femur on the medial side of the knee. The anterior and posterior meniscal allograft ligaments were then anchored to the anterior and posterior meniscal insertion sites by passing the Fiberwire sutures through the bone tunnels. The sutures were then fixed over buttons on the medial side of the knee. Tracking and appropriate sizing of the meniscus were confirmed after fixation. The outer rim of the meniscus was then reattached to the lateral capsule using 2 or 3 interrupted absorbable sutures. At the conclusion of the transplant fixation, the osseous femoral attachment of the lateral collateral ligament was reattached to the femur using a 4.0-mm cancellous bone screw, and the wound was closed in layers, as described above.

Sham Operation

The sham operation was performed using the same approach to the lateral compartment required for the meniscectomy procedure and transplant procedure. In this group, no further surgery was performed after exposure of the joint.

POSTOPERATIVE CARE

After surgery, postoperative activity was restricted for the first 2 weeks by housing the animals in closed confinement. The limbs were not immobilized. At 2 months, 2 animals from the sham group, 12 animals from the meniscectomy group, and 8 animals from the allograft group were sacrificed. Both the operated and nonoperated limbs were harvested for analysis. At 4 months, the remaining animals in the sham and meniscectomy groups and all but 1 of the remaining transplant animals were sacrificed, and both limbs were sent for analysis (2 sham, 12 meniscectomy, 8 allograft). The final allograft animal was sacrificed at 1 year.

POSTSACRIFICE ANALYSIS

After sacrifice, both the operative and nonoperative knees were detached at the level of the midfemur and midtibia. All but 7 of the limbs were immediately frozen and stored for analysis. The remaining 7 limbs were kept fresh for cell viability analysis of the allograft menisci using a paravital staining technique. The time between euthanasia and analysis of the frozen limbs was between 5 and 7 days. The fresh limbs were evaluated within 24 hours after sacrifice. The frozen knees were thawed before analysis and then assessed sequentially with cartilage-sensitive MRI, MRI with T2 mapping, gross inspection with india ink staining, biomechanical testing of cartilage stiffness, and semiquantitative histology. Analysis of the vascularity of the transplanted menisci was performed using the Spälteholz technique on 3 of the specimens from the 4-month transplant group. Complete analysis of each limb was performed within a 24-hour period to avoid any potential degenerative effects from exposure to air. The specimens were kept refrigerated between tests during that 24-hour period, and all tests were performed in a temperature-controlled laboratory set at 65° F. None of the tests resulted in heating of the tissue. All limbs were treated with the same protocol, eliminating the potential for any significant differences due to prolonged exposure. Seven of the limbs (5 at 2 months and 2 at 4 months) were delivered fresh and analyzed within 24 hours of sacrifice. In addition to the routine analyses described above, the fresh menisci from these animals were evaluated for cell viability using paravital staining techniques.

MAGNETIC RESONANCE IMAGING

All animals were imaged in a clinical 1.5-T superconducting magnet (Signa Horizon LX, General Electric Medical Systems, Milwaukee, Wis) with a 5-inch, curved, receive-only linear shoulder coil (IGC-Medical Advances, Milwaukee, Wis). Animals were imaged using a fast spin echo sequence in the coronal and sagittal planes with a repetition time of 4200 to 5000 milliseconds, effective echo time of 17 milliseconds, 31.2-kHz receiver bandwidth, and field of view of 8 × 6 cm with a matrix of 512 × 384, yielding an in-plane resolution of 156 μm × 156 μm × 1 mm slice resolution. Images were obtained with 3 excitations. Tailored radiofrequency (GE Health Care, Milwaukee, Wis) was used to reduce interecho spacing, with echo train lengths ranging between 8 and 12.

Subsequent spin echo T2 relaxation maps were obtained using repetition time of 500 to 650 milliseconds; echo times of 11, 40, and 80 milliseconds; at one excitation. Field of view was 8 × 6 cm with a matrix of 256 × 160, yielding an in-plane resolution of 312 μm × 375 μm with 2-mm slices. Receiver bandwidth was 15.6 kHz (over the entire frequency range). T2 relaxation maps were then reconstructed using a monoexponential fit model to calculate T2 relaxation pixel by pixel (Functool 3.1.10, Advantage Windows work station, GE Health Care).

The fast spin echo images were analyzed to assess morphologic changes in cartilage, bone, and bone marrow edema, as well as the presence or absence of osteophytes. Maximum cartilage thickness in the nonosteoarthritic sheep model was 0.8 mm based on MRI measurements. An MRI score was calculated based on the observed changes in cartilage, subchondral bone, and bone marrow edema, as well as the presence or absence of osteophytes. A similar system for cartilage degeneration has been previously validated in a clinical knee study using arthroscopy as the standard.[27] Cartilage was scored at the anterior, central, posterior, and peripheral margin over the lateral condyle and lateral plateau using a 1 to 4 grading system: 1, increased signal intensity; 2, <50% cartilage loss; 3, >50% cartilage loss; 4, exposed subchondral bone. The scoring was performed by a single attending MRI radiologist who was blinded to the surgical procedure. A sample of the images were scored a second time to confirm intraobserver reliability; no significant differences were found between scoring sessions. The subchondral bone was also assessed in each of these locations for the presence of sclerosis, scoring 1 (none apparent), 2 (mild), 3 (moderate), and 4 (severe). Bone marrow edema and osteophyte formation were both scored as absent (0) or present (1). A total MRI score for the lateral compartment was calculated by summing the mean values for each of the 4 categories. With this system, the minimum value of 2 corresponded to normal joint characteristics with no evidence of degeneration, whereas the maximum score of 10 corresponded to advanced degenerative changes.

Spin echo T2 maps of the lateral tibial plateau were created in this study to reduce the potential error introduced by stimulated echo formation generated in most multiecho fast spin echo techniques, yielding additive T1 contrast.[20] Quantitative T2 values were then obtained from the anterior, central, and posterior regions of the central weightbearing zone of the lateral tibial plateau using a standardized region of interest analysis. These areas of interest corresponded to the areas in which maximal cartilage degeneration was seen in all animals due to the loading characteristics of the postmeniscectomy ovine knee. They also corresponded to the 3 areas of interest identified for mechanical testing using indentation probe testing. Subsequent color maps were generated using the same Functool program in which T2 value stratification was depicted as prolonged values in green to blue and shorter values in orange to red, using an expanded color scale stratified from a minimum echo time of 0 milliseconds to a maximum echo time of 150 milliseconds.

GROSS INSPECTION

After MRI, all limbs were dissected, and the tibial plateaus were cleared of all surrounding soft tissue. The cartilage surfaces were stained with a dilute (1%) india ink solution (Higgins waterproof black india ink), and all specimens were photographed for determination of gross evidence of cartilage degeneration as demonstrated by uptake of india ink stain. Average stain areas overlying the tibial plateaus were measured using a Metamorph computer analysis (square millimeters; Universal Imaging Corporation, Downington, Pa).

BIOMECHANICAL TESTING

Cartilage stiffness was measured over the central weightbearing zone of the lateral tibial plateau. The area tested represented the area of greatest wear in the postmeniscectomy knees. Three measurements were collected from 3 different locations along the central contact area of the tibia: anterior, central, and posterior. The location of these data points was the same in all specimens and was verified by dividing the central weightbearing zone into thirds and finding the center point of each section. The location of these data points also corresponded to the areas sampled for the T2 analysis. The 3 data points from each location were averaged. Stiffness was measured using a cartilage indentation probe specifically designed for thin cartilage (Artscan Inc, Helsinki, Finland). The probe consisted of a measurement rod with a 100-μm-diameter indenter located in the center of a reference plate at the end of the probe. The value of the indenter force (newtons) reflects the force that the cartilage exerts against the indenter and can reliably be used as an index of cartilage stiffness. Several studies have demonstrated the association between cartilage degeneration and decreased cartilage stiffness.[2,6,11,17,19,26,30]

HISTOLOGIC ANALYSIS

Histologic sections were subsequently prepared and scored by an attending pathologist blinded to the procedure performed. The specimens were sectioned in the coronal plane at the midpoint of the weightbearing zone of the tibial plateau. The osteochondral specimens were then fixed in 10% neutral buffered formalin (Sigma Diagnostics, St Louis, Mo) and then decalcified in 5% nitric acid (50 mL concentrated nitric acid to 950 mL dH_2O). The tissues were checked daily; as soon as the decalcification was complete, the tissues were removed, so as to avoid overdecalcification. Tissue processing and paraffin embedding were then performed using the Tissue Tek VIP1000 tissue processor. Five-micrometer-thick sections were cut and then stained with H&E and safranin O. The histologic sections were taken from the middle third of the tibia and were directed from the lateral edge (peripheral zone) to the intercondylar notch (central zone). The central zone corresponded to the area of greatest wear that was evaluated with the biomechanical testing.

The histologic sections were graded using the modified Mankin grading scale for hyaline cartilage degeneration.[21,32] This semiquantitative analysis assessed cartilage structure (0-6), cellular abnormalities (0-3), matrix staining (0-4), and tidemark integrity (0-1). A minimum score of 0 denotes no cartilage degeneration, and a maximum score of 14 indicates severe cartilage destruction. Regional differences between the central zone and peripheral zone were evaluated.

Polarized light microscopy was performed to further assess collagen organization within 4 layers of the matrix: superficial layer, transitional zone, radial zone, and calcified zone. The collagen was scored as organized (0) or disorganized (1) in each of these 4 zones, resulting in a score range between 0 and 4.

Paravital staining to assess cell viability of the transplanted menisci was performed on 7 fresh specimens (5 from the 2-month allograft transplant group and 2 from the 4-month allograft transplant group).[24] A full detail of the technique for cell viability paravital staining has been previously reported.[18] The paravital technique was made up of a combination of 2 indicators. Propidium iodide is a cell impermeable dye that labels nucleic acids only in dead cells with a bright red indicator. Fluorescein diacetate is a cell permeable dye that labels cytoplasmic activity of live cells with a green indicator. The staining technique results in a clear contrast between viable (green indicator) and nonviable (red indicator) cells.

Vascularity of the transplanted menisci was assessed in 3 of the 4-month allograft transplant animals using standard Spälteholz technique.[3] After MRI was completed in these specimens and before gross dissection, the limbs were injected with india ink solution (Higgins waterproof black india ink) via the femoral artery under maximal manual pressure to perfuse the entire knee joint. The vessels distal to the knee were occluded by ligation and tourniquet application. A minimum of 600 mL of india ink was injected into each specimen. Capillary perfusion with india ink was demonstrated by visible black mottling of the skin. The specimens were then frozen, and 3-mm sagittal and coronal sections were cut using a band saw. The sections were then cleared by a modified Spälteholz technique[3,4] involving (1) fixing the sections in 10% buffered formalin for 3 days, (2) decalcification using 5% nitric acid for 3 days (changing the solution daily), (3) dehydration in ethyl alcohol for 6 days, and (4) defatting in chloroform for 2 days. The tissue was then cleared by changing its refractive index with the Spälteholz solution. This solution is made up of 3 parts benzyl benzoate and 5 parts methyl salicylate. The specimens were then visualized under direct magnification and photographed using high-resolution film for further review.

STATISTICAL METHODS

Means and standard deviations were calculated for all measurements. A paired Wilcoxon nonparametric test was used to make direct comparisons between sham operation animals and nonoperated control animals, between the central tibial plateaus and peripheral tibial plateaus of the allograft transplant animals, between the 2-month meniscectomy and 4-month meniscectomy groups, and between the 2-month allograft transplant and the 4-month allograft transplant groups. Significant differences ($P < .05$) between allograft animals, meniscectomy animals, and nonoperated control animals were calculated with a 1-way analysis of variance followed by *t* tests with a Bonferroni correction or a Kruskal-Wallis test followed by Mann-Whitney tests. Correlations between T2 data and all other variables were calculated with Spearman rank correlation (r^2 values) tests for nonparametric data. The collected data were analyzed and interpreted by each of the investigators to ensure accuracy, and all data were analyzed in a blinded fashion.

RESULTS

Operative Observations

At the time of the initial surgery, there was no evidence of gross cartilage degeneration within the lateral compartment of the joint. Complete visualization of the lateral tibial plateau was feasible in all operative specimens using the approach described.

Sham Operation

No statistical differences were found between any of the sham operation animals and the nonoperated control limbs with regard to MRI, T2 mapping, gross inspection with india ink, biomechanical testing, and histologic analysis. Thus, the nonoperated limbs were subsequently used as the control group in all comparisons between the meniscectomy and allograft groups.

STUDY GROUPS

Postmeniscectomy Animals

There were statistically significant differences ($P < .05$) between the nonoperative control limbs and the meniscectomy limbs in all outcome measures at both 2 months and 4 months after meniscectomy (MRI, T2 mapping, gross inspection with india ink, biomechanical testing, and histologic analysis) (Tables 1 and 2).

Magnetic Resonance Imaging. The MRI appearance of the nonoperated control limbs demonstrated good preservation

TABLE 1
Evaluation of Tibial Plateaus in Postmeniscectomy Animals and Nonoperated Controls at 2 Months After Surgery[a]

	Meniscectomy			Control			
Variable	n	Mean	SD	n	Mean	SD	*P*
MRI score	12	7.1	0.6	12	2.0	0.0	<.0001
T2 map, ms	6	57.2	11.1	6	41.6	7.0	.01
India ink, mm^2	12	36.1	7.9	12	3.0	6.2	<.0001
Biomechanics, N	12	0.37	0.13	12	0.63	0.08	.0001
Mankin	12	7.3	1.5	12	0.25	0.45	<.0001
Polarized	12	2.2	0.8	12	0.0	0.0	<.0001

[a]Modified Mankin scores are between 0 and 14; polarized light scores are between 0 and 4; MRI scores are between 2 and 10. Highly significant differences were seen in all outcome measures ($P < .05$).

TABLE 2
Evaluation of Tibial Plateaus in Postmeniscectomy Animals and Nonoperated Controls at 4 Months After Surgery[a]

	Meniscectomy			Control			
Variable	n	Mean	SD	n	Mean	SD	*P*
MRI score	12	8.4	0.7	12	2.0	0.0	<.0001
T2 map, ms	6	55.1	13.0	6	35.7	13.0	.004
India ink, mm^2	12	46.7	13.0	12	2.8	7.0	<.0001
Biomechanics, N	12	0.25	0.08	12	0.63	0.08	<.0001
Mankin	12	11.3	1.6	12	0.67	0.89	<.0001
Polarized	12	3.5	0.8	12	0.0	0.0	<.0001

[a]Modified Mankin scores are between 0 and 14; polarized light scores are between 0 and 4; MRI scores are between 2 and 10. Highly significant differences were seen in all outcome measures ($P < .05$).

of the lateral compartment joint space, no cartilage wear (mean cartilage thickness was approximately 0.8 mm), no subchondral sclerosis or edema, and no peripheral osteophyte formation (mean score, 2.0) (Figure 2A). By 2 months after meniscectomy, MRI demonstrated moderate cartilage degeneration, with significant focal cartilage wear over the central weightbearing zone of the tibial plateau, mild to moderate subchondral sclerosis, and the presence of osteophytes and subchondral edema in the majority of the specimens (mean score, 7.1 ± 0.6). By 4 months, advanced degeneration was clearly seen with large areas of full-thickness cartilage wear, significant sclerosis, and the presence of osteophytes and edema in all specimens (mean score, 8.4 ± 0.7) (Figure 2B).

T2 Mapping. T2 maps demonstrated significant prolongation ($P > .05$) of T2 relaxation times in the lateral tibial plateau after meniscectomy compared with nonoperated controls at both 2 months (Figure 3) and 4 months (Figure 4; Tables 1 and 2). The mean T2 relaxation time for the nonoperated controls was 38.7 ± 10.0 milliseconds. There was no significant difference between T2 relaxation times in the control animals at 2 months (41.6 ± 7.0) compared with 4 months (35.7 ± 13.0). At 2 months after meniscectomy, the mean T2 relaxation time had increased to 57.2 ± 11.1 milliseconds, and by 4 months after meniscectomy, it was also elevated at 55.1 ± 13.0 milliseconds. This finding confirmed the osteoarthritis noted on traditional MRI, with increased signal intensity seen at both 2 months and 4 months compared with control limbs. There was no significant difference between the increased T2 relaxation time seen at 2 months and 4 months, suggesting that a threshold of cartilage degeneration was reached by 2 months that was beyond the limits of resolution of the T2 mapping to detect further cartilage deterioration. Little to no stratification of T2 relaxation times was noted over the plateau, likely because of the advanced degree of degeneration and the limitations of the in-plane resolution of the T2 mapping sequence, given the time requirements for obtaining 3 echo samples.

In an attempt to identify correlations between the T2 mapping and the other outcome measures, Spearman rank correlations were calculated and subjected to post hoc analysis. There was no assumption of a linear relationship between variables at 2 months and 4 months (Table 3). Significant correlations were identified between prolongation of T2 relaxation times and all other outcome measures at 4 months ($P < .05$). At 2 months, significant correlations were identified between prolongation of T2 relaxation times and all other outcome measurements except the morphologic MRI score and the india ink staining area ($P < .05$).

Gross Inspection. Representative gross specimens at 4 months stained with 1% dilute india ink are seen in Figures 5 A and B. The nonoperated control limbs (Figure 5A) demonstrated minimal staining over the lateral plateau at 4 months (mean stain area, 3.0 ± 6.2 mm^2). This

Figure 2. A, magnetic resonance imaging of the nonoperated control limbs demonstrated no evidence of cartilage wear or subchondral bony changes. B, by 4 months after meniscectomy, advanced changes were seen in all specimens, including subchondral depression, edema pattern, and marked thinning of the cartilage.

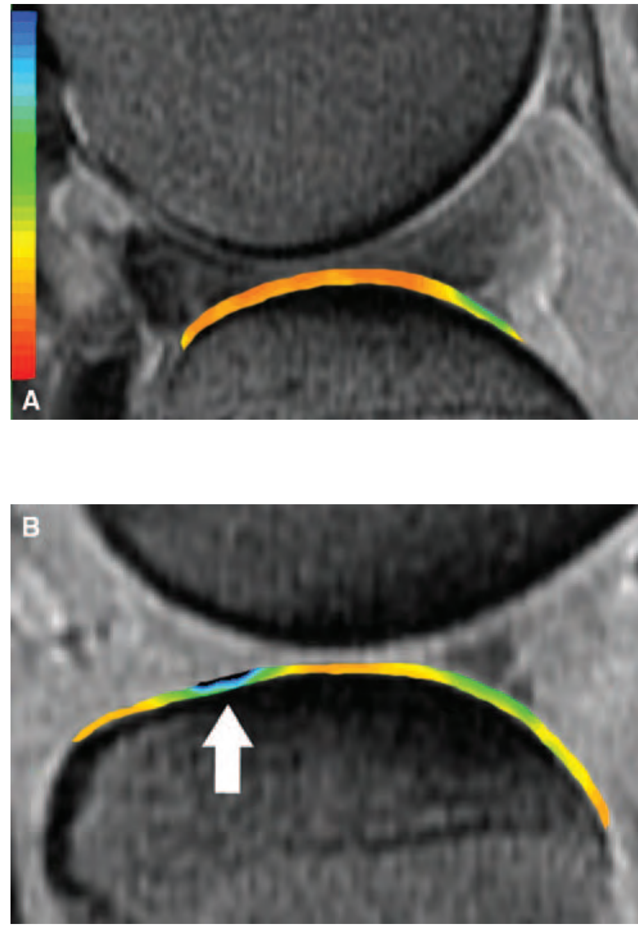


Figure 3. Quantitative T2 relaxation time maps comparing the nonoperated control (A) and the 2-month postmeniscectomy (B) tibial plateau. The color maps are coded to capture T_2 values ranging from 0 to 150 milliseconds, with green and blue reflecting longer T_2 values, yellow intermediate values, and orange/red the shorter values. The apparent prolongation in T2 values to the posterior margin (green regions) is owing to the magic angle effect, yielding the expected prolongation of T2 when the collagen is oriented close to 55° relative to the magnetic field. Note diffuse prolongation of T2 values over the anterior margin (arrow; blue region in B) after meniscectomy (B) compared with the nonoperated control (A).

finding was consistent across all animals, with virtually no evidence of baseline cartilage degeneration in the lateral plateau. At 2 months after meniscectomy, there was a significantly increased stain consistent with moderate cartilage degeneration (mean stain area, 36.1 ± 7.9 mm^2). By 4 months, advanced cartilage wear was evident by gross inspection (mean stain area, 46.7 ± 13.0 mm^2) (Figure 5B).

Biomechanical Testing. The central weightbearing zone of the tibial plateau represented the area of most rapid degeneration and was the area that was focused on for biomechanical and histologic testing. The biomechanical testing was performed in the anterior, central, and posterior regions of the weightbearing zone depicted by the areas of

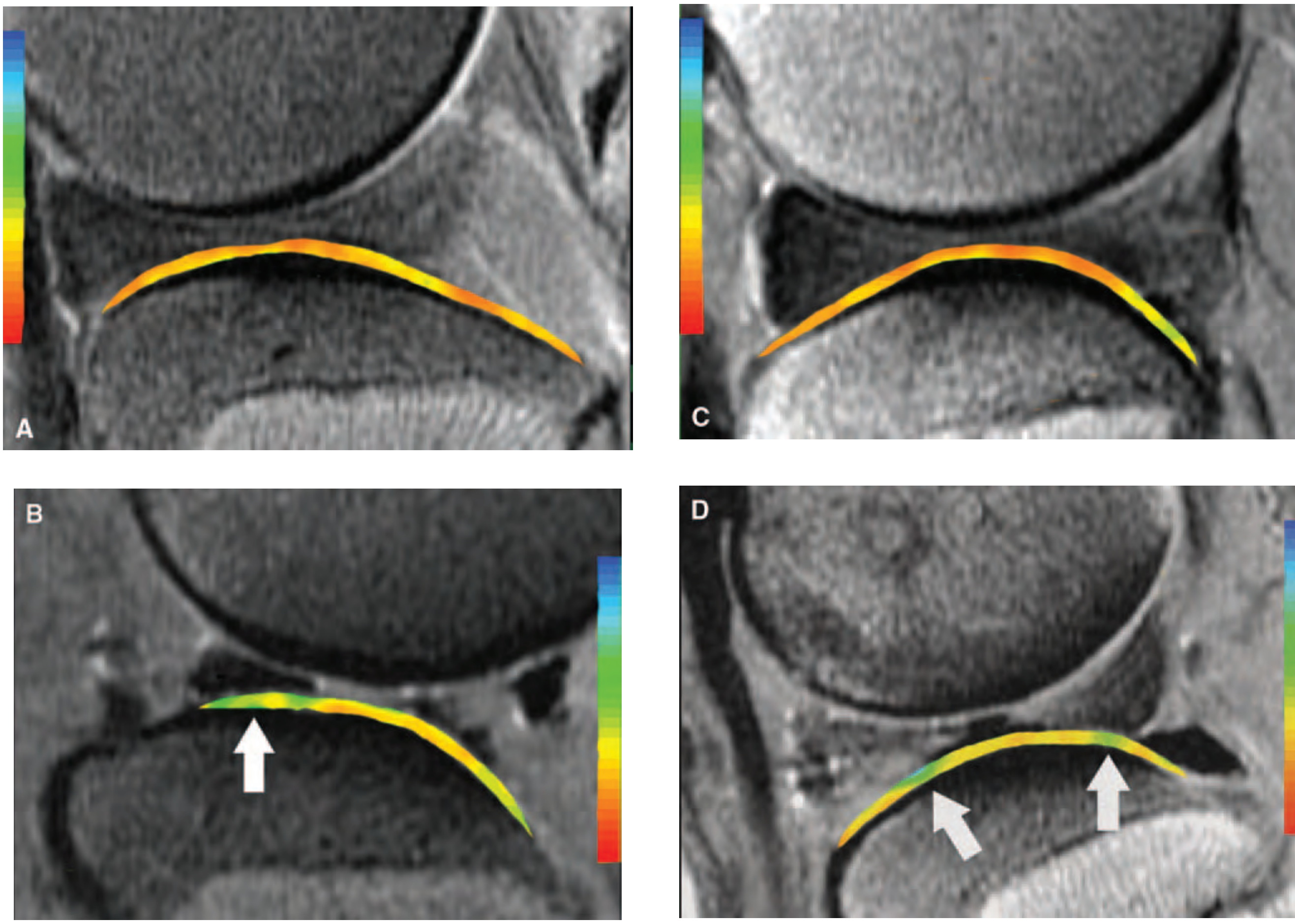


Figure 4. Quantitative T2 relaxation time maps of the lateral tibial plateaus comparing the nonoperated control (A), the 4-month postmeniscectomy (B), and the 2-month (C) and 4-month (D) postmeniscal allograft transplantation animals. The color maps are coded to capture T_2 values ranging from 0 to 150 milliseconds, with green and blue reflecting longer T_2 values, yellow intermediate values, and orange/red the shorter values. Note diffuse prolongation of T2 values after meniscectomy (B) compared with the nonoperated control (A), particularly over the anterior margin (arrow). There is comparatively diffuse prolongation of T2 relaxation times (arrows) 4 months after meniscal allograft transplantation (D) compared with the 2-month allograft specimen (C), which cannot be attributed to the magic angle phenomenon.

TABLE 3
Correlation of T2 With Other Variables at 2 Months and 4 Months[a]

	2 Months		4 Months	
Variable	r^2	*P*	r^2	*P*
MRI	0.37	.07[b]	0.63	<.05
India ink	0.43	.06[b]	0.55	<.05
Biomechanics	–0.58	<.05	–0.67	<.05
Mankin	0.69	<.05	0.51	<.05
Polarized	0.64	<.05	0.55	<.05

[a]Spearman rank correlation was used, nonlinear.
[b]Not significant.

highest stain uptake (Figure 5B). There was a significant decrease in cartilage stiffness at both 2 months (0.37 ± 0.13 N) and 4 months (0.25 ± 0.08 N) compared with controls (0.64 ± 9 N). Significant differences between the 2- and 4-month animals were also detected ($P < .05$). Biomechanical testing of 4-month meniscectomy knees demonstrated significantly decreased articular cartilage stiffness over the entire lateral tibial plateau (anterior, central, and posterior data points) compared with controls ($P = .006$), whereas at 2 months, stiffness was significantly decreased over the anterior lateral tibial plateau only ($P = .01$).

Histologic Analysis: H&E. Histology specimens were cut in the coronal plane and extended from the periphery of the tibial plateau to the central (intercondylar notch) region at the midpoint of the tibial plateau. Normal articular cartilage was seen in all nonoperated controls and sham animals and was consistent with the absence of any baseline cartilage wear over the lateral plateau (mean modified Mankin score was 0.46 ± 0.67). At 2 months, histologic evidence of moderate cartilage degeneration was seen (modified Mankin score was 7.3 ± 1.5), and by 4 months, advanced cartilage degeneration was confirmed

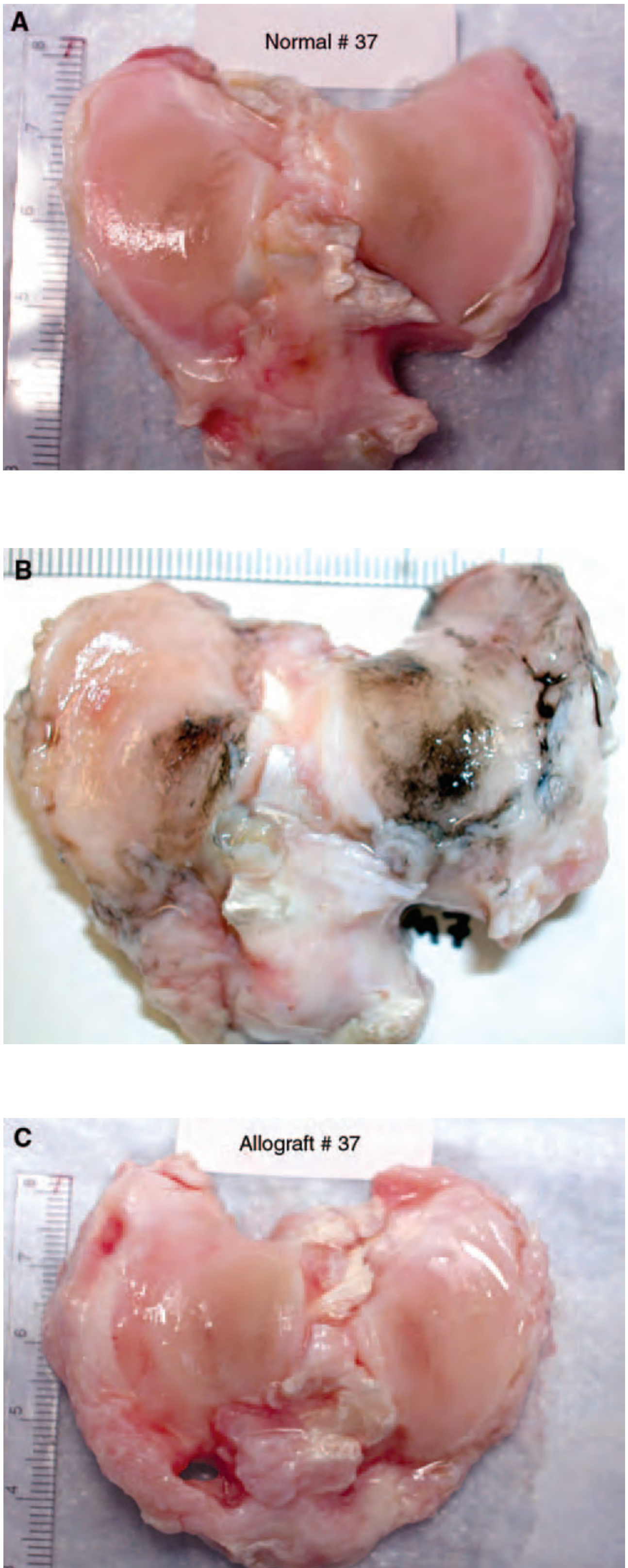


Figure 5. Gross inspection with 1% dilute india ink comparing the nonoperated control tibial plateau (A), the 4-month postmeniscectomy tibial plateau (B), and the 4-month meniscal allograft transplant tibial plateau (C).

in all specimens (mean modified Mankin score was 11.2 ± 1.6). Characteristic histologic findings included disorganization of cartilage structure with fissure formation, hypocellularity, reduced matrix staining, and loss of tidemark integrity.

Histologic Analysis: Polarized Light Microscopy. Polarized light microscopy was used to further evaluate the collagen organization. The control animals demonstrated normal cartilage with polarized light analysis, which was reflected by maintenance of collagen organization within the 4 layers of the matrix: superficial layer, transitional zone, radial zone, and calcified zone (polarized light score of 0). Significant loss of collagen organization was seen at both 2 months (polarized light score of 2.2 ± 0.8) and 4 months after meniscectomy (polarized light score of 3.5 ± 0.8). Polarized light scores demonstrated significantly decreased collagen organization at 4 months compared with 2 months ($P = .002$). Collagen disorganization was evident in the superficial and transitional zones by 2 months, with extension into the deeper layers (radial zone and calcified zone) at 4 months.

Allograft

There were statistically significant differences between the allograft limbs and the meniscectomy limbs in all objective categories at 2 months (MRI, T2 mapping, gross inspection with india ink, biomechanical testing, and histologic analysis). At 4 months, allograft limbs demonstrated significant differences in all objective categories except the T2 mapping (Table 4). In comparing the allograft limbs to the nonoperated control limbs, no significant differences were seen at 2 months in any of the categories except the MRI data. At 4 months, the nonoperated control limbs demonstrated significantly less wear compared to the allograft limbs in all categories except the modified Mankin scores (Table 5). One animal was sacrificed at 12 months after surgery. The scores in all categories for this animal remained better than the mean scores at 2 months in the postmeniscectomy animals.

Magnetic Resonance Imaging. The MRI appearance of the allograft limbs demonstrated significant improvements in all morphologic criteria compared with the meniscectomy limbs at both 2 and 4 months, although there was a statistically significant increase in the MRI score between 2 and 4 months (2.7-4.2, $P < .05$). Compared with the nonoperated control limbs, however, MRI scores were significantly worse at both 2 and 4 months after allograft transplantation (Table 5). Magnetic resonance imaging further evaluated the transplanted meniscus with regard to intrameniscal signal, extrusion in the sagittal and coronal planes, and meniscal morphologic characteristics. At 2, 4, and 12 months, the transplanted allografts demonstrated minimal intrameniscal signal, minimal extrusion in either plane, and preservation of normal meniscal shape. The allografts were healed at the capsular attachment site. Several specimens demonstrated evidence of fibrous tissue ingrowth into the anterior and posterior meniscal-ligament attachment sites. No meniscal tears were seen on MRI.

TABLE 4
Allograft Transplant and Postmeniscectomy Outcome Measures Evaluating the Tibial Plateaus at 2 and 4 Months After Surgery[a]

	2 Months							4 Months						
	Meniscectomy			Allograft				Meniscectomy			Allograft			
Variable	n	Mean	SD	n	Mean	SD	P	n	Mean	SD	n	Mean	SD	P
MRI	12	7.1	0.6	7	2.7	1.0	<.001	12	8.4	0.7	5	4.2	0.9	<.001
T2 map, ms	12	57.2	11.1	5	46	2	.02	11	55.1	13.0	5	50	5	.08
India ink, mm^2	12	36.1	7.9	8	6	7	<.001	12	46.7	13.0	8	18	6	<.001
Biomechanics, N	12	0.37	0.13	8	0.6	0.1	<.001	12	0.25	0.08	8	0.4	0.06	.001
Mankin	12	7.3	1.5	8	0.3	1.0	<.001	12	11.3	1.6	8	0.7	1.0	<.001
Polarized	12	2.2	0.8	8	0	0	<.001	12	3.5	0.8	8	0.9	0.7	<.001

[a]Modified Mankin scores are between 0 and 14; polarized light scores are between 0 and 4; MRI scores are between 2 and 10. All outcome measures demonstrated significant differences between the 2 groups except the T2 mapping at 4 months ($P < .05$).

TABLE 5
Allograft Transplant and Nonoperated Control Outcome Measures Evaluating the Central Weightbearing Zone of the Tibial Plateaus at 2 and 4 Months After Surgery[a]

	2 Months							4 Months						
	Control			Allograft				Control			Allograft			
Variable	n	Mean	SD	n	Mean	SD	P	n	Mean	SD	n	Mean	SD	P
MRI	12	2.0	0.0	7	2.7	1.0	.045	12	2	0	5	4.2	0.9	.01
T2 map, ms	6	41.6	7.0	5	46	2	.3	6	29	3	5	50	5	.005
India ink, mm^2	12	3.0	6.2	8	6	7	.4	12	3	7	8	18	6	.01
Biomechanics, N	12	0.63	0.08	8	0.6	0.1	.9	12	0.6	0.09	8	0.4	0.06	.01
Mankin	12	0.25	0.45	8	0.3	1.0	.7	12	0.67	0.89	8	0.7	1.0	.9
Polarized	12	0.0	0.0	8	0	0	.9	12	0	0	8	0.9	0.7	.01

[a]Modified Mankin scores are between 0 and 14; polarized light scores are between 0 and 4; MRI scores are between 2 and 10. At 2 months, the MRI score was the only outcome measure that was statistically different from the control animals. At 4 months, all values except the modified Mankin scores were significantly worse compared with the control animals ($P < .05$).

T2 Mapping. T2 maps demonstrated improved maintenance of T2 relaxation times at 2 months and 4 months compared with meniscectomy (Table 4 and Figure 4). This improvement was statistically significant at 2 months but not at 4 months. This finding suggests improved preservation of collagen organization resulting from the meniscus transplant and is correlated with the findings observed under polarized light microscopy. There were no significant differences in the T2 maps between the nonoperated control limbs and the allograft limbs at 2 months. However, by 4 months, the allograft limbs demonstrated a significant prolongation in T2 relaxation times compared with the nonoperated controls (Table 5).

Gross Inspection. A representative gross specimen 4 months after allograft transplantation is depicted in Figure 5C. Compared with the meniscectomy limbs, there were significantly decreased india ink stain areas over the lateral plateau at both 2 and 4 months. However, there was a significant increase in stain area between 2 and 4 months (6-18 mm^2, $P < .05$). The wear pattern, as evidenced by the india ink staining, demonstrated additional wear along the periphery of the tibial plateau in some specimens. This wear pattern differed from the meniscectomy animals, in which the wear was isolated to the central weightbearing zone. At 2 months, there was no difference in the gross appearance between the allograft animals and control animals (Table 5). By 4 months, however, the allograft animals demonstrated significantly increased stain area compared with the control animals.

Biomechanical Testing. Biomechanical testing was performed in the same locations along the central weightbearing zone of the lateral plateau as was done for the meniscectomy animals. There was significantly improved maintenance of cartilage stiffness at both 2 and 4 months compared with the meniscectomy animals (Table 4); however, stiffness values were significantly lower at 4 months compared with 2 months (0.4 N vs 0.6 N, $P < .05$). Similar to the other outcome measures, 2-month allograft limbs demonstrated no differences compared with control limbs,

TABLE 6
Comparison of the Regional Histology (Modified Mankin Scores and Polarized Light Scores) of the Central Zone and Peripheral Zone After Meniscal Allograft Transplantation at 2 and 4 Months[a]

	Central Zone			Peripheral Zone			
Variable	n	Mean	SD	n	Mean	SD	*P*
2 mo							
Mankin	9	0.3	1.0	9	3.78	1.79	.007
Polarized	9	0	0	9	1.33	0.5	.006
4 mo							
Mankin	7	0.7	1.0	7	3.86	1.52	.02
Polarized	7	0.9	0.7	7	1.29	0.49	.08

[a]Modified Mankin scores are between 0 and 14; polarized light scores are between 0 and 4. Significantly greater wear was noted at the periphery compared with the central zone by modified Mankin scores at both time points. The polarized light scores were significantly worse at the periphery for the 2-month animals only ($P < .05$).

but by 4 months, the allografts were significantly worse compared with controls (Table 5).

Histologic Analysis: H&E. Compared with the meniscectomy animals, there were statistically significant improvements in the modified Mankin scores over the central weightbearing zone at both 2 months and 4 months. Excellent preservation of the cartilage structure, cellularity, matrix staining, and tidemark integrity was observed in this central zone. However, there was significantly more cartilage wear in the peripheral zone beneath the allograft meniscus compared with the central weightbearing zone of the tibial plateau (Table 6). This finding was true for the modified Mankin scores at both 2 and 4 months ($P = .007$ and $P = .02$, respectively). Scores along the periphery of the tibial plateau for the allograft animals were still lower than were the Mankin scores for the meniscectomy animals in the central weightbearing zone. No significant differences were noted between the Mankin scores at 2 months and 4 months in the allograft animals. In comparing the central zone histologic findings of the meniscal allograft animals and the nonoperated control animals, no significant differences were noted at 2 or 4 months (Table 5).

Histologic Analysis: Polarized Light. Polarized light microscopy demonstrated maintenance of collagen organization after allograft transplantation at both 2 and 4 months compared with the meniscectomy animals (Table 4); however, there was loss of collagen organization at 4 months compared with 2 months ($P < .05$), thus correlating with the prolonged T2 relaxation times noted in the 4-month allograft group. Compared with the control limbs, polarized light scores were not significantly different at 2 months, but by 4 months, allograft limbs demonstrated significantly decreased collagen organization. In comparing the peripheral zone to the central weightbearing zone of the tibial plateau, the polarized light scores were significantly different at 2 months only ($P = .006$) (Table 6).

Allograft Explant Analysis

All allograft explants were evaluated by gross examination (Figure 6). There was tissue ingrowth into the allograft at

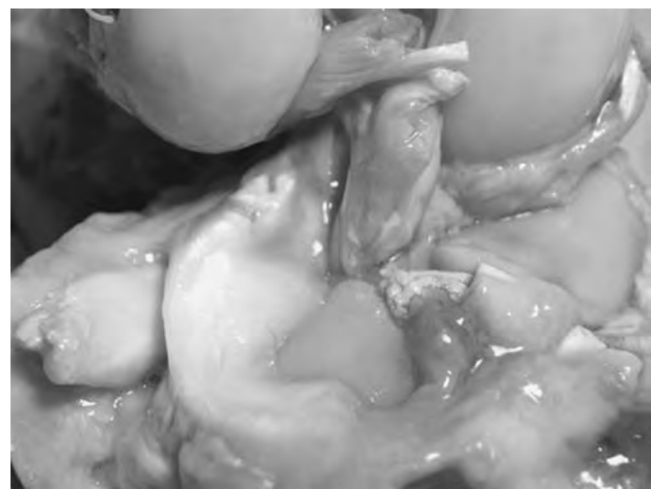


Figure 6. Gross examination of the allograft transplants demonstrated good fixation at the anterior and posterior ligament insertion sites, as well as along the capsular periphery. Good preservation of the central weightbearing cartilage on the tibial plateau was also seen by gross examination.

the anterior and posterior attachment sites, as well as along the capsular periphery. The allografts appeared to be firmly fixed within the joint, with no evidence of lateral extrusion or any evidence of rupture of the attachment sites. No meniscal tears were seen at any location along the length of the allograft at any of the sacrifice time points (2, 4, and 12 months).

Routine histologic examination of the meniscus was performed on 3 of the specimens and demonstrated normal-appearing fibrocartilage that was indistinguishable from the native medial meniscus. Histologic evaluation of the anterior and posterior attachment sites demonstrated fibrous tissue loosely integrated into the recipient bone. Cell viability of the allograft menisci was evaluated using paravital staining techniques in 7 allograft specimens (5 at 2 months and 2 at 4 months). These specimens were

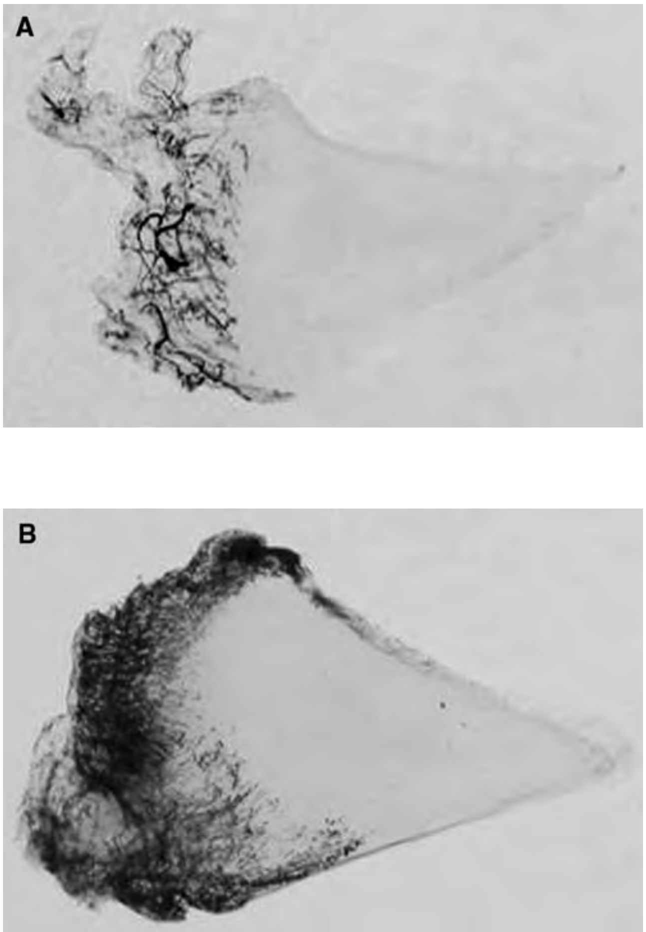


Figure 7. Vascularity of the normal control meniscus (A) compared with the 4-month allograft transplant meniscus (B).

evaluated fresh and not subjected to a freeze-thaw cycle as were the other specimens. At both 2 and 4 months, there was greater than 90% cell viability in all allograft menisci examined. Again, the allograft tissue was indistinguishable from the native medial meniscus. Evaluation of the vascularity of the allograft meniscus was assessed using the Spälteholz technique in 3 of the 4-month specimens. The nonoperated limbs of 2 animals were also assessed with the vascular injection study to determine the vascularity of the native lateral meniscus. Extensive vascular ingrowth was observed at both the anterior and posterior attachment sites as well as along the periphery. The allografts were hypervascular compared with the native meniscus (Figure 7).

DISCUSSION

Currently, there is no consistently reproducible animal model for meniscal allograft transplantation in the literature. Previous animal models have demonstrated variable results; however, these earlier studies have not emphasized anatomical reconstruction of the native meniscal insertion sites, nor have they used bone tunnel fixation as is typically performed in humans. Arnoczky et al[5] and Mikic et al[22] reported some degree of protection of the cartilage after meniscal allograft transplantation in dogs; however, these findings were not compared with meniscectomy. Edwards et al[10] found no radiographic differences between meniscal transplants and those of meniscectomy at 21 months and concluded that meniscal autogenous grafts and allografts did not protect cartilage. Cummins et al[8] found that meniscal allografts offered some histologic evidence of articular cartilage protection in a rabbit model. Szomor et al[31] reported perhaps the best published large-animal model for the protective effects of autograft and allograft meniscal transplantation. They demonstrated a 50% decrease in cartilage wear as determined by macroscopic grading of the cartilage; however, they found no differences between the meniscectomy and transplant groups when histologic criteria were examined. No further outcome measures were used in any of these studies.

The surgical technique used in this study attempted to restore the anatomical anterior tibial and posterior femoral meniscal attachments. In our dissections and cadaveric transplant trials, re-creation of the normal, anatomical anterior and posterior lateral meniscal attachments grossly reproduced normal meniscal kinematics. Adhering to these anatomical considerations resulted in significantly decreased cartilage wear compared with meniscectomy and may provide a more accurate evaluation of the chondroprotective effect of a meniscus transplant. We used a wide array of outcome measures to provide a comprehensive evaluation of the chondroprotective effects of this surgical procedure. We were able to demonstrate the protective effects of allograft transplantation by gross inspection, histologic analysis, biomechanical testing, MRI, and T2 mapping of the tibial plateau to 4 months. A single animal was sacrificed at 1 year with promising results; however, further studies with larger numbers of long-term survival animals are necessary. Each of these outcome measures provides useful information regarding the status of the underlying cartilage and subchondral bone. Although this model demonstrated significant improvements compared with meniscectomy, progressive cartilage degeneration still occurred. As early as 4 months after allograft transplantation, we noted significantly more cartilage degeneration compared with control animals in all outcomes except the modified Mankin scores, even in this "best-case scenario" of transplantation immediately after meniscectomy.

Our outcome analyses focused on the central tibial plateau. This was the area of greatest cartilage degeneration noted after meniscectomy. In the absence of the meniscus, the lateral femoral condyle focally loaded the central tibial plateau, resulting in rapid cartilage destruction. The anatomical allograft transplantation resulted in a redistribution of the load away from the central tibia, so that the focal wear was eliminated. Histologic analysis of the central tibia as well as biomechanical testing of the central cartilage stiffness demonstrated significant "chondroprotection" after transplantation of the meniscus. However, we did observe increased wear along the periphery, where the allograft meniscus had direct contact with the peripheral tibial plateau. We believe that this increased peripheral wear was in part a result of the surgical approach (release of the lateral collateral ligament and popliteus with open exposure to the joint); however, it may have also been a result of allograft size mismatch and subsequent increased cartilage loading along the periphery. Despite the increased wear along the periphery, this area of cartilage wear in the allograft animals was still less than the cartilage wear seen in the central weightbearing zone of the meniscectomy animals.

The second main purpose of this study was to evaluate the utility of T2 relaxation time mapping as a noninvasive measure of early articular cartilage degeneration and to determine if it could be used to monitor cartilage protection in the meniscal allograft transplantation model using clinically relevant MRI field strengths of 1.5 T. Although cartilage-sensitive techniques are helpful in assessing morphologic changes,[27] a study of healthy bovine and degenerative human cartilage samples indicated that routine clinical images do not reveal early degenerative changes, thus emphasizing the need for more sensitive MRI techniques.[29] T2 mapping techniques have been shown in very high-field magnetic resonance microscopy systems to reflect the structure and orientation of the collagen component of the extracellular matrix, exploiting the depth-sensitive internuclear dipolar interaction of the hydrogen nuclei.[25,34]

Clinically, T2 relaxation time is a quantifiable MRI parameter that at high-field strengths of 3 T has demonstrated a relationship between the water content of hyaline cartilage, as well as the relative restricted mobility of water in the cartilage within an anisotropic solid matrix.[9] Further work at 3 T has demonstrated that aging is associated with an asymptomatic increase in T2 relaxation times in the transitional zone of articular cartilage, compatible with a relative increase in water mobility.[23] In this study, we were able to demonstrate maintenance of T2 mapping times 2 months after allograft transplantation compared with 2 months after meniscectomy. This difference was no longer significant after 4 months (Table 5), whereas all other outcome measures were significantly different between the transplant and meniscectomy groups. This finding suggests that T2 mapping may be able to detect more minor changes in collagen organization that are not detectable with the other traditional outcome modalities and, therefore, has important clinical applications. We are currently using T2 mapping in select patients in an attempt to identify early cartilage degeneration that is not appreciated with traditional MRI techniques.

We found significant correlations between T2 mapping values and our other more traditional outcome measures (routine MRI, gross inspection, biomechanical testing, and histology). Perhaps the most important correlation seen in this study was between the T2 mapping and the polarized light scores. Polarized light microscopy evaluates collagen organization and provides a histologic corollary to the structure and orientation of the collagen component of the extracellular matrix reflected by the T2 mapping.

Of interest, there was a significant 30% increase in surface area of cartilage degeneration from 2 to 4 months detected by india ink staining that was not detected by T2 relaxation times. This finding suggests that a threshold of detectable degeneration reflected in the T2 relaxation times was met and exceeded by 2 months after meniscectomy. This threshold is likely owing to the limits of the resolution of T2 mapping in the context of the moderate to severe degree of cartilage degeneration seen in these animals at the sacrifice time points analyzed. Further cartilage degeneration beyond the 2-month time point was not reflected in additional changes in the T2 mapping score. This is a fair limitation of this technique for looking at differences between moderate to severe cartilage degeneration as seen in the postmeniscectomy animals but does not reflect an inability of T2 mapping to detect more subtle changes in early cartilage degeneration.

In summary, this meniscal allograft transplantation model demonstrated significantly decreased cartilage degeneration compared with meniscectomy, as well as a high degree of allograft cell viability and vascular ingrowth. We developed a more anatomical surgical technique that accurately reproduces normal meniscus anatomy and more securely fixes the transplanted meniscus compared with previously described techniques. We used a wide array of outcome measures to more fully and accurately characterize the cartilage surfaces after meniscal transplantation, as well as the allograft tissue after transplantation, and have provided a comprehensive baseline against which future animal studies investigating this procedure may be compared. We recognize the importance of early detection of cartilage wear to optimize the results of meniscal allograft transplantation, and our findings help to validate, by standard MRI, histology, and biomechanical testing, the use of T2 mapping of cartilage to assess collagen in a noninvasive manner. In this study, MRI with T2 mapping proved to be very sensitive for the early detection of hyaline cartilage matrix changes and promises to be a valuable clinical tool for the early detection of degenerative joint disease. By increasing the sensitivity and sophistication of our testing parameters through noninvasive imaging of early cartilage breakdown, and integrating these tools with surgical planning and timing, the outcome of these surgical interventions should be improved. Future studies will be aimed at evaluating the efficacy of delayed allograft transplantation as well as the use of novel biomaterials to provide cartilage protection after meniscectomy.

ACKNOWLEDGMENT

Research assistance was provided by Peter Torzilli, Manjula Bansal, Stephen Lyman, Li Foong Foo, and Chris Chen. This research was supported by grants from the American Orthopaedic Society for Sports Medicine Young Investigator's Award, National Football League Charities, and Aircast Foundation.

REFERENCES

1. Allen MJ, Houlton JE, Adams SB, Rushton N. The surgical anatomy of the stifle joint in sheep. *Vet Surg*. 1998;27:596-605.
2. Appleyard RC, Burkhardt D, Ghosh P, et al. Topographical analysis of the structural, biochemical and dynamic biomechanical properties of cartilage in an ovine model of osteoarthritis. *Osteoarthritis Cartilage*. 2003;11:65-77.

3. Arnoczky SP, Warren RF. Microvasculature of the human meniscus. *Am J Sports Med*. 1982;10:90-95.
4. Arnoczky SP, Warren RF. The microvasculature of the meniscus and its response to injury: an experimental study in the dog. *Am J Sports Med*. 1983;11:131-141.
5. Arnoczky SP, Warren RF, McDevitt CA. Meniscal replacement using a cryopreserved allograft: an experimental study in the dog. *Clin Orthop Relat Res*. 1990;252:121-128.
6. Bae WC, Temple MM, Amiel D, Coutts RD, Niederauer GG, Sah RL. Indentation testing of human cartilage: sensitivity to articular surface degeneration. *Arthritis Rheum*. 2003;48:3382-3394.
7. Canham W, Stanish W. A study of the biological behavior of the meniscus as a transplant in the medial compartment of a dog's knee. *Am J Sports Med*. 1986;14:376-379.
8. Cummins JF, Mansour JN, Howe Z, Allan DG. Meniscal transplantation and degenerative articular change: an experimental study in the rabbit. *Arthroscopy*. 1997;13:485-491.
9. Dardzinski BJ, Mosher TJ, Li S, Van Slyke MA, Smith MB. Spatial variation of T2 in human articular cartilage. *Radiology*. 1997;205:546-550.
10. Edwards DJ, Whittle SL, Nissen MJ, Cohen B, Oakeshott RD, Keene GC. Radiographic changes in the knee after meniscal transplantation: an experimental study in a sheep model. *Am J Sports Med*. 1996;24: 222-226.
11. Franz T, Hasler EM, Hagg R, Weiler C, Jakob RP, Mainil-Varlet P. In situ compressive stiffness, biochemical composition, and structural integrity of articular cartilage of the human knee joint. *Osteoarthritis Cartilage*. 2001;9:582-592.
12. Friedlaender GE, Mankin HJ, Sell KW. *Osteochondral Allografts: Biology, Banking and Clinical Applications*. Boston, Mass: Little, Brown and Co; 1983.
13. Garrett JC. Meniscal transplantation. *Am J Knee Surg*. 1996;9:32-34.
14. Garrett JC. Meniscal transplantation: a review of 43 cases with 2- to 7-year follow-up. *Sports Med Arthrosc Rev*. 1993;1:164-167.
15. Garrett JC, Steensen RN, Stevensen RN. Meniscal transplantation in the human knee: a preliminary report. *Arthroscopy*. 1991;7:57-62.
16. Jackson DW, McDevitt CA, Simon TM, Arnoczky SP, Atwell EA, Silvino NJ. Meniscal transplantation using fresh and cryopreserved allografts: an experimental study in goats. *Am J Sports Med*. 1992;20: 644-656.
17. Korhonen RK, Wong M, Arokoski J, et al. Importance of the superficial tissue layer for the indentation stiffness of articular cartilage. *Med Eng Phys*. 2002;24:99-108.
18. Lucchinetti E, Adams CS, Horton WE Jr, Torzilli PA. Cartilage viability after repetitive loading: a preliminary report. *Osteoarthritis Cartilage*. 2002;10:71-81.
19. Lyyra T, Kiviranta I, Vaatainen U, Helminen HJ, Jurvelin JS. In vivo characterization of indentation stiffness of articular cartilage in the normal human knee. *J Biomed Mater Res*. 1999;48:482-487.
20. Maier CF, Tan SG, Hariharan H, Potter HG. T2 quantitation of articular cartilage at 1.5 T. *J Magn Reson Imaging*. 2003;17:358-364.
21. Mankin HJ, Dorfman H, Lippiello L, Zarins A. Biochemical and metabolic abnormalities in articular cartilage from osteo-arthritic human hips. *J Bone Joint Surg Am*. 1971;53:523.
22. Mikic ZD, Brankov MZ, Tubic MV, Lazetic AB. Transplantation of fresh-frozen menisci: an experimental study in dogs. *Arthroscopy*. 1997;13:579-583.
23. Mosher TJ, Dardzinski BJ, Smith MB. Human articular cartilage: influence of aging and early symptomatic degeneration on the spatial variation of T2. Preliminary findings at 3T. *Radiology*. 2000;214:259-266.
24. Muldrew K, Chung M, Novak K, et al. Evidence of chondrocyte repopulation in adult ovine articular cartilage following cryoinjury and long-term transplantation. *Osteoarthritis Cartilage*. 2001;9:432-439.
25. Nieminen MT, Rieppo J, Toyras J, et al. T2 relaxation reveals spatial collagen architecture in articular cartilage: a comparative quantitative MRI and polarized light microscopic study. *Magn Reson Med*. 2001; 46:487-493.
26. Peterson L, Brittberg M, Kiviranta I, Akerlund EL, Lindahl A. Autologous chondrocyte transplantation: biomechanics and long-term durability. *Am J Sports Med*. 2002;30:2-12.
27. Potter HG, Linklater JM, Allen AA, Hannafin JA, Haas SB. Magnetic resonance imaging of articular cartilage in the knee: an evaluation with use of fast-spin-echo imaging. *J Bone Joint Surg Am*. 1998;80: 1276-1284.
28. Rodeo SA. Meniscal allografts: where do we stand? *Am J Sports Med*. 2001;29:246-261.
29. Rubenstein JD, Li JG, Majumdar S, Henkelman RM. Image resolution and signal-to-noise ratio requirements for MR imaging of degenerative cartilage. *AJR Am J Roentgenol*. 1997;169:1089-1096.
30. Swann AC, Seedhom BB. The stiffness of normal articular cartilage and the predominant acting stress levels: implications for the aetiology of osteoarthrosis. *Br J Rheumatol*. 1993;32:16-25.
31. Szomor ZL, Martin TE, Bonar F, Murrell GA. The protective effects of meniscal transplantation on cartilage: an experimental study in sheep. *J Bone Joint Surg Am*. 2000;82:80-88.
32. van der Sluijs JA, Geesink RG, van der Linden AJ, Bulstra SK, Kuyer R, Drukker J. The reliability of the Mankin score for osteoarthritis. *J Orthop Res*. 1992;10:58-61.
33. Veltri DM, Warren RF, Wickiewicz TL, O'Brien SJ. Current status of allograft meniscal transplantation. *Clin Orthop Relat Res*. 1994;303: 44-55.
34. Xia Y, Moody JB, Burton-Wurster N, Lust G. Quantitative in situ correlation between microscopic MRI and polarized light microscopy studies of articular cartilage. *Osteoarthritis Cartilage*. 2001;9:393-406.

Magnetic Resonance Imaging of the Hip: Detection of Labral and Chondral Abnormalities Using Noncontrast Imaging

Douglas N. Mintz, M.D., Timothy Hooper, M.B.B.S., David Connell, M.B.B.S., Robert Buly, M.D., Douglas E. Padgett, M.D., and Hollis G. Potter, M.D.

Purpose: Traditional imaging techniques have limited ability to detect subtle chondral and labral injuries of the hip. We performed a retrospective review of patients who underwent magnetic resonance imaging (MRI) of the hip and subsequent hip arthroscopy in order to evaluate the ability of optimized, noncontrast MRI to identify tears of the acetabular labrum and defects in articular cartilage. **Type of Study:** Retrospective review of a consecutive sample. **Methods:** Between January 1997 and July 2000, 92 patients had MRI of the hip, followed by arthroscopic surgery of that hip by 1 of 2 surgeons (R.B., D.E.P.). Two musculoskeletal MR radiologists blinded to the initial MRI and surgical findings, independently interpreted the studies, looking for the location and degree of articular cartilage and acetabular labral pathology. **Results:** Of the 92 patients studied, each of 2 radiologists correctly identified 83 (94%) and 84 (95%) of the 88 labral tears present at surgery, respectively. There was 92% interobserver agreement on the MRI studies. For articular cartilage defects on the femoral head and acetabulum, there was good agreement (92% and 86% within 1 grade) between MRI and surgical grading and between the 2 MR readers (kappa of 0.8 for femoral head cartilage and 0.7 for acetabular cartilage). **Conclusions:** This study shows that noncontrast MRI of the hip, using an optimized protocol, can noninvasively identify labral and chondral pathology. Such information may facilitate deciding which patients warrant surgical intervention, thus preserving hip arthroscopy as a therapeutic tool. **Level of Evidence:** Level II, Development of Diagnostic Criteria Study. **Key Words:** Acetabular labrum—Articular cartilage—Cartilage—Hip—Labrum—Magnetic resonance imaging.

The radiographic assessment of the patient presenting with hip pain has traditionally been performed using plain radiography. Radiographs, however, are typically normal if hip pain and/or impaired function are caused by labral tears, focal chondral defects, synovitis, or unossified intra-articular loose bodies.

Other methods of diagnostic evaluation, such as conventional contrast arthrography and magnetic resonance arthrography, have been proposed, but they are invasive procedures that carry potential risks such as iatrogenic injury to adjacent neurovascular structures.[1-4] Hip arthroscopy is becoming popular at many institutions and has been proposed as the diagnostic standard for disclosing intra-articular pathology.[5] However, it is invasive, technically challenging, and not without potential morbidity.

The hypothesis of this study was to show that noncontrast magnetic resonance imaging (MRI) of the hip is a sensitive, noninvasive method of detecting labral tears and chondral injuries of the hip compared with arthroscopy as the standard.

METHODS

Patient Selection

To find patients in whom we could directly compare MRI with arthroscopic results, we reviewed the

From the Department of Radiology and Imaging and the Department of Orthopaedic Surgery, Hospital for Special Surgery, (D.N.M., R.B., D.E.P., H.G.P.), New York, New York, U.S.A; Queensland Diagnostic Imaging, St. Andrew's Hospital (T.H.), Brisbane, Australia; and the Department of Radiology, Royal National Orthopaedic Hospital (D.C.), Stanmore, United Kingdom.

Address correspondence and reprint requests to Hollis G. Potter, M.D., Department of Radiology and Imaging, Hospital for Special Surgery, 535 East 72nd St, New York, NY 10021, U.S.A. E-mail: potterh@hss.edu

0749-8063/05/2104-3954$30.00/0
doi:10.1016/j.arthro.2004.12.011

records of patients who had MRI and subsequent arthroscopy of the hip at our institution from January 1997 to July 2000. These patients were found by cross-referencing an MRI database and the hospital's radiology report system with the records of 2 surgeons who perform hip arthroscopy at our institution. We excluded patients for whom a comprehensive surgical record, including arthroscopic pictures of the acetabular labrum and articular cartilage of the femoral head, was not available.

Arthroscopic Technique

Arthroscopic examination of the hip joint was performed under epidural block or general anesthesia. The patient was placed in the lateral or supine position on a standard fracture table. The foot was placed into a traction boot and hip distraction was confirmed using an image intensifier. Seventeen-gauge spinal needles, 6 inches in length, were introduced into the hip joint under fluoroscopic guidance. Peritrochanteric and anterior portals were commonly used. The peritrochanteric portals were made just above the greater trochanter on the lateral aspect of the hip, with one being more posterior and the other being slightly more anterior. The anterior portal was made near the intersection of a line dropped vertically from the anterior superior iliac spine and a horizontal line drawn from the tip of the greater trochanter.

Once the correct position of the spinal needle was confirmed under fluoroscopy, the stylet was replaced with a thin wire. Blunt cannulated obturators (Smith & Nephew Dyonics, Andover, MA) were then inserted over the thin wires and passed into the distracted hip joint. A 4.5-mm arthroscope was used with both 30° and 70° lenses. Additional instruments (3-mm probe, 4.5-mm motorized full-radius resectors, extra length, straight and curved, and Holmium-YAG laser [VersaPulse Select; Coherent, Santa Clara, CA]) were inserted, as needed, through the working portal. Traction was maintained for the duration of the procedure. The hip joint was then injected with a mixture of morphine and anesthetic agent, with corticosteroids added if synovitis was present.

Each surgeon determined operative results by reviewing operative reports and arthroscopic pictures. These results were tabulated on standardized score sheets. The diagnosis of injuries to the acetabular labrum was based on arthroscopic visualization of a defect and probing of the affected area.

MRI

All MRI scans were performed with the same technique using a 1.5-T superconducting magnet (Signa; GE Medical Systems, Milwaukee, WI). Patients were positioned supine with the leg in neutral position. Two sequences were performed using the body coil. Three additional sequences used a phased-array surface coil (shoulder array; Med Rad, Indianola, PA).

Body coil images included an axial fast spin-echo sequence and a coronal fast inversion recovery sequence using the following parameters. The axial fast spin-echo sequence was obtained with a TR(msec)/TE(msec) of 4,000/28-34 (effective [Ef.]), matrix of 512 × 256, slice thickness of 5 mm, no interslice gap, echo train length (ETL) of 7-8, 2 excitations (NEX), and field of view (FOV) of 30 to 36 cm. The fast inversion recovery used TR/TE of 3,500-4,500/17-24 [Ef.], inversion time (TI) of 150 msec, matrix of 256 × 192, slice thickness of 5 mm, no interslice gap, ETL of 8-10, 2 NEX, and FOV of 32 to 38 cm to include both of the hips and the pelvis.

Surface coil sequences were performed in sagittal, axial, and coronal planes. Each sequence consisted of a fast spin-echo acquisition with a TR/TE of 3,500-4,500/28-34 [Ef.], a matrix of 512 × 384 for the coronal and sagittal images and 512 × 256 for the axial images, 3-mm slices for the sagittal and 4-mm for the coronal and axial planes, no interslice gap, ETL of 8-12, 3 NEX, and FOV 15 to 17 cm. Bandwidth was 31 kHz, except for the axial surface coil sequence, for which it was 20 kHz. The total examination time was approximately 35 to 40 minutes.

The MRIs were analyzed by 2 experienced musculoskeletal MRI radiologists who were blinded to each other's readings, the original reading, and the surgical results. Two independent readers were used to establish interobserver variability and to see if, and to what degree, accuracy was dependent on a specific MRI reader. Both the acetabular and femoral articular surfaces were assessed. The articular cartilage was graded on the MRI and at arthroscopy with a modification of the classification system of Outerbridge.[6] Grade 0 indicated intact articular cartilage; grade 1, chondral softening (high signal); grade 2, superficial ulceration, fissuring, or fibrillation involving less than 50% of the depth of the articular surface; grade 3, ulceration, fissuring, or fibrillation involving more than 50% of the depth of

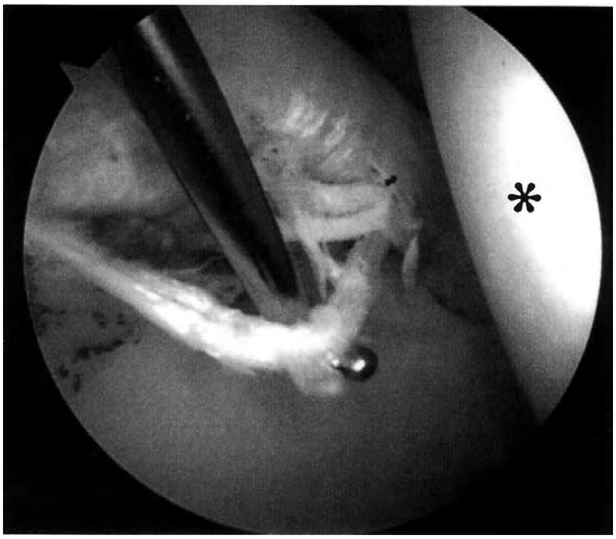


Figure 1. Labral tear at arthroscopy: Intraoperative photograph showing a complex tear of the anterior portion of the acetabular labrum. The probe goes through the tear (* indicates the smooth femoral head cartilage). Both portals were established laterally above the greater trochanter. The probe comes in over the antero-superior edge of the labrum.

the articular cartilage; and grade 4, full-thickness chondral wear with exposure of subchondral bone.[7] All chondral lesions on MRI were confirmed in at least 2 separate planes. Results were recorded on a score sheet by each reviewer for each patient.

The MRIs were studied for abnormalities of the acetabular labrum, including tears and their locations, and the presence of intracapsular or extracapsular paralabral cysts. The acetabular labrum was considered normal if images revealed a triangular, homogenous low signal intensity labrum in all planes with the base sitting flush with the acetabulum. The MRI criterion for a labral tear was a line of high signal coursing from the articular side through the base or into the substance of the labrum, with or without distraction of the labrum. This criterion has been successfully applied in the glenoid labrum.[8] Focal increased signal confined to the labrum was felt to represent intrasubstance degeneration and not a tear. Results were recorded on a score sheet by each reviewer for each patient.

To directly compare the pathology seen on MRI with that seen at arthroscopic evaluation, the standardized score sheets from the MRI readings were compared with the identical score sheets of the arthroscopic findings. Sensitivity, specificity, accuracy, and positive and negative predictive values were calculated for each reader. For labral tears, interobserver agreement of labral tears was calculated. A kappa analysis of interobserver agreement for cartilage defects was performed. Because of the retrospective nature of the study, the presence or absence of statistical significance was used to confirm that an adequate number of patients were enrolled in the study. The study was approved by our hospital's Institutional Review Board.

RESULTS

The study group comprised 92 patients with 58 women (63%) and 34 men (37%). The mean patient age was 38.5 years (range, 15 to 74 years). There were 56 (61%) right hips and 36 (39%) left hips. The average interval between MRI and arthroscopy was 93 days (range, 1 to 562 days).

Figure 2. Anterior labral tear: Sagittal MRI shows high signal extending through the normal through the low-signal triangular acetabular labrum, defining a tear (long white arrow). The acetabular articular cartilage exhibits mild high signal (short arrow) but no defect.

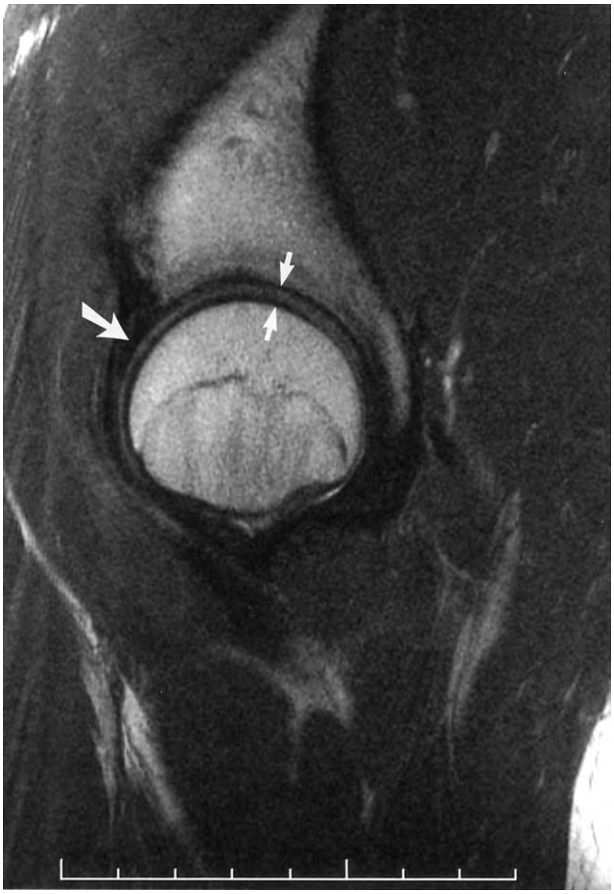


FIGURE 3. Normal anterior labrum: Sagittal MRI of the hip shows the anterior labrum (arrow) is a normal triangular focus of low signal. The normal articular cartilage (small arrows) is the gray signal overlying the low signal cortical bone.

Labral Evaluation

At arthroscopy, 89 patients had a torn acetabular labrum (Fig 1). Reader A correctly identified 86 of the 88 labral tears (98%) (Fig 2). Of the 4 cases reported by reader A as negative at MRI, 1 was normal at arthroscopy (true negative) (Fig 3). The other 3 labra were torn (false negative). The 2 other normal labra at arthroscopy, reader A called torn. Reader B correctly identified 85 of the 89 labral tears (96%). Of the 5 labra reported negative by reader B, also only 1 was normal at arthroscopy. Reader B thought the other 2 normal labra at arthroscopy were torn on MRI. Both readers thought that 1 of these was superior and 1 was posterior. Sensitivity, specificity, positive-predictive value, negative-predictive value, and accuracy of detecting labral tears for readers A and B are listed in Table 1.

Eighty-four of 89 (94%) of the labral tears were anterior at surgery. Three (3%) were anterosuperior, and the last was superior. Reader A diagnosed 78 (88%) anterior, 3 (3%) superior, and 5 (6%) anterosuperior labral tears (Fig 4). The 2 remaining tears were felt to involve both the anterior and posterior labra. Reader B saw 62 (70%) anterior, 16 (18%) anterosuperior, 6 (7%) superior, and 1 (1%) posterior labral tear. The remaining 2 suspected tears were felt to involve the anterior and posterior labra. Tears were most often at the base of labrum.

Articular Cartilage

Agreement of MRI with arthroscopy within 1 grade for femoral articular cartilage was 92% (85 of 92) for reader A and 86% (79 of 92) for reader B. Collapsing the cartilage grades into disease-positive (grades 2, 3, and 4) and disease-negative (grades 0 and 1) states, the statistics in Table 1 compare MRI with the standard of arthroscopy (Figs 5 and 6).

For acetabular cartilage, reader A was within 1 grade in 88% (81 of 92) of patients and reader B was within 1 grade in 85% (78 of 92) of patients. Comparison of MRI with arthroscopic cartilage evaluation, again collapsing cartilage injury grades into disease-positive (grades 2, 3, and 4) and dis-

TABLE 1. *MRI Results With Arthroscopy as the Standard*

	Labral Tears		Femoral Cartilage		Acetabular Cartilage	
	Reader A	Reader B	Reader A	Reader B	Reader A	Reader B
Sensitivity	97 (86/89)	96 (85/89)	86 (36/42)	93 (39/42)	91 (40/44)	93 (41/44)
Specificity	33 (1/3)	33 (1/3)	88 (44/50)	72 (36/50)	85 (41/48)	75 (36/48)
PPV	98 (86/88)	98 (85/87)	86 (36/42)	74 (39/53)	85 (40/47)	77 (41/53)
NPV	25 (1/4)	20 (1/5)	88 (44/50)	92 (36/39)	91 (41/45)	92 (36/39)
Accuracy	95 (87/92)	93 (86/92)	87 (80/92)	82 (75/92)	88 (81/92)	84 (77/92)

Abbreviations: PPV, positive-predictive value; NPV, negative-predictive value.

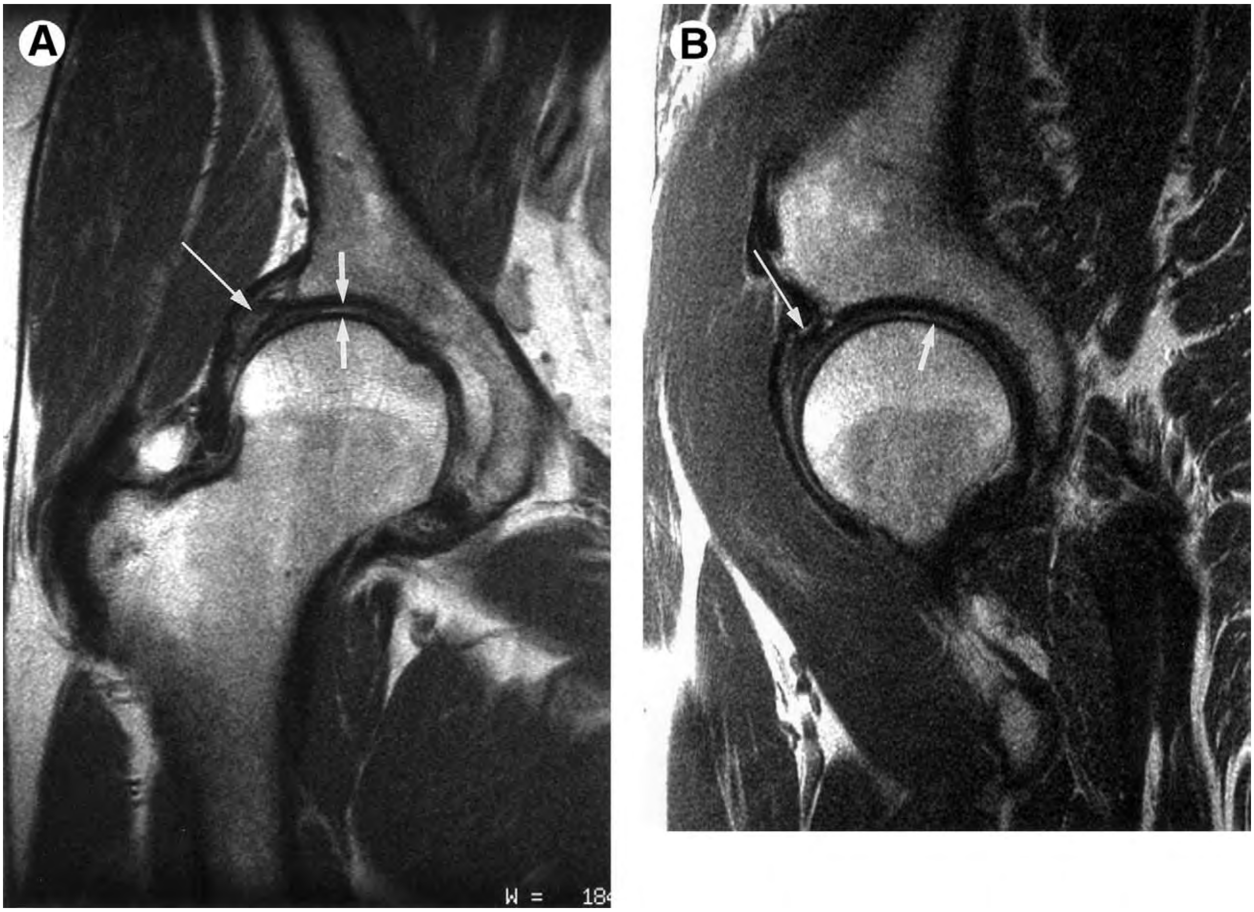


FIGURE 4. Degenerative labral tear and articular cartilage loss: (A) Coronal MRI of the right hip shows focal near full-thickness cartilage loss on the acetabular and femoral sides (arrows). A degenerated torn superior labrum (long arrow) displaces the lateral capsule and reflected head of the biceps femoris muscle. (B) Sagittal MRI of the same patient confirms the cartilage loss (arrow) and shows the extension of the superior labral tear to the anterior labrum (long arrow).

ease-negative (grades 0 and 1) states, is provided in Table 1.

Interobserver Variation

Collapsed into disease-positive (grades 2-4) and disease-negative (grades 0 and 1) states, the interobserver agreement of MRI evaluation yields a kappa of 0.8 ($P < .001$) for the femoral and 0.7 ($P < .001$) for the acetabular cartilage. Interobserver agreement was 92% for presence or absence of labral tears.

Paralabral Cysts

Reader A saw paralabral cysts on 35 of 92 MRIs (38%). Reader B saw cysts on 32 of 92 MRIs (35%). The 3 cysts that reader A saw retrospectively but not by reader B were noted by reader B on re-examination of the MRIs. Because paralabral cysts are often not seen at arthroscopic evaluation, the surgeons did not consistently comment on their presence or absence, limiting the ability of direct comparison and confirmation of the MRI findings (Fig 7).

DISCUSSION

The acetabular labrum is a fibrocartilaginous ring that surrounds the bony acetabulum and blends inferiorly with the transverse acetabular ligament. It increases the joint surface area by adding depth to the acetabulum, and thereby reduces mechanical stress on the articular cartilage.[9,10]

The labrum consists of densely packed collagen bundles that are more loosely organized when compared with the meniscus of the knee.[11] Electron

FIGURE 5. Cartilage defect at arthroscopy: Intraoperative photograph showing the shaver at the edge of a full-thickness articular cartilage defect of the anterior acetabular wall. The defect is adjacent to the anterior labrum (toward the top of the image). Both portals were established laterally above the greater trochanter.

microscopy divides the labrum into 3 distinct layers, of which the basal layer has fibrous bundles running parallel to the acetabular margin.[12] The composition of the labrum allows it to dissipate load stresses across the hip joint, but makes the basal layer vulnerable to shear forces. This likely accounts for the high prevalence of labral tears occurring at the base, as noted in our study, rather than within the midsubstance.

Lecovet et al.[13] evaluated anatomic variations in 200 asymptomatic hips with specific attention to morphology and signal characteristics. Younger individuals have triangular labra with sharply defined margins and homogeneous low signal that undergo a progressive change in morphology, becoming rounded or blunted, increasing in signal intensity with age. Although there is anatomic variation, it may be argued that the majority of changes seen in labral morphology are due to the dynamics and translational stresses placed on the hip labrum. Changes in signal intensity reflect degeneration and injury, simulating the changes seen in the meniscal fibrocartilage of the knee. A potential pitfall is the transitional zone between hyaline cartilage and the labral fibrocartilage, where small focal areas of intermediate signal intensity are believed to represent undifferentiated connective tissue.[14] The parallel orientation of the articular cartilage to the labrum helps to differentiate this normal finding from a flap tear, which tends to be more obliquely oriented relative to the articular surface. Further, the water-sensitive pulse sequence used on the higher resolution surface coil images allows for differential contrast between the high signal intensity of synovial fluid extending into a labral flap tear versus the more intermediate signal intensity of intrasubstance degeneration.

As with the meniscus of the knee, there is an increase with age in the incidence of asymptomatic tears of the labrum diagnosed with MRI.[13,15] Accurate, noninvasive diagnosis of symptomatic tears, when combined with a comprehensive physical examination, reserves more invasive procedures, such as arthroscopy, for treatment rather than primary diagnosis. Also true regarding articular cartilage, it can provide prognostic information preoperatively, allowing the surgeon to anticipate and prepare for what he will find, and alert the surgeon to look in areas that might otherwise be neglected.

The labrum is subject to continuous weight-bearing stresses, undergoing morphologic change and degeneration with age.[13] Abnormal hip stress results in labral injury, which usually manifests as a tear, sometimes with displacement or detachment of a labral flap.[16] Patients usually present with anterior groin pain and/or catching or clicking of the hip, and may respond well to arthroscopic debridement of the torn margin.[17-19]

Paralabral cyst formation is commonly seen in association with acetabular dysplasia and degenerative torn labra.[20] Cysts commonly decompress in an extracapsular fashion, often adjacent to the iliopsoas muscle-tendon junction, and may also decompress into bone, thereby accounting for the prominent intraosseous cysts noted on MRI and the lucencies seen on plain radiographs. Identification of cysts should intensify evaluation of the labrum to exclude a tear.

Traditionally, radiologists have used conventional contrast arthrography to detect labral tears; more recently, MR arthrography has been used.[1-4,21] Using a noncontrast MRI technique, we have shown the ability to identify labral tears with accuracy similar to MR arthrography and with better accuracy than previously reported.[14] We believe that the improved accuracy is the result of imaging with a small pixel size (in-plane resolution of 330 to 442 μm in the sagittal plane), allowing detailed evaluation of morphology, and a fast spin-echo sequence that provides differential contrast between normal and degenerative fibrocartilage, hyaline cartilage,

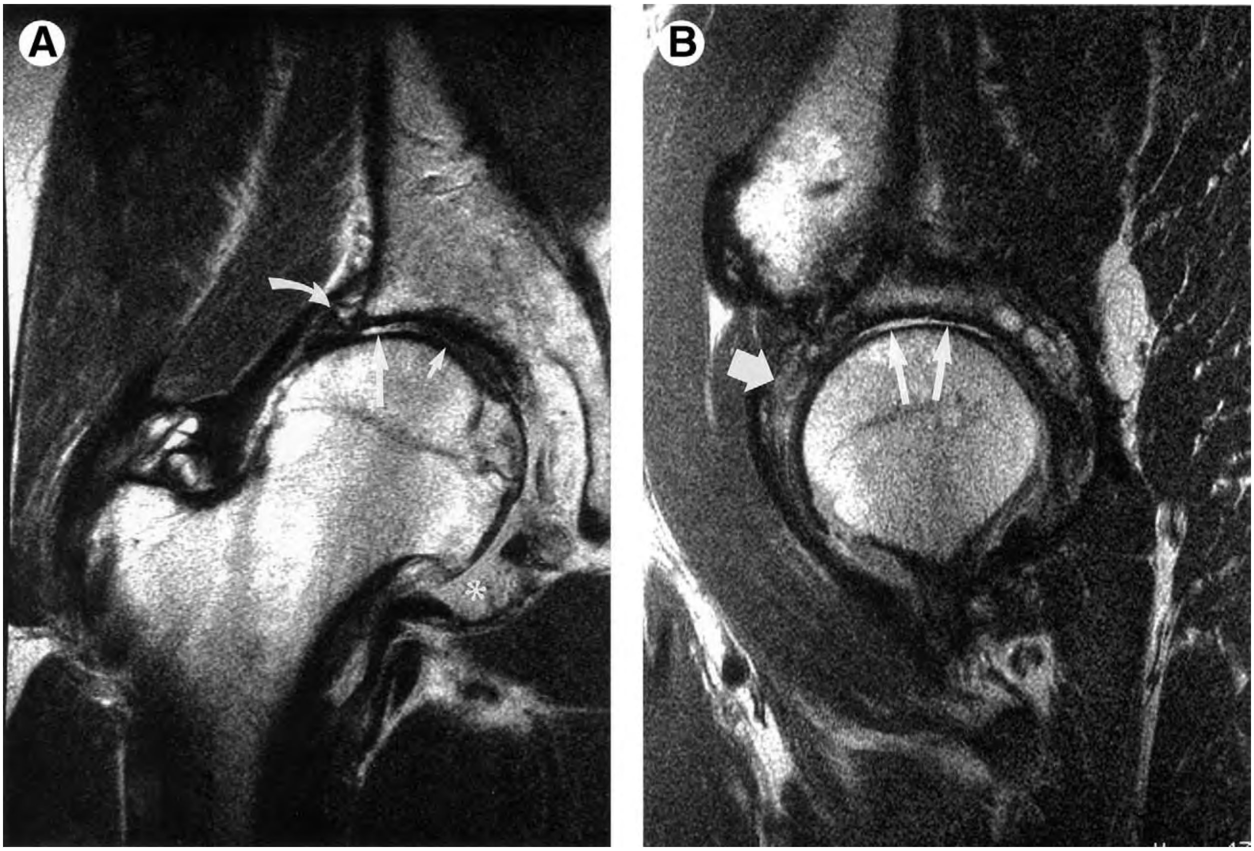


Figure 6. Degenerative labral tear and articular cartilage loss: (A) Coronal MRI of the right hip shows full-thickness cartilage loss over the acetabulum and femoral head laterally (arrow). The cartilage in the suprafoveal region is intact (short arrow). A joint effusion with synovitis is present (asterisk). There is a tear of the superior labrum and lateral osteophyte (curved arrow). (B) Sagittal image in the same patient showing the full-thickness cartilage loss (arrows) and degenerative anterior labral tear (broad arrow).

and synovial fluid. The sagittal images were found to be the most useful for showing anterior and anterosuperior labral injuries. The second most useful images were from the coronal sequence, which depicted the direct superior labrum to better advantage. The axial images were the least useful in this series, but are useful for evaluation of the posterior labrum, which can be injured as the result of posterior subluxation.

The use of MRI for evaluating labral tears and cartilage defects should improve with better coils, yielding better signal and higher in-plane resolution. Currently it may be difficult to discern subtle tears and distinguish between articular cartilage at the base of the labrum, and the labrum itself and small foci of synovial thickening.

The current study indicates that noncontrast MRI can effectively evaluate the articular cartilage and labrum of the hip in a reproducible and noninvasive manner. Compared with MR arthrography, this technique has similar accuracy in detection of labral tears and cartilage defects.[1-4] Its accuracy exceeds that of noncontrast MRI previously reported.[2]

Chondral and labral injuries may present with similar symptoms, and focal full-thickness chondral defects may exist despite preservation of the joint space shown by conventional radiographs. There is a substantial amount of research that is currently being directed toward the treatment of focal chondral lesions.[22] While many of the resurfacing techniques used in the knee have yet to be applied extensively to the hip joint, their future application will necessitate a reproducible, accurate and, ideally, noninvasive method to evaluate hip cartilage.

Weaknesses of this study include its retrospective approach and the fact that the surgeons were not blinded to the MRI results at the time of surgery. Since the MRI studies were performed as diagnostic

FIGURE 7. Anterior labral tear with small cyst: Sagittal MRI of the hip shows a tear at the base of the anterior labrum with fluid imbibition, creating a small paralabral cyst (long arrow).

procedures, blinding would not have been feasible. Because the surgeons rely on the MRI study as an accurate diagnostic tool, there is an inherent selection bias in the patients who underwent arthroscopy. Our study population had a high incidence of labral and chondral pathology. Our study cohort was carefully screened through a combination of history taking and physical examination by an orthopaedic surgeon. The surgeons at our institution are extremely reluctant to subject patients to hip arthroscopy without a strong clinical suspicion and correlative MRI evidence of labral or chondral pathology. It was thus difficult to provide a suitable control group of patients with surgically normal labra and intact articular cartilage. This fact is reflected in the relatively low specificity and negative-predictive value of MRI for detection of labral tears. Although the MRI results reported here are fewer than 10% of the MRIs performed at our institution, they are the only ones with surgical confirmation of the results. We have shown the ability of a noncontrast MRI technique to identify labral tears and cartilage lesions with accuracy similar to MR arthrography.[1,3,4,23]

CONCLUSION

In conclusion, MRI offers a noninvasive method to screen patients with symptoms referable to the hip by revealing the presence of focal chondral lesions and labral tears. This preserves hip arthroscopy as a therapeutic, rather than diagnostic, tool.

Acknowledgment: The authors thank Dr. Margaret Peterson for her help in the statistical analysis of the data from this project.

REFERENCES

1. Petersilge CA, Haque MA, Petersilge WJ, Lewin JS, Lieberman JM, Buly R. Acetabular labral tears: Evaluation with MR arthrography. *Radiology* 1996;200:231-235.
2. Czerny C, Hofmann S, Neuhold A, Tschauner C, Engel A, Recht MP, Kramer J. Lesions of the acetabular labrum: Accuracy of MR imaging and MR arthrography in detection and staging. *Radiology* 1996;200:225-230.
3. Leunig M, Werlen S, Ungersbock A, Ito K, Ganz R. Evaluation of the acetabular labrum by MR arthrography. *J Bone Joint Surg Br* 1997;79:230-234.
4. Schmid MR, Notzli HP, Zanetti M, Wyss TF, Hodler J. Cartilage lesions in the hip: Diagnostic effectiveness of MR arthrography. *Radiology* 2003;226:382-386.
5. McCarthy JC, Day B, Busconi B. Hip arthroscopy: Applications and technique. *J Am Acad Orthop Surg* 1995;3:115-122.
6. Outerbridge RE. The etiology of chondromalacia patellae. *J Bone Joint Surg Br* 1961;43:752-757.
7. Potter HG, Linklater JM, Allen AA, Hannafin JA, Haas SB. Magnetic resonance imaging of articular cartilage in the knee. An evaluation with use of fast-spin-echo imaging. *J Bone Joint Surg Am* 1998;80:1276-1284.
8. Connell DA, Potter HG, Wickiewicz TL, Altchek DW, Warren RF. Noncontrast magnetic resonance imaging of superior labral lesions. 102 cases confirmed at arthroscopic surgery. *Am J Sports Med* 1999;27:208-213.
9. Ferguson SJ, Bryant JT, Ganz R, Ito K. The influence of the acetabular labrum on hip joint cartilage consolidation: A poroelastic finite element model. *J Biomech* 2000;33:953-960.
10. Kelley B, Anderson R, Miles K. Acetabular labrum tear in a 15-year-old male: Diagnosis with correlative imaging. *Australas Radiol* 1997;41:157-159.
11. Sawadda K. Histological observation on glenoid labrum of the hip joint in human embryo and fetuses adolescents and adults. *Sapporo Med J* 1968;33:252-266.
12. Shibutani N. [Three-dimensional architecture of the acetabular labrum—A scanning electron microscopic study.] *Nippon Seikeigeka Gakkai Zasshi* 1988;62:321-329.
13. Lecouvet FE, Vande Berg BC, Malghem J, Lebon CJ, Moysan P, Jamart J, Maldague BE. MR imaging of the acetabular labrum: Variations in 200 asymptomatic hips. *AJR Am J Roentgenol* 1996;167:1025-1028.
14. Hodler J, Yu JS, Goodwin D, Haghighi P, Trudell D, Resnick D. MR arthrography of the hip: Improved imaging of the acetabular labrum with histologic correlation in cadavers. *AJR Am J Roentgenol* 1995;165:887-891.

15. Abe I, Harada Y, Oinuma K, Kamikawa K, Kitahara H, Morita F, Moriya H. Acetabular labrum: Abnormal findings at MR imaging in asymptomatic hips. *Radiology* 2000;216:576-581.
16. Ipavec M, Iglic A, Iglic VK, Srakar F. Stress distribution on the hip joint articular surface during gait. *Pflugers Archiv* 1996;431:R275-R276 (suppl 2).
17. Byrd JW, Jones KS. Prospective analysis of hip arthroscopy with 2-year follow-up. *Arthroscopy* 2000;16:578-587.
18. Farjo LA, Glick JM, Sampson TG. Hip arthroscopy for acetabular labral tears. *Arthroscopy* 1999;15:132-137.
19. Santori N, Villar RN. Acetabular labral tears: Result of arthrocopic partial limbectomy. *Arthroscopy* 2000;16:11-15.
20. Schnarkowski P, Steinbach LS, Tirman PF, Peterfy CG, Genant HK. Magnetic resonance imaging of labral cysts of the hip. *Skeletal Radiol* 1996;25:733-737.
21. Dorrell JH, Catterall A. The torn acetabular labrum. *J Bone Joint Surg Br* 1986;68:400-403.
22. Brittberg M, Lindahl A, Homminga G, Nilsson A, Isaksson O, Peterson L. A critical analysis of cartilage repair. *Acta Orthop Scand* 1997;68:186-191.
23. Czerny C, Kramer J, Neuhold A, Urban M, Tschauner C, Hofmann S. [Magnetic resonance imaging and magnetic resonance arthrography of the acetabular labrum: Comparison with surgical findings.] *Rofo Fortschr Geb Rontgenstr Neuen Bildgeb Verfahr* 2001;173:702-707.

Magnetic Resonance Imaging of Articular Cartilage

Hollis G. Potter and Li F. Foo

Am J Sports Med 2006 34: 661
DOI: 10.1177/0363546505281938

Magnetic Resonance Imaging of Articular Cartilage

Trauma, Degeneration, and Repair

Hollis G. Potter,* MD, and Li F. Foo, FRCR
From the Hospital for Special Surgery, New York, New York

The assessment of articular cartilage using magnetic resonance imaging has seen considerable advances in recent years. Cartilage morphologic characteristics can now be evaluated with a high degree of accuracy and reproducibility using dedicated pulse sequences, which are becoming standard at many institutions. These techniques detect clinically unsuspected traumatic cartilage lesions, allowing the physician to study their natural history with longitudinal evaluation and also to assess disease status in degenerative osteoarthritis. Magnetic resonance imaging also provides a more objective assessment of cartilage repair to augment the information obtained from more subjective clinical outcome instruments. Newly developed methods that provide detail at an ultrastructural level offer an important addition to cartilage evaluation, particularly in the detection of early alterations in the extracellular matrix. These methods have created an undeniably important role for magnetic resonance imaging in the reproducible, noninvasive, and objective evaluation and monitoring of cartilage. An overview of the advances, current techniques, and impact of magnetic resonance imaging in the setting of trauma, degenerative arthritides, and surgical treatment for cartilage injury is presented.

Keywords: magnetic resonance imaging (MRI); cartilage; cartilage repair; T2 mapping

Magnetic resonance imaging (MRI) is arguably the most important addition to diagnostic imaging in orthopaedic and sports medicine during the past 2 decades. Accurate assessment of ligament and meniscal injuries is now possible. More recently, the advent of cartilage-sensitive pulse sequences have been developed to provide a reproducible, noninvasive means by which to detect traumatic cartilage injury, monitor disease progression in both degenerative and inflammatory arthritides, and provide an important objective assessment in the evaluation of surgically manipulated cartilage.

Although these techniques have proven essential to the daily management of many orthopaedic conditions, they have not obviated the need for appropriately performed conventional radiographs in the initial assessment of these patients. Recommended radiographic assessment for the knee, for example, includes an anteroposterior standing view, which more closely approximates true joint-loading conditions compared with supine views; a standardized lateral view; and an axial view of the patellofemoral joint. The posteroanterior semiflexed view is also quite helpful in detecting the posterior margin of the joint space. Full-length hip-to-ankle anteroposterior views are essential when evaluating the mechanical axis of the limb, which can be crucial in planning for potential surgical cartilage repair techniques. Failure to address abnormalities in knee alignment may account for premature failure of otherwise well-performed cartilage repair procedures.

Although radiographs are helpful as a cost-effective means by which to evaluate joint space, they do not directly depict the radiolucent articular cartilage of the knee. Indeed, the assessment of joint space alone has also been noted to be an inaccurate indicator of the structural integrity of articular cartilage.[21] Because MRI uses no ionizing radiation and has direct multiplanar capabilities, the latter of which is important in obtaining reproducible, tomographic depiction of a curved joint surface, it is superior to both plain radiographs and computerized tomography. Furthermore, MRI has superior soft tissue contrast, which is helpful in discerning the articular cartilage as having a different appearance and contrast from fibrocartilage and fluid. With appropriate pulse sequencing, MRI can disclose discrete full-thickness cartilage defects in the presence of complete preservation of joint space, as well as subtle subchondral bony abnormalities that precede the appearance of subchondral sclerosis on plain radiographs.

BASICS OF MAGNETIC RESONANCE IMAGING

To better understand the current pulse sequences used in MRI to study cartilage, it is important to consider how an

*Address correspondence to Hollis G. Potter, MD, Hospital for Special Surgery, 535 East 70th Street, New York, NY 10021 (e-mail: potterh@hss.edu).

No potential conflict of interest declared.

The American Journal of Sports Medicine, Vol. 34, No. 4
DOI: 10.1177/0363546505281938

TABLE 1
Comparison of Commonly Used Pulse Sequences in Joint Imaging[a]

	T1-Weighted SE or FSE	T2-Weighted SE or FSE	Non-Fat-Suppressed Moderate TE FSE	Fat-Suppressed T1-Weighted Gradient Echo
Signal intensity characteristics of				
Joint fluid	Low/intermediate	High	High	Low
Cartilage	Intermediate	Low	Intermediate	High
Fat in subchondral bone marrow	High	Intermediate	High	Very low
Ability to see meniscus and ligament	Fair to poor	Good	Good	Poor
Scan time	++	+	+	+++
Signal to noise[b]	Good	Fair	Good	Fair
Image quality in presence of instrumentation	Good	Fair	Good	Poor

[a]SE, spin echo; FSE, fast spin echo; TE, echo time.
[b]These are general observations only. Actual measurements of signal to noise will depend on specific parameters, including slice thickness and spatial resolution.

MRI signal and, hence, images are generated. Nuclei with an odd number of protons or neutrons have magnetic properties, behaving like small bar magnets, with a dipole moment, yielding amplitude and direction. Although many elements have an isotope suitable for MRI, hydrogen is typically exploited in clinical MRI because of its copious concentration in soft tissue and, in this particular setting, in hyaline cartilage. In the absence of an external magnetic field, these charged, spinning nuclei are randomly oriented. When placed in a strong magnetic MRI unit, these nuclei align along the direction of the external magnetic field (denoted as B_0) as they precess, a resonance phenomenon that describes the wobbling of the axis of these magnetic moments around the axis of B_0. This process defines the plane of longitudinal magnetization. To obtain an MRI signal from these spinning nuclei, their energy state must be increased, which is achieved by imparting radiofrequency (RF) pulses into the tissue. The application of an RF pulse causes a vector quantity of the hydrogen nuclei to flip from the lower energy state of longitudinal magnetization into a higher energy state, the plane of transverse magnetization. When this excitational pulse is turned off, the energy emitted by the excited nuclei as they recover to their lower energy state generates a current in the receiver imaging coil placed around the joint, which is then converted to the MRI signal.

The recovery of longitudinal magnetization is an exponential regrowth after the RF pulse and reflects a transfer of energy stored in the excited hydrogen spins to the kinetic energy of surrounding nuclei. The rate at which this longitudinal magnetization is recovered reflects T1 relaxation time. Nuclei that transfer energy efficiently, such as fat nuclei, have a shorter T1 relaxation time and thus demonstrate increased signal intensity on a T1-weighted sequence (Table 1). Nuclei with a longer rate of T1 recovery demonstrate lower signal intensity on T1-weighted sequences (joint fluid).

Once the nuclei flip down into the transverse plane, there is another simultaneous effect that describes the interactions between these excited nuclei. This effect is an exponential decay function, reflecting loss of signal that occurs very rapidly as a function of time, much more rapidly than the time required for the recovery of longitudinal magnetization. T2 relaxation time reflects the time for initial transverse magnetization (which is maximal immediately after the disturbing RF pulse is applied) to decay to approximately 37% of its original value. Tissues that maintain internuclear coherence (and therefore decay more slowly) demonstrate higher signal intensity on a T2-weighted sequence (such as water).

It is important to remember that in clinical MRI, the signal characteristics reflect not only the amount of hydrogen but also the relative mobility of hydrogen in water. For example, cortical bone has little to no mobile water (hydrogen) and is therefore perceived as a signal void. The limited mobility of water in the subchondral plate and tide mark is perceived as low signal intensity. Similarly, the low signal intensity found in the type I collagen of ligament and tendon reflects the restriction of water motion. In degenerative tendons, however, when the collagen ultrastructure is disrupted, the hydrogen nuclei that are normally restricted from motion by the clinical MRI unit become perceptible as areas of increased signal intensity or tendinosis.

By alternating the time between successive RF pulses (repetition time [TR]) and the time between the excitational RF pulse and the time of obtaining signal information (echo time [TE]), one can create pulse sequences of different tissue contrast. Generally speaking, a T1-weighted pulse sequence has a short TR and short TE (on the order of 400-600 milliseconds and 10-30 milliseconds, respectively). Because fluid is of lower signal intensity on a T1-weighted sequence, there is little tissue contrast between the fluid in the joint and the intermediate signal intensity articular cartilage. There is, however, good contrast between the high signal intensity (short T1) of the fatty marrow and the adjacent joint surface (Table 1).

Conversely, T2-weighted sequences demonstrate good contrast between the high signal intensity of fluid and the adjacent articular surface. Very heavily T2-weighted sequences, however, are not suitable for evaluation of cartilage because of the shorter T2 values of the more highly ordered basilar components of cartilage (to be discussed further in the "T2 Mapping" section).

In the past decade, many different pulse sequences have become available. Many clinical sites have abandoned traditional spin echo images for fast spin echo, which is a more efficient pulse sequence that allows for a more rapid acquisition of imaging data. Gradient echo techniques were one of the first MRI sequences used, requiring less imaging time than standardized spin echo images. These sequences tend to have short TR and TE values and are amenable to 3D volumetric techniques, whereby an entire slab of tissue (as opposed to a single slice) is excited, which can then be divided into slices of varying dimension.

Fat suppression is often used to alter tissue contrast on MRI. Fat in the bone marrow and subcutaneous tissues yields a large amount of signal on MRI, obscuring the more subtle signal intensity differences between cartilage, water, and synovium. The "removal" from the picture rescales the contrast range, allowing those previously subtle differences between cartilage, fluid, and synovium to be more readily discerned. It is important to remember that only a portion of fat is suppressed on standardized fat-suppression techniques. Different methods of fat suppression are clinically available. Frequency-selective fat suppression can be applied to any type of pulse sequence including spin echo, fast spin echo, or gradient echo. In the setting of orthopaedic instrumentation or in curved joints, where the focal magnetic field becomes more inhomogeneous, however, the ability to separate the frequency fat and water nuclei becomes hampered. In that setting, inversion recovery (STIR) techniques provide for more robust fat suppression.

Figure 1. A coronal fast spin echo magnetic resonance image of the knee in a 40-year-old man with prior anterior cruciate ligament reconstruction, medial collateral ligament augmentation, high tibial osteotomy, and medial meniscectomy demonstrates excellent depiction of cartilage (arrows) in the lateral tibiofemoral compartment, despite the presence of stainless steel instrumentation.

IMAGING OF CARTILAGE: PULSE SEQUENCES

Although many pulse sequences are now currently available, conventional pulse sequences are ineffective in visualizing articular cartilage, have been proven inaccurate in correlative studies compared with arthroscopy, or correlate poorly with clinical evaluation.[8,38,63] The traditional combination of T1-weighted and heavily T2-weighted MR images is not suitable for detecting articular cartilage.[32] The first MRI pulse sequence to be judged with acceptable accuracy using arthroscopy as the standard was a T1-weighted gradient echo sequence with fat suppression.[53] In this pulse sequence, the low signal intensity of suppressed fat in subchondral bone marrow contrasts to the higher signal intensity of articular cartilage, whereas fluid is depicted as lower signal intensity. Disler et al[15] studied a series of 43 patients using this pulse sequence, performing arthroscopy in a subset, and reported a sensitivity of 93% and a specificity of 94%. The high contrast between the cartilage and subchondral bone seen with the gradient echo sequences renders them more amenable to semiautomated segmentation algorithms, which can provide reproducible assessment of cartilage thickness measurements and volume.[18,19] These volumetric rendering techniques have been validated in both clinical and nonclinical models, providing accurate measurements that enable longitudinal assessment of a patient over time.

It is crucial to remember that cartilage volume is a function of both thickness and surface area, and the separation of the volume into these components must be performed in the analysis of morphologic characteristics. These techniques require a rigorous statistical analysis to ensure precision and reproducibility for quantitative measurements.[17,28] Cicuttini et al[13] compared tibial cartilage volume and radiographic evidence of osteoarthritis (joint space narrowing and osteophytes) in a group of 252 subjects, demonstrating a strong negative linear association between tibial cartilage volume and increasing grade of joint space narrowing. The relationship between changes in cartilage volume and clinical function, however, remains unclear. A smaller study cohort of 32 patients with symptomatic knee osteoarthritis disclosed no statistical correlation between loss of cartilage volume and changes in clinical variables, such as the Western Ontario and McMaster Osteoarthritis Index score and the short form 36 health survey.[52] Further clinical study is necessary in the longitudinal application of these MRI techniques to patients with osteoarthritis.

Although gradient echo imaging techniques present certain advantages, they may be limited in the clinical setting because of rapid degradation of the signal in the presence of orthopaedic instrumentation or metallic debris from prior arthroscopy. Effective cartilage imaging should not be limited by the presence of instrumentation (Figure 1). In addition, gradient echo techniques require increased scan time to obtain a 3D volume set and are limited to cartilage imaging only, with poor evaluation of adjacent structures.[50] In contrast, fast spin echo images provide differential contrast between fluid, subchondral bone, and meniscus, allowing for evaluation not only of the articular cartilage but also of associated meniscal lesions and ligament tears. Fast spin echo images are cartilage sensitive because of a phenomenon known as magnetization transfer contrast. Because of its highly organized structure, water within hyaline cartilage exists in both a free pool and a pool

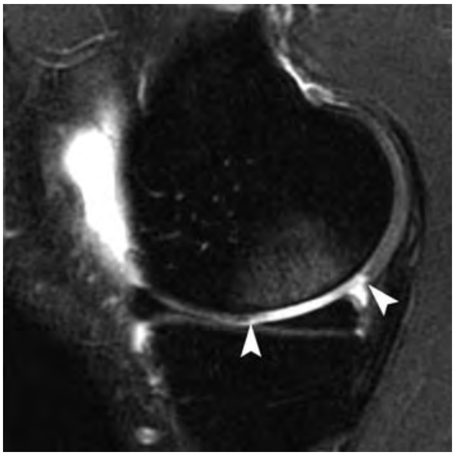


Figure 2. A fat-suppressed fast spin echo magnetic resonance image of the knee in a 27-year-old man demonstrates good contrast between the low signal intensity bone marrow, intermediate signal intensity cartilage, and high signal intensity of joint fluid. Note the geographic bone marrow edema pattern affecting the medial femoral condyle, adjacent to a full-thickness cartilage shearing injury (arrowheads).

structurally bound to extracellular matrix elements. In a fast spin echo pulse sequence using multiple slices to cover the regional anatomy, there is an exchange of off-resonance magnetization, the effect of which is to saturate the bound pool of hydrogen nuclei, resulting in a decrease in signal intensity from the free pool of water (and consequently from the cartilage). Thus, with only a moderate TE (30-35 milliseconds), one can achieve differential contrast between articular cartilage of intermediate signal intensity, fibrocartilage of low signal intensity (because of its even more highly ordered structure and restriction of water), and the high signal intensity of the freely mobile water in synovial fluid.

Reproducibility in assessing the accuracy of cartilage imaging is essential for its use as an objective outcome standard in the evaluation of cartilage repair techniques or disease-modifying pharmaceuticals. Potter et al[50] evaluated more than 600 articular surfaces in 88 patients using arthroscopy as the standard and 2 independent MRI observers. This study disclosed a sensitivity of 87%, a specificity of 94%, and an accuracy of 92%, with minimal interobserver variability, as indicated by weighted kappa statistic of 0.93 (almost perfect agreement). The use of higher in-plane resolution (250-350 microns in the frequency direction) in the latter study enabled superior detection of partial-thickness lesions.[50]

Bredella et al[10] studied cartilage imaging using fat-suppressed fast spin echo sequences. Fat-suppression techniques rescale the contrast range, depicting subchondral marrow as low signal intensity, cartilage as intermediate signal intensity, and fluid as a hyperintense signal (Figure 2). In the latter study, overall accuracy was 98%, although images were only reviewed by a single, experienced musculoskeletal radiologist.[10] Yoshioka et al[75] compared fat-suppressed gradient echo with fat-suppressed fast spin echo imaging, concluding that interobserver variability was minimized using the fat-suppressed fast spin echo imaging. Although both gradient echo and fast spin echo techniques have their individual utility in the assessment of articular cartilage, from a clinical standpoint, it is the authors' experience that gradient echo techniques are less sensitive to partial-thickness cartilage lesions (Figure 3).

A

B

Figure 3. A sagittal (A) cartilage-sensitive fast spin echo magnetic resonance image of the knee demonstrates a focal high-grade partial-thickness cartilage defect overlying the medial femoral condyle (arrowheads). This fast spin echo sequence was obtained in half the time required for a sagittal fat-suppressed T1-weighted gradient echo sequence (B) in which the lesion is not as well appreciated.

The use of contrast agents has occasionally been employed to improve contrast between the synovial fluid and cartilage, either in a direct fashion via MR arthrography or in an indirect fashion via intravenous injection.[51] Both of these techniques, however, convert MRI into a more invasive (and sometimes expensive) procedure.

Despite the acceptable accuracy and reproducibility of these pulse sequences, additional cartilage-sensitive sequences have been developed, including water-selective balanced steady-state free precession,[37,55] driven equilibrium Fourier transform,[7] and ultrashort TE sequencing.[25] In a comparative study of pulse sequences, Hargreaves et al[31] noted that the fat-suppressed, steady-state free precession

Figure 4. A sagittal cartilage-sensitive magnetic resonance image of the knee in a 25-year-old man demonstrates the vertically oriented low signal intensity lines in the deeper component of tibial cartilage (arrow), corresponding to the highly ordered collagen components.

Figure 5. A coronal oblique cartilage-sensitive magnetic resonance image of the shoulder in a 65-year-old man with clinical symptoms of impingement demonstrates a full-thickness cartilage defect at the posterosuperior aspect of the humeral head with exposed subchondral bone (arrow). Cartilaginous debris is noted in the axillary pouch (arrowhead).

pulse sequence provided the highest cartilage signal-to-noise efficiency, providing superior cartilage-fluid contrast and less blurring on the images. Further validation of these newer pulse sequences, with a measure of reproducibility, will be necessary to promote their more ubiquitous acceptance in current clinical imaging.

Challenges in imaging articular cartilage include appropriate contrast resolution between articular cartilage, fibrocartilage, and fluid; adequate in-plane resolution to perceive subtle surface fibrillation and alterations in the subchondral trabecular pattern; and minimizing imaging artifacts such as chemical shift misregistration. On high field (1.5-T) MRI systems, the difference in precessional frequency between fat and water protons is approximately 220 Hz. The close apposition of fluid and fat within an imaging voxel (such as seen between the fat in subchondral bone and the water of articular cartilage) causes misregistration of the positional interface between these 2 layers, creating artifacts that may factitiously lose the ability to define the subchondral plate and overall cartilage integrity. The use of a wider receiver bandwidth is therefore essential in minimizing this frequency shift in cartilage imaging that does not use fat suppression.

A laminar appearance of articular cartilage may be evident on clinical cartilage images, largely because of the highly ordered structure of collagen in the deeper components, at times allowing for perception of vertically oriented low signal intensity lines (Figure 4). Some investigators have suggested that the laminar appearance of cartilage observed on gradient echo techniques is caused by truncation, which is an artifact created during image reconstruction at high contrast interfaces.[20] Although truncation artifact may account for some of the multilaminar appearance on traditional fat-suppressed T1-weighted gradient echo sequencing obtained at low spatial resolution, it does not account for the stratification of laminar appearance of cartilage observed by multiple additional investigators with higher resolution protocols.[72]

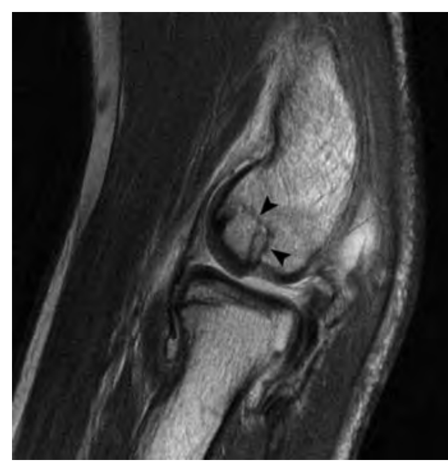


Figure 6. A sagittal cartilage-sensitive magnetic resonance image of the elbow in a 13-year-old boy after mosaicplasty (arrowheads) for osteochondritis dissecans of the capitellum demonstrates slightly proud offset of the subchondral bone.

A further challenge in clinical cartilage imaging is the detection of lesions in smaller joints, which requires not only a validated cartilage pulse sequence but also a superior surface coil design to obtain signal from the thinner cartilage over the wrist, elbow, and shoulder joints. Although the clinical significance of cartilage injuries in the shoulder remains unclear, additional study of these lesions may provide insight to their significance and account for symptoms of pain and stiffness in patients with recalcitrant response to nonoperative management for impingement syndrome (Figure 5). Cartilage imaging should be applicable to assessing cartilage repair procedures in smaller joints, as well as in the knee joint (Figure 6).

Although many cartilage-sensitive pulse sequences are available, a suggested protocol for 1.5-T systems that

TABLE 2
Recommended Protocol for Magnetic Resonance Imaging of the Knee[a]

Coil	Phased array extremity knee coil
Position	Feet first supine
Landmark	Patellar apex
Series I	Coronal fast spin echo (cartilage sensitive): TR 4000-4500/TE 34 ms (effective); VBW 32 kHz; ETL 8-12; FOV 11-13 cm; SL 3.0 mm with no gap; matrix 512 × 256-320; NEX 2; phase correct; NPW
Series II	Sagittal fast spin echo with fat suppression: TR 3500-4000/TE 40 ms (effective); VBW 20.8 kHz; ETL 8-12; FOV 16 cm; SL 3.5-4 mm with no gap; matrix 256 × 224; NEX 2; phase correct; NPW
Series III	Sagittal fast spin echo (cartilage sensitive): TR 4000-4500/TE 34 ms (effective); VBW 32 kHz; ETL 8-12; FOV 16 cm; SL 3.5 mm with no gap; matrix 512 × 384; NEX 2; phase correct; NPW
Series IV	Axial fast spin echo (below patellar apex to base; cartilage sensitive): TR 4500/TE 34-40 ms (effective); VBW 32 kHz; ETL 10; FOV 14 cm; SL 3.5 mm with no gap; matrix 512 × 256-384; NEX 2; phase correct; NPW
Series V	Sagittal fast spin echo (meniscal windows): TR 2300/TE 13 ms (effective); VBW 20.8; ETL 4-5; matrix 256 × 224; NEX 2

[a]TR, repetition time; TE, echo time; VBW, variable bandwidth (reported over the entire frequency range); ETL, echo train length; FOV, field of view; SL, slice thickness; NEX, number of excitations; NPW, no phase wrap.

Figure 7. A sagittal cartilage-sensitive magnetic resonance image obtained in a 0.7-T open unit of the knee in a 33-year-old man with prior posterior cruciate ligament reconstruction demonstrates flap formation extending down to the subchondral bone over the medial femoral condyle (arrowhead).

Figure 8. A coronal cartilage-sensitive magnetic resonance image obtained in a 3-T unit of the knee in a 31-year-old man with a clinically suspected meniscal tear demonstrates a focal chondral flap (arrowhead) over the medial femoral condyle.

has been proven accurate and reproducible in the knee is provided in Table 2.

IMAGING WITH DIFFERENT FIELD STRENGTHS

Cartilage imaging should be reproducible among high field systems, and lesions should be perceptible to an observer with only a moderate amount of MRI interpretive experience. Most of the validation studies for MRI of cartilage have been performed at clinically relevant field strengths of 1.5 T. Woertler et al[70] compared images from a conventional high field (1.5-T) system and a dedicated low field (0.18-T) extremity unit using a variety of pulse sequences. The authors noted that the higher field system demonstrated significantly better diagnostic detection of partial-thickness and full-thickness lesions.[70] With the development of higher field strength MR systems, cartilage imaging has proven feasible using open units in clinical practice, but to our knowledge, no formal validation study has yet been reported (Figure 7).

Increasingly higher field systems of 3 T or above are being used for clinical imaging. These systems recruit more protons and therefore provide more signal to noise, allow for higher in-plane resolution, and can depict subtle surface lesions in cartilage (Figure 8). However, increasing field strength does come with its challenges, with increased chemical shift misregistration due to the higher frequency difference between fat and water at higher field strengths, thus requiring the use of even wider receiver bandwidths for effective cartilage imaging in the absence of fat suppression.[23]

CLINICAL UTILITY OF CARTILAGE IMAGING: TRAUMA AND DEGENERATION

Like any imaging tool, MRI of cartilage is best correlated to a comprehensive clinical examination and patient history. However, MRI is frequently able to determine a clinically unsuspected cause of joint symptoms and provide relevant

Figure 9. Cartilage-sensitive magnetic resonance images of the hip in a 17-year-old girl after a posterior hip dislocation. The coronal image (A) demonstrates a focal loss of the low signal intensity subchondral plate (black arrow), indicating an osteochondral fracture of the femoral head. The loose osteochondral fragment is demonstrated laterally (white arrowheads) and is also seen in the axial plane (B) in which a posterior labral tear is depicted (black arrowhead). At 21 weeks after open reduction and internal fixation, the coronal image (C) demonstrates bioabsorbable pins through the osteochondral fragment, with some fibrillation of the overlying cartilage (white arrow).

information that will guide either nonoperative or operative management. Preoperative MRI detection of an unsuspected cartilage flap extending down to the subchondral bone in the same compartment as a clinically suspected meniscal tear can guide the clinician in preparing the patient toward the expectations of the additional rehabilitation time necessary for a cartilage resurfacing technique, compared with simple arthroscopic meniscectomy (Figure 8).

In an acute traumatic injury, detection of a full-thickness cartilage shear is important; even more crucial is the recognition of an osteochondral injury amenable to bioabsorbable pinning (Figure 9). A clue to the recognition of an osteochondral shearing injury is focal loss of the low signal intensity line (representing the subchondral plate and zone of calcification), which separates the high signal of the fatty marrow from the intermediate signal intensity articular cartilage.

The bone bruise associated with anterior cruciate ligament (ACL) disruption has been a topic of recent interest.[33] In a prospective study correlating bone bruises detected on MRI with arthroscopy, Spindler et al[64] noted a cartilage lesion at arthroscopy in 46% of cases, most commonly occurring over the lateral femoral condyle. Johnson et al[34] performed arthroscopic biopsy in 10 patients with ACL disruption with preoperative MRI evidence of bone bruise, disclosing areas of chondrocyte degeneration, loss of proteoglycan, and osteocyte necrosis. The clinical significance of these lesions, however, remains controversial. Shelbourne et al[62] noted no significant correlation between articular cartilage defect size and postoperative subjective clinical scores in a series of patients undergoing ACL reconstruction. However, the authors did note that patients with an Outerbridge grade 3 or 4 articular cartilage lesion seen at the time of ACL reconstruction had significantly lower subjective scores than did a control group without a similar cartilage lesion.[62] Preliminary data from a prospective MRI evaluation of isolated ACL tears without a concomitant meniscal lesion from Potter et al (unpublished data, 2002) demonstrated that all patients had sustained cartilage injury at the time of tibial translation, suggesting that the bone bruise is, in fact, a transchondral fracture of varying severity (Figure 10). The disparity between objective MRI assessment of cartilage lesions and arthroscopic inspection at the time of the ACL reconstruction may be attributed to the fact that these lesions are eccentrically located over the posterior tibia and may be arthroscopically occult. These preliminary data suggest that all patients sustain some degree of cartilage injury after an ACL tear, the clinical significance of which still remains uncertain because of a lack of prospective, longitudinal studies.

The detection of a bone marrow edema pattern on MRI in the setting of degenerative osteoarthritis does not necessarily indicate an acute traumatic cartilage injury but, rather, may be seen over both sides of a load-bearing joint as a result of subchondral bony remodeling (Figure 11). A histologic study of explants obtained from patients referred for total knee arthroplasty who demonstrated a bone marrow edema pattern on preoperative MRI disclosed that bone marrow edema per se was not a major contributor to the signal abnormality but, rather, that subchondral marrow necrosis, remodeled trabeculae, and fibrosis were implicated.[76] The presence of an intense bone marrow edema pattern that is disproportionate to one side of a degenerative joint, however, should raise high clinical suspicion of the presence of a subchondral insufficiency fracture, which has been implicated as a cause of spontaneous osteonecrosis.[74] Careful scrutiny of focal, asymmetric subchondral edema is important, so as not to miss the presence of such fractures, potentially leading to the institution of clinically ineffective therapy (Figure 12).

For MRI to serve as an instrument in epidemiologic studies and clinical trials of osteoarthritis, several methods have been suggested. In addition to the aforementioned volumetric quantification of cartilage, other scoring systems for osteoarthritis have been devised based on cartilage signal intensity and morphologic characteristics, as well as the appearance and signal of the subchondral bone

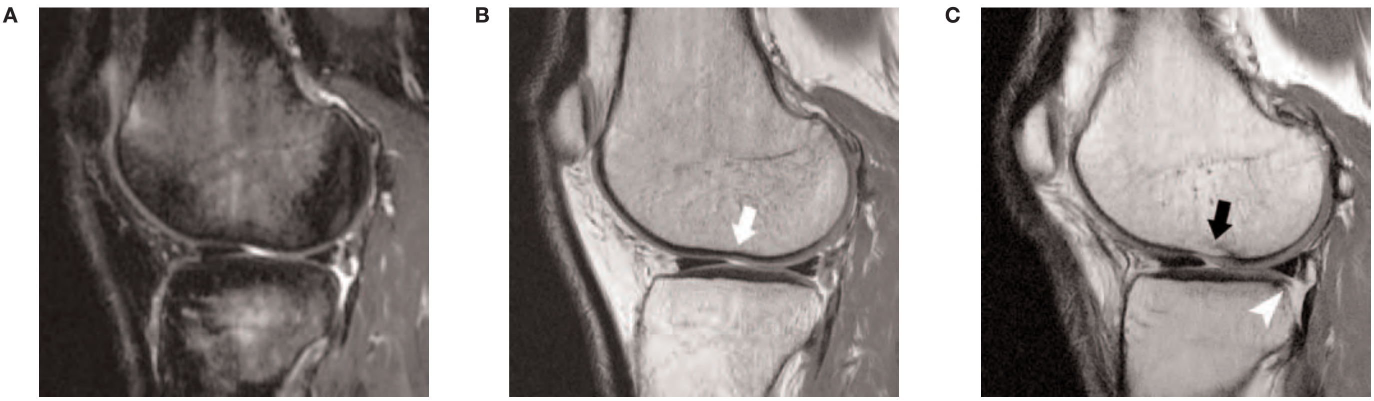


Figure 10. Prospective magnetic resonance evaluation of the bone bruise in the knee of a 28-year-old man with a complete anterior cruciate ligament tear. Sagittal fat-suppressed (A) and fast spin echo (B) magnetic resonance images obtained at the time of injury demonstrate a characteristic pattern of bone marrow edema with compression of cartilage over the lateral femoral condyle (white arrow). A sagittal magnetic resonance image obtained 19 months later (C) demonstrates proud subchondral bone with focal cartilage loss over the condyle (black arrow) as well as a flap over the tibial plateau (arrowhead).

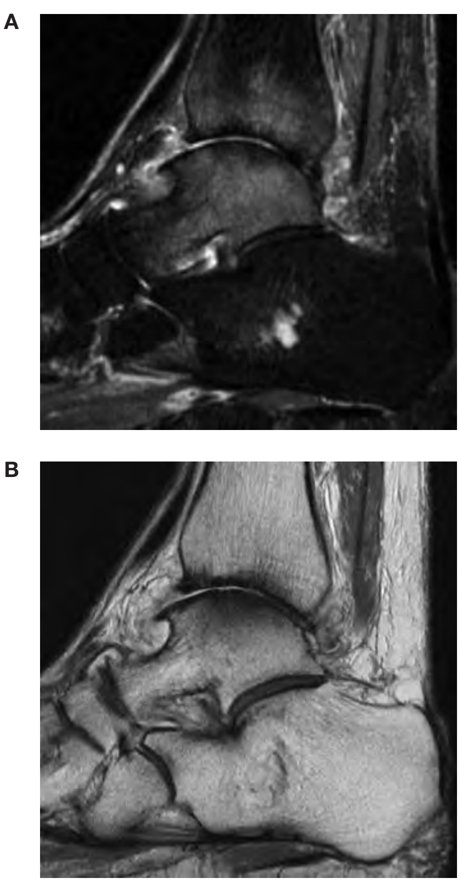


Figure 11. Sagittal fat-suppressed magnetic resonance image (A) of the ankle in a 64-year-old man demonstrates bone marrow edema pattern over both sides of the tibiotalar joint. The corresponding cartilage-sensitive magnetic resonance image (B) demonstrates severe osteoarthritis and subchondral sclerosis. The presence of bone marrow edema over both sides of a joint in the setting of osteoarthritis does not indicate superimposed fracture or osteonecrosis.

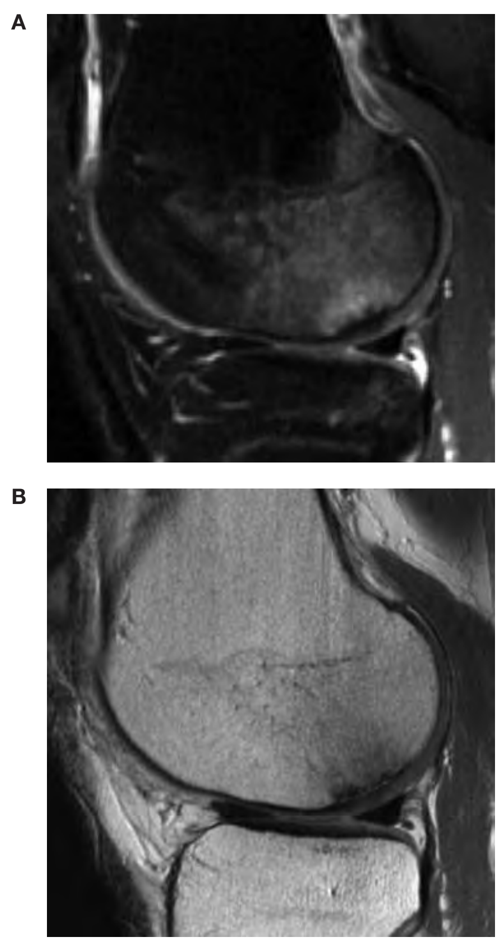


Figure 12. Sagittal fat-suppressed (A) and cartilage-sensitive (B) magnetic resonance images of the knee in a 46-year-old man demonstrate a subchondral insufficiency fracture of the lateral femoral condyle, yielding disproportionate bone marrow edema pattern over the condyle. There is no delamination of the overlying cartilage.

(cysts, flattening) and the presence of osteophytes.[49] Such scoring systems are preliminary and have been validated in relatively small cohorts (19 patients with 2 independent observers[49]); further validation of these techniques in larger cohorts will be necessary to confirm reproducibility across sites. A consensus of European investigators has recently suggested that although MRI may be used as an outcome in phase II studies of pharmaceutical intervention for disease-modifying agents in osteoarthritis, further data are needed before accepting MRI as a primary end point in phase III clinical trials.[1]

CARTILAGE REPAIR

The advent of numerous cartilage repair techniques has prompted interest in the longitudinal evaluation of these patients.[11,29,30] Although clinical evaluation of cartilage repair techniques is essential, the addition of histologic evaluation from biopsy adds an objective means by which to assess the biology of repair.[36] Eventually, MRI may serve as a noninvasive surrogate for biopsy. An MRI assessment system applied to autologous chondrocyte implantation (ACI) and microfracture suggested by Brown et al[12] studied several variables, including (1) the relative signal intensity from the repaired area compared with the native cartilage using a region of interest analysis on a standardized MRI workstation, (2) the morphology of the repair (flush, depressed, or proud) with respect to the native cartilage, (3) the presence or absence of delamination, (4) the nature of the interface (presence, absence, and/or size of fissures) with the adjacent surface, and (5) the percentage of fill of a lesion using both coronal and sagittal images. Furthermore, the authors recommended the assessment of the adjacent and opposite cartilage surfaces, particularly in the setting of hypertrophy of cartilage repair.[12] One hundred eighty MRI examinations were performed on 112 patients who had undergone either microfracture or ACI. Compared with microfracture, ACI demonstrated consistently better fill at all times but was complicated by graft hypertrophy in 19 of 30 (63%) surgeries, most commonly seen within a 6-month follow-up period.[12] This complication was more frequently noted in patients in whom the ACI had been performed for osteochondritis dissecans. The lack of containment at the intercondylar notch may be implicated in periosteal hypertrophy (Figure 13). Initially, the periosteal cover is discerned as a linear, hypointense focus that incorporates over time, eventually appearing indistinct from the repair cartilage (Figure 14). Other authors have noted that the presence of fluid signal intensity between the cartilage repair and the subchondral bone is indicative of partial or complete delamination, most commonly occurring in the first 6 months after ACI.[3] In a review article, Verstraete et al[67] described a hyperintense "primitive" repair tissue with signal intensity close to water in the early period after ACI (0-8 weeks), followed by a transitional phase (3-6 months) with lower and often inhomogeneous signal intensity. The authors noted progressive edge integration with the native cartilage during the transitional phase. T2-weighted images were useful in differentiating persistent defects, which were filled with hyperintense joint fluid, from maturing cartilage signal, which was of lower signal intensity.[67] In the final, so-called remodeling phase (6-18 months), the authors noted more complete edge integration that could take up to 2 years and manifest as the lack of fluid intensity between the native and transplanted cartilages.[67]

Figure 13. Coronal fast spin echo magnetic resonance image of the knee in a 15-year-old boy performed 3 months after autologous chondrocyte implantation for an osteochondral lesion over the medial femoral condyle demonstrates repair cartilage that is proud and hyperintense relative to native cartilage, consistent with hypertrophy of the graft (arrowheads). Reprinted by permission of Lippincott Williams and Wilkins, from *Clin Orthop Rel Res*. 2004;422:214-223.

Similar to those after ACI, the signal properties of the repair cartilage after microfracture vary with the interval between surgery and the time of MRI. In general, the signal characteristics of the reparative fibrocartilage forming over microfracture are largely hyperintense to native cartilage, consistent with a less organized matrix and increased mobility of water[4,12,44] (Figure 15). Alparslan et al[4] noted that the repair tissue may appear thin and indistinct, with a marrow edema pattern in the subchondral bone. In a prospective study of patients treated with microfracture evaluated by validated clinical outcome instruments and cartilage-sensitive MRI, bony overgrowth was noted in 25% of patients; however, the presence of overgrowth did not have a negative effect on clinical outcome scores.[44] However, adverse functional scores after 24 months correlated with poor percentage of fill by repair cartilage.[44] Brown et al[12] noted overgrowth of the subchondral bone in 42 of 86 microfractures studied with MRI, resulting in the thinning of the overlying reparative fibrocartilage.

In addition to signal characteristics and peripheral integration, MRI is able to assess 2 additional features unique to osteochondral allograft or autograft transplantation (mosaicplasty), specifically, incorporation of the bony plug and restoration of the radius of curvature of the joint surface. Both clinical and nonclinical models of osteochondral transplantation have used MRI. In a canine model of osteochondral transfer, no statistically significant difference

A

B

Figure 14. Coronal cartilage-sensitive magnetic resonance images of the knee in a 31-year-old man obtained after autologous chondrocyte implantation. At 6 weeks after surgery (A), the graft is hyperintense with an intact, hypointense overlying periosteal cover (arrow). At 20 months after surgery (B), there is incorporation of periosteum to now isointense reparative cartilage such that the periosteal cover is no longer distinct (arrow). Reprinted by permission of Lippincott Williams and Wilkins, from *Clin Orthop Rel Res*. 2004;422:214-222.

Figure 15. Sagittal cartilage-sensitive magnetic resonance image of the knee in a 30-year-old woman at 5 months after microfracture demonstrates hyperintense repair cartilage over trochlea (arrow). Note the linear signal alteration in the subchondral bone.

Figure 16. Sagittal cartilage-sensitive magnetic resonance image of the knee in a 21-year-old man treated with mosaicplasty for a large osteochondral defect of the lateral femoral condyle. There is restoration of the radius of curvature using multiple plugs. Note the thinning of cartilage over the more posterior plugs and the fibrillation of cartilage over the tibial plateau (arrowhead).

in the imaging, biomechanical, and histologic appearance of fresh osteochondral autograft versus allograft plugs was noted, and MRI demonstrated excellent bony incorporation of both graft types, with no significant difference in the appearance of the articular cartilage.[22] Despite good incorporation of graft plug to native bone, 90% of the knees, including allograft and autograft specimens, demonstrated a cleft between the graft and host articular surfaces, and 32 of 36 plugs (89%) were noted to have discernible fissures on MRI.[22]

In the clinical setting, restoration of the geometry of the subchondral bone and radius of joint curvature can be challenging in the setting of a prior osteochondritis dissecans or avascular necrosis (Figure 16). A well-incorporated graft is disclosed as uniform, fatty signal intensity on MRI. It should be noted that the press-fit techniques will often demonstrate a linear focus of diminished signal intensity along the long axis of the plug, which is a function of sclerosis of adjacent trabeculae rather than a lack of incorporation. The presence of increased (fluid) signal intensity at the interface between the graft and the host bone suggests the presence of incomplete graft incorporation and potential instability.[4] In a prospective, longitudinal study of cartilage defects treated with hypothermically stored fresh osteochondral allografts using validated clinical outcome instruments and cartilage-sensitive MRI, allografts remained

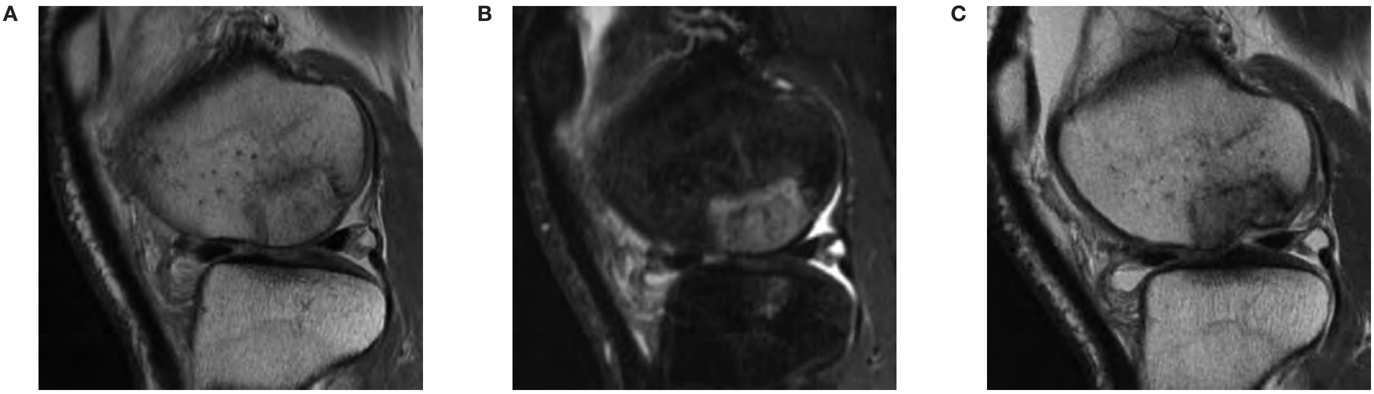


Figure 17. Sagittal cartilage-sensitive magnetic resonance image of the knee (A) in a 17-year-old boy 7 months after mosaicplasty for osteochondritis dissecans using a fresh osteochondral allograft. There is intact cartilage over a graft that is slightly proud. A corresponding fat-suppressed magnetic resonance image (B) demonstrates intense bone marrow edema pattern in the graft. A sagittal magnetic resonance image obtained 6 months later (C) demonstrates interval collapse and fragmentation of the allograft, with debris in the posterior recess of the joint.

intact without displacement, with fissures noted at the graft/host interface in 16 of 19 (84%) grafts; a smooth graft/host interface was observed in only 3 of 19 (16%) grafts (Williams et al, unpublished data, 2005). Poor incorporation was noted in 6 of 19 (32%) grafts, 3 of which demonstrated an intense bone marrow edema pattern and the remainder of which demonstrated frank subchondral marrow fibrosis (low signal on all pulse sequences) (Figure 17). Collapse of the subchondral bone in the graft has been noted to correlate with a lack of bony integration based on signal characteristics.[67]

IMAGING BEYOND MORPHOLOGY: INSIGHT INTO STRUCTURE

Although the imaging of traumatic cartilage injury, degenerative change, and cartilage repair based on morphologic characteristics is helpful, additional imaging techniques have been developed that provide noninvasive insight into the ultrastructure of cartilage, detecting early degenerative changes before discernible loss of thickness on conventional cartilage-sensitive MRI. Indeed, the standardized in-plane resolution of 400 to 600 microns of most conventional MRI demonstrates only gross cartilage thinning and signal alterations.[60] Although higher resolution techniques permit visualization of more subtle surface changes, the ability to detect changes in structure would be helpful in not only assessing surgically manipulated cartilage but also in revealing early degenerative changes in joints. The signal properties of articular cartilage are dependent on many variables, including the pulse sequence used; the structural composition of collagen, proteoglycans, and water; and indeed the orientation of the collagen in the different laminae.

Articular cartilage contains chondrocytes embedded in an organized extracellular matrix composed primarily of water, collagen, and proteoglycan. Water is the most abundant component of cartilage, the majority of which is contained within interstitial space created by the collagen and proteoglycan solid matrix. Metabolic homeostasis of cartilage is maintained by chondrocytes, which are responsible for sustaining a stable extracellular matrix. Cartilage may be divided structurally and functionally into 4 zones. The superficial zone comprises approximately 10% to 20% of the articular cartilage thickness and contains the highest collagen content, and the collagen fibers have a highly ordered alignment that is parallel to the articular surface.[48] The middle zone comprises 40% to 60% of articular cartilage volume and has a higher compressive modulus than the superficial zone and a more random arrangement of the collagen fibers.[48] In the deep or radial zone (comprising 30% of the cartilage thickness), the collagen fibers are once again highly ordered, being perpendicular to the subchondral plate. The deep or radial zone contains the highest proteoglycan content and thus the highest compressive modulus and the lowest water concentration.

The signal characteristics of cartilage reflect this ultrastructure. Although the majority of signal emitted from the cartilage is attributed to free water, there are 2 important pools of bound water protons that contribute to its MRI and functional properties. Proteoglycans provide compressive strength to the cartilage, generating pressure because of their hydrophilic properties, and collagen provides the tensile strength. With appropriate MRI techniques, each of these components of the matrix may be studied.

Osteoarthritis is associated with loss of proteoglycan content and with an increased hydraulic permeability of the matrix.[61] These proteoglycan changes may be tracked via alterations in the fixed charged density of the tissue, which is afforded by the negatively charged glycosaminoglycan (GAG) chains within the proteoglycan. As early osteoarthritis is associated with loss of negatively charged GAG, the fixed charge density would be correspondingly altered. Methods by which to track this change include positively charged sodium (^{23}Na) MRI, T1ρ MRI, and the use of negatively charged gadolinium salts. Sodium MRI is a sensitive and specific measure for assessing these alterations in fixed charged density on high field strength (4-T) units.[54] Sodium

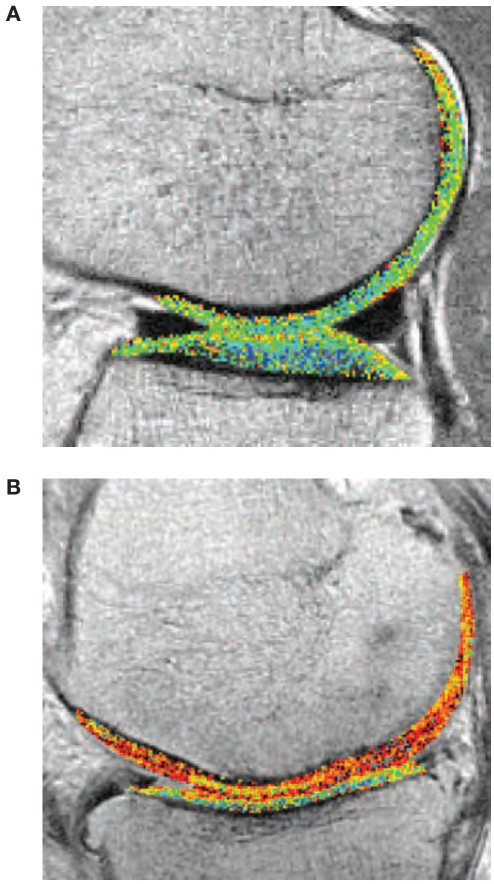


Figure 18. Sagittal $T1_{Gd}$ images of the knee demonstrate global and focal ranges of glycosaminoglycan distribution ($T1_{Gd}$) index. The lateral compartment in a 26-year-old female professional dancer (A) shows high-range (blue-green) $T1_{Gd}$ values for tibial plateau and weightbearing zones of femoral condyle compartments. Medial compartment of a 78-year-old woman with moderately severe osteoarthritis (B) demonstrates $T1_{Gd}$ values in low range (red). Reprinted by permission of American Roentgen Ray Society, from *Am J Roentgenol*. 2004;182:167-172.

MRI, however, is unlikely to become ubiquitous in clinical practice, as it is technically challenging because of low signal-to-noise ratio created by the relatively lower concentration of ^{23}Na in human cartilage, as well as its requirement for special imaging coils and long scan times.[24]

More recently, T1ρ MRI (spin-lattice relaxation in the rotating frame) has been correlated to fixed charged density, thus reflective of proteoglycan content, showing strong correlation in both enzymatically degraded bovine and clinical osteoarthritis samples.[68] More recent data also suggest that changes in collagen concentration may account for variation of T1ρ seen in human tissue.[43] These methods have been shown to be clinically feasible on 1.5-T scanners evaluating a small cohort of healthy and symptomatic volunteers.[56,57] Clinical application of these techniques and further study will be necessary to assess the utility of T1ρ MRI in detecting changes of osteoarthritis.

The use of negatively charged gadolinium salts has also been used to assess fixed charged density. This procedure was initially performed using small explants soaked in gadolinium salt (diethylenetriaminepentaacetic acid [$Gd\text{-}DTPA^{-2}$]), followed by the subsequent use in clinical cohorts[5,6,69] (Figure 18). The clinical use of the delayed gadolinium-enhanced MRI (dGEMRIC) technique entails the intravenous injection of double dose $Gd\text{-}DTPA^{-2}$, followed by joint exercise and a delay of 90 minutes, during which time the contrast material is thought to diffuse into the cartilage as a function of fixed charged density. Subsequent inversion recovery acquisitions are performed to calculate a T1-weighted map, which reflects the relative GAG content. Additional study has disclosed that the MRI relaxivity of the gadolinium contrast agents depends on the macromolecular content of the regional tissue, suggesting that quantitative MRI analyses using these techniques require independent measurement of the gadolinium relaxivity in the tissue to be studied.[65]

The dGEMRIC techniques have been used in a clinical setting to assess relative GAG loss in the setting of osteoarthritis[69] and in a preliminary study of patients with early osteoarthritis secondary to hip dysplasia.[35] In addition, dGEMRIC techniques were performed in patients who had sustained a recent ACL tear and compared with healthy volunteers. The authors noted a decreased relative GAG content in the lateral femoral condyle adjacent to the site of the bone bruise.[66] They further noted decreased relative GAG content in the medial femoral condyle, where bone bruises were relatively uncommon, suggesting that traumatic injury may lead to a generalized alteration in cartilage biology, with more diffuse proteoglycan depletion.[66] Synovial fluid GAG concentration in those patients also showed a positive correlation with the T1 relaxation times using dGEMRIC technique.[66] As the dGEMRIC index depends on the equilibrating bath concentration of $Gd\text{-}DTPA^{-2}$, additional validation studies are necessary to assess the influence of regional synovitis on the clinical application of the index. Despite these challenges, this technique holds promise in assessing the relative proteoglycan component of cartilage.

T2 MAPPING

T2 relaxation time mapping has been used to assess the collagen component of the extracellular matrix. T2 relaxation time is a reproducible MRI parameter that reflects the internuclear reaction (dephasing) that occurs as a result of transverse relaxation of the excited hydrogen dipoles. The stratification of T2 reflects the arrangement of the type II collagen fibers within the matrix. In the radial zone, where the collagen is highly ordered, being perpendicular to the articular surface and subchondral plate, the T2 relaxation values are relatively short, compared with the transitional zone, where the collagen fibers have a more random orientation, allowing for greater mobility of water. In the relatively thin superficial zone, where the collagen is again highly ordered, T2 values are again shortened; however, this zone is generally beyond the resolution of clinical field strengths at the current time. This stratification of T2 has

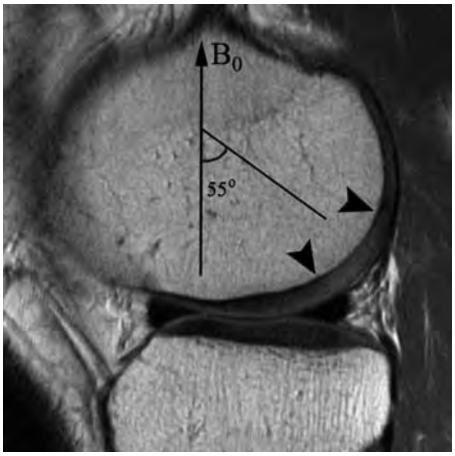


Figure 19. A sagittal fast spin echo magnetic resonance image of the knee in a 26-year-old man demonstrates the magic angle effect (arrowheads) with focal loss of gray scale stratification at 55° relative to the external field (B_0), indicating highly ordered components in the cartilage matrix. Note the normal gray scale stratification of the remaining medial femoral condyle and tibial plateau.

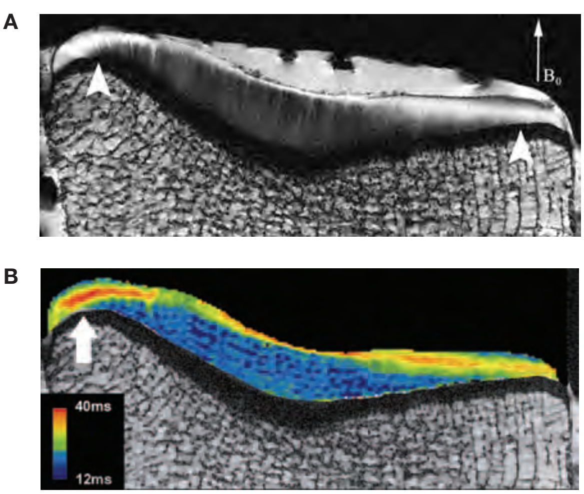


Figure 20. A, the lateral tibial plateau of a 35-year-old woman. B_0 = main magnetic field. On midcoronal spin echo image, variations in signal intensity produce a characteristic 3-layer appearance. In the central region of the plateau, prominent radial striations extend across a thick deep layer, and minor fibrillation is seen at low signal intensity surface. In submeniscal and tibial eminence regions (arrowheads), the transitional layer is much thicker. B, on the corresponding T2 map, changes in T2 parallel changes in signal intensity. Peak T2 values are located in the middle of the transitional layer (arrow). Reprinted by permission of American Roentgen Ray Society, from *Am J Roentgenol*. 2004;182:311-318.

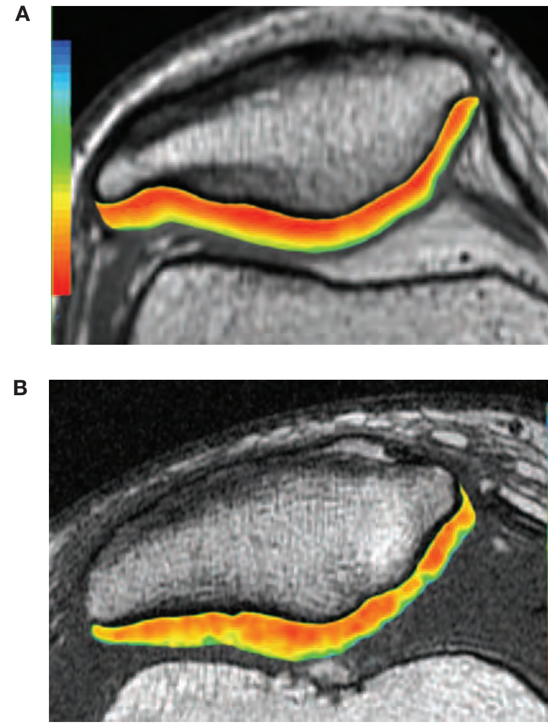


Figure 21. A, an axial T2 relaxation time map from an asymptomatic 32-year-old man demonstrates normal stratification of T2 values. The color map is coded to capture T2 values ranging from 25 to 75 milliseconds, with green reflecting longer T2 values; yellow, intermediate values; and orange/red, shorter values. Stratification of T2 values with shorter values is seen in the radial zone, where water is most restricted. B, an axial T2 relaxation time map from a 56-year-old man with chronic patellofemoral overload. Note the stratification of T2 values with shorter values in the radial zone but with foci of prolonged T2 values over the apex and lateral facet because of breakdown in the matrix.

been extensively studied in MRI microscopy systems, and the T2 characteristics of cartilage have been shown to be statistically equivalent to the histologic zones based on collagen fiber orientation using polarized light microscopy as the standard.[73]

Further investigation has shown that proteoglycan depletion has little effect on the T2 of cartilage.[9] Mlynárik et al[45] found no significant difference in quantitative T2 between normal regions and those depleted of proteoglycan, as studied on explants obtained from patients who underwent joint arthroplasty.

T2 relaxation time is further influenced by the structural anisotropy of the collagen. Xia[71] has related this anisotropy to the magic angle phenomenon, which describes the well-defined relationship between spinning hydrogen dipoles within the collagen and the long axis of the magnetic field, which in a traditional closed MR unit, runs parallel to the long axis of the patient. When the angle between the external field and the spinning hydrogen nuclei reaches approximately 55°, there is prolongation of T2 relaxation time. Recognition of this phenomenon is clinically relevant, as this phenomenon may be noted in the apparent gray scale stratification on clinical cartilage pulse sequences (Figure 19). Loss of the tissue anisotropy may be a sensitive marker to early changes associated with osteoarthritis. The clinical application of these techniques, however, can be challenging.

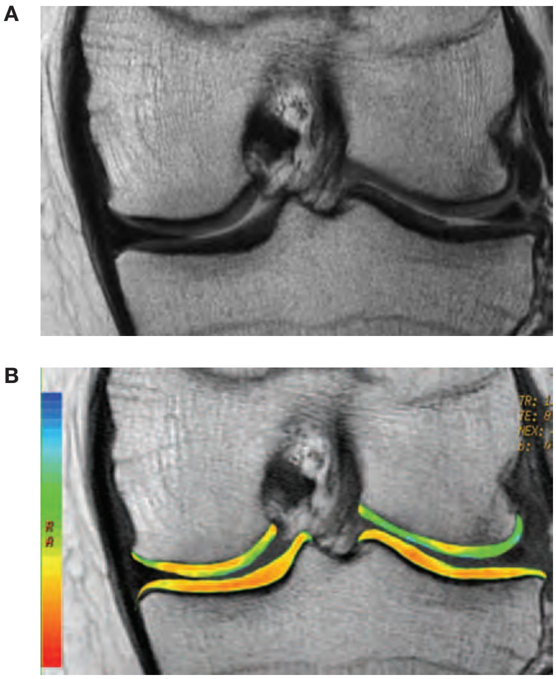


Figure 22. A, a coronal fast spin echo magnetic resonance image of the knee of a 15-year-old girl with a previous partial meniscectomy demonstrates mild fibrillation of the cartilage overlying the lateral tibial plateau. B, a corresponding T2 relaxation time map of the femorotibial articular cartilage in the same coronal plane demonstrates prolongation of T2 values over the plateau but with additional prolongation over the lateral femoral condyle, which appeared normal on the traditional cartilage imaging.

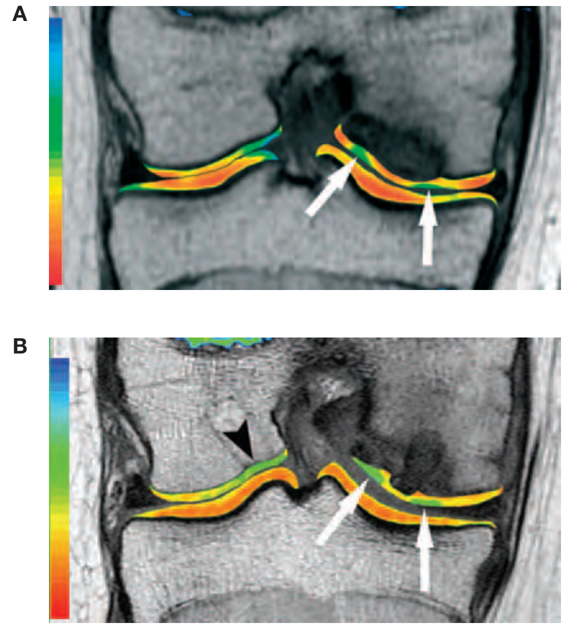


Figure 23. Coronal T2 relaxation time maps of the femorotibial articular cartilage of a 13-year-old girl with osteochondritis dissecans. The color maps are coded to capture T2 values ranging from 5 to 100 milliseconds, with green and blue reflecting longer T2 values; yellow, intermediate values; and orange, shorter values. The preoperative image (A) demonstrates a normal lateral compartment, with the expected stratification of T2 values. Note the prolongation of T2 relaxation times at the margins of the osteochondral lesion (arrows). Three months after mosaicplasty (B), there is prolongation of T2 values at the donor site (arrowhead), reflecting the reparative fibrocartilage and less organized matrix. Also note the persistent prolongation of T2 values at the margins of the plugs (arrows). There is an intact appearance (albeit with reduced thickness) in the cartilage over the central, slightly proud plug.

A recent evaluation of quantitative T2 maps in a clinical cohort at 3 T has raised some question as to which zone contains the greatest orientational effect, observing less than the expected angular dependence in the radial zone compared with ex vivo studies.[47] The authors attribute these differences to regional variations in cartilage compression, yielding a preferential loss of water from the superficial cartilage and attenuating the magic angle effect in the intact joint.[47,59]

Goodwin et al[27] have suggested that the more complex 3D joint geometry and regional alterations in the arrangement of the fibrous architecture of cartilage, rather than the individual fiber orientation, affect these parameters and account for alterations in the appearance noted on clinical images, as well as on T2 maps. Studying tibial explants at 7 T, Goodwin et al[26] noted anisotropy in the transitional layer of the submeniscal region, which correlated to the architecture of the matrix in the plane of fracture (Figure 20). Caution should be used when evaluating clinical T2 relaxation maps obtained in the submeniscal zone, so as not to misinterpret prolongation of T2 (increased signal intensity), which normally exists as a function of cartilage structure, as prolonged T2 due to osteoarthritis or cartilage damage. In addition, errors in the pulse sequences designed to acquire the T2 values may result in substantial inaccuracies in quantitative measurement.[39,42]

In osteoarthritis, breakdown in the collagen component of the matrix is associated with swelling of proteoglycan and an increase in cartilage permeability.[40,41] As the disruption of the collagen framework occurs, water becomes more mobile, and T2 values would be expected to increase with loss of stratification (Figure 21). Using a spin echo sequence to study cartilage bone plugs harvested from cadaveric knees and specimens obtained at the time of arthroplasty, David-Vaudey et al[14] determined that increased T2 relaxation time correlated to histologic degeneration of cartilage, providing an efficient means by which to differentiate severely degenerated cartilage from intermediate and normal cartilage. T2 mapping has also been applied to animal models of osteoarthritis, observing a prolongation of T2 values. Working at 7 T, Alhadlaq et al[2] noted a shift in the depth of maximal T2, with a decrease in superficial zone thickness and an increase in total cartilage thickness in the submeniscal region obtained from an ACL transaction canine model. Kelly et al (unpublished data, 2004), in a sheep meniscectomy model at clinical field strengths of 1.5 T, showed that prolongation of T2 occurred early after meniscectomy, correlating to observable biomechanical changes using arthroscopic indentation probes.

In a clinical cohort, Dunn et al[16] noted increasing T2 in the medial compartment when comparing cartilage in patients characterized radiographically as having normal, mild, or severe osteoarthritis. Mosher et al[46] examined asymptomatic volunteers as well as a cohort of patients with symptomatic patella pain at 3 T, noting a continuous increase in T2 from the radial zone to the articular surface in the asymptomatic volunteers, with prolongation of T2 in senescent cartilage. These techniques may prove helpful in the longitudinal evaluation of those patients who are deemed candidates for surgical procedures aimed at delaying the progression of osteoarthritis, such as meniscal transplantation. As substantial arthrosis at the time of transplantation is predictive of transplant failure, longitudinal T2 mapping performed in these patients may help to determine the optimal time of surgery[58] (Figure 22).

These techniques will also provide insight into the ultrastructure of surgically manipulated cartilage, not only over the repair site, but also (and perhaps most important) at the site of peripheral integration (Figure 23).

Noninvasive assessment of cartilage matrix using MRI is still under development and requires further validation and application to longitudinal clinical studies. Despite these technical challenges, T2 mapping in combination with some measure of proteoglycan assessment will prove to be powerful noninvasive techniques in detecting early ultrastructure changes in cartilage.

SUMMARY

Magnetic resonance imaging provides an effective noninvasive means by which to detect articular cartilage injury and monitor disease progression in osteoarthritis. Validated pulse sequences are now available for imaging of all joints, and it should be the expectation of orthopaedic surgeons to obtain accurate, reproducible imaging of cartilage in patients referred for MRI. The detection of clinically unsuspected cartilage lesions may affect patient management and provide appropriate preoperative patient education as to the expected postoperative rehabilitation regimen. After surgical manipulation of cartilage, MRI provides an important objective outcome assessment for cartilage repair techniques, to augment the equally important but more subjective clinical and functional assessment from validated outcome instruments. Future development includes the ability of cartilage MRI to noninvasively detect early changes in the matrix before morphologic alteration, thus aiding in the decision regarding the optimal timing of surgical procedures designed to delay the progression of osteoarthritis.

REFERENCES

1. Abadie E, Ethgen D, Avouac B, et al. Recommendations for the use of new methods to assess the efficacy of disease-modifying drugs in the treatment of osteoarthritis. *Osteoarthr Cartil*. 2004;12:263-268.
2. Alhadlaq HA, Xia Y, Moody JB, Matyas JR. Detecting structural changes in early experimental osteoarthritis of tibial cartilage by microscopic magnetic resonance imaging and polarised light microscopy. *Ann Rheum Dis*. 2004;63:709-717.
3. Alparslan L, Minas T, Winalski CS. Magnetic resonance imaging of autologous chondrocyte implantation. *Semin Ultrasound CT MR*. 2001;22:341-351.
4. Alparslan L, Winalski CS, Boutin RD, Minas T. Postoperative magnetic resonance imaging of articular cartilage repair. *Semin Musculoskelet Radiol*. 2001;5:345-363.
5. Bashir A, Gray ML, Boutin RD, Burstein D. Glycosaminoglycan in articular cartilage: in vivo assessment with delayed Gd(DTPA)$^{-2}$-enhanced MR imaging. *Radiology*. 1997;205:551-558.
6. Bashir A, Gray ML, Burstein D. Gd-DTPA^{-2} as a measure of cartilage degradation. *Magn Reson Med*. 1996;36:665-673.
7. Becker ED, Farrar TC. Driven equilibrium Fourier transform spectroscopy: a new method for nuclear magnetic resonance enhancement. *J Am Chem Soc*. 1969;91:7784-7785.
8. Blackburn WD Jr, Bernreuter WK, Rominger M, Loose LL. Arthroscopic evaluation of knee articular cartilage: a comparison with plain radiographs and magnetic resonance imaging. *J Rheumatol*. 1994;21:675-679.
9. Borthakur A, Shapiro EM, Beers J, Kudchodkar S, Kneeland JB, Reddy R. Sensitivity of MRI to proteoglycan depletion in cartilage: comparison of sodium and proton MRI. *Osteoarthr Cartil*. 2000;8:288-293.
10. Bredella MA, Tirman PF, Peterfy CG, et al. Accuracy of T2-weighted fast spin echo MR imaging with fat saturation in detecting cartilage defects in the knee: comparison with arthroscopy in 130 patients. *Am J Roentgenol.* 1999;172:1073-1080.
11. Brittberg M, Lindahl A, Nilsson A, Ohlsson C, Isaksson O, Peterson L. Treatment of deep cartilage defects in the knee with autologous chondrocyte transplantation. *N Engl J Med*. 1994;331:889-895.
12. Brown WE, Potter HG, Marx RG, Wickiewicz TL, Warren RF. Magnetic resonance imaging appearance of cartilage repair in the knee. *Clin Orthop Rel Res*. 2004;422:214-223.
13. Cicuttini FM, Wluka AE, Forbes A, Wolfe R. Comparison of tibial cartilage volume and radiologic grade of the tibiofemoral joint. *Arthritis Rheum*. 2003;48:682-688.
14. David-Vaudey E, Ghosh S, Ries M, Majumdar S. T2 relaxation time measurements in osteoarthritis. *Magn Reson Imaging*. 2004;22:673-682.
15. Disler DG, McCauley TR, Wirth CR, Fuchs MD. Detection of knee hyaline cartilage defects using fat-suppressed three-dimensional spoiled gradient-echo MR imaging: comparison with standard MR imaging and correlation with arthroscopy. *AJR Am J Roentgenol*. 1995;165:377-382.
16. Dunn TC, Lu Y, Jin H, et al. T2 relaxation time of cartilage at MR imaging: comparison with severity of knee osteoarthritis. *Radiology.* 2004;232:592-598.
17. Eckstein F, Glaser C. Measuring cartilage morphology with quantitative magnetic resonance imaging. *Semin Musculoskelet Radiol*. 2004;8:329-353.
18. Eckstein F, Schnier M, Haubner M, et al. Accuracy of cartilage volume and thickness measurements with magnetic resonance imaging. *Clin Orthop Rel Res*. 1998;352:137-148.
19. Eckstein F, Westhoff J, Sittek H, et al. In vivo reproducibility of three-dimensional cartilage volume and thickness measurements with MR imaging. *AJR Am J Roentgenol*. 1998;170:593-597.
20. Erickson SJ, Waldschmidt JG, Czervionke LF, Prost RW. Hyaline cartilage: truncation artifact as a cause of trilaminar appearance with fat-suppressed three-dimensional spoiled gradient-recalled sequences. *Radiology*. 1996;201:260-264.
21. Fife RS, Brandt KD, Braunstein EM, et al. Relationship between arthroscopic evidence of cartilage damage and radiographic evidence of

joint space narrowing in early osteoarthritis of the knee. *Arthritis Rheum*. 1991;34:377-382.
22. Glenn E, McCarty E, Potter HG, et al. Comparison of fresh osteochondral autografts and allografts: a canine model. *Am J Sports Med.* In press.
23. Gold GE, Han E, Stainsby J, Wright G, Brittain J, Beaulieu C. Musculoskeletal MRI at 3.0 T: relaxation times and image contrast. *AJR Am J Roentgenol*. 2004;183:343-351.
24. Gold GE, McCauley TR, Gray ML, Disler DG. What's new in cartilage? *Radiographics*. 2003;23:1227-1242.
25. Gold GE, Thedens DR, Pauly JM, et al. MR imaging of articular cartilage of the knee: new methods using ultrashort TEs. *AJR Am J Roentgenol*. 1998;170:1223-1236.
26. Goodwin DW, Wadghiri YZ, Zhu H, Vinton CJ, Smith ED, Dunn JF. Macroscopic structure of articular cartilage of the tibial plateau: influence of a characteristic matrix architecture on MRI appearance. *AJR Am J Roentgenol*. 2004;182:311-318.
27. Goodwin DW, Zhu H, Dunn JF. In vitro MRI imaging of hyaline cartilage: correlation with scanning electron microscopy. *AJR Am J Roentgenol*. 2000;174:405-409.
28. Graichen H, von Eisenhart-Rothe R, Vogl T, Englmeier KH, Eckstein F. Quantitative assessment of cartilage status in osteoarthritis by quantitative magnetic resonance imaging: technical validation for use in analysis of cartilage volume and further morphologic parameters. *Arthritis Rheum*. 2004;50:811-816.
29. Gross AE, Agnidis Z, Hutchinson CR. Osteochondral defects of the talus treated with fresh osteochondral allograft transplantation. *Foot Ankle Int*. 2001;22:385-391.
30. Hangody L, Feczko P, Bartha L, Bodo G, Kish G. Mosiacplasty for the treatment of articular defects of the knee and ankle. *Clin Orthop Rel Res.* 2001;391(suppl):S328-S336.
31. Hargreaves BA, Gold GE, Beaulieu CF, Vasanawala SS, Nishimura DG, Pauly JM. Comparison of new sequences for high-resolution cartilage imaging. *Magn Reson Med*. 2003;49:700-709.
32. Hayes CW, Sawyer RW, Conway WF. Patellar cartilage lesions: in vitro detection and staging with MR imaging and pathologic correlation. *Radiology*. 1990;176:479-483.
33. Johnson DL, Bealle DP, Brand JC Jr, Nyland J, Caborn DN. The effect of a geographic lateral bone bruise on knee inflammation after acute anterior cruciate ligament rupture. *Am J Sports Med*. 2000;28:152-155.
34. Johnson DL, Urban WP Jr, Caborn DN, Vanarthos WJ, Carlson CS. Articular cartilage changes seen with magnetic resonance imaging-detected bone bruises associated with acute anterior cruciate ligament rupture. *Am J Sports Med*. 1998;26:409-414.
35. Kim YJ, Jaramillo D, Millis MB, Gray ML, Burstein D. Assessment of early osteoarthritis in hip dysplasia with delayed gadolinium-enhanced magnetic resonance imaging of cartilage. *J Bone Joint Surg Am*. 2003; 85:1987-1992.
36. Knutsen G, Engebretsen L, Ludvigsen TC, et al. Autologous chondrocyte implantation compared with microfracture in the knee: a randomized trial. *J Bone Joint Surg Am*. 2004;86:455-464.
37. Kornaat PR, Doornbos J, van der Molen AJ, et al. Magnetic resonance imaging of knee cartilage using a water selective balanced steady-state free precession sequence. *J Magn Reson Imaging*. 2004; 20:850-856.
38. Link TM, Steinbach LS, Ghosh S, et al. Osteoarthritis: MR imaging findings in different stages of disease and correlation with clinical findings. *Radiology*. 2003;226:373-381.
39. Maier CF, Tan SG, Hariharan H, Potter HG. T2 quantitation of articular cartilage at 1.5 T. *J Magn Reson Imaging*. 2003;17:358-364.
40. Maroudas A, Venn M. Chemical composition and swelling of normal and osteoarthrotic femoral head cartilage, II: swelling. *Ann Rheum Dis*. 1977;36:399-406.
41. Maroudas AI. Balance between swelling pressure and collagen tension in normal and degenerate cartilage. *Nature*. 1976;260:808-809.
42. Mendlik T, Faber SC, Weber J, et al. T2 quantitation of human articular cartilage in a clinical setting at 1.5 T: implementation and testing of four multiecho pulse sequence designs for validity. *Invest Radiol*. 2004;39:288-299.
43. Menezes NM, Gray ML, Hartke JR, Burstein D. T2 and T1ρ MRI in articular cartilage systems. *Magn Reson Med*. 2004;51:503-509.
44. Mithöefer K, Williams RJ, Warren RF, et al. Prospective evaluation of the microfracture technique for treatment of articular cartilage lesions in the knee. *J Bone Joint Surg Am*. In press.
45. Mlynárik V, Trattnig S, Huber M, Zembsch A, Imhof H. The role of relaxation times in monitoring proteoglycan depletion in articular cartilage. *J Magn Reson Imaging*. 1999;10:497-502.
46. Mosher TJ, Dardzinski BJ, Smith MB. Human articular cartilage: influence of aging and early symptomatic degeneration on the spatial variation of T2: preliminary findings at 3 T. *Radiology*. 2000;214:259-266.
47. Mosher TJ, Smith H, Dardzinski BJ, Schmithorst VJ, Smith MB. MR imaging and T_2 mapping of femoral cartilage: in vivo determination of the magic angle effect. *AJR Am J Roentgenol*. 2001;177:665-669.
48. Mow VC, Proctor CS, Kelly MA. Biomechanics of articular cartilage. In: Nordin M, Frankel VH, eds. *Basic Biomechanics of the Musculoskeletal System*. Philadelphia, Pa: Lea & Febiger; 1989:31-57.
49. Peterfy CG, Guermazi A, Zaim S, et al. Whole-Organ Magnetic Resonance Imaging Score (WORMS) of the knee in osteoarthritis. *Osteoarthr Cartil*. 2004;12:177-190.
50. Potter HG, Linklater JM, Allen AA, Hannafin JA, Haas SB. Magnetic resonance imaging of articular cartilage in the knee: an evaluation with use of fast-spin-echo imaging. *J Bone Joint Surg Am*. 1998;80: 1276-1284.
51. Rand T, Brossmann J, Pedowitz R, Ahn JM, Haghigi P, Resnick D. Analysis of patellar cartilage: comparison of conventional MR imaging and MR and CT arthrography in cadavers. *Acta Radiol*. 2000;41: 492-497.
52. Raynauld JP, Martel-Pelletier J, Berthiaume MJ, et al. Quantitative magnetic resonance imaging evaluation of knee osteoarthritis progression over two years and correlation with clinical symptoms and radiologic changes. *Arthritis Rheum*. 2004;50:476-487.
53. Recht MP, Piraino DW, Paletta GA, Schils JP, Belhobek GH. Accuracy of fat-suppressed three-dimensional spoiled gradient-echo FLASH MR imaging in the detection of patellofemoral articular cartilage abnormalities. *Radiology*. 1996;198:209-212.
54. Reddy R, Insko EK, Noyszewski EA, Dandora T, Kneeland JB, Leigh JS. Sodium MRI of human articular cartilage in vivo. *Magn Reson Med*. 1998;39:697-701.
55. Reeder SB, Pelc NJ, Alley MT, Gold GE. Rapid MR imaging of articular cartilage with steady-state free precession and multipoint fat-water separation. *AJR Am J Roentgenol*. 2003;180:357-362.
56. Regatte RR, Akella SVS, Wheaton AJ, et al. 3D- T1ρ-relaxation mapping of articular cartilage: in vivo assessment of early degenerative changes in symptomatic osteoarthritic subjects. *Acad Radiol*. 2004;11:741-749.
57. Regatte RR, Akella SVS, Wheaton AJ, Borthakur A, Kneeland JB, Reddy R. T1ρ-relaxation mapping of human femoral-tibial cartilage in vivo. *J Magn Reson Imaging*. 2003;18:336-341.
58. Rodeo SA. Meniscal allografts: where do we stand? *Am J Sports Med*. 2001;29:246-261.
59. Rubenstein JD, Kim JK, Henkelman RM. Effects of compression and recovery on bovine articular cartilage: appearance on MRI images. *Radiology*. 1996;201:843-850.
60. Rubenstein JD, Li JG, Majumdar S, Henkelman RM. Image resolution and signal-to-noise ratio requirements for MR imaging of degenerative cartilage. *AJR Am J Roentgenol*. 1997;169:1089-1096.
61. Setton LA, Mow VC, Muller FJ, Pita JC, Howell DS. Mechanical properties of canine articular cartilage are significantly altered following transection of the anterior cruciate ligament. *J Orthop Res*. 1994;12:451-463.
62. Shelbourne KD, Jari S, Gray T. Outcome of untreated traumatic articular cartilage defects of the knee. *J Bone Joint Surg Am*. 2003;85 (suppl 2):S8-S16.
63. Speer KP, Spritzer CE, Goldner JL, Garrett WE Jr. Magnetic resonance imaging of traumatic knee articular cartilage injuries. *Am J Sports Med*. 1991;19:396-402.
64. Spindler KP, Schils JP, Bergfeld JA, et al. Prospective study of osseous, articular, and meniscal lesions in recent anterior cruciate ligament tears by magnetic resonance imaging and arthroscopy. *Am J Sports Med.* 1993;21:551-557.

65. Stanisz GJ, Henkelman RM. Gd-DTPA relaxivity depends on macromolecular content. *Magn Reson Med*. 2000;44:665-667.
66. Tiderius CJ, Olsson LE, Nyquist F, Dahlberg L. Cartilage glycosaminoglycan loss in the acute phase after an anterior cruciate ligament injury: delayed gadolinium-enhanced magnetic resonance imaging of cartilage and synovial fluid analysis. *Arthritis Rheum*. 2005;52:120-127.
67. Verstraete KL, Almqvist F, Verdonk P, et al. Magnetic resonance imaging of cartilage and cartilage repair. *Clin Radiol*. 2004;59:674-689.
68. Wheaton AJ, Casey FL, Gougoutas AJ, et al. Correlation of T1ρ with fixed charge density in cartilage. *J Magn Reson Imaging.* 2004;20:519-525.
69. Williams A, Gillis A, McKenzie C, et al. Glycosaminoglycan distribution in cartilage as determined by delayed gadolinium-enhanced MRI of cartilage (dGEMRIC): potential clinical applications. *AJR Am J Roentgenol*. 2004;182:167-172.
70. Woertler K, Strothmann M, Tombach B, Reimer P. Detection of articular cartilage lesions: experimental evaluation of low- and high-field-strength MR imaging at 0.18 and 1.0 T. *J Magn Reson Imaging*. 2000; 11:678-685.
71. Xia Y. Relaxation anisotropy in cartilage by NMR microscopy (μMRI) at 14-μm resolution. *Magn Reson Med*. 1998;39:941-949.
72. Xia Y, Farquhar T, Burton-Wurster N, Lust G. Origin of cartilage laminae in MRI. *J Magn Reson Imaging*. 1997;7:887-894.
73. Xia Y, Moody JB, Burton-Wurster N, Lust G. Quantitative in situ correlation between microscopic MRI and polarized light microscopy studies of articular cartilage. *Osteoarthr Cartil*. 2001;9:393-406.
74. Yamamoto T, Bullough PG. Spontaneous osteonecrosis of the knee: the result of subchondral insufficiency fracture. *J Bone Joint Surg Am*. 2000;82:858-866.
75. Yoshioka H, Stevens K, Hargreaves BA, et al. Magnetic resonance imaging of articular cartilage of the knee: comparison between fat-suppressed three-dimensional SPGR imaging, fat-suppressed FSE imaging, and fat-suppressed three-dimensional DEFT imaging, and correlation with arthroscopy. *J Magn Reson Imaging*. 2004;20:857-864.
76. Zanetti M, Bruder E, Romero J, Hodler J. Bone marrow edema pattern in osteoarthritic knees: correlation between MR imaging and histologic findings. *Radiology*. 2000;215:835-840.

Magnetic Resonance Imaging After Total Hip Arthroplasty: Evaluation of Periprosthetic Soft Tissue

Hollis G. Potter, Bryan J. Nestor, Carolyn M. Sofka, Stephanie T. Ho, Lance E. Peters and Eduardo A. Salvati
J Bone Joint Surg Am. 2004;86:1947-1954.

Magnetic Resonance Imaging After Total Hip Arthroplasty: Evaluation of Periprosthetic Soft Tissue

BY HOLLIS G. POTTER, MD, BRYAN J. NESTOR, MD,
CAROLYN M. SOFKA, MD, STEPHANIE T. HO, MD, LANCE E. PETERS, MD, AND EDUARDO A. SALVATI, MD

Investigation performed at the Division of Magnetic Resonance Imaging and the Department of Orthopaedic Surgery, Hospital for Special Surgery, New York, NY

Background: The evaluation of periprosthetic osteolysis in patients who have had a total hip arthroplasty is challenging, and traditional imaging techniques, including magnetic resonance imaging and computerized tomography, are limited by metallic artifact. The purpose of the present study was to investigate the use of modified magnetic resonance imaging techniques involving commercially available software to visualize periprosthetic soft tissues, to define the bone-implant interface, and to detect the location and extent of osteolysis.

Methods: Twenty-eight hips in twenty-seven patients were examined to assess the extent of osteolysis (nineteen hips), enigmatic pain (five), heterotopic ossification (two), suspected tumor (one), or femoral nerve palsy (one). The results were correlated with conventional radiographic findings as well as with intraoperative findings (when available).

Results: Magnetic resonance imaging demonstrated the bone-implant interface and the surrounding soft-tissue envelope in all hips. Radiographs consistently underestimated the extent and location of acetabular osteolysis when compared with magnetic resonance imaging. Magnetic resonance imaging also disclosed radiographically occult extraosseous soft-tissue deposits that were similar in signal intensity to areas of osteolysis, demonstrated the relationship of these deposits to adjacent neurovascular structures, and allowed further visualization of hypertrophic synovial deposits that accompanied the bone resorption in twenty-five of the twenty-eight hips.

Conclusions: Magnetic resonance imaging is effective for the assessment of the periprosthetic soft tissues in patients who have had a total hip arthroplasty. While not indicated for every patient who has pain at the site of an arthroplasty, these techniques can be effective for the evaluation of the surrounding soft-tissue envelope as well as intracapsular synovial deposits and are more effective than radiographs for the detection and evaluation of osteolysis, thus aiding in clinical management.

Level of Evidence: Diagnostic study, Level III-1 (study of nonconsecutive patients [no consistently applied reference "gold" standard]). See Instructions to Authors for a complete description of levels of evidence.

Periprosthetic osteolysis resulting from wear-generated debris frequently leads to implant loosening and has become the leading problem associated with total hip replacement[1]. Despite severe bone loss, many patients remain asymptomatic[2]. The recognition and assessment of osteolysis has relied on the use of routine serial radiographs that are made as part of the follow-up evaluation[3-6]. It is generally recognized, however, that radiographs either fail to detect lesions or grossly underestimate the extent of bone loss that is observed intraoperatively[7-9]. The use of additional oblique radiographs has been reported to increase the recognition of osteolysis[10]. Conventional radiographs, however, only provide a two-dimensional analysis of a three-dimensional process[11].

More recently, computerized tomography involving the use of software designed to reduce beam-hardening artifact has been shown to more accurately measure periprosthetic osteolysis in a three-dimensional manner[12]. While more precise quantification of osteolysis is possible with computerized tomography, one disadvantage of that technique is the exposure of the patient to ionizing radiation. In addition, computerized tomography is primarily used to evaluate bone and is of limited value for the visualization of surrounding soft tissues and neurovascular structures.

Although magnetic resonance imaging has proved to be useful for the evaluation of the native hip, it has not been widely used following total hip arthroplasty, largely because of signal loss adjacent to the metallic components. Preliminary studies have addressed the use of magnetic resonance imaging to evaluate various complications following total hip arthroplasty[13-15]. White et al.[14] evaluated twelve patients (fourteen total hip replacements) with use of magnetic resonance imaging before and after the administration of intravenous gadolinium contrast medium and noted periprosthetic abnormalities (including loosening, granulomatosis, and infection) in eleven hips. Tissue depiction around the femoral component was deemed to be of diagnostic quality in all eleven patients, but tissue depiction around the acetabular component was determined to be of diagnostic quality in only five. Similarly, previous authors have used modified commercially available pulse-sequence parameters to assess various complications of hip arthroplasty, including deep venous thrombosis and the integrity of the soft-tissue envelope in cases of instability and loosening[13,16].

The purpose of the present study was to investigate the use of modified magnetic resonance imaging techniques involving commercially available software to visualize periprosthetic soft tissues, to define the bone-implant interface, and to detect the location and extent of osteolysis. Our hypothesis was that magnetic resonance imaging would be superior to conventional radiographs for the detection of both acetabular and proximal femoral osteolysis.

Materials and Methods

Clinical Data

Twenty-eight hips in twenty-seven patients were examined; one patient with bilateral replacement had imaging of both hips. The inclusion criteria were the presence of a primary total hip replacement and evidence of osteolysis on magnetic resonance images. The study group included nine men and eighteen women who had a mean age of sixty-two years (range, thirty-five to eighty-four years) at the time of imaging. The mean interval between the index arthroplasty and the initial magnetic resonance imaging examination was 12.9 years (range, three to thirty-one years). The indications for hip arthroplasty included osteoarthritis (seventeen hips), osteonecrosis (six), fracture (three), inflammatory arthritis (one), and tumor resection (one).

The components that had been used for the twenty-eight arthroplasties included an uncemented titanium acetabular component with a cemented cobalt-chromium femoral stem and a modular cobalt-chromium head in fifteen hips, an uncemented titanium acetabular component with an uncemented titanium femoral stem and a modular cobalt-chromium head in five, a cemented polyethylene acetabular component and a cemented nonmodular cobalt-chromium stem in three, an uncemented titanium acetabular component with a cemented nonmodular stainless steel stem in two, an uncemented titanium acetabular component with an

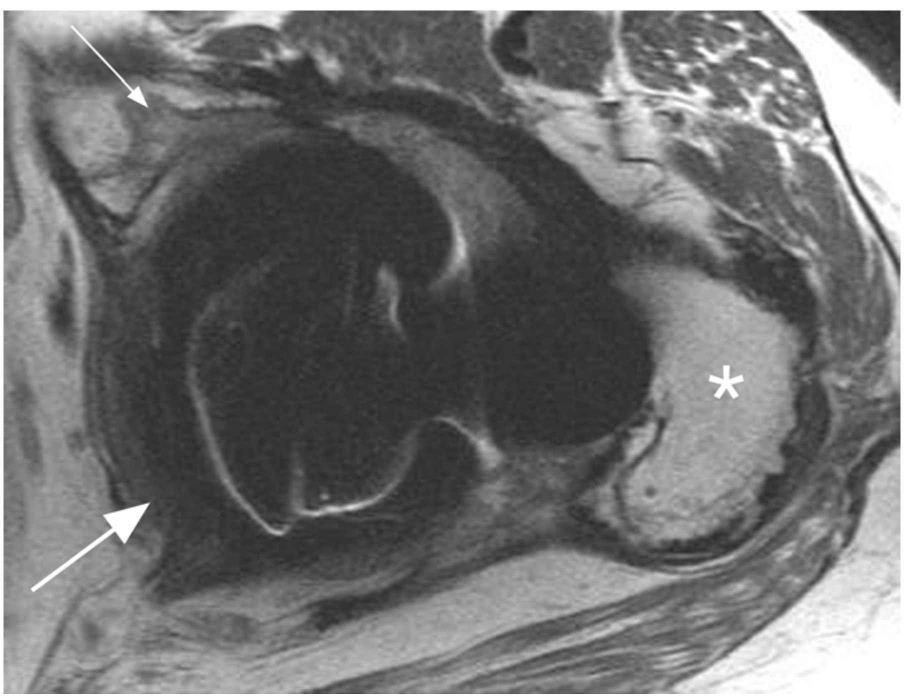


Fig. 1

Axial fast-spin-echo magnetic resonance image of the hip of a seventy-one-year-old woman, obtained fourteen years after total hip arthroplasty, showing well-defined foci of marrow replacement in the medial wall (thick arrow), and in the anterior column (thin arrow). For orientation purposes, the greater trochanter is shown on the right (asterisk). Note the sharp contrast between the intermediate signal intensity of the osteolysis (similar to that of skeletal muscle) and the adjacent higher signal intensity of the fatty marrow. The pseudocapsule is distended anteriorly by material with the same signal characteristics.

uncemented cobalt-chromium stem and a modular cobalt-chromium head in two, and a cemented titanium acetabular component with an uncemented titanium femoral stem and a modular cobalt-chromium head in one.

All patients who had been referred for magnetic resonance imaging were evaluated with conventional anteroposterior and frog-leg lateral radiographs and a comprehensive physical examination. In eighteen patients (nineteen hips), magnetic resonance imaging was performed specifically for the evaluation of osteolysis. In the remaining nine patients (nine hips), osteolysis had been noted on radiographs and magnetic resonance imaging was performed for other reasons. Specifically, five patients had been referred for the evaluation of severe, enigmatic pain that was not thought to be related to the osteolysis seen on radiographs; two, for the preoperative assessment of heterotopic ossification; one, for the evaluation of a suspected tumor; and one, for the evaluation of a femoral nerve palsy.

Plain Radiographic Assessment

Anteroposterior and frog-leg lateral radiographs were made for all patients, and any areas of periprosthetic radiolucency were noted. All radiographic measurements were made by means of a consensus review by two experienced attending orthopaedic surgeons (L.E.P. and E.A.S.) who were blinded to the magnetic resonance imaging findings. When osteolysis was seen on plain radiographs before magnetic resonance images were obtained, an assessment of the areas of femoral and acetabular osteolysis was performed.

Osteolysis on the acetabular side was measured on the anteroposterior radiograph of the pelvis with use of the ruler (magnification, 120%) on a standard transparent template. Measurements were made to the nearest millimeter. The dimensions of a radiolucent lesion were determined by measuring the greatest diameter of the lesion and then measuring a second diameter perpendicular to the first, similar to the technique described by Maloney et al.[17]. The total area of a lesion was calculated (in square millimeters) by multiplying the two diameters (length $\times$ width)[17]. The location of the acetabular lesions was classified as zone I, II, or III, according to the system described by DeLee and Charnley[18]. If a lesion spanned two zones, it was classified as a combined zone (e.g., zone I/II or zone II/III).

On the femoral side, radiolucent lesions were measured and their area was calculated in a similar manner on both anteroposterior and frog-leg lateral radiographs. With use of a technique similar to that described by Huddleston[19], the location of the femoral lesions was classified on both anteroposterior radiographs (zones 1 through 7) and lateral radiographs (zones 8 through 14) according to the system described by Gruen et al.[20]. Once again, if a lesion spanned two zones, then a hybrid zone (e.g., zone 2/3 or zone 8/9) was created. The total osteolysis load for each patient was calculated (in square millimeters) by adding the areas of all lesions on the acetabular and femoral sides.

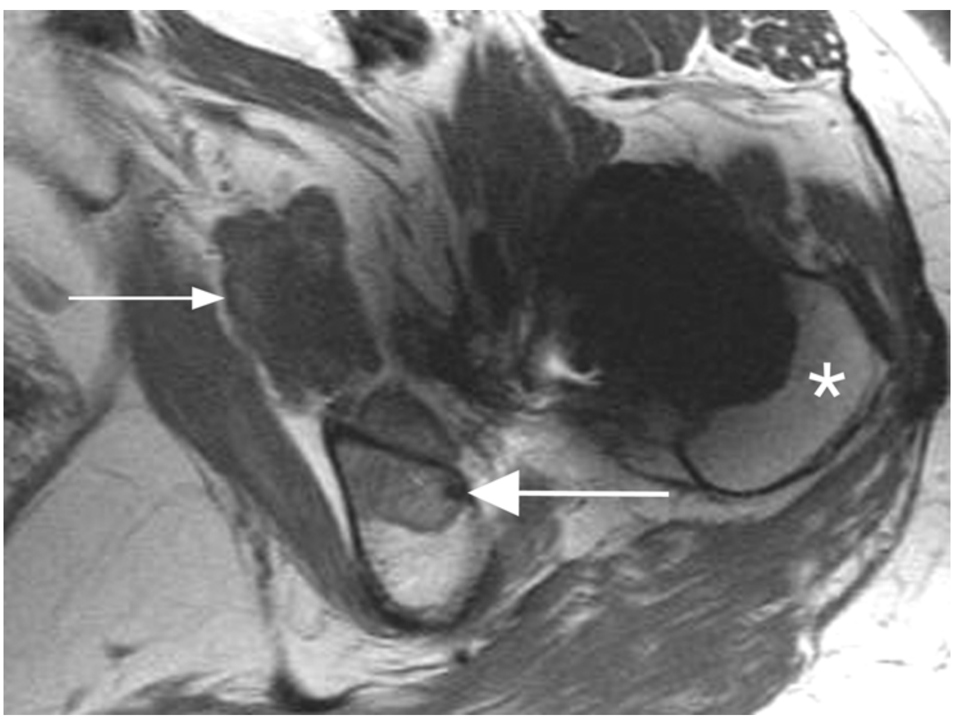


Fig. 2

Axial fast-spin-echo magnetic resonance image of the hip of a sixty-nine-year-old woman, showing a soft-tissue mass of intermediate signal intensity (thin arrow). The signal intensity of this soft-tissue mass is the same as that of the osteolysis replacing the posterior margin of the ischium (thick arrow). For orientation purposes, the greater trochanter is shown on the right (asterisk). Note the low-signal-intensity rim outlining the focus of marrow replacement.

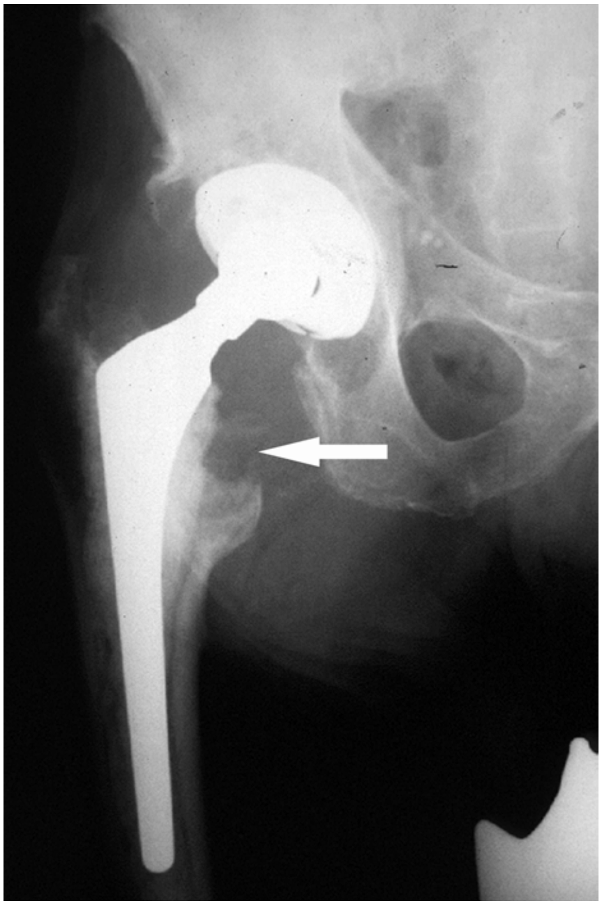


Fig. 3-A

Fig. 3-B

Fig. 3-A Plain radiograph of the hip of a seventy-two-year-old man, obtained 10.5 years after total joint arthroplasty, showing evidence of osteolysis. The prominent erosion of the medial portion of the femoral neck (arrow) raised the clinical concern of a superimposed tumor. **Fig. 3-B** Subsequent coronal magnetic resonance image of the same hip shown in Figure 3-A, demonstrating massive osteolysis (thick arrow) replacing the normal high signal intensity of the marrow. For orientation purposes, the greater trochanter is shown on the left (asterisk). Note the additional involvement at the acetabular dome and the extension into the iliacus bursa (thin arrow). Also note that the osteolysis is well defined and is of intermediate signal intensity with a low-signal-intensity rim, indicating an indolent pattern of bone destruction that is atypical of tumors. The extent of osteolysis seen on radiographs did not reflect the severe degree of osteolysis seen on magnetic resonance imaging, which aided in the planning for revision arthroplasty and removed any concern regarding the presence of a neoplasm.

Magnetic Resonance Imaging Technique and Evaluation

All procedures were performed on a 1.5-T clinical superconducting magnet (Signa Horizon LX; General Electric Medical Systems, Milwaukee, Wisconsin) with use of a shoulder phased array (Med Rad, Indianola, Pennsylvania) centered over the proximal aspect of the femoral component. Initial images were obtained with a body coil utilizing an initial coronal fast inversion recovery sequence with a field of view of 35 cm, a repetition time of 4500 to 5000 msec, an effective-echo time of 17 msec, an inversion time of 150 msec, a receiver bandwidth of 31.2 to 62.5 kHz (over the entire frequency range), and a slice thickness of 5 mm with no interslice gap. Additional coronal, sagittal, and axial fast-spin-echo sequences (Fast Spin Echo XL; General Electric Medical Systems) were obtained with use of the surface shoulder coil with a repetition time of 3000 to 5000 msec, an echo time of 30 to 36 msec, and a wider receiver bandwidth of 62.5 to 83.5 kHz. The field of view ranged from 17 to 20 cm, the slice thickness ranged from 3 to 4 mm with no gap, and the matrix was 512 by 320 to 384 at six excitations, yielding a maximum in-plane resolution of 332 μm. Tailored radiofrequency (Tailored RF; General Electric Medical Systems) was performed to further reduce interecho spacing. The total imaging time ranged from twenty-five to forty minutes, depending on the size of the patient and the need for repetition of pulse sequences due to involuntary motion.

The bone-cement or metal-bone interface was evaluated, without knowledge of the plain radiographic findings, for the presence of intermediate signal intensity (reflecting osteolysis) replacing the normally hyperintense fatty marrow; all findings were confirmed on at least two planes of imaging. The location of lesions in the femur was classified according to the zones of

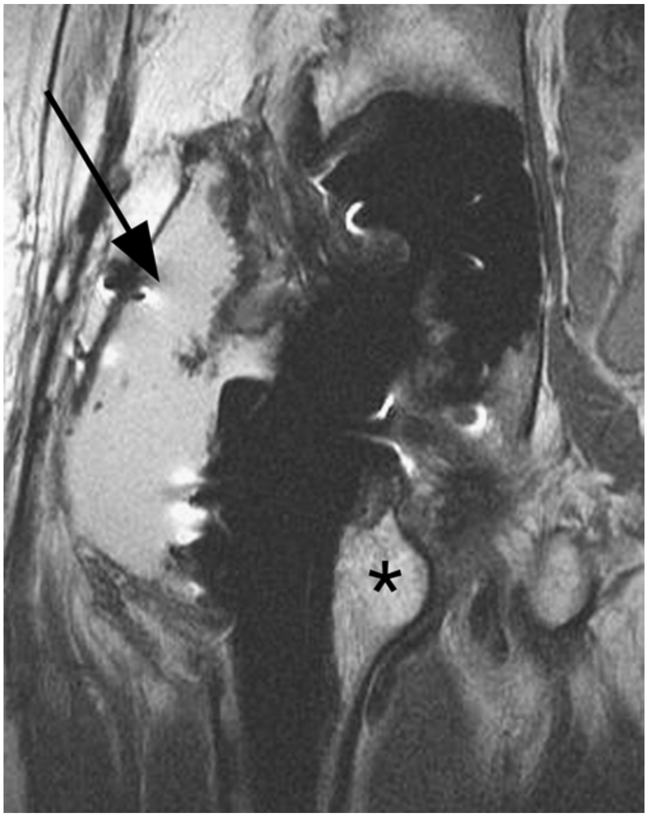


Fig. 4

Coronal fast-spin-echo magnetic resonance image of the hip of a sixty-seven-year-old woman who presented with pain twenty-four years after primary arthroplasty, demonstrating a large fluid collection (arrow) lined by metallic debris in the greater trochanteric bursa lateral to the site of the arthroplasty. For orientation purposes, the lesser trochanter is shown on the lower right (asterisk).

Gruen et al.[20]. Because of the extension of osteolysis between regions without a discernible interface, the location of lesions in the acetabulum was classified according to anatomic regions rather than according to the zones of DeLee and Charnley[18]. To determine osteolysis volume, image files were transferred onto a standard personal computer and a manual outline of the affected areas was made. Subsequent conversion of pixels to cubic millimeters was performed with use of a software conversion program developed on Mat Lab 6.2 software according to the formula Volume = Σ (Ar $\times$ ST), where Ar is the area of osteolysis in the slice and ST is the slice thickness (Applied Science Laboratory, General Electric Medical Systems). No additional correction for field disturbance was made during post-processing. The osteolysis volume (in cubic millimeters) that was determined on magnetic resonance images was compared with the total osteolysis load (in square millimeters) that was measured on radiographs. The results of the magnetic resonance imaging evaluation were then correlated with the findings on preoperative conventional radiographs as well as with the subjective findings noted at the time of subsequent surgery (when performed).

Results

Delineation of Osteolysis

In all twenty-eight hips, magnetic resonance imaging consistently allowed visualization of the bone-implant interface and the surrounding soft tissues. The areas of periprosthetic osteolysis in all hips were characterized by intermediate to slightly increased intraosseous signal intensity (similar to that of skeletal muscle) with an additional line of low signal intensity surrounding the focal marrow replacement (Fig. 1). In three hips, extraosseous deposits of material sharing the same signal characteristics were noted (Fig. 2). The signal characteristics of osteolysis were distinctly different from those of infection or tumor (Fig. 3-B) in that the signal intensity was intermediate (closer to that of skeletal muscle) and the lesion was well defined, whereas the signal intensity at the site of infection typically is hyperintense (closer to that of fluid) and poorly defined because of the more aggressive pattern of bone destruction. Conversely, extravasated cement is markedly hypointense, with a signal intensity that is closer to that of cortical bone (Table I).

The mean area of acetabular osteolysis on conventional radiographs was 740.58 mm^2 (range, 126 to 1380 mm^2), and the mean volume on magnetic resonance images was 43,976.30 mm^3 (range, 738 to 436,688 mm^3). The mean area of femoral osteolysis on conventional radiographs was 426.68 mm^2 (range, 60 to 2035 mm^2), and the mean volume on magnetic resonance images was 7569.95 mm^3 (range, 180 to 33,733 mm^3).

In general, there was good association between the presence and location of osteolytic lesions as observed on conventional radiographs and magnetic resonance images. Discrepancies in the location of acetabular osteolysis were noted in three hips. In two of these hips, plain radiographs failed to detect anterior column lesions, one of which had an extraosseous extension. In the third hip, magnetic resonance imaging was degraded because of motion, which limited the diagnostic ability.

The proximal-medial margin of the femoral bone-prosthesis interface was slightly more difficult to discern on magnetic resonance images, likely because of the relative paucity of high-signal-intensity fatty marrow. In addition, the fact that the shoulder surface coil that was utilized did not extend to the tip of the femoral stem precluded the ability to visualize Gruen zones 3, 4, 5, 10, 11, and 12 on magnetic resonance images. This latter limitation was noted in three hips, in which plain radiographs demonstrated lesions at the tip of the stem that were not seen on magnetic resonance images. In five hips, osteolytic lesions that were noted in Gruen zone 7 on radiographs were not seen on prospective interpretation of magnetic resonance images. In two of these hips, osteolysis was noted in an adjacent zone (zone 8), suggesting some variability in the determination of discrete zones between the tomographic magnetic resonance images and the two-dimensional radiographs. In the remaining three hips, involvement of Gruen zone 7 was not seen on magnetic resonance images, even at the time of a retrospective review. In one hip there was severe degradation of image quality due to motion, and in the other two hips the marrow appeared normal.

TABLE I Spectrum of Magnetic Resonance Imaging Findings at the Site of Total Hip Arthroplasty

Pathologic Condition	Soft Tissue	Surrounding Bone
Osteolysis	Discrete intermediate signal intensity deposits, close to skeletal muscle	Typically hypointense rim, well demarcated from surrounding fatty marrow
Infection	High signal intensity, close to fluid	Hyperintense surrounding marrow edema replacing normal fat
Extruded cement	Low signal intensity, close to cortical bone	No reaction: normal fatty signal of marrow
Heterotopic ossification	Discrete high signal intensity, fatty marrow deposits when mature	No reaction: normal fatty signal of marrow when mature

Twenty-five of the twenty-eight hips had distention of the normally thin, hypointense pseudocapsule by particulate synovitis. The intracapsular debris typically had signal characteristics that were similar to those of the material replacing the bone; the only exception was noted in one hip, in which metallic debris was seen. The implant in that hip had a titanium stem and a titanium acetabular component that articulated with a cobalt-chromium head (Fig. 4).

Intraoperative Correlation and Implant Loosening

Fifteen of the twenty-eight hips underwent subsequent revision arthroplasty. In this subset, all cases of osteolysis that had been noted on magnetic resonance images were confirmed intraoperatively by gross inspection and histopathological analysis. Histopathological analysis demonstrated granulomatous reactions, metal and polyethylene debris, and an absence of inflammatory infiltrates or positive cultures that were indicative of infection. Nine of the fifteen revisions were performed for the treatment of loosening, including loosening of the acetabular component (seven hips), the femoral component (one), or both components (one), and the remaining six revisions were performed for the treatment of osteolysis without overt evidence of loosening. The subjective assessment of the location and extent of osteolysis correlated with the findings on magnetic resonance images in all nine hips that were revised because of loosening. In the six hips without loosening, the limitations of operative exposure precluded a direct correlation between the actual size and extent of the pelvic osteolytic lesions as seen on magnetic resonance images and those observed intraoperatively.

Additional Magnetic Resonance Imaging Findings

Two patients had been referred for the preoperative evaluation of the location and extent of heterotopic ossification relative

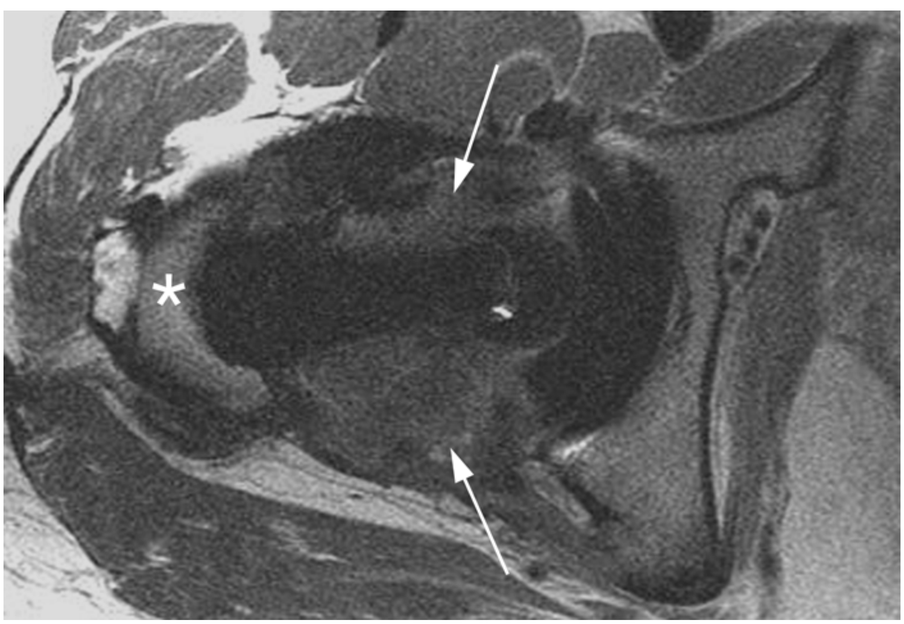


Fig. 5

Axial fast-spin-echo magnetic resonance image of the hip of a forty-five-year-old man who presented, one year after total hip arthroplasty, with posterior dislocation despite acceptable component alignment on plain radiographs. For orientation purposes, the greater trochanter is shown on the left (asterisk). The image demonstrates marked distention of the pseudocapsule, which is filled with diminished-signal-intensity debris (arrows), that was attributed to particle reaction, without concomitant osteolysis. These findings were confirmed at the time of revision arthroplasty.

to the neurovascular bundles and joint. Foci of mature heterotopic ossification are denoted as foci of discrete fatty marrow signal intensity in the adjacent soft tissues, often with no discernible tissue plane adjacent to the implant[21]. Two patients demonstrated an insufficiency fracture of the hemisacrum and pubic ramus (one patient) or the sacral ala (one patient). Two hips demonstrated moderate greater trochanteric bursitis as evidenced by the presence of a discrete, characteristic fluid collection at that site[22]. One examination demonstrated osteolysis and diminished signal intensity throughout the synovial lining and adjacent bursae, indicating an extensive debris load (Fig. 4).

Discussion

Conventional radiography has been the standard method of imaging for the detection of periprosthetic osteolysis[3-6]. However, the quantification of related bone loss is underestimated by two-dimensional plain radiography, particularly when standardized views are used[7-11]. Additionally, Engh et al.[23] reported poor interobserver reproducibility in a study on the assessment of osteolysis with use of plain radiographs. Saleh et al.[24] proposed a new classification system, based on an anteroposterior radiograph of the pelvis and frog-leg lateral radiographs of the hip, that demonstrated improved interobserver reliability for the assessment of the degree of bone loss and improved correlation with the intraoperative findings. However, intraoperative observation of bone loss, which frequently exceeds that observed on plain radiographs, typically confirms the limitation of radiographs in the assessment of osteolysis[25]. While a more accurate assessment of osteolysis may facilitate better preoperative planning for revision arthroplasty, improved quantification of osteolysis also is needed for the serial evaluation of nonoperative treatment modalities, such as the use of oral bisphosphonates, which are currently being evaluated in clinical trials.

Robertson et al.[26], in a study of nineteen patients with a failed total hip arthroplasty, compared three-dimensional physical models based on computerized tomographic data with radiographic findings and noted that plain radiographs underestimated bone loss by at least 20% and resulted in selection of the correct type of prosthesis in only half of the patients who underwent revision. Such studies provide further support for the need to quantify osteolysis volume. While computerized tomography is more effective than conventional radiographs, it is still somewhat limited by the beam-hardening artifact at the metal-bone interface, particularly in cases of bilateral arthroplasty, and by exposure of the patient to the radiation required for serial studies. Moreover, computerized tomographic techniques that reduce the artifact typically require an increase in the energy dose and thus increase the exposure of the patient.

Magnetic resonance imaging does not expose the patient to ionizing radiation. Osteolysis is more conspicuous on magnetic resonance imaging, likely because of the superior soft-tissue contrast associated with this method, with segments of osteolysis having an intermediate signal intensity that contrasts with the high signal intensity of the medullary fat. This superior contrast allows for improved depiction of extraosseous soft-tissue deposits that may encroach on neurovascular structures and also allows for the detection of synovitis within the pseudocapsule, which may be present before there is evidence of osteoclastic bone resorption on radiographs or magnetic resonance images (Fig. 5). Finally, magnetic resonance imaging can disclose unsuspected findings that may contribute to morbidity, such as occult pelvic fractures, which were noted in three patients in this study.

The assessment of volume on the magnetic resonance images was based on a program that is available on many commercial workstations, and it does not provide any additional geometric calibration for the adjacent field distortion beyond that provided by the parameter modification. A direct correlation between the radiographic and magnetic resonance imaging findings regarding osteolysis was not possible in the present study because of the comparison of a two-dimensional, nondigitized radiographic technique with the volumetric (three-dimensional) digital magnetic resonance imaging technique. The present study also was limited by the lack of a gross quantitative standard with which to judge the accuracy of magnetic resonance imaging in assessing the degree of osteolysis, as the limitations of standardized operative exposure may not allow for an accurate measurement of osteolysis volume. This is particularly true in cases of acetabular osteolysis in which the metallic shell is well fixed and bone loss can only be assessed through the holes of the cup. Additional in vitro studies are warranted to correlate the extent of bone loss observed at the time of surgery with that predicted preoperatively on magnetic resonance images. Nonetheless, we believe that magnetic resonance imaging is superior to conventional radiographs for detecting areas of bone resorption and for evaluating the periprosthetic soft tissues.

Compared with the surrounding soft tissue, metallic components at the site of an arthroplasty have a different magnetic susceptibility (i.e., ability to become magnetized) that distorts the regional magnetic field, creating large areas of signal void that obscure and distort the anatomic boundaries of the surrounding soft tissue, including neurovascular bundles and the pseudocapsule[27]. The intensity of the artifact is a function of several factors, including the orientation of the components relative to the external magnetic field, the relative ferromagnetism, and the shape of the implant. Titanium is less ferromagnetic than cobalt-chromium alloy, and therefore it causes less artifact[15,28]. In the present study, the majority of the implants were composed of cobalt-chromium heads and stems. This fact did not preclude diagnostic imaging with our protocol, thus demonstrating that imaging of nontitanium components is possible.

In the current study, the use of modified magnetic resonance imaging parameters, which may be duplicated on any closed, high-field unit, provided a useful adjunct to conventional radiographs for the evaluation of patients who had periprosthetic osteolysis. It is not our intention to suggest that such imaging is indicated or cost-effective for the evaluation of all patients who have had an arthroplasty, but rather that it may be appropriate for the evaluation of patients in whom the precise location and extent of osteolysis cannot be discerned. Magnetic resonance imaging is justified if it can provide clinically important information that will affect patient management or if it is used as a research tool. Magnetic resonance imaging of total hip arthroplasty is an evolving technique, and further pulse-sequence refinement and clinical correlation will further elucidate the optimal applications of this technique. ■

NOTE: The authors thank Drs. Mathias Bostrom, Robert L. Buly, and Steven B. Haas for providing case material. We also acknowledge Cynthia Maier, PhD, of the Applied Science Laboratory of General Electric Medical Systems, Milwaukee, Wisconsin, for providing the post-processing software for digital measurements of the osteolysis load.

Hollis G. Potter, MD
Bryan J. Nestor, MD
Carolyn M. Sofka, MD
Stephanie T. Ho, MD
Eduardo A. Salvati, MD
Division of Magnetic Resonance Imaging (H.G.P., C.M.S., and S.T.H.) and Department of Orthopaedic Surgery (B.J.N. and E.A.S.), Hospital for Special Surgery, 535 East 70th Street, New York, NY 10021. E-mail address for H.G. Potter: potterh@hss.edu

Lance E. Peters, MD
Orthopaedic Associates, 65 Pennsylvania Avenue, Binghamton, NY 13903

The authors did not receive grants or outside funding in support of their research or preparation of this manuscript. They did not receive payments or other benefits or a commitment or agreement to provide such benefits from a commercial entity. No commercial entity paid or directed, or agreed to pay or direct, any benefits to any research fund, foundation, educational institution, or other charitable or nonprofit organization with which the authors are affiliated or associated.

References

1. **Harris WH.** The problem is osteolysis. *Clin Orthop.* 1995;311:46-53.
2. **Lavernia CJ.** Cost-effectiveness of early surgical intervention in silent osteolysis. *J Arthroplasty.* 1998;13:277-9.
3. **Hozack WJ, Mesa JJ, Carey C, Rothman RH.** Relationship between polyethylene wear, pelvic osteolysis, and clinical symptomatology in patients with cementless acetabular components. A framework for decision making. *J Arthroplasty.* 1996;11:769-72.
4. **Johnston RC, Fitzgerald RH Jr, Harris WH, Poss R, Muller ME, Sledge CB.** Clinical and radiographic evaluation of total hip replacement. A standard system of terminology for reporting results. *J Bone Joint Surg Am.* 1990;72:161-8.
5. **Maloney WJ, Peters P, Engh CA, Chandler H.** Severe osteolysis of the pelvis in association with acetabular replacement without cement. *J Bone Joint Surg Am.* 1993;75:1627-35.
6. **Zicat B, Engh CA, Gokcen E.** Patterns of osteolysis around total hip components inserted with and without cement. *J Bone Joint Surg Am.* 1995;77:432-9.
7. **Carlsson AS, Gentz CF.** Radiographic versus clinical loosening of the acetabular component in noninfected total hip arthroplasty. *Clin Orthop.* 1984;185:145-50.
8. **Hodgkinson JP, Shelley P, Wroblewski BM.** The correlation between the roentgenographic appearance and operative findings at the bone-cement junction of the socket in Charnley low friction arthroplasties. *Clin Orthop.* 1988;228:105-9.
9. **Sutherland CJ.** Radiographic evaluation of acetabular bone stock in failed total hip arthroplasty. *J Arthroplasty.* 1988;3:73-9.
10. **Zimlich RH, Fehring TK.** Underestimation of pelvic osteolysis: the value of the iliac oblique radiograph. *J Arthroplasty.* 2000;15:796-801.
11. **Southwell DG, Bechtold JE, Lew WD, Schmidt AH.** Improving the detection of acetabular osteolysis using oblique radiographs. *J Bone Joint Surg Br.* 1999;81:289-95.
12. **Puri L, Wixson RL, Stern SH, Kohli J, Hendrix RW, Stulberg SD.** Use of helical computed tomography for the assessment of acetabular osteolysis after total hip arthroplasty. *J Bone Joint Surg Am.* 2002;84:609-14.
13. **Potter HG, Montgomery KD, Padgett DE, Salvati EA, Helfet DL.** Magnetic resonance imaging of the pelvis. New orthopaedic applications. *Clin Orthop.* 1995;319:223-31.
14. **White LM, Kim JK, Mehta M, Merchant N, Schweitzer ME, Morrison WB, Hutchinson CR, Gross AE.** Complications of total hip arthroplasty: MR imaging—initial experience. *Radiology.* 2000;215:254-62.
15. **Ebraheim NA, Savolaine ER, Zeiss J, Jackson WT.** Titanium hip implants for improved magnetic resonance and computed tomography examinations. *Clin Orthop.* 1992;275:194-8.
16. **Lemmens JA, van Horn JR, den Boer J, van der Riet W, Ruijs JH.** MR imaging of 22 Charnley-Muller total hip prostheses. *ROFO Fortschr Geb Rontgenstr Nuklearmed.* 1986;145:311-5.
17. **Maloney WJ, Herzwurm P, Paprosky W, Rubash HE, Engh CA.** Treatment of pelvic osteolysis associated with a stable acetabular component inserted without cement as part of a total hip replacement. *J Bone Joint Surg Am.* 1997;79:1628-34.
18. **DeLee JG, Charnley J.** Radiological demarcation of cemented sockets in total hip replacement. *Clin Orthop.* 1976;121:20-32.
19. **Huddleston HD.** Femoral lysis after cemented hip arthroplasty. *J Arthroplasty.* 1988;3:285-97.
20. **Gruen TA, McNeice GM, Amstutz HC.** "Modes of failure" of cemented stem-type femoral components: a radiographic analysis of loosening. *Clin Orthop.* 1979;141:17-27.
21. **Ledermann HP, Schweitzer ME, Morrison WB.** Pelvic heterotopic ossification: MR imaging characteristics. *Radiology.* 2002;222:189-95.
22. **Kozlov DB, Sonin AH.** Iliopsoas bursitis: diagnosis by MRI. *J Comput Assist Tomogr.* 1998;22:625-8.
23. **Engh CA Jr, Sychterz CJ, Young AM, Pollock DC, Toomey SD, Engh CA Sr.** Interobserver and intraobserver variability in radiographic assessment of osteolysis. *J Arthroplasty.* 2002;17:752-9.
24. **Saleh KJ, Holtzman J, Gafni A, Saleh L, Davis A, Resig S, Gross AE.** Reliability and intraoperative validity of preoperative assessment of standardized plain radiographs in predicting bone loss at revision hip surgery. *J Bone Joint Surg Am.* 2001;83:1040-6. Erratum in: *J Bone Joint Surg Am.* 2001;83:1712.
25. **Campbell DG, Garbuz DS, Masri BA, Duncan CP.** Reliability of acetabular bone defect classification systems in revision total hip arthroplasty. *J Arthroplasty.* 2001;16:83-6.
26. **Robertson DD, Sutherland CJ, Lopes T, Yuan J.** Preoperative description of severe acetabular defects caused by failed total hip replacement. *J Comput Assist Tomogr.* 1998;22:444-9.
27. **Sperling JW, Potter HG, Craig EV, Flatow E, Warren RF.** Magnetic resonance imaging of painful shoulder arthroplasty. *J Shoulder Elbow Surg.* 2002;11:315-21.
28. **Frazzini VI, Kagetsu NJ, Johnson CE, Destian S.** Internally stabilized spine: optimal choice of frequency-encoding gradient direction during MR imaging minimizes susceptibility artifact from titanium vertebral body screws. *Radiology.* 1997;204:268-72.

The Utility of High-Resolution Magnetic Resonance Imaging in the Evaluation of the Triangular Fibrocartilage Complex of the Wrist*

BY HOLLIS G. POTTER, M.D.†, LAUREN ASNIS-ERNBERG, B.A.†, ANDREW J. WEILAND, M.D.†, ROBERT N. HOTCHKISS, M.D.†, MARGARET G. E. PETERSON, PH.D.†, AND RICHARD R. McCORMACK, JR., M.D.†, NEW YORK, N.Y.

Investigation performed at the Departments of Radiology, Orthopaedic Surgery, and Biostatistics, The Hospital for Special Surgery, New York City

ABSTRACT: **We performed a prospective study in order to assess the utility of high-resolution magnetic resonance imaging in the detection and specific localization of tears of the triangular fibrocartilage complex. Seventy-seven patients who had pain in the wrist were studied with use of a dedicated surface coil and three-dimensional gradient-recalled techniques with a field of view of eight centimeters and a slice thickness of one millimeter. The patients had pain on the ulnar side of the wrist, ligamentous instability, occult ganglia, or a combination of these. Magnetic resonance images were assessed for radial or ulnar avulsion, or both; central defects; degenerative intrasubstance changes; and complex tears of the triangular fibrocartilage complex. Partial tears were differentiated from complete tears. The findings on the magnetic resonance images were then compared with the arthroscopic findings. Fifty-seven of the fifty-nine tears that were suspected on magnetic resonance images were confirmed with arthroscopy; the two suspected tears that were not confirmed had been interpreted as small partial tears on the magnetic resonance images. With use of arthroscopy as the standard, magnetic resonance imaging had a sensitivity of 100 per cent (fifty-seven of fifty-seven), a specificity of 90 per cent (eighteen of twenty), and an accuracy of 97 per cent (seventy-five of seventy-seven) for the detection of a tear (κ = 0.93, p < 0.00001). Fifty-three of the fifty-seven tears were localized correctly with use of magnetic resonance imaging. With regard to the location of the tear, magnetic resonance imaging had a sensitivity of 100 per cent (fifty-three of fifty-three), a specificity of 75 per cent (eighteen of twenty-four), and an accuracy of 92 per cent (seventy-one of seventy-seven) (κ = 0.9, p < 0.0001).**

We concluded that high-resolution magnetic resonance imaging permits accurate depiction and localization of tears of the triangular fibrocartilage complex. When the appropriate pulse sequence is used, magnetic resonance imaging is an accurate and effective method for the non-invasive evaluation of pain in the wrist.

Disorders of the triangular fibrocartilage complex are a common source of pain on the ulnar side of the wrist[6,12,19]. However, a tear or degeneration of the triangular fibrocartilage complex may not be readily apparent on physical examination because a variety of lesions, including occult fractures, chondral tears, extensor carpi ulnaris tendinitis, osteoarthrosis of the pisiform-triquetral joint, and instability of the distal radio-ulnar joint may produce pain on the ulnar side, making a correct diagnosis difficult.

Historically, arthrography of the wrist, particularly the three-compartment injection method, has been shown to be efficacious in the detection of tears or perforations of the triangular fibrocartilage complex, which allow contrast medium to communicate between the radiocarpal and distal radio-ulnar joints[14,27]. However, the arthrogram often does not permit exact localization of the tear or supply information about the adjacent soft-tissue structures, including articular cartilage and ligaments.

Because of its superior soft-tissue contrast and its tomographic nature, magnetic resonance imaging can detect ligamentous injuries of the wrist[5,9,18,22,23,25,26,29]. The purposes of the present prospective study were to assess the utility of high-resolution magnetic resonance imaging in the detection and specific localization of tears of the triangular fibrocartilage complex in patients who had pain in the wrist and to compare these findings with those of direct arthroscopic inspection.

Materials and Methods

Seventy-seven patients who had pain in the wrist were evaluated prospectively, from January 1993 to April 1996, with a standardized magnetic resonance im-

*No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article. No funds were received in support of this study.

†Departments of Radiology (H. G. P. and L. A.-E.), Orthopaedic Surgery (A. J. W.; R. N. H.; and R. R. McC., Jr.), and Biostatistics (M. G. E. P.), The Hospital for Special Surgery, 535 East 70th Street, New York, N.Y. 10021. E-mail address for Dr. Potter: potterh@hss.edu.

aging technique before being examined arthroscopically. The patients ranged in age from thirteen to seventy years (mean and standard deviation, 35.7 ± 13.5 years). Fifty-two patients were male and twenty-five were female. Fifty-eight patients had had a previous traumatic injury of the wrist that had been caused by hyperextension (thirty-nine patients), twisting (fourteen patients), or lifting (five patients); the remaining nineteen had no history of trauma. The study was reviewed and approved by the Institutional Review Board.

All of the magnetic resonance images were made with use of a 1.5-tesla superconducting magnet (Signa; General Electric, Milwaukee, Wisconsin) and either a five-inch (12.7-centimeter) curved receive-only surface coil or a quadrature design phased-array wrist coil (both from Medical Advances, Milwaukee, Wisconsin), the latter of which became available in November 1994. The patient was placed in the supine position with the affected hand at the side and the forearm in full pronation. Coronal images were made with use of a volumetric gradient-recalled acquisition technique, with a repetition time of forty to fifty-six milliseconds, an echo time of twenty milliseconds, a flip angle of 20 degrees, and a field of view of eight centimeters. Images were made from the palmar extrinsic ligaments to the dorsal extrinsic ligaments. The coronal volumetric acquisition was centered over the proximal aspect of the lunate, just distal to the radiocarpal joint space. The slice thickness was one millimeter with no interslice gap. The images were made with either a 256-by-192 matrix (fifty patients) or a 256-by-256 matrix (twenty-seven patients) at two excitations. (The matrix was increased at the time of acquisition of the quadrature coil.) The field of view was centered over the ulnar side of the proximal aspect of the lunate.

Axial images were made with a long repetition time (3000 to 4000 milliseconds) and a long effective-echo time (eighty-eight to 102 milliseconds). Fast-spin-echo images were made with an eight echo train and a 256-by-192 matrix at two excitations. The field of view was eight to nine centimeters, and the slice thickness was four millimeters with no interslice gap. No contrast medium was used in any patient.

The magnetic resonance images were studied for abnormalities of the triangular fibrocartilage complex, including radial or ulnar avulsion or detachment; complete or partial perforation of the mid-substance of the articular disc; degenerative intrasubstance changes, as manifested by increased signal intensity and loss of the normal contour of the articular disc; and joint fluid coursing through a defect in the articular disc.

Complete tears were defined as full-thickness foci of discontinuity that extended from the radiocarpal side of the articular disc to the distal radio-ulnar side. Partial tears were defined as foci of abnormal morphology and increased signal intensity that did not extend all the way from one side of the articular disc to the other. If a partial tear was detected, a note was made as to whether it was on the radiocarpal side or the distal radio-ulnar side. A tear needed to be identified on only one magnetic resonance image in order to be considered present, but the criteria regarding abnormal morphology and increased signal intensity had to be met. To simplify the statistical analysis, the location of the tears was classified as ulnar, radial, central, or complex (two or more components).

An articular disc was considered to be normal if images revealed uniformly low signal intensity at both the radial and the ulnar attachment (Fig. 1), no central defect, and no foci of thinning or increased signal intensity.

In addition, the images were studied for concomitant tears of the scapholunate and lunotriquetral ligaments, defects of the articular cartilage, tears of the dorsal and volar distal radio-ulnar ligaments, and occult ganglia of the wrist.

The images were evaluated by one radiologist, who did not have access to the clinical findings or the plain radiographs.

Arthroscopic Procedure

The arthroscopic examination was performed on an outpatient basis with use of axillary block anesthesia; the wrist was distracted with seven to ten pounds (3.1 to 4.5 kilograms) of traction applied with use of finger traps and an overhead bar. The joint was distended with injection of approximately five milliliters of normal saline solution, and an outflow portal was established at the 6U location[1] (just ulnar to the extensor carpi ulnaris tendon) with a 16-gauge angiocatheter. After the creation of a pathway with a blunt cannula, a 2.9-millimeter arthroscope (model 4130; Smith and Nephew Dyonics, Andover, Massachusetts) was inserted between the extensor pollicis longus and the extensor digitorum communis at the 3/4 portal, and the radiocarpal joint was inspected from radial to ulnar. The findings were recorded on VHS videotape or as still images. Additional instruments (a two-millimeter probe and a 2.9 or 2.0-millimeter motorized full-radius resector) were inserted into the radiocarpal joint between the extensor digitorum communis and the extensor digiti quinti at the 4/5 portal or just radial to the extensor carpi ulnaris at the 6R portal[1]. Inflamed synovial tissue and tears of the central portion of the triangular fibrocartilage complex were debrided arthroscopically with a motorized resector. Peripheral detachments of the triangular fibrocartilage complex from the base of the ulnar styloid process were reattached with an open operative technique or with an arthroscopically guided suture repair, depending on the preference of the surgeon.

Patients who had evidence of a partial-thickness tear of the triangular fibrocartilage complex on the magnetic resonance images but who did not have arthroscopic examination of both the radiocarpal and the distal radio-ulnar joint were not included in the study.

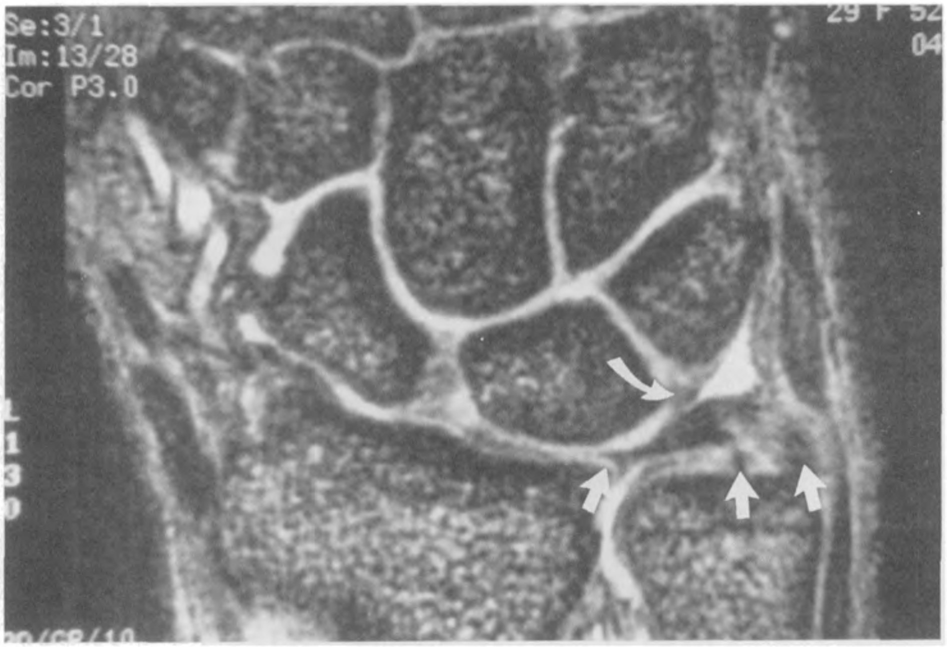


FIG. 1

Coronal gradient-echo image of a thirty-one-year-old woman who had an occult ganglion of the wrist and no history of trauma. The image, made through the middle portion of the articular disc, demonstrates intact radial and ulnar attachments (straight arrows) and an intact lunotriquetral ligament (curved arrow). The triangular fibrocartilage complex was found to be intact on arthroscopic examination.

In patients who had a normal-appearing triangular fibrocartilage complex on the preoperative magnetic resonance images but who were examined arthroscopically because of evidence of another injury or condition (such as a chondral injury, an injury of the scapholunate or lunotriquetral ligament, a soft-tissue ganglion, or a combination of these) on the images or at the clinical examination, the triangular fibrocartilage complex was carefully inspected and probed for subtle abnormalities such as attenuation and partial tears.

The findings on the preoperative magnetic resonance images were compared with the arthroscopic findings with regard to the presence and location of a tear of the triangular fibrocartilage complex or a ligamentous injury, or both. The time from the magnetic resonance imaging to the arthroscopic examination

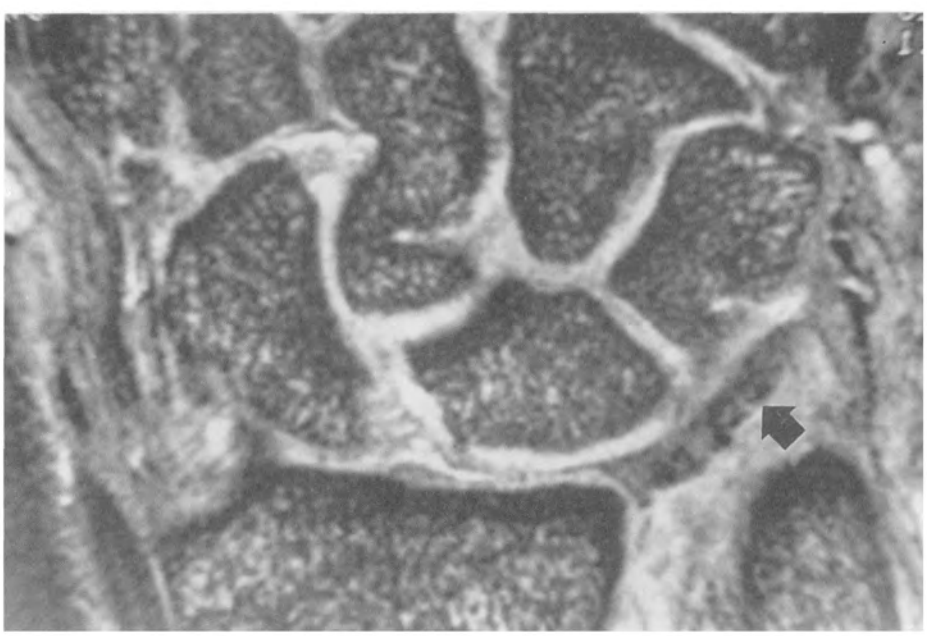


FIG. 2

Coronal gradient-echo image of a thirty-two-year-old man who had sustained a traumatic injury of the wrist one day previously. The image demonstrates ulnar detachment of the palmar aspect of the articular disc (arrow). The tear extended to involve the volar radio-ulnar ligament. Both findings were confirmed with arthroscopy, and a primary reattachment was performed.

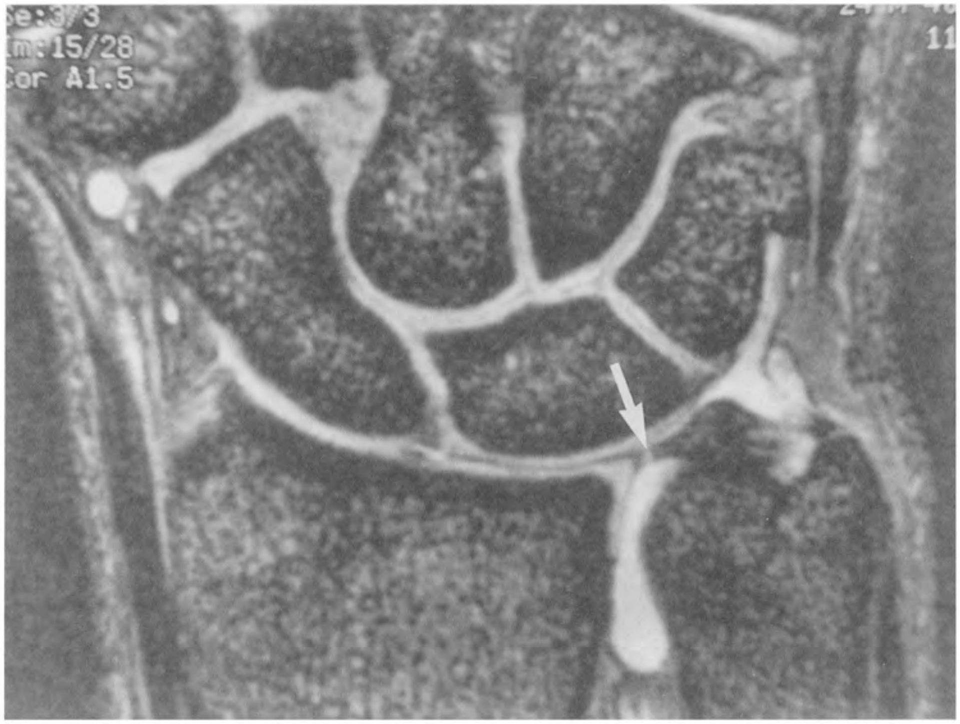


FIG. 3

Coronal gradient-echo image of a twenty-five-year-old man who had a recurrent, painful ganglion. There is a small defect close to the radial attachment of the articular disc (arrow). The defect was interpreted prospectively as a partial tear. A partial tear on the distal radio-ulnar side of the disc was confirmed with arthroscopy. The ganglion was noted on a more dorsal image.

ranged from one day to forty-one weeks (mean, 6.5 ± 7.6 weeks).

Statistical Analysis

The statistical analyses were done with SPSS (SPSS, Chicago, Illinois) and STATA (Stata, College Station, Texas) software. Sensitivity, specificity, accuracy, and kappa statistics were calculated to evaluate the capacity of magnetic resonance imaging to establish the correct diagnosis and location of tears of the articular disc, with use of arthroscopy of the wrist as the standard. Ninety-five per cent confidence intervals were calculated. Basic demographic data, the age of the patient, and the time from the magnetic resonance imaging to the arthroscopic examination were compared with regard to gender with use of a two-tailed t test and the Mann-Whitney U test. A two-tailed t test and one-way analysis of variance also were used to determine whether age had an effect on the location of the tear (peripheral [radial and ulnar], central, or complex). The extent of the tear was compared with use of the Wilcoxon test. All values were expressed as the mean and the standard deviation. P values were not corrected for multiple comparisons. A conservative correction would place alpha at 0.005.

Results

A tear of the triangular fibrocartilage complex was identified prospectively on the magnetic resonance images of fifty-nine of the seventy-seven patients (Fig. 2). Fifty-seven of the fifty-nine suspected tears were confirmed at the arthroscopic examination; the two tears that were not confirmed arthroscopically had been interpreted as small partial tears on the magnetic resonance images. Twenty articular discs were found to be intact on direct visual examination and probing at the time of arthroscopy. With use of arthroscopy as the standard, magnetic resonance imaging had a sensitivity of 100 per cent (fifty-seven of fifty-seven) (95 per cent confidence interval, 92 to 100 per cent), a specificity of 90 per cent (eighteen of twenty) (95 per cent confidence interval, 83 to 97 per cent), and an accuracy of 97 per cent (seventy-five of seventy-seven) (95 per cent confidence interval, 93 to 100 per cent) for the detection of a tear of the triangular fibrocartilage complex ($\kappa = 0.93$; $p < 0.00001$).

Twenty-one partial tears were identified with magnetic resonance imaging, and fourteen of these were confirmed as partial tears on arthroscopic examination (Fig. 3). Thirty-eight complete tears were identified with magnetic resonance imaging, and thirty-seven of these were confirmed as complete tears on arthroscopic examination. (Two articular discs that were thought to have a partial tear on magnetic resonance images were found to be intact at the time of arthroscopy, as mentioned previously.) Thus, the extent of fifty-one of the fifty-seven confirmed tears had been correctly interpreted on magnetic resonance images. The extent of the remaining six confirmed tears had been misinterpreted: five tears that had been interpreted as partial on the

FIG. 4

Coronal gradient-echo image of a thirty-two-year-old man who had had a previous hyperextension injury, demonstrating abnormal morphology at the undersurface and middle portion of the articular disc (long arrow). The tear was interpreted as partial on the magnetic resonance image, but it was found to be complete on arthroscopic examination. The scapholunate and lunotriquetral ligaments were intact (short arrows).

magnetic resonance images were found to be complete on arthroscopic examination (Fig. 4), and one tear that had been interpreted as complete on the magnetic resonance images was found to be partial at the time of arthroscopic examination. When misinterpretation of the extent of the tear was considered a false-positive result, magnetic resonance imaging had a sensitivity of 100 per cent (fifty-one of fifty-one) (95 per cent confidence interval, 91 to 100 per cent), a specificity of 69 per cent (eighteen of twenty-six) (95 per cent confidence interval, 59 to 79 per cent), and an accuracy of 90 per cent (sixty-nine of seventy-seven) (95 per cent confidence interval, 83 to 97 per cent) ($\kappa = 0.7$; $p = 0.0001$).

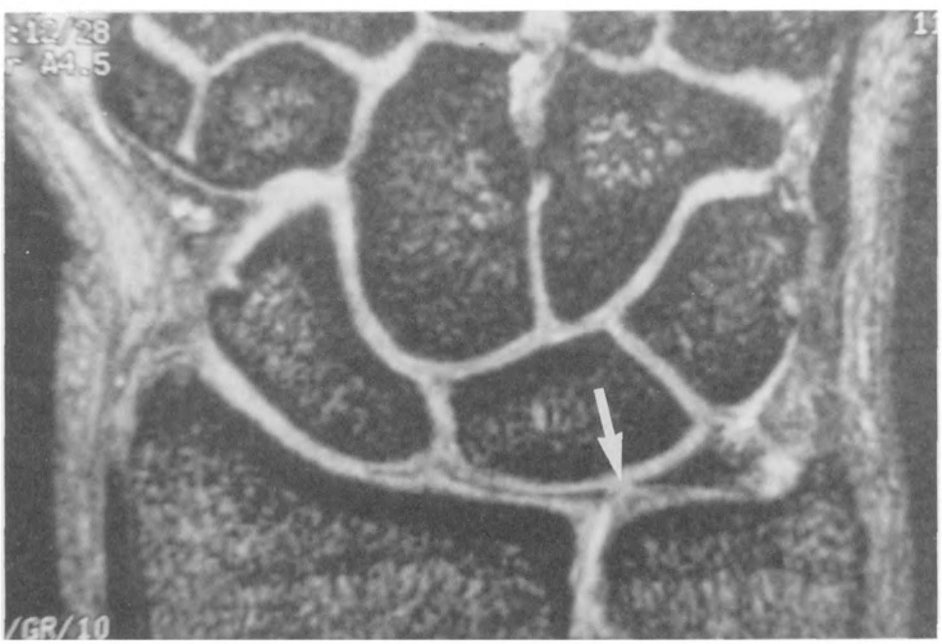


FIG. 5

Coronal gradient-echo image of a forty-six-year-old man who had had a previous twisting injury, demonstrating a radial detachment of the articular disc (arrow). The detachment was confirmed at the time of arthroscopy.

Twenty-nine tears were ulnar, eight were radial (Figs. 5 and 6), nine were central, and eleven were complex (Figs. 7-A and 7-B) as determined on arthroscopic examination compared with thirty, eight, nine, and twelve, respectively, as determined on the preoperative magnetic resonance images. Fifty-three of the fifty-seven confirmed tears had been localized correctly on the magnetic resonance images. Statistical analysis for location was performed with use of a strict criterion as the findings on the magnetic resonance images had to agree absolutely with the findings of the arthroscopic examination in order to yield a so-called true-positive result. According to this criterion, magnetic resonance imaging had a sensitivity of 100 per cent (fifty-three of fifty-three) (95 per cent confidence interval, 91 to 100 per cent), a specificity of 75 per cent (eighteen of twenty-four) (95 per cent confidence interval, 65 to 85 per cent), and an accuracy of 92 per cent (seventy-one of seventy-seven) (95 per cent confidence interval, 86 to 98 per cent) ($\kappa = 0.9$; $p < 0.0001$).

To determine if age had a predictive role in the determination of the site of the tear, the locations were recategorized from ulnar, radial, central, and complex to the broader groups of peripheral (ulnar and radial), central, and complex. The mean age was 35.5 ± 14.4 years (range, thirteen to sixty-six years) for the thirty-seven patients who had a peripheral tear, 40.7 ± 14.4 years (range, twenty-one to seventy years) for the nine patients who had a central tear, and 39.3 ± 12.3 years (range, sixteen to fifty-seven years) for the eleven patients who had a complex tear. In our relatively young study group (mean age, 35.7 years), the two-tailed t test and one-way analysis of variance showed that there was no significant age difference among the patients in these categories.

A two-tailed t test and one-way analysis of variance were used to compare the age of the patients and the time from the magnetic resonance imaging to the arthroscopic examination with regard to gender. The mean age was 36.2 ± 15.1 years (range, thirteen to seventy years) for the male patients and 34.8 ± 9.4 years (range, twenty-one to fifty-six years) for the female patients ($p = 0.7$). The mean time from the magnetic resonance imaging to the arthroscopic examination was 7.0 ± 8.2 weeks (range, one day to forty-one weeks) for the male patients and 5.4 ± 6.1 weeks (range, one to twenty-four weeks) for the female patients ($p = 0.5$).

In addition to the triangular fibrocartilage complex, the scapholunate and lunotriquetral ligaments were consistently identified and surveyed for abnormalities on the magnetic resonance images. Arthroscopic inspection, however, was not conducted for every patient; fifty-three of the seventy-seven patients had arthroscopic examination of the scapholunate ligament, and thirty-six had arthroscopic examination of the lunotriquetral ligament. Fifteen patients had a tear of the

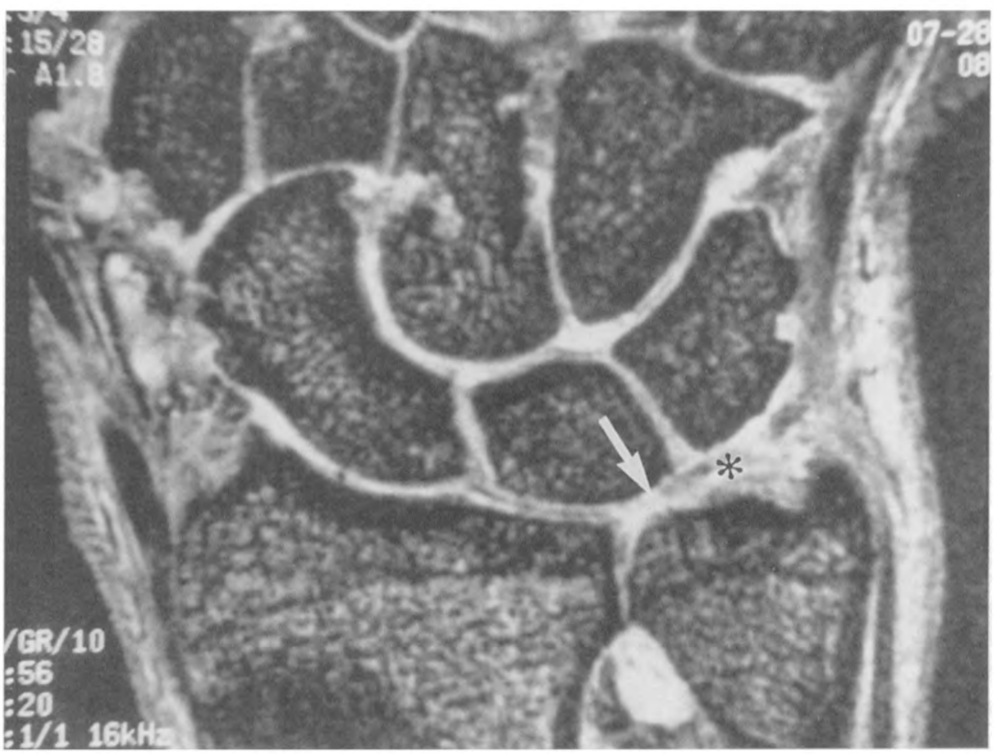


Fig. 6

Coronal gradient-echo image of a sixty-six-year-old man who had no history of traumatic injury. There is diffusely increased signal intensity within the articular disc (asterisk), indicating severe intrasubstance degeneration. A complete radial tear (arrow) was suspected prospectively and was confirmed with arthroscopy. Subsequent arthroscopic débridement was performed, with additional removal of a loose body (not shown).

scapholunate ligament on both magnetic resonance imaging and arthroscopic examination, thirty-six patients had an intact scapholunate ligament on both magnetic resonance imaging and arthroscopic examination, and two patients were thought to have an intact scapholunate ligament on magnetic resonance imaging but were found to have a tear on arthroscopic examination. Two patients had a tear of the lunotriquetral ligament on both magnetic resonance imaging and arthroscopic examination, and thirty patients had an intact lunotriquetral ligament on both magnetic resonance imaging and arthroscopic examination. In the remaining

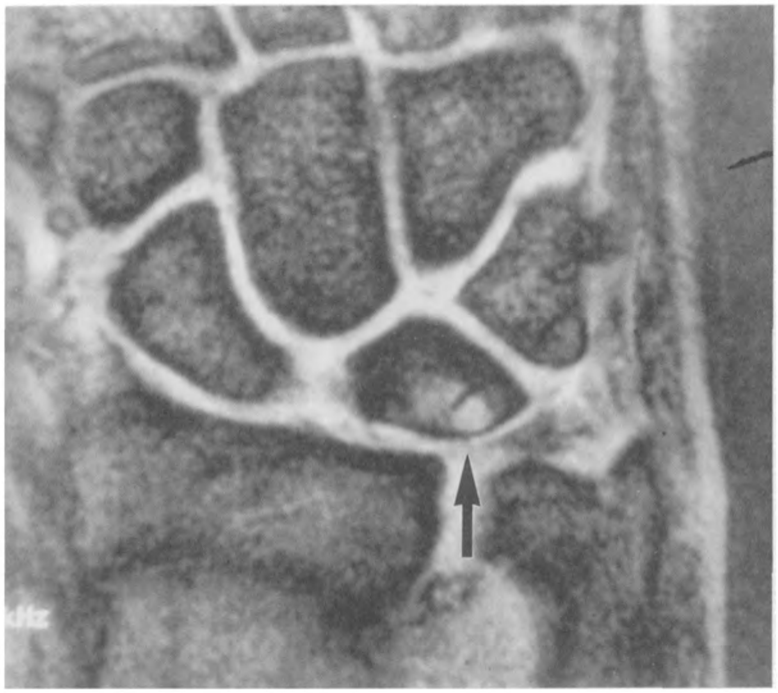


FIG. 7-A

Figs. 7-A and 7-B: Coronal gradient-echo images of a fifty-seven-year-old man who had no history of traumatic injury.

Fig. 7-A: Image made through the middle portion of the articular disc, demonstrating a central defect (arrow) extending to the radial attachment. Superimposed thinning and intrasubstance degeneration are evident. An intraosseous cyst is seen in the lunate.

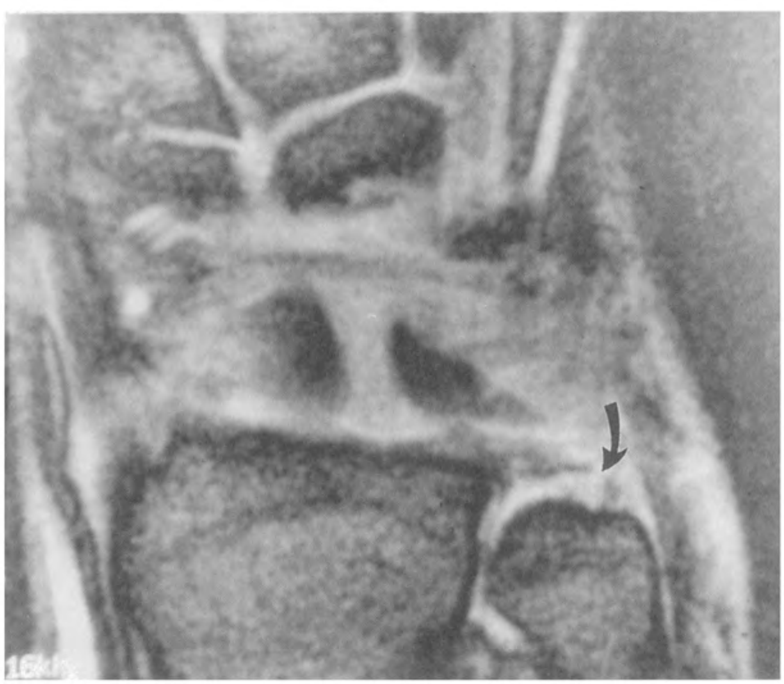


FIG. 7-B

More dorsal image demonstrating a second tear, in an ulnar location (arrow).

four patients, the status of the ligament was misinterpreted on the magnetic resonance images; there were one false-positive and three false-negative findings. Additional incidental ligamentous injuries that were noted on both magnetic resonance imaging and arthroscopic examination included four tears of the palmar distal radio-ulnar ligament and two tears of the radioscaphocapitate ligament.

Discussion

In the past, the diagnosis of a tear of the triangular fibrocartilage complex was made by either direct operative visualization or arthrographic evaluation. Arthrographic detection of such tears requires the communication of contrast medium between the radiocarpal and distal radio-ulnar joints. Previous reports have described the use of a multiple-compartment injection technique for arthrographic evaluation of the wrist. Levinsohn et al. noted that only sixteen (67 per cent) of twenty-four complete tears of the triangular fibrocartilage complex that were identified at the time of an operation had been seen with preoperative triple-compartment arthrography. Metz et al. found no association between the localization of symptoms and the specific site of an arthrographic abnormality. More recently, Chung et al. reported that the results of triple-injection arthrography agreed with those of arthroscopic examination for only sixty-three (42 per cent) of 150 patients.

We believe that proper magnetic resonance imaging technique is crucial for the detection of subtle morphological changes in the triangular fibrocartilage complex. Previous reports have suggested that magnetic resonance imaging is inferior to arthrography[10], but those studies were limited by low-contrast, thick-section (three-millimeter) image acquisition resulting from the limitations of previous versions of software. Pederzini et al. stated that magnetic resonance imaging was unable to localize the precise site of injury of an articular disc. Cerofolini et al. reached a similar conclusion with use of a relatively large field of view and conventional spin-echo low-contrast pulse sequencing. Sugimoto et al. reported abnormally high signal intensity within the substance of the triangular fibrocartilage complex on the magnetic resonance images of thirty-five (50 per cent) of seventy asymptomatic volunteers. That study, however, was limited by a relatively large field of view (fifteen centimeters), which yielded poor spatial resolution. Previous studies on the use of magnetic resonance imaging for the detection of tears of the triangular fibrocartilage complex have relied largely on a so-called arthrogram effect, which occurs when fluid (characterized by high signal intensity) courses through the triangular fibrocartilage complex (characterized by low signal intensity)[9,29]. Because magnetic resonance images are digitized, spatial resolution is limited by the size of the picture element, or pixel. A smaller field of view and a higher matrix yield small pixels and impart superior spatial resolution. In addition, thin (one-millimeter) slices promote less signal average. Thus, magnetic resonance images made with thin slices, a small field of view, and a high matrix may obviate the diagnostic reliance on the communication of high-signal-intensity fluid between the radiocarpal and distal radio-ulnar joints. The use of such thin-section, high-resolution techniques may allow acceptable diagnostic accuracy to be achieved without the use of intra-articular injections of contrast media such as gadolinium, thereby preserving the noninvasive advantage of magnetic resonance imaging.

It should be recognized that gradient-echo techniques are limited by increased sensitivity to inhomogeneities in the magnetic field, including paramagnetic agents (such as hemoglobin degradation products) and ferromagnetic instrumentation (such as suture anchors). These techniques, therefore, may be of limited use in the postoperative setting, when thin-section fast-spin-echo techniques may prove superior to gradient-echo sequences. It is established that fast-spin-echo techniques are more effective for the evaluation of soft tissues surrounding metallic implants[11,21]. In addition, short echo-time sequences, such as gradient-echo techniques, are subject to an artefact known as the so-called magic angle phenomenon[8]. This artefact is an increase in signal intensity within the substance of type-I collagen constructs due to a decay in T2 relaxation time, which occurs when the long axis of fibrocartilage, tendon, or ligament is oriented at 55 degrees relative to the long axis of the magnetic field. However, with regard to the triangular fibrocartilage complex, the magic angle phenomenon can only account for abnormal signal intensity within the articular disc, and thus it should not be confused with morphological abnormalities such as retraction, fraying, and detachment. An awareness of this artefact is important for proper positioning of the wrist relative to the long axis of the magnetic field. Inappropriate positioning may result in artefactually increased signal intensity, possibly leading to misdiagnosis of intrasubstance degeneration.

Arthroscopy is an effective diagnostic tool for the detection and localization of lesions of the triangular fibrocartilage complex; however, at our institution it is considerably more expensive than magnetic resonance imaging. Therefore, while arthroscopy may confirm an intact articular disc, it may not be cost-effective unless therapeutic operative intervention is indicated.

In the present series, the level of agreement between magnetic resonance imaging and arthroscopy with regard to the localization of tears of the articular disc was high, as indicated by an accuracy of 92 per cent (seventy-one of seventy-seven). The ability of magnetic resonance imaging to distinguish between partial and complete tears, however, was not quite as good, as indicated by an accuracy of 90 per cent (sixty-nine of seventy-seven). Full-thickness disruptions that were misinterpreted as partial disruptions on the magnetic resonance images may have reflected fragments of fibrocartilage that were disrupted but closely apposed, creating the illusion of partial continuity (Fig. 4).

Despite this limitation, the superior soft-tissue contrast of magnetic resonance imaging made it possible to visualize the morphology of the triangular fibrocartilage complex and enabled distinction between degenerative intrasubstance tears, which demonstrate increased signal intensity within the articular disc (Fig. 6), and traumatic, more discrete peripheral detachments (Fig. 2). Most degenerative tears occur in older patients as a result of age-related attritional changes within the relatively avascular portion of the disc, as previously shown in anatomical studies[2,16]. Age alone, however, does not necessarily impart predictive value with regard to the localization of tears, as older patients may also sustain a traumatic peripheral avulsion. Several patients in the present series sustained a complex tear with traumatic avulsion superimposed on a central attritional defect (Figs. 7-A and 7-B). We could not detect a significant difference in age when the tears were divided according to location (peripheral, central, or complex). Thus, in our group of relatively young patients (mean age, 35.7 years), the site of the tear of the triangular fibrocartilage complex could not be predicted on the basis of age alone. The high prevalence of peripheral tears (thirty-seven of fifty-seven tears) is most likely a function of the relatively young age of our patients as well as the frequency of an antecedent traumatic injury involving hyperextension of the wrist with forced rotation of the forearm. An interesting finding in the present study was that traumatic injuries were more commonly localized to the ulnar aspect of the disc than to the radial aspect. This is in contrast with the findings of previous reports in which a high rate of radial tears was noted[6].

Our results are similar to those reported by Totterman et al.[26], who used a similar volumetric gradient-recalled sequence. In that series, in which thirty-one patients were evaluated with magnetic resonance imaging and subsequent arthroscopy of the wrist, eleven of twelve full-thickness tears of the triangular fibrocartilage complex were described accurately. The findings of the present series confirm the conclusion of Totterman et al. that high-resolution magnetic resonance imaging is a reliable technique for the detection of tears of the triangular fibrocartilage complex.

A valid criticism of our study is that the rate of false-negative findings could not be determined accurately because hand surgeons at our institution are hesitant to perform an arthroscopic examination for patients who have normal findings on preoperative high-resolution magnetic resonance images. We believe, however, that the high prevalence of tears of the triangular fibrocartilage complex in asymptomatic patients, as noted by Kirschenbaum et al. and Cantor et al. with arthrography and by Sugimoto et al. with magnetic resonance imaging, does not invalidate the utility of such imaging in the evaluation of symptomatic patients. This position was emphasized in a recent editorial comment by Miller and Totterman, and it is not inconsistent with the findings of previous magnetic resonance imaging studies of the spine in asymptomatic patients[3,28].

We concluded that high-resolution magnetic resonance imaging is an effective tool for the assessment of patients who have pain on the ulnar side of the wrist in whom an abnormality of the triangular fibrocartilage complex is suspected. In addition, we conclude that our imaging technique is accurate for the detection and specific localization of tears of the triangular fibrocartilage complex and that it can be used to direct appropriate operative intervention or non-operative treatment as needed.

NOTE: The authors thank Lewis Lane, M.D., and Michelle Gerwin, M.D., for providing additional patients.

References

1. **Abrams, R. A.; Petersen, M.;** and **Botte, M. J.:** Arthroscopic portals of the wrist: an anatomic study. *J. Hand Surg.,* 19A: 940-944, 1994.
2. **Bednar, M. S.; Arnoczky, S. P.;** and **Weiland, A. J.:** The microvasculature of the triangular fibrocartilage complex: its clinical significance. *J. Hand Surg.,* 16A: 1101-1105, 1991.
3. **Boden, S. D.; Davis, D. O.; Dina, T. S.; Patronas, N. J.;** and **Wiesel, S. W.:** Abnormal magnetic-resonance scans of the lumbar spine in asymptomatic subjects. A prospective investigation. *J. Bone and Joint Surg.,* 72-A: 403-408, March 1990.
4. **Cantor, R. M.; Stern, P. J.; Wyrick, J. D.;** and **Michaels, S. E.:** The relevance of ligament tears or perforations in the diagnosis of wrist pain: an arthrographic study. *J. Hand Surg.,* 19A: 945-953, 1994.
5. **Cerofolini, E.; Luchetti, R.; Pederzini, L.; Soragni, O.; Colombini, R.; D'Alimonte, P.;** and **Romagnoli, R.:** MR evaluation of triangular fibrocartilage complex tears in the wrist: comparison with arthrography and arthroscopy. *J. Comput. Assist. Tomog.,* 14: 963-967, 1990.
6. **Chidgey, L. K.:** The distal radioulnar joint: problems and solutions. *J. Am. Acad. Orthop. Surgeons,* 3: 95-109, 1995.
7. **Chung, K. C.; Zimmerman, N. B.;** and **Travis, N. T.:** Wrist arthrography versus arthroscopy: a comparative study of 150 cases. *J. Hand Surg.,* 21A: 591-594, 1996.
8. **Erickson, S. J.; Cox, I. H.; Hyde, J. S.; Carrera, G. F.; Strandt, J. A.;** and **Estkowski, L. D.:** Effect of tendon orientation on MR imaging signal intensity: a manifestation of the "magic angle" phenomenon. *Radiology,* 181: 389-392, 1991.
9. **Golimbu, C. N.; Firooznia, H.; Melone, C. P., Jr.; Rafii, M.; Weinreb, J.;** and **Leber, C.:** Tears of the triangular fibrocartilage of the wrist: MR imaging. *Radiology,* 173: 731-733, 1989.
10. **Gundry, C. R.; Kursunoglu-Brahme, S.; Schwaighofer, B.; Kang, H. S.; Sartoris, D. J.;** and **Resnick, D.:** Is MR better than arthrography for evaluating the ligaments of the wrist? In vitro study. *AJR: Am. J. Roentgenol.,* 154: 337-341, 1990.
11. **Gusmer, P. B.; Potter, H. G.; Donovan, W. D.;** and **O'Brien, S. J.:** MR imaging of the shoulder after rotator cuff repair. *AJR: Am. J. Roentgenol.,* 168: 559-563, 1997.

12. **Hermansdorfer, J. D.,** and **Kleinman, W. B.:** Management of chronic peripheral tears of the triangular fibrocartilage complex. *J. Hand Surg.,* 16A: 340-346, 1991.
13. **Kirschenbaum, D.; Sieler, S.; Solonick, D.; Loeb, D. M.;** and **Cody, R. P.:** Arthrography of the wrist. Assessment of the integrity of the ligaments in young asymptomatic adults. *J. Bone and Joint Surg.,* 77-A: 1207-1209, Aug. 1995.
14. **Levinsohn, E. M.; Rosen, I. D.;** and **Palmer, A. K.:** Wrist arthrography: value of the three-compartment injection method. *Radiology,* 179: 231-239, 1991.
15. **Metz, V. M.; Mann, F. A.;** and **Gilula, L. A.:** Three-compartment wrist arthrography: correlation of pain site with location of uni- and bidirectional communications. *AJR: Am. J. Roentgenol.,* 160: 819-822, 1993.
16. **Mikic, Z. D.:** Age changes in the triangular fibrocartilage of the wrist joint. *J. Anat.,* 126: 367-384, 1978.
17. **Miller, R. J.,** and **Totterman, S. M.:** Triangular fibrocartilage in asymptomatic subjects: investigation of abnormal MR signal intensity [comment]. *Radiology,* 196: 22-23, 1995.
18. **Oneson, S. R.; Scales, L. M.; Timins, M. E.; Erickson, S. J.;** and **Chamoy, L.:** MR imaging interpretation of the Palmer classification of triangular fibrocartilage complex lesions. *Radiographics,* 16: 97-106, 1996.
19. **Palmer, A. K.:** Triangular fibrocartilage complex lesions: a classification. *J. Hand Surg.,* 14A: 594-606, 1989.
20. **Pederzini, L.; Luchetti, R.; Soragni, O.; Alfarano, M.; Montagna, G.; Cerofolini, E.; Colombini, R.;** and **Roth, J.:** Evaluation of the triangular fibrocartilage complex tears by arthroscopy, arthrography, and magnetic resonance imaging. *Arthroscopy,* 8: 191-197, 1992.
21. **Potter, H. G.; Montgomery, K. D.; Padgett, D. E.; Salvati, E. A.;** and **Helfet, D. L.:** Magnetic resonance imaging of the pelvis. New orthopaedic applications. *Clin. Orthop.,* 319: 223-231, 1995.
22. **Smith, D. K.:** Dorsal carpal ligaments of the wrist: normal appearance on multiplanar reconstructions of three-dimensional Fourier transform MR imaging. *AJR: Am. J. Roentgenol.,* 161: 119-125, 1993.
23. **Smith, D. K.:** Scapholunate interosseous ligament of the wrist: MR appearances in asymptomatic volunteers and arthrographically normal wrists. *Radiology,* 192: 217-221, 1994.
24. **Sugimoto, H.; Shinozaki, T.;** and **Ohsawa, T.:** Triangular fibrocartilage in asymptomatic subjects: investigation of abnormal MR signal intensity. *Radiology,* 191: 193-197, 1994.
25. **Totterman, S. M.,** and **Miller, R. J.:** Triangular fibrocartilage complex: normal appearance on coronal three-dimensional gradient-recalled-echo MR images. *Radiology,* 195: 521-527, 1995.
26. **Totterman, S. M.; Miller, R. J.; McCance, S. E.;** and **Meyers, S. P.:** Lesions of the triangular fibrocartilage complex: MR findings with a three-dimensional gradient-recalled-echo sequence. *Radiology,* 199: 227-232, 1996.
27. **Wilson, A. J.; Gilula, L. A.;** and **Mann, F. A.:** Unidirectional joint communications in wrist arthrography: an evaluation of 250 cases. *AJR: Am. J. Roentgenol.,* 157: 105-109, 1991.
28. **Wood, K. B.; Garvey, T. A.; Gundry, C.;** and **Heithoff, K. B.:** Magnetic resonance imaging of the thoracic spine. Evaluation of asymptomatic individuals. *J. Bone and Joint Surg.,* 77-A: 1631-1638, Nov. 1995.
29. **Zlatkin, M. B.; Chao, P. C.; Osterman, A. L.; Schnall, M. D.; Dalinka, M. K.;** and **Kressel, H. Y.:** Chronic wrist pain: evaluation with high-resolution MR imaging. *Radiology,* 173: 723-729, 1989.

Magnetic Resonance Imaging of Articular Cartilage in the Knee

An Evaluation with Use of Fast-Spin-Echo Imaging*

BY HOLLIS G. POTTER, M.D.†, JAMES M. LINKLATER, M.D.†, ANSWORTH A. ALLEN, M.D.†, JO A. HANNAFIN, M.D., PH.D.†, AND STEVEN B. HAAS, M.D., M.P.H.†, NEW YORK, N.Y.

Investigation performed at the Departments of Radiology and Orthopaedics, The Hospital for Special Surgery, New York City

ABSTRACT: The purpose of this study was to demonstrate that specialized magnetic resonance imaging provides an accurate assessment of lesions of the articular cartilage of the knee. Arthroscopy was used as the comparative standard.

Eighty-eight patients who had an average age of thirty-eight years were evaluated with magnetic resonance imaging and subsequent arthroscopy because of a suspected meniscal or ligamentous injury. The magnetic resonance imaging was performed with a specialized sequence in the sagittal, coronal, and axial planes. Seven articular surfaces (the patellar facets, the trochlea, the femoral condyles, and the tibial plateaus) were graded prospectively on the magnetic resonance images by two independent readers with use of the 5-point classification system of Outerbridge, which was also used at arthroscopy.

Six hundred and sixteen articular surfaces were assessed, and 248 lesions were identified at arthroscopy. Eighty-two surfaces had chondral softening; seventy-five, mild ulceration; fifty-three, deep ulceration, fibrillation, or a flap without exposure of subchondral bone; and thirty-eight, full-thickness wear. To simplify the statistical analysis, grades 0 and 1 were regarded as disease-negative status and grades 2, 3, and 4 were regarded as disease-positive status. When the grades that had been assigned by reader 1 were used for the analysis, magnetic resonance imaging had a sensitivity of 87 per cent (144 of 166), a specificity of 94 per cent (424 of 450), an accuracy of 92 per cent (568 of 616), a positive predictive value of 85 per cent (144 of 170), and a negative predictive value of 95 per cent (424 of 446) for the detection of a chondral lesion. Interobserver variability was minimum, as indicated by a weighted kappa statistic of 0.93 (almost perfect agreement).

With use of this readily available modified magnetic resonance imaging sequence, it is possible to assess all articular surfaces of the knee accurately and thereby identify lesions that are amenable to arthroscopic treatment.

The articular or hyaline cartilage of the knee covers the articulating surfaces of the patella, femur, and tibia. The thickness of the cartilage is variable. The articular cartilage transmits and distributes load, thereby minimizing stress on the underlying subchondral bone, and provides a smooth articulating surface as well as lubrication, thereby reducing friction in the joint. Most chondral injuries are secondary to trauma or degeneration of the joint. Although chondral injuries usually occur in association with other intra-articular abnormalities, such as ligamentous and meniscal injuries, isolated chondral lesions can occur, with a reported prevalence of approximately 4 per cent (twelve of 312)[28]. Patients are often seen with non-specific pain in the knee, low-grade effusion, and symptoms that mimic those of a meniscal tear, such as pain along the joint line and locking[11,20].

Traditional techniques for the operative treatment of acute and chronic chondral lesions include débridement of the chondral flap; perforation of the subchondral bone by drilling[15], abrasion[3,10,12], or microfracture[15,24]; and insertion of a perichondral graft[6,17,18,25]. More recently, the implantation of autologous cartilage[2] as well as mosaicplasty[9] have stimulated new interest in the treatment of chondral injuries. This interest has resulted in an increasing demand for an accurate, reproducible, and, ideally, non-invasive method for the assessment of lesions of articular cartilage, both for the initial diagnosis and for subsequent monitoring after operative treatment.

Magnetic resonance imaging, by virtue of its superior soft-tissue contrast, lack of ionizing radiation, and multiplanar capabilities, is superior to more conventional techniques for the evaluation of articular cartilage[14,22]. The particular magnetic resonance imaging sequence most suited for the detection of chondral abnormalities

*No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article. No funds were received in support of this study.

†Departments of Radiology (H. G. P. and J. M. L.) and Orthopaedics (A. A. A., J. A. H., and S. B. H.), The Hospital for Special Surgery, 535 East 70th Street, New York, N.Y. 10021.

is controversial. There has been some consensus in the radiological literature that a fat-suppressed volumetric (three-dimensional) gradient-echo sequence may be the best technique[4]. However, this sequence is limited by a long acquisition time[4,5] and typically relies on subsequent reconstruction of images derived from a single plane. The imaging time is prolonged further by the need for additional sequences, as the fat-suppressed gradient-echo sequence is not optimum for the assessment of ligaments, menisci, or subchondral bone. Previous authors have suggested that multiplanar reconstructions derived from the initial sagittal volumetric sequence do not offer images of sufficient quality to allow for the accurate diagnosis of chondral lesions in areas best assessed in the axial or coronal plane[23].

Our hypothesis was that a specialized proton-density-weighted, high-resolution, fast-spin-echo sequence, which was previously shown to provide an accurate assessment of other structures in the knee[21], would provide a suitable assessment of articular cartilage in the knee without substantially prolonging the total imaging time. The purpose of the present investigation was to assess the accuracy of magnetic resonance imaging in the detection, grading, and localization of chondral lesions in the knee and to compare the findings with those of direct arthroscopic inspection.

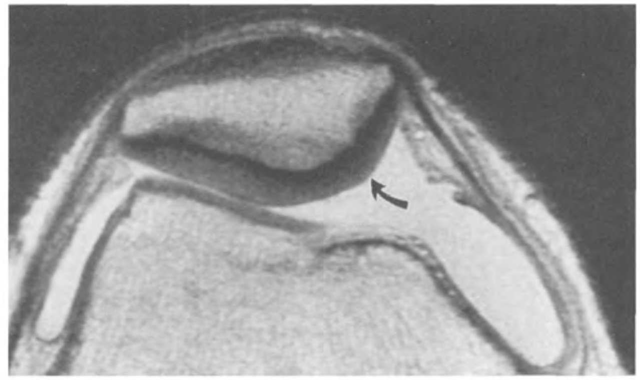


FIG. 1-A

Figs. 1-A and 1-B: A thirty-year-old man who had grade-0 (intact) articular cartilage.

Fig. 1-A: Axial fast-spin-echo magnetic resonance image demonstrating uniform thickness of the articular cartilage over the patellar facets. The sharp interface between the articular surface and the joint fluid (arrow) indicates an absence of fibrillation of the surface.

FIG. 1-B

Coronal fast-spin-echo magnetic resonance image demonstrating uniform thickness of the cartilage and a homogeneous appearance over the condyles and plateaus.

Materials and Methods

Patient Selection

All patients who had had magnetic resonance imaging and subsequent arthroscopy of the knee at our institution from January 1996 to August 1997 and for whom the operating surgeon had completed a chondral injury data sheet were eligible for the present study. A total of ninety patients were enrolled. Two patients were excluded from the study because of severe degradation of the images, caused by motion of the patient, that precluded confirmation of chondral lesions in two planes. Another two patients were included despite the presence of metallic hardware in the knee in association with reconstruction of the anterior cruciate ligament and the placement of an interference screw. The average age of the eighty-eight patients who met the criteria for inclusion was thirty-eight years (range, twenty-three to eighty-two years). There were forty-eight men and forty women.

The average interval between magnetic resonance imaging and arthroscopy was twenty-seven days (range, four to 377 days). Seventy-five patients (85 per cent) had arthroscopy within two months after magnetic resonance imaging; a review of the charts revealed that no injuries had been documented during this interval. The study was approved by our Institutional Review Board.

Magnetic Resonance Imaging

Magnetic resonance imaging of the knee was performed with a 1.5-tesla magnet (Signa, Horizon; General Electric Medical Systems, Milwaukee, Wisconsin) and a conventional send-receive extremity coil. Three sequences were used to assess the articular cartilage in the sagittal, axial, and coronal planes. Each sequence consisted of fast-spin-echo images that were performed with a long repetition time (3500 to 5000 milliseconds), a short effective-echo time (thirty to thirty-four milliseconds), an echo train length of eight to ten, a bandwidth of 20.8 to 31.3 kilohertz, two excitations, and a slice thickness of 3.5 to 4.0 millimeters with no interslice gap. Sagittal images were performed with a 512-by-256 matrix and a field of view of fifteen to sixteen centimeters (scan time, 4.5 minutes), axial images were performed with a 512-by-256 matrix and a field of view of fourteen to fifteen centimeters (scan time, 4.0 minutes), and coronal images were performed with a 256-by-256 matrix and a field of view of twelve to thirteen centimeters (scan time, 4.0 minutes). As part of our routine assessment of the knee, we performed an additional sagittal fast-spin-echo sequence (repetition time, 4000 milliseconds; effective-echo time, thirty-four milliseconds) with frequency-selective fat suppression (Chemsat; General Electric Medical Systems) and an individual scan time of 3.5 minutes. The total scanning time was approximately twenty minutes.

The magnetic resonance images were prospectively analyzed by two blinded, independent readers. One of the readers (H. G. P.) was a musculoskeletal magnetic resonance imaging radiologist, and the other (J. M. L.) was a musculoskeletal magnetic resonance imaging fellow. Seven articular surfaces were assessed: the medial and lateral patellar facets, the trochlea, the medial and lateral femoral condyles, and the medial and lateral tibial plateaus. The articular cartilage was graded on the magnetic resonance images and at arthroscopy with a modification of the classification system of Outerbridge[19]. Grade 0 indicated intact cartilage; grade 1, chondral softening or blistering with an intact surface; grade 2, shallow superficial ulceration, fibrillation, or fissuring involving less than 50 per cent of the depth of the articular surface; grade 3, deep ulceration, fibrillation, fissuring, or a chondral flap involving 50 per cent or more of the depth of the articular cartilage without exposure of subchondral bone; and grade 4, full-thickness chondral wear with exposure of subchondral bone. All chondral lesions were confirmed in at least two separate planes. On magnetic resonance images, the intermediate signal intensity of the articular cartilage contrasted with the lower signal intensity of the subchondral plate and the higher signal intensity of the joint fluid. The cartilage was considered to be intact if the band of intermediate signal intensity had a uniform thickness (Figs. 1-A and 1-B).

Arthroscopic Technique

Arthroscopy was performed by one of three surgeons (S. B. H., A. A. A., or J. A. H.). The indications for arthroscopy included a meniscal tear, disruption of the anterior cruciate ligament, and chondral injury. Arthroscopy was performed with use of standard anterolateral and anteromedial portals. A superolateral or superomedial portal was used for inflow. The typical examination included a thorough inspection of the undersurface of the patella from both the anterolateral and the anteromedial portal. The surface of the cartilage was probed from the contralateral portal. The femoral trochlea was viewed from the anterolateral portal. The knee was flexed and extended to assess tracking of the patella and to document the presence of so-called kissing lesions involving the femoral trochlea and the patella. The medial femoral condyle and the medial tibial plateau were viewed through the anterolateral portal. The posterior aspect of the medial femoral condyle was viewed through the intercondylar notch. The lateral compartment was viewed with the lower limb in the figure-four position, and the anteromedial portal was used as necessary to visualize the posterior aspect of the lateral femoral condyle. The articular surfaces were probed, and arthroscopic photographs of the involved joint surfaces were made. The arthroscopic assessment of the articular cartilage was recorded at the time of arthroscopy by the operating surgeon on a standardized data-entry form. The magnetic resonance images and related reports were available to the surgeon at the time of arthroscopy. However, the reports did not include the comprehensive grading sheet that had been used to evaluate the individual articular surfaces, and the images primarily were used to assess the ligaments and menisci of the knee.

TABLE I
ARTHROSCOPIC GRADING OF THE SIX HUNDRED AND SIXTEEN ARTICULAR SURFACES*

Surface	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4
Medial patellar facet	47	10	18	9	4
Lateral patellar facet	49	14	13	8	4
Trochlea	50	14	7	10	7
Medial femoral condyle	34	8	13	19	14
Lateral femoral condyle	71	9	4	2	2
Medial tibial plateau	56	12	13	2	5
Lateral tibial plateau	61	15	7	3	2
Total	368	82	75	53	38

*The values are given as the number of surfaces.

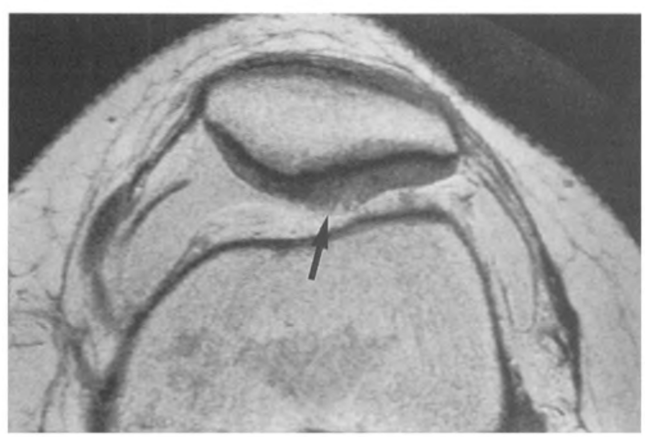


FIG. 2

Axial fast-spin-echo magnetic resonance image through the knee of a thirty-year-old woman who had an arthroscopically confirmed grade-2 lesion of the lateral patellar facet. There is a focal blister in the articular surface as well as a lack of a sharp interface between the articular surface and the joint fluid (arrow). Hyperintensity of the signal in the superficial layers of cartilage suggested intrasubstance softening, or a grade-1 lesion.

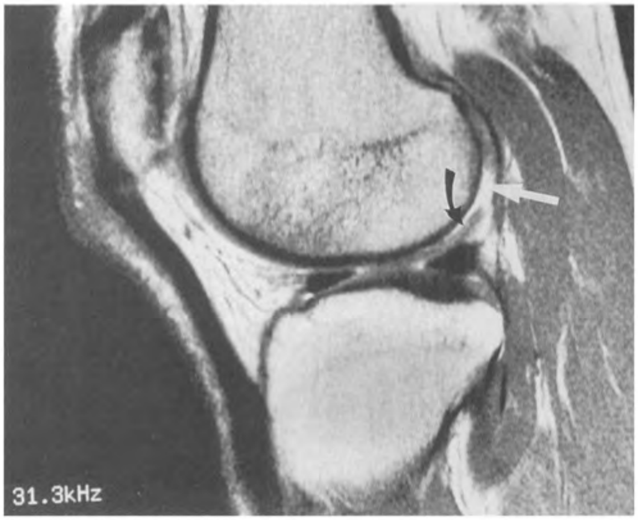


FIG. 3-A

Figs. 3-A, 3-B, and 3-C: A thirty-four-year-old man who had symptoms suggestive of a meniscal tear, including intermittent locking of the knee.

Fig. 3-A: Sagittal fast-spin-echo magnetic resonance image demonstrating a discrete full-thickness chondral defect (white arrow) over the posterior margin of the lateral femoral condyle, with an adjacent chondral flap (black arrow).

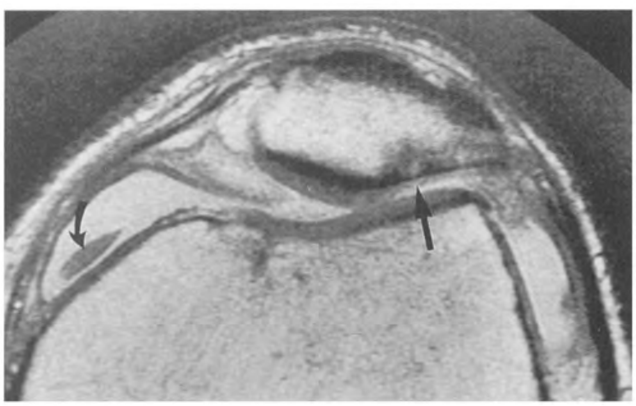


FIG. 3-B

Axial fast-spin-echo magnetic resonance image demonstrating a loose body in the medial aspect of the suprapatellar pouch (curved arrow). There is severe fibrillation (straight arrow) of the surface over the lateral patellar facet, which was interpreted as grade 3 and focal grade 4. There is also a relatively intact rind of cartilage over the trochlea, with mild intrasubstance softening over the medial patellar facet. The findings on the magnetic resonance images were confirmed at arthroscopy.

Statistical Analysis

Weighted kappa statistics were calculated to assess the degree of interobserver agreement as well as the degree of agreement between the findings on magnetic resonance imaging and those on arthroscopy. The weightings were calculated with the formula $1 - (|i - j|/[k - 1])$, where i and j index the rows and columns of the ratings assigned by the two readers and k is the maximum number of possible ratings (Release 4, Statistical Analysis Package; Stata, College Station, Texas). If the grades agreed exactly, the weighting was 1.00; if they differed by one, the weighting was 0.75; if they differed by two, the weighting was 0.50; if they differed by three, the weighting was 0.25; and if they differed by four, the weighting was 0.00. A weighted kappa value of less than 0.00 indicates poor agreement, a value of 0.00 to 0.20 indicates slight agreement, a value of 0.21 to 0.40 indicates fair agreement, a value of 0.41 to 0.60 indicates moderate agreement, a value of 0.61 to 0.80 indicates substantial agreement, a value of 0.81 to less than 1.00 indicates almost perfect agreement, and a value of 1.00 indicates perfect agreement[13].

To facilitate comparison with previous reports, the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of magnetic resonance imaging were calculated for each reader and each articular surface by collapsing all grades into disease-positive status (grades 2, 3, and 4) and disease-negative status (grades 0 and 1)[5]. Grade 1 was considered disease-negative status because of its relatively limited clinical importance and a suspected higher subjectivity of establishing its presence at arthroscopy.

Results

A total of eighty-eight patients met the criteria for inclusion in the study, and a total of 616 articular surfaces were assessed (Table I). At arthroscopy, 368 articular surfaces were classified as normal (grade 0); eighty-two, as grade 1; seventy-five, as grade 2 (Fig. 2); fifty-three, as grade 3 (Figs. 3-A, 3-B, and 3-C); and thirty-eight, as grade 4. Grade-4 lesions were most commonly seen over the medial femoral condyle (Figs. 4-A, 4-B, and 4-C) and the trochlea but were uncommon in the lateral femorotibial compartment. Grade-3 lesions were also most commonly seen over the medial femoral condyle and the trochlea.

When the classifications that were assigned at arthroscopy were compared with those that had been assigned by each independent reader on the basis of magnetic resonance imaging, there was exact agreement

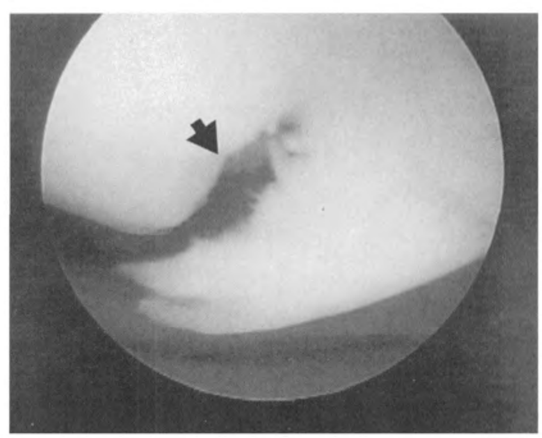


FIG. 3-C

Arthroscopic image of a chondral flap (arrow) over the lateral femoral condyle. (Reprinted, with permission, from: Linklater, J., and Potter, H. G.: Imaging of chondral defects. Op. Tech. Orthop., 7: 281, 1997.)

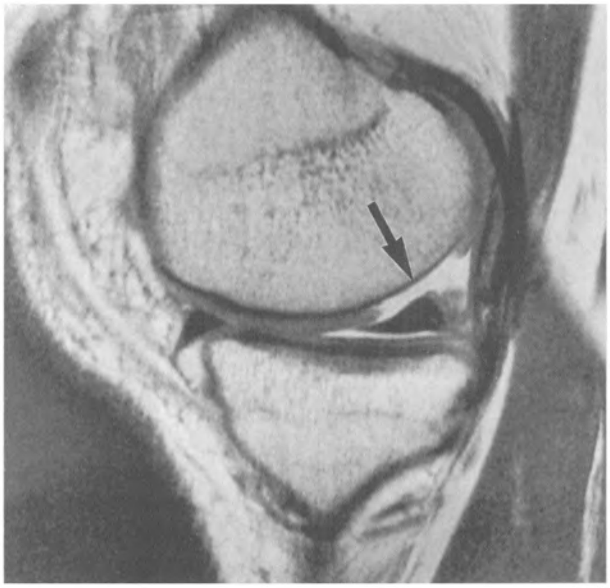


FIG. 4-A

Figs. 4-A, 4-B, and 4-C: A thirty-three-year-old man who had an arthroscopically confirmed grade-4 lesion over the medial femoral condyle.

Fig. 4-A: Sagittal fast-spin-echo magnetic resonance image demonstrating the discrete chondral defect (arrow).

FIG. 4-B

Coronal fast-spin-echo magnetic resonance image confirming the full-thickness defect (arrow).

for 444 articular surfaces (72 per cent) as assessed by reader 1 and for 453 articular surfaces (74 per cent) as assessed by reader 2, a difference of one grade for 155 surfaces (25 per cent) as assessed by reader 1 and for 147 surfaces (24 per cent) as assessed by reader 2, a difference of two grades for sixteen surfaces (3 per cent) as assessed by reader 1 and for fourteen surfaces (2 per cent) as assessed by reader 2, and a difference of three grades for one surface (0.2 per cent) as assessed by reader 1 and for two surfaces (0.3 per cent) as assessed by reader 2 (Table II). When discrepancies between grade 1 (disease-negative status) and grade 2 (disease-positive status) were analyzed, with use of the arthroscopic classification as the standard, it was found that reader 1 had classified nineteen grade-1 surfaces as grade 2 and thirteen grade-2 surfaces as grade 1. Similarly, reader 2 had classified fifteen grade-1 surfaces as grade 2 and thirteen grade-2 surfaces as grade 1. When the seven different articular surfaces were analyzed separately, the rate of exact agreement between arthroscopy and magnetic resonance imaging ranged from 66 to 80 per cent for reader 1 and from 65 to 79 per cent for reader 2 (Table II).

The weighted kappa statistic for interobserver agreement between readers 1 and 2 was 0.93, indicating almost perfect agreement[13]. The weighted kappa statistic for agreement between magnetic resonance imaging and arthroscopy was 0.88 for reader 1 and 0.89 for reader 2, also indicating almost perfect agreement (Table III).

The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of magnetic resonance imaging were calculated for each reader by collapsing all grades into disease-positive status (grades 2, 3, and 4) and disease-negative status (grades 0 and 1). A review of the grades that had been assigned by reader 1 revealed 144 true-positive findings, 424 true-negative findings, twenty-six false-positive findings, and twenty-two false-negative findings; these data yielded a sensitivity of 87 per cent (144 of 166), a specificity of 94 per cent (424 of 450), a positive predictive value of 85 per cent (144 of 170), a negative predictive value of 95 per cent (424 of 446), and an accuracy of 92 per cent (568 of 616). When the grades that had been assigned by reader 2 were used for the analysis, the sensitivity was 87 per cent (144 of 166), the specificity was 95 per cent (429 of 450), and the accuracy was 93 per cent (573 of 616).

The relative sensitivity, specificity, and accuracy of magnetic resonance imaging also were calculated for each articular surface (Table IV). Once again, grades 0 and 1 were considered disease-negative status and

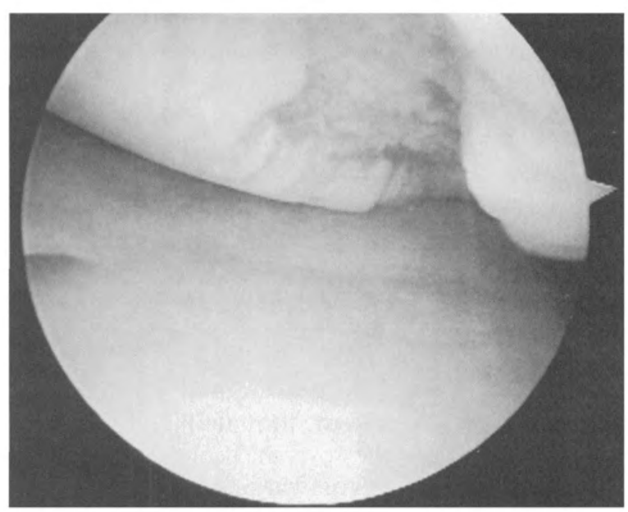


FIG. 4-C

Arthroscopic photograph confirming a full-thickness chondral defect over the posterior aspect of the medial femoral condyle. The defect measured eight by twenty millimeters.

TABLE II

AGREEMENT BETWEEN THE FINDINGS OF THE INDEPENDENT READERS OF THE MAGNETIC RESONANCE IMAGES AND THE FINDINGS AT ARTHROSCOPY

	Exact Agreement (per cent)		Difference of One Grade (per cent)		Difference of Two Grades (per cent)	
Surface	Reader 1	Reader 2	Reader 1	Reader 2	Reader 1	Reader 2
Medial patellar facet	66	70	30	29	4	1
Lateral patellar facet	71	76	27	20	2	3
Trochlea*	75	74	25	25	0	2
Medial femoral condyle	67	65	28	32	5	2
Lateral femoral condyle	80	78	19	21	1	1
Medial tibial plateau†	70	79	29	20	1	1
Lateral tibial plateau	77	74	18	22	5	4
All articular surfaces	72	73	25	24	3	2

*The arthroscopic assessment differed by three grades from the magnetic resonance assessment by reader 2 for one surface.

†The arthroscopic assessment differed by three grades from the magnetic resonance assessment by reader 1 and reader 2 for one surface each.

grades 2, 3, and 4 were considered disease-positive status. The lateral tibial plateau was associated with the poorest sensitivity, with proportionately more false-negative readings. In contrast, the patellar facets (Fig. 1-A) and the trochlea were associated with relatively high sensitivity and specificity, possibly because of the relative thickness of the cartilage in this region.

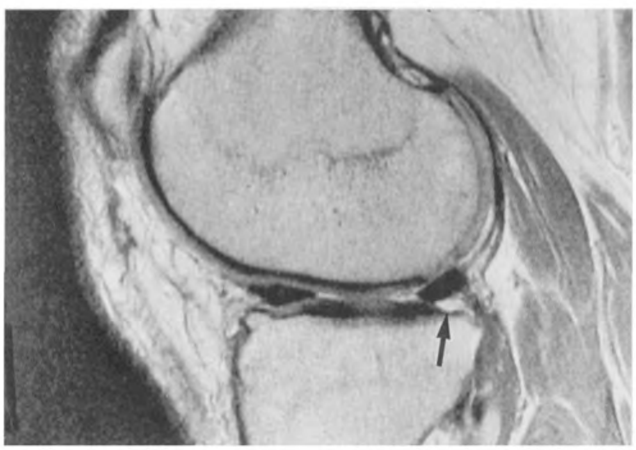


FIG. 5

Sagittal fast-spin-echo magnetic resonance image through the knee of a fifty-two-year-old man, demonstrating a smoothly marginated but full-thickness chondral defect over the posterior margin of the lateral tibial plateau (arrow) beneath the posterior horn of the lateral meniscus. This lesion was not confirmed at arthroscopy.

False-positive results (observed when a surface that had been prospectively classified as grade 2, 3, or 4 on the basis of magnetic resonance images was classified as grade 0 or 1 at arthroscopy) typically were associated with smoothly marginated ulcerations without fibrillation of the adjacent surface (Fig. 5) and with very posterior condylar lesions (Fig. 6). Reader 1 had prospectively classified five grade-0 surfaces (as determined arthroscopically) as grade 2, one grade-0 surface as grade 3, nineteen grade-1 surfaces as grade 2, and one grade-1 surface as grade 3, for a total of twenty-six false-positive results. Reader 2 had prospectively classified fifteen grade-1 surfaces as grade 2, one grade-1 surface as grade 3, four grade-0 surfaces as grade 2, and one grade-0 surface as grade 3, for a total of twenty-one false-positive results. None of the surfaces that were classified as grade 0 or 1 at arthroscopy had been prospectively classified as grade 4 by either reader.

Discussion

The results of our study suggest that the use of a specialized fast-spin-echo magnetic resonance imaging sequence with a high-resolution matrix allows for an accurate assessment of articular cartilage in the knee with little interobserver variability. Our data compare well with those in the study by Disler et al.[5], in which a fat-suppressed three-dimensional T1-weighted gradient-echo technique was used to assess chondral defects in the knee and exact agreement was found for forty-three (63 per cent) of sixty-eight true-positive interpretations.

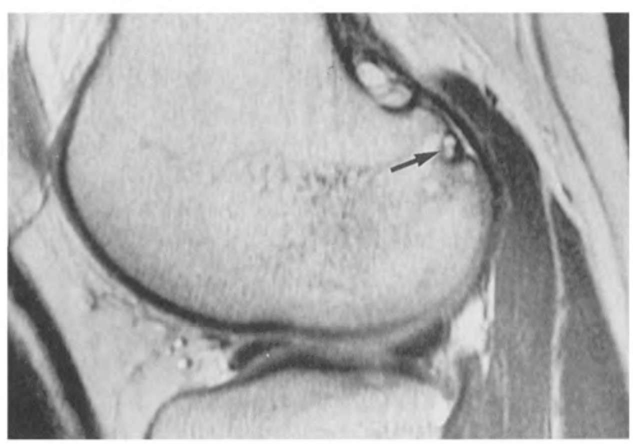


FIG. 6

Sagittal fast-spin-echo magnetic resonance image through the knee of a sixty-one-year-old woman, demonstrating a discrete osteochondral injury over the lateral femoral condyle (arrow) with a full-thickness chondral defect. This was not seen at arthroscopy, possibly because of its eccentric location.

TABLE III
WEIGHTED KAPPA STATISTICS

Comparison	Weighted Kappa Statistic
Reader 1 and arthroscopy	0.88
Reader 2 and arthroscopy	0.89
Reader 1 and reader 2	0.93

Recht et al.[23] reported a sensitivity of 81 per cent (thirty of thirty-seven), a specificity of 97 per cent (283 of 291), and an accuracy of 95 per cent (313 of 328) in a study in which a similar gradient-echo technique was used to grade 328 articular surfaces in forty-one patients. Arthroscopy was used as the comparative standard. In that study, evaluation was limited to the patellofemoral joint, arthroscopic grading was performed retrospectively by viewing a videotape, and the magnetic resonance images were graded by consensus review.

The pulse sequence described in the present study offers a slight advantage in that it allows adjacent menisci, ligaments, and subchondral bone to be evaluated. In addition, after arthroscopic treatment, metallic instrumentation (such as suture anchors and compression screws) and residual metallic debris from the arthroscope may cause local disturbance in the magnetic field. Fast-spin-echo sequences are superior to gradient-echo techniques in diminishing the susceptibility artifact caused by metallic instrumentation, which may obscure the overlying articular cartilage[21].

Previous authors have reported that magnetic resonance imaging has a lower sensitivity with regard to the detection of partial-thickness chondral lesions. Ochi et al., in a study of sixty-three patients, reported that magnetic resonance imaging had a sensitivity of 38 per cent (nine of twenty-four) for the detection of chondral injuries on prospective evaluation and a sensitivity of 75 per cent (eighteen of twenty-four) on retrospective evaluation. However, the pulse sequence that was used to evaluate the cartilage, a conventional spin-echo multiecho acquisition with a relatively thick (five-millimeter) slice and a 256-by-256 matrix, was different from ours and yielded poorer spatial resolution. Similarly, Blackburn et al. reported that arthroscopy was more sensitive than both plain radiography and magnetic resonance imaging for the evaluation of chondral abnormalities in patients who had osteoarthrosis of the knee. Those authors conducted a consensus review of the magnetic resonance images that had been performed for sixteen of their thirty-three patients. The images in that study were performed with T1-weighted fat-suppressed spin-echo sequences as well as gradient-recalled sequences; however, the maximum matrix was 256 by 256, which limited the spatial resolution. Finally, Spiers et al., in a prospective study of fifty-eight patients, reported that three-dimensional gradient-echo magnetic resonance images that were performed with a 256-by-256 matrix had a high specificity (100 per cent) but a low sensitivity (18 per cent) for the detection of lesions in the articular cartilage of the knee.

We believe that proper technique is crucial to the ability to detect subtle chondral injuries with the use of magnetic resonance imaging. Higher resolution allows for the detection of early morphological changes in the articular surface, such as fibrillation, and places less diagnostic reliance on changes in signal intensity, which may be subject to imaging artifacts[7,8]. Even in the absence of substantial intra-articular joint fluid, the pulse sequence that we used permitted differentiation among articular cartilage, subchondral bone, and meniscus (Fig. 7). This obviates the need for an intra-articular contrast agent and preserves the advantage of magnetic resonance imaging as a non-invasive tool. Poor contrast between joint fluid and the superficial layers of cartilage has been implicated as a cause of relatively poor sensitivity when magnetic resonance imaging has been used prospectively for the detection of chondral injuries[26].

In the present study, confirmation of chondral injuries in two planes helped to avoid partial volume effects, particularly in the region where the condyles curve toward the intercondylar notch. Because of the obliquity of the patellar facets, axial images were deemed superior for the visualization of the articular cartilage of the patella.

Magnetic resonance imaging demonstrated relatively poor sensitivity (seven of twelve) with regard to the detection of severe (grade-2, 3, or 4) chondral lesions of the lateral tibial plateau; this finding is in part reflective of the relatively small number of chondral lesions that were noted in this region at arthroscopy. It should be noted, however, that the lateral tibial plateau also was described by Disler et al.[5] as a difficult region in which to detect chondral lesions. In part, this difficulty

FIG. 7

Coronal fast-spin-echo magnetic resonance image through the knee of a thirty-seven-year-old man, demonstrating a small full-thickness chondral defect over the medial femoral condyle (arrow). The lesion was confirmed at arthroscopy. With use of appropriate pulse sequences, the lack of effusion in the joint does not limit prospective evaluation of important chondral lesions.

TABLE IV
RELATIVE SENSITIVITY, SPECIFICITY, AND ACCURACY FOR EACH ARTICULAR SURFACE FOR THE FINDINGS OF READER 1 COMPARED WITH THOSE AT ARTHROSCOPY*

Surface	Findings on Magnetic Resonance Imaging: True-Positive†	True-Negative†	False-Positive†	False-Negative†	Disease-Positive Status at Arthroscopy†	Sensitivity (per cent)	Specificity (per cent)
Medial patellar facet	30	51	6	1	31	97	89
Lateral patellar facet	23	59	4	2	25	92	94
Trochlea	22	61	3	2	24	92	95
Medial femoral condyle	38	40	2	8	46	83	95
Lateral femoral condyle	8	77	3	0	8	100	96
Medial tibial plateau	16	65	3	4	20	80	96
Lateral tibial plateau	7	71	5	5	12	58	93
Total	144	424	26	22	166	87	94

*Grades 0 and 1 were considered disease-negative status, and grades 2, 3, and 4 were considered disease-positive status.
†The values indicate the number of surfaces associated with each finding.

may be a function of the convex surface of the plateau, which, when subjected to sectioning into tomographic coronal and sagittal images, may impart more partial volume effects and imaging artifacts. In contrast, magnetic resonance imaging demonstrated superior sensitivity (92 and 96 per cent) with regard to the detection of defects involving the patellar facets, which are relatively thick and straight; this finding also is consistent with those of other studies[23].

When the results of magnetic resonance imaging and arthroscopy were compared, there appeared to be a tendency for the readers of the magnetic resonance images to overdiagnose chondral softening, or grade-1 lesions. It is unclear if this finding suggests that magnetic resonance imaging has superior sensitivity with regard to the detection of edema in the cartilage, which may not be apparent as palpable softening at arthroscopy, or if it represents an imaging artifact. The reported truncation artifact[7] that could account for a factitious laminar appearance on magnetic resonance pulse sequences is minimized with our technique by virtue of the relatively small pixel size and the high-resolution matrix. In addition, chemical shift misregistration, which may account for misregistration of the interfaces between the fat contained in the subchondral marrow and the fluid contained in the cartilage, is minimized with the additional fat-suppression technique. Because of its reliance on morphological changes rather than changes in signal intensity, our magnetic resonance pulse sequence can be used in conjunction with most standardized arthroscopic classification systems, which are designed to assess morphological changes in the chondral surface. Of note, given the superior visualization of subtle chondral lesions with the use of a smaller pixel size, we subsequently modified our imaging parameters to include a matrix of 512 by 384 in the sagittal plane and a matrix of 512 by 256 in the coronal plane.

The present study had a number of limitations. First, there was a selection bias because of the high prevalence of chondral injuries observed at our tertiary-care center. Second, the orthopaedic surgeons had access to the magnetic resonance images and reports at the time of arthroscopy. However, the magnetic resonance images primarily were used to assess menisci and ligaments and the surgeons did not have access to the grading sheets. Finally, although our patients ranged in age from twenty-three to eighty-two years, the average age of thirty-eight years is relatively young, indicating that a greater number of chondral lesions were due to trauma as opposed to osteoarthrosis. Additional studies of older patients are necessary to determine the value of this pulse sequence in the detection of lesions due to osteoarthrosis.

Despite these limitations, we believe that this magnetic resonance pulse sequence provides a non-invasive, accurate, and reproducible method with which to diagnose traumatic chondral lesions of the knee. This is the largest study to date, of which we are aware, in which all of the articular surfaces of the knee were assessed by independent readers with the use of magnetic resonance imaging. With the use of readily available software on all high-field-strength magnetic resonance units, this sequence should provide a reasonable method with which to study patients after operative intervention for lesions in the cartilage.

NOTE: The authors acknowledge the contributions of George A. Paletta, M.D., Riley Williams, M.D., and Margaret Peterson, Ph.D.

References

1. **Blackburn, W. D., Jr.; Bernreuter, W. K.; Rominger, M.;** and **Loose, L. L.:** Arthroscopic evaluation of knee articular cartilage: a comparison with plain radiographs and magnetic resonance imaging. *J. Rheumatol.,* 21: 675-679, 1994.
2. **Brittberg, M.; Lindahl, A.; Nilsson, A.; Ohlsson, C.; Isaksson, O.;** and **Peterson, L.:** Treatment of deep cartilage defects in the knee with autologous chondrocyte transplantation. *New England J. Med.,* 331: 889-895, 1994.
3. **Convery, F. R.; Akeson, W. H.;** and **Keown, G. H.:** The repair of large osteochondral defects. An experimental study in horses. *Clin. Orthop.,* 82: 253-262, 1972.

4. **Disler, D. G.; McCauley, T. R.; Wirth, C. R.;** and **Fuchs, M. D.:** Detection of knee hyaline cartilage defects using fat-suppressed three-dimensional spoiled gradient-echo MR imaging: comparison with standard MR imaging and correlation with arthroscopy. *AJR: Am. J. Roentgenol.,* 165: 377-382, 1995.
5. **Disler, D. G.; McCauley, T. R.; Kelman, C. G.; Fuchs, M. D.; Ratner, L. M.; Wirth, C. R.;** and **Hospodar, P. P.:** Fat-suppressed three-dimensional spoiled gradient-echo MR imaging of hyaline cartilage defects in the knee: comparison with standard MR imaging and arthroscopy. *AJR: Am. J. Roentgenol.,* 167: 127-132, 1996.
6. **Engkvist, O.,** and **Ohlsen, L.:** Reconstruction of articular cartilage with free autologous perichondrial grafts. An experimental study in rabbits. *Scandinavian J. Plast. and Reconstr. Surg.,* 13: 269-274, 1979.
7. **Erickson, S. J.; Waldschmidt, J. G.; Czervionke, L. F.;** and **Prost, R. W.:** Hyaline cartilage: truncation artifact as a cause of trilaminar appearance with fat-suppressed three-dimensional spoiled gradient-recalled sequences. *Radiology,* 201: 260-264, 1996.
8. **Frank, L. R.; Brossmann, J.; Buxton, R. B.;** and **Resnick, R.:** MR imaging truncation artifacts can create a false laminar appearance in cartilage. *AJR: Am. J. Roentgenol.,* 168: 547-554, 1997.
9. **Hangody, L.,** and **Karpati, Z.:** A new surgical treatment of localized cartilaginous defects of the knee. *Hungarian J. Orthop. Trauma,* 37: 237-242, 1994.
10. **Johnson, L. L.:** Arthroscopic abrasion arthroplasty historical and pathologic perspective: present status. *Arthroscopy,* 2: 54-69, 1986.
11. **Johnson-Nurse, C.,** and **Dandy, D. J.:** Fracture-separation of articular cartilage in the adult knee. *J. Bone and Joint Surg.,* 67-B(1): 42-43, 1985.
12. **Kim, H. K. W.; Moran, M. E.;** and **Salter, R. B.:** The potential for regeneration of articular cartilage in defects created by chondral shaving and subchondral abrasions. An experimental investigation in rabbits. *J. Bone and Joint Surg.,* 73-A: 1301-1315, Oct. 1991.
13. **Landis, J. R.,** and **Koch, G. G.:** The measurement of observer agreement for categorical data. *Biometrics,* 33: 159-174, 1977.
14. **Linklater, J.,** and **Potter, H. G.:** Imaging of chondral defects. *Op. Tech. Orthop.,* 7: 279-288, 1997.
15. **Mitchell, N.,** and **Shepard, N.:** The resurfacing of adult rabbit articular cartilage by multiple perforations through the subchondral bone. *J. Bone and Joint Surg.,* 58-A: 230-233, March 1976.
16. **Ochi, M.; Sumen, Y.; Kanda, T.; Ikuta, Y.;** and **Itoh, K.:** The diagnostic value and limitation of magnetic resonance imaging on chondral lesions in the knee joint. *J. Arthroscopy,* 10: 176-183, 1994.
17. **O'Driscoll, S. W.,** and **Salter, R. B.:** The repair of major osteochondral defects in joint surfaces by neochondrogenesis with autogenous osteoperiosteal grafts stimulated by continuous passive motion. An experimental investigation in the rabbit. *Clin. Orthop.,* 208: 131-140, 1986.
18. **O'Driscoll, S. W.; Keeley, F. W.;** and **Salter, R. B.:** Durability of regenerated articular cartilage produced by free autogenous periosteal grafts in major full-thickness defects in joint surfaces under the influence of continuous passive motion. A follow-up report at one year. *J. Bone and Joint Surg.,* 70-A: 595-606, April 1988.
19. **Outerbridge, R. E.:** The etiology of chondromalacia patellae. *J. Bone and Joint Surg.,* 43-B(4): 752-757, 1961.
20. **Outerbridge, R. E.,** and **Dunlop, J. A. Y.:** The problem of chondromalacia patellae. *Clin. Orthop.,* 110: 177-196, 1975.
21. **Potter, H. G.; Rodeo, S. A.; Wickiewicz, T. L.;** and **Warren, R. F.:** MR imaging of meniscal allografts: correlation with clinical and arthroscopic outcomes. *Radiology,* 198: 509-514, 1996.
22. **Recht, M. P.,** and **Resnick, D.:** MR imaging of articular cartilage: current status and future directions. *AJR: Am. J. Roentgenol.,* 163: 283-290, 1994.
23. **Recht, M. P.; Piraino, D. W.; Paletta, G. A.; Schils, J. P.;** and **Belhobeck, G. H.:** Accuracy of fat-suppressed three-dimensional spoiled gradient-echo FLASH MR imaging in the detection of patellofemoral articular cartilage abnormalities. *Radiology,* 198: 209-212, 1996.
24. **Rodrigo, J. J.; Steadman, J. R.;** and **Silliman, J. F.:** Osteoarticular injuries of the knee. In *Operative Orthopaedics,* edited by M. W. Chapman. Ed. 2, vol. 3, pp. 2077-2082. Philadelphia, J. B. Lippincott, 1993.
25. **Rubak, J. M.:** Reconstruction of articular cartilage defects with free periosteal grafts. An experimental study. *Acta Orthop. Scandinavica,* 53: 175-180, 1982.
26. **Speer, K. P.; Spritzer, C. E.; Goldner, J. L.;** and **Garrett, W. E., Jr.:** Magnetic resonance imaging of traumatic knee articular cartilage injuries. *Am. J. Sports Med.,* 19: 396-402, 1991.
27. **Spiers, A. S. D.; Meagher, T.; Ostlere, S. J.; Wilson, D. J.;** and **Dodd, C. A. F.:** Can MRI of the knee affect arthroscopic practice? A prospective study of 58 patients. *J. Bone and Joint Surg.,* 75-B(1): 49-52, 1993.
28. **Terry, G. C.; Flandry, F.; Manen, J. W. V.;** and **Norwood, L. A.:** Isolated chondral fractures of the knee. *Clin. Orthop.,* 234: 170-177, 1988.

Louis A. Shapiro is President and Chief Executive Officer of Hospital for Special Surgery (HSS). He has served in this role since October 2006, overseeing all strategic and operational aspects of the Hospital's mission -- to advance the field of musculoskeletal medicine through world-class patient care, research, and education. Under Mr. Shapiro's leadership, the Hospital has experienced significant growth, expansion of facilities, and external recognition of its reputation as the world leader in its specialty areas of orthopedics, rheumatology, and their related disciplines.

As HSS marks its 150th anniversary next year, Mr. Shapiro and his leadership team's commitment to excellence in every aspect of the institution have made HSS a world leader in shaping the future of musculoskeletal medicine. The key to this longevity and success is in the Hospital's unique culture of continual improvement, innovation and compassionate care. Mr. Shapiro is a strong proponent of the link between internal culture and performance and ensures that every employee is aligned with the Hospital's mission and vision of providing every patient with an unsurpassed experience that result in excellent medical outcomes.

Mr. Shapiro has more than 30 years of healthcare experience in a variety of settings. Prior to his arrival at HSS, he served as Executive Vice President and Chief Operating Officer at Geisinger Health System in Pennsylvania. Prior to Geisinger, Mr. Shapiro was a leader in the healthcare practice at McKinsey & Company and began his career at Allegheny General Hospital, where he served in a number of capacities in the Pittsburgh-based system.

Mr. Shapiro is a Fellow of the American College of Healthcare Executives and received its Award of Distinction in 2009. He is also a member of the Regional Policy Board for the American Hospital Association and the Young Presidents Organization. He was elected Vice Chair of the Greater New York Hospital Association Board of Governors for the 2012-13 term. He serves on the Board of the non profit organization Crutches for Kids. Mr. Shapiro earned his B.S. and M.H.A degrees from the University of Pittsburgh.

Stacey L. Malakoff - Executive Vice President and Chief Financial Officer, joined the Hospital in November 1990 as Director of Reimbursement. Effective August 1992, she was named Controller and effective September 1996, Vice President of Finance. She was appointed to her current position as Executive Vice President and Chief Financial Officer in August 1998. She received her Bachelor of Science Degree in Business Administration from Washington University in Saint Louis, MO in 1985 and was licensed as a Certified Public Accountant in 1987.

Prior to joining the Hospital, Ms. Malakoff served as manager in the audit division of Ernst & Young LLP. She is a member of the New York State Society of CPAs, the American Institute of CPAs, the Greater New York Hospital Association Fiscal Policy Committee, and is an advanced member of the Healthcare Financial Management Association. She is also the Treasurer and member of the Board of Directors of MIAC. In 2001, she was honored by Crain's Magazine in their "40 under 40" issue listing of top executives in the New York City area.

Lisa A. Goldstein - Executive Vice President and Chief Operating Officer, joined the Hospital in March 1997. She received her Bachelor of Science Degree in Industrial and Labor Relations from Cornell University in 1977 and her Master of Professional Studies Degree in Health Services Administration from the Business School at Cornell University in 1979.

Prior to joining the Hospital, Ms. Goldstein served as Vice President and Chief Operating Officer at Wayne General Hospital in Wayne, New Jersey from 1986-1996. Ms. Goldstein is a Fellow of the American College of Healthcare Executives.

Ralph J. Bianco - Vice President, Operations, joined the Hospital in October of 1976. As Vice President, Operations he is responsible for oversight of multiple departments including the Department of Radiology & Imaging and the Division of Magnetic Resonance Imaging. Mr. Bianco received his Bachelor of Science degree from Arizona State University and graduated from the New York Hospital School of Radiology prior to joining Hospital for Special Surgery as a Radiologic Technologist in 1976. In 1983 Mr. Bianco received a Masters Degree in Healthcare Administration from Long Island University.

CURRICULUM VITAE
HOLLIS G. POTTER, MD
2012

A. GENERAL INFORMATION

Hospital Address:	Department of Radiology & Imaging, Division of MRI Hospital for Special Surgery 535 East 70th Street New York, NY 10021 Tel: 212-606-1023 Fax: 212-774-2786 E-mail: potterh@hss.edu
Home Address:	52 Dingletown Road Greenwich, CT 06830
Citizenship:	USA

B. EDUCATIONAL BACKGROUND

A.B.	1976 – 1980	Smith College -- Magna cum Laude Northampton, MA
	1978 – 1979	Dartmouth College -- Junior Year Exchange Hanover, NH
M.D.	1981 – 1985	New York Medical College New York, NY

C. PROFESSIONAL POSITIONS & EMPLOYMENT

Post-Doctoral Training

Intern Internal Medicine	Danbury Hospital Danbury, CT	1985 - 1986
Resident Diagnostic Radiology	North Shore University Hospital Manhasset, NY	1986 - 1990
Chief Resident Diagnostic Radiology	North Shore University Hospital Manhasset, NY	1989 - 1990
Fellow Musculoskeletal Radiology	Hospital for Special Surgery New York, NY	1990 - 1991

C. PROFESSIONAL POSITIONS & EMPLOYMENT {Cont'd}

Post-Doctoral Training

Fellow Skeletal Radiology	New York Hospital Cornell University Medical College New York, NY	1990 - 1991

Academic Positions

Assistant Professor of Radiology	Cornell University Medical College New York, NY	1991 - 1998
Senior Scientist/Senior Clinical Investigator, Research Division	Hospital for Special Surgery New York, NY	1995-present
Associate Professor of Radiology	Weill Medical College of Cornell University New York, NY	1998 - 2002
Professor of Radiology	Weill Medical College of Cornell University New York, NY	2002-present

Hospital Positions

Junior Attending Radiologist	Hospital for Special Surgery New York, NY	1990 - 1991
Assistant Attending Radiologist	Hospital for Special Surgery & New York Hospital New York, NY	1991 - 1998
Associate Attending Radiologist	Hospital for Special Surgery & New York Hospital New York, NY	1998 - 2002
Chief, Division of Magnetic Resonance Imaging	Hospital for Special Surgery New York, NY	1994-present
Director of Research	Hospital for Special Surgery New York, NY	2000-present
Member, Laboratory for Soft Tissue Research	Hospital for Special Surgery New York, NY	2001-present
Attending Radiologist	Hospital for Special Surgery New York, NY	2002-present

D. LICENSURE, BOARD CERTIFICATION, MALPRACTICE

Licensure:	1986 State of New York (Lic #168228)
DEA:	BP2699633
Board Certification:	1985 National Board of Medical Examiners 1990 American Board of Radiology
Malpractice Insurance:	Yes -- Premium paid by Hospital for Special Surgery
NPI:	1629085188

E. PROFESSIONAL MEMBERSHIPS

Scientific Societies:	Radiological Society of North America	1986
	New York Roentgen Society	1990
	American College of Radiology	1990
	American Roentgen Ray Society	1993
	American Academy of Orthopaedic Surgeons	1996
	International Society for Magnetic Resonance in Medicine	1996
	Society of Skeletal Radiology	1997
	International Cartilage Repair Society	1998
	American Orthopaedic Society for Sports Medicine	2001
	ACL Study Group	2001
	Elected to Research Committee, AOSSM	2003
	Orthopaedic Research Society	2003
	American Shoulder and Elbow Surgeons	2003
	The Knee Society	2006
	The Hip Society	2007
	Elected to Program Committee, ISMRM	2008
	ISMRM MSK Program Committee Chair 2010-2011	2010
Hospital Committees:	Director of Research, Department of Radiology	1998-present
	Chairperson, Clinical Research Committee	2000-02
	Research Faculty Council	2000-02
	HSS Research Council	2004-present
	By-Laws Committee	2003-2008
	Educational Curriculum Committee	2003-present
	Authorship Committee	2003-present
	Orthopaedic Clinical Research Panel	2003-present
	Chairperson, Radiology Clinical Pre-review Panel	2003-present
	Board of Trustees	2004-2007
	Development Committee	2004-present
	Research Leadership Committee	2011-present
	Institutional Registry Committee	2011-present

F. ADVISORY BOARDS and NIH/NIAMS STUDY SECTIONS

2005 Member: Scientific Advisory Board – Osteoarthritis Policy Model
Division of Rheumatology, Immunology and Allergy
Brigham & Women's Hospital

2008-12 Consultant, Orthopaedic and Rehabilitation Devices Panel, Medical Devices Advisory Committee and Center for Devices and Radiological Health, Food and Drug Administration, Department of Health and Human Services, Rockville MD

2009 Consultant, Cellular, Tissue and Gene Therapies Advisory Committee, Food and Drug Administration, Rockville/Gaithersburg, MD

2010 Member: International Scientific Advisory Board
Austrian Science Fund
Technical University of Vienna and the Medical University of Vienna

Study Sections
The National Institute of Health (NIH); Skeletal Biology Development and Disease Study Section 2007--2009
NIH (NIAMS); NIAMS Musculoskeletal Disease Research Core Centers Study Section, 2008
NIH (NIAMS BAA), Ancillary and Complementary Research to the Osteoarthritis Initiative, 2009
NIH (NIAMS), Special Emphasis Panel, BRDG-SPAN and Catalyst ARRA, 2009
NIH, Biomedical Imaging Technology, 2010-11
NIH (NIAMS): NIAMS Post Traumatic Osteoarthritis Study Section, 2010
NIH (NIAMS): P50 Center of Research Translation, Special Emphasis Panel Member, 2010
NIH (NIAMS): Ancillary Studies Review Panel (SRO), 2011
The Merit Review Panel for Cellular and Molecular Medicine (CAMM 1), 2011
NIH Medical Imaging Study Section (MEDI) 2012

Working Groups
OARSI FDA Biomarker and Imaging Working Groups, 2008, 2009
OARSI FDA OA Initiative: Assessment of Structural Change Working Group, 2009, 2010

Associate Editor for Imaging, Sports Health (AOSSM)

Editorial Board, Osteoarthritis and Cartilage

Editorial Board, Cartilage (The International Cartilage Repair Society journal)

G. CURRENT CONSULTING RELATIONSHIPS

Consultant	Kensey Nash Corporation Biomet BioMimetic Therapeutic, Inc. (completed 2011) Smith & Nephew (cartilage repair; completed 2011)
Medical Education Consultant	Depuy Orthopaedics, Inc. (completed 2010)
Advisory Board	Kensey Nash Corporation (cartilage repair)

H. HONORS & AWARDS

1980 Phi Beta Kappa

1985 Alpha Omega Alpha

1994 The American Orthopaedic Association Research Award. Montgomery KD, **Potter HG**, Helfet DL. The use of magnetic resonance imaging to evaluate the deep venous system of the pelvis in patients with acetabular fractures.

1994 Gary G. Winzelberg Memorial Research Award. Surgery of the Pelvis and Acetabulum: The Second International Consensus. Montgomery KD, **Potter HG**, Helfet DL. Detection and management of proximal deep venous thrombosis in patients with acute acetabular fractures.

1995 Philip D. Wilson Award for Excellence in Orthopaedic Surgery. Montgomery KD, **Potter HG**, Helfet DL. The use of magnetic resonance imaging to evaluate the deep venous system of the pelvis in patients with acetabular fractures.

1997 Philip D. Wilson Award for Excellence in Orthopaedic Surgery. Simonian PT, Sussmann PS, Wickiewicz TL, **Potter HG**, van Trommel M, Weiland-Holland S, Warren RF. Popliteomeniscal fasciculi and the unstable lateral meniscus.

2000 Philip D. Wilson Award for Excellence in Orthopaedic Surgery. Ryan MG, Westrich GH, **Potter HG**, Maun LM, Sculco, TP, Salvati EA. Effect of mechanical compression on the incidence of proximal deep venous thrombosis as assessed by magnetic resonance venography.

2005 Cabaud Award for Excellence in Basic Science. The American Orthopaedic Society for Sports Medicine. McCarty EC, Glenn E, Juliao SJ, Ho ST, Gordon J, Spindler KP, **Potter HG**. Fresh osteochondral allograft versus autograft: Twelve month results in isolated canine knee defects.

2005 Charles L. Christian Award for Musculoskeletal Research. Campbell SE, Foo LF, Camacho NP, Tamaroff ER, **Potter HG**. Quantitative T_2 mapping and FT-IRIS of intact and enzymatically degraded cartilage: Alterations in structural anisotropy.

2005 Keynote Speaker: 22nd Annual Interim Meeting – Knee Society. MRI of Osteoarthritis: Early Disease Detection to Imaging of Joint Arthroplasty.

2006 Charles L. Christian Award for Musculoskeletal Research. Fung S, Rodeo SA, Williams RJ, Marx R, **Potter HG**. Stratification of cartilage injury following isolated ACL injury.

2006 Distinguished Speaker: Annual Faculty Lecture of the 1st Musculoskeletal and Quantitative Imaging Research Awards. MRI of Cartilage: Injury, degeneration and repair. San Francisco, CA. August 29, 2006

2006 RSNA Certificate of Merit: Choi YS, Potter HG, Chun TJ. MR imaging of cartilage repair in the knee and ankle. 92nd Scientific Assembly & Annual Meeting of the Radiologic Society of North America. November 26 – December 1, 2006.

2007 ABJS Nicholas Andry Award: Salvati EA, Sharrock NE, Westrich G, Potter HG, Gonzalez Della Valle A, Sculco TP. Three decades of clinical, basic and applied research on thromboembolic disease after total hip arthroplasty. The rationale and clinical results of a multimodal prophylaxis protocol.

2008 Keynote Speaker: Forum 2008. Sandy Kirkley Memorial Lecture. MRI of cartilage. Paradise Island, Bahamas. January 19, 2008

2009 The 2009 Littlejohn Lecturer in Comparative Orthopaedics. The University of Missouri Comparative Orthopaedic Laboratory and Department of Orthopaedic Surgery. Magnetic resonance imaging of articular cartilage: trauma, degeneration, and repair. Columbia, Missouri. April 10, 2009.

2010 EFORT Jacques Duparc Award: Kepler C, Green D, Bogner E, Potter HG, Hammoud S. MRI Evaluation of Medial Patellofemoral Ligament Injury after Primary Patellar Dislocation in Children.

2011 Fellow, International Society for Magnetic Resonance in Medicine

2011 Keynote Speaker: ASTM International. What imaging modalities are available for characterizing adverse local tissue reactions in MOM. Anaheim, CA. May 17, 2011

2011 Outstanding Teacher Award. International Society of Magnetic Resonance in Medicine Annual Meeting.

2003-12 New York Magazine's Best Doctors

2011 Charles L. Christian Award for Musculoskeletal Research. Hayter CL, Koff MF, Koch KM, Shah P, Su EP, **Potter HG**. Magnetic Resonance Imaging of Metal on Metal Hip Resurfacing Implants.

2011 Keynote Speaker: The Royal Australian and New Zealand College of Radiologists 62 Annual Scientific Meeting. Melbourne, Victoria, Australia. October 6-9, 2011.

2012 8th Annual Lodwick Award for Excellence in Musculoskeletal Research. Hayter CL, Koff MF, Shah P, Koch KM, Miller TT, Potter HG. MRI After Arthroplasty: Comparison of MAVRIC and conventional Fast Spin Echo Techniques. AJR 2011;197(3):W405-11

I. INSTITUTIONAL AFFILIATION

Primary Hospital:	Hospital for Special Surgery
Other Hospital:	New York Presbyterian Hospital Weill Medical College of Cornell University

J. CURRENT INSTITUTIONAL RESPONSIBILITIES & PERCENT EFFORT

Teaching Experience

Third Year Cornell University Medical Student - Radiology Clerkship - Bone & Joint	1989 - present

Teaching Experience

First - Fourth Year Radiology Residents North Shore University Hospital Cornell University	1989 - 1990
First - Fourth Year Radiology Residents New York Presbyterian Hospital Weill Medical College of Cornell University	1990 - present
First - Fourth Year Orthopaedic Residents Hospital for Special Surgery Weill Medical College of Cornell University	1991 - present
Musculoskeletal MRI Fellows Hospital for Special Surgery Weill Medical College of Cornell University	1995 - present
Orthopaedic Fellows Sports Medicine Shoulder Service Hospital for Special Surgery Weill Medical College of Cornell University	1994 - present

Clinical Care

Chief, MRI Division: Responsible for daily interpretation of cases, protocol changes and case review with clinicians, residents and fellows.

Administrative Duties

Chief, MRI Division: Coordinate the daily function of MR units: scheduling of cases; technologists supervision; hiring of new technologists and support staff; initiation, update and standardization of MRI protocols. Direct the future development of MRI at HSS, including software, coil and hardware acquisition, research and engineering support negotiations with vendors, review of architectural design and engineering requirements for the expanded MRI Center for the Diagnosis of Musculoskeletal Conditions.

Research

Director of Research, Department of Radiology & Imaging: Entails mentoring of fellows and residents in MRI projects. Direct and coordinate all research projects using MR facilities in both clinical and non-clinical models.

Research Coordinator for Imaging, Sports Medicine and Shoulder Service: Guide the utilization of imaging services in study designs, as well as the collection and interpretation of data for all projects using MRI.

Member, Research Council: Multidisciplinary executive council for the Research Division, elected by research professional staff. Acts to review current research policy (both clinical and basic science) at HSS, and make modifications necessary in existing research policy, including issues of space allocation, appointment and promotion, laboratory organization, and authorship.

Percent Effort

Teaching	20%	Administration	20%
Clinical Care	30%	Research	30%

K. <u>RESEARCH SUPPORT</u>

Active

1. NIH/NIBIB Training Grant (1T35EB006732)
   - Clinical Summer Immersion for Biomedical Engineering PhD Students
   The objective of this training project is to provide substantial clinical exposure for biomedical engineering students through a short-term intensive summer immersion program
   Role: Co-investigator; Principle investigator: Yi Wang, PhD

2. NIH/NIAMS (1R01AR057343-01A2)
   $2,092,486.00
   4/1/2010-4/1/2014
   - Designing a Meniscal Substitute Through An Integrated Experimental Computational and Statistical Approach
   The major goal is to define the relationship between meniscal material and structural properties and joint contact mechanics under multiple physiological activities across a range of patient populations.
   Role: Consultant; Principal investigator: Suzanne Maher PhD

4. Cornell University: Clinical Fellowship Program-Pownder
   $80,000
   8/1/10-7/31/12.
   - This is an educational grant to fund a veterinarian scientist in MRI research techniques utilizing preclinical models of tissue engineered constructs, cartilage repair and tendon to bone healing models, specifically using quantitative MRI as a biomarker for tissue integrity.

5. General Electric Health Care
   $1,000,000 1/1/09-12/31/13
   - Research support for orthopaedic applications of MRI
     - T_2 mapping of articular cartilage
     - MR imaging of arthroplasty
     - Segmentation analysis of cartilage
     - UTE imaging

   Role: Principal Investigator: Hollis G. Potter, MD

Completed

1. GE Medical Systems
   Milwaukee, WI
   1996 - 2003
   - Physicist support/Discounts for hardware/software (value approx. $480,000)
     Beta site for testing orthopaedic applications of pulse sequence modification using prototype software and coils.
   - Foundation of first dedicated Applied Science Laboratory of General Electric Medical Systems for Orthopaedics. Involves supervising new pulse sequence design for orthopaedic application, coordination with ASL scientists to devise new coils, and implement software modifications for orthopaedic imaging at three field strengths (0.7T, 1.5T and 3.0T).
   - Responsible for recruitment and hiring of new staff physicist for HSS, to work in conjunction with ASL scientists.
   - 1.5 Tesla surface coil clinical evaluation
     July 1996 - present
     Coordinate prospective comparative study of various prototype phased array design coils versus standardized designs. Supervise all comparative studies, interpret images, and provide report to GE Medical Systems.
     Principal investigator: Hollis G. Potter, MD

2. W.L. Gore and Associates
   Donation of coil (value approx. $10,000)
   July 1996 - January 1997
   MR evaluation of extremities utilizing prototype miniflex coil
   - Evaluate utility of prototype miniflex coil in small part (elbow, midfoot, wrist, etc.) imaging.
     Principal investigator: Hollis G. Potter, MD

3. Innovasive Devices Incorporated
   $42,500
   1997 - 1998
   - Investigate the use of autogenous osteochondral plug transplantation to treat full thickness articular cartilage and osteochondral defects of the knee. Study was performed in a dog model with contralateral subchondral drilling as controls.
     Following sacrifice, histopathologic evaluation was performed as well as biomechanical testing.
     Principal investigator: George A. Paletta, Jr., MD
     Coinvestigators: Jo A. Hannafin, MD PhD, Peter Torzilli, PhD, Hollis G. Potter, MD

4. Soft Tissue Lab
   Hospital for Special Surgery
   $5,000 grant
   September 1995 - 1999
   - Retrospective analysis of meniscal allograft transplantation in the knee joint
     Principal investigator: Scott Rodeo, MD
     Coinvestigators: Hollis G. Potter, MD, Russell F. Warren, MD, Thomas L. Wickiewicz, MD

5. Soft Tissue Lab
   Hospital for Special Surgery
   $2,200 grant
   March 1997 – 2000
   - Coordinate project for reduction of susceptibility artifact in the presence of hemiarthroplasty or total shoulder arthroplasty. Grant was provided for asymptomatic control group.
     Principal Investigator: Hollis G. Potter, MD
     Coinvestigators: John Sperling, MD, Edward V. Craig, MD, Evan Flatow, MD, Russell F. Warren, MD

6. Sulzer Medica
   $ 83,511
   1998 - 1999
   - The effect of bone derived growth factors on tendon healing in a bone tunnel.
     Principal investigator: Scott Rodeo, MD
     Coinvestigators: Kyle Anderson, MD, Kazutaka Izawa, MD, Aruna Seneviratne, MD, Hollis G. Potter, MD

7. The Orthopaedic Research and Education Foundation
   $150,000 grant ($50,000 for 3 years)
   October 1998 - September 2000
   - The effect of intraoperative heparin administered during total hip replacement on the incidence of proximal deep vein thrombosis assessed by magnetic resonance venography
     Principal investigator: Geoffrey H. Westrich, MD
     Coinvestigators: Hollis G. Potter, MD, Eduardo Salvati, MD, Nigel Sharrock, MD

8. National Institute of Health (RO1) NIH-NIAMS #R01 AR44482
   $1,400,000
   2001 - 2004
   - Cartilage Damage from Traumatic Impact Loads
     Principal investigator: Peter A. Torzilli, PhD
     Coinvestigators: Hollis G. Potter, MD, Madhu M. Bhargava, PhD, Eleftherios Paschalis, PhD, Stephen B. Doty, PhD, David L. Helfet, MD, Richard Spencer, PhD, MD, A. Robin Poole, PhD, Walter E. Horton, Jr. PhD.

9. NFL Charities Foundation
   $99,800
   7/01 - 7/02
   - Incorporation and function of fresh osteochondral grafts in a canine model
     Principal investigator: Eric C. McCarty, MD
     Coinvestigators: Hollis G. Potter, MD and Kurt Spindler, MD

10. Office of Research and Sponsored Programs
    Weill Medical College of Cornell University
    $75,000
    7/7/01 - 6/30/02
    - A prospective randomized clinical trial comparing bone-patellar tendon bone and semitendinosis and gracilis tendons grafts for anterior cruciate ligament reconstruction
      Principal investigator: Robert Marx, MD
      Coinvestigators: Hollis G. Potter, MD, Russell F. Warren, MD, Edwards C. Jones, MD, MA, Melanie Harrison, MD, MSc, Margaret Peterson, PhD

11. Medical Indemnity Assurance Corporation Grant
    $57,500
    2001 - 2002
    - The genetic factor: Identifying patients at high risk for developing PE after total hip replacement using a genetic screening test
      Principal investigator: Geoffrey H. Westrich, MD
      Coinvestigators: Hollis G. Potter, MD, Eduardo Salvati, MD, Babette B. Weksler, MD

12. Bionix, Inc. and Institute for Sports Medicine Research
    $63,453
    2001 - 2002
    - Aperture fixation in tendon to bone healing in a sheep model
      Principal Investigator: Frank A. Cordasco, MD
      Coinvestigators: Peter A. Torzilli, PhD, Hollis G. Potter, MD, Jo A. Hannafin, MD PhD, Scott A. Rodeo, MD, Beth Shubin-Stein, MD

13. Institute for Sports Medicine Research
    $39,955
    2002 - 2003

- The use of an all-epiphyseal femoral tunnel during anterior cruciate ligament reconstruction in a skeletally immature canine model
  Principal Investigator: Steven C. Chudik, MD
  Coinvestigators: Scott Rodeo, MD, Thomas Wickiewicz, MD, Hollis Potter, MD, Leslie Beasley, MD

14. American Orthopaedic Society for Sports Medicine
    $40,000
    2001 – 2003
    - Meniscal allograft transplantation in the sheep knee: Evaluation of early markers for degenerative change and assessment of surgical timing on articular cartilage deterioration
      Principal Investigator: Bryan T. Kelly, MD
      Coinvestigators: Scott A. Rodeo, MD, Hollis G. Potter, MD, Russell F. Warren, MD, Virginia Kraus, PhD

15. The Aircast Foundation
    $100,000
    2002-2004
    - Meniscal allograft transplantation in the sheep knee: Evaluation of early markers for degenerative change and assessment of surgical timing on articular cartilage deterioration
      Principal Investigator: Bryan T. Kelly, MD
      Coinvestigators: Scott A. Rodeo, MD, Hollis G. Potter, MD, Russell F. Warren, MD, Virginia Kraus, PhD

16. Godsen-Robinson Early Arthritis Fund
    $75,000 for two years
    - Assessment of synovial load and disease progression in early rheumatoid arthritis using contrast enhanced magnetic resonance imaging and power Doppler sonography.
      Principal Investigator: Lisa Varley, MD
      Coinvestigators: Hollis G. Potter, MD, Ronald Adler, MD, PhD, and Lisa Mandl, MD

17. Zimmer Orthopaedic Career Development Award
    $50,000
    07/01/04 – 06/30/05
    - The utility and precision of standard and computerized preoperative planning for primary total hip arthroplasty.
      Principal Investigator: Alejandro González Della Valle, MD
      Coinvestigators: Eduardo Salvati, MD, Hollis G. Potter, MD

18. MacArthur Grant
    $50,000
    2004 - 2007
    - Validation of the use of clinical MR imaging to identify early stage articular cartilage degeneration using bovine explants: Correlation with Fourier transform infrared imaging spectroscopy and histology studies.
      Principal Investigator: Xiao Hong Bi, PhD
      Coinvestigators: Hollis G. Potter, MD, Nancy Camacho, PhD

20. NFL Grant Charities
    $125,000
    2006-8
    - Natural history of chondral and subchondral lesions in the ACL reconstructed knee. Principal Investigator: Riann Palmieri, PhD, ATC

21. Major League Baseball Medical Advisory Committee Grant
    $50,000 2009-2010
    - Adaptive Changes in Symptomatic and Asymptomatic Throwing Shoulders of Elite Baseball Players

22. NIH NIAMS Challenge Grant (RC1AR058255-01)
    $879,393 2009-2012 Project period 09/23/09 - 08/31/11 (with no cost extension to 2012)
    - Evaluation of an MRI Biomarker for Meniscal Repair
      Role: Principal investigator; Matthew Koff PhD, co PI

L. EXTRAMURAL PROFESSIONAL RESPONSIBILITIES

Journal Reviewer

Arthritis and Rheumatism
Clinical Orthopaedics and Related Research
Journal of the American Academy of Orthopaedic Surgeons
Journal of Biomechanics
Osteoarthritis and Cartilage
American Journal of Roentgenology
Journal of Orthopaedic Research
The Journal of Bone and Joint Surgery
The American Journal of Sports Medicine – Principle Reviews List
The Journal of Shoulder and Elbow Surgery
The British Journal of Sports Medicine
Journal of Magnetic Resonance Imaging
Cartilage
Sports Health
Journal of Arthroplasty

Visiting Professorship / Grand Rounds

1. Rheumatology Grand Rounds, Danbury Hospital, Danbury, CT. November 8, 1991.

2. Radiology Grand Rounds, Albert Einstein College of Medicine. New York, NY. February, 1993.

3. Radiology Grand Rounds, North Shore University Hospital. Manhasset, NY. October, 1994.

4. Orthopaedic-Radiology Grand Rounds, St. Barnabas Medical Center. Livingston, NJ. March 1, 1995.

5. Orthopaedic Grand Rounds, US Army Medical Department. West Point, NY. April 7, 1995.

6. Rheumatology Grand Rounds, Hospital for Special Surgery, New York, NY. May 29, 1996.

7. Radiology Grand Rounds, North Shore University Hospital. Manhasset, NY. April 15, 1998.

8. Orthopaedic Grand Rounds. Beth Israel Medical Center. New York, NY. October 14, 1998.

9. Podiatric Grand Rounds. The New York Hospital-Queens, New York, NY. January 12, 1999.

10. Orthopaedic Grand Rounds. New England Baptist Hospital. Boston, MA. May 10, 2000.

11. Visiting Professor for the Combined Grand Rounds of the Departments of Radiology and Orthopaedics. Penn State University. Hershey, PA. October 10, 2002.

12. Radiology Grand Rounds. Long Island Jewish Medical Center. New Hyde Park, NY. April 11, 2002.

13. Orthopaedic Grand Rounds. The New York Orthopaedic Hospital at Columbia Presbyterian. New York, NY. December 12, 2002.

14. Podiatry Grand Rounds. St. Vincent's Hospital. Staten Island, NY. February 12, 2003.

15. Orthopaedic Grand Rounds. Mt. Sinai School of Medicine. New York, NY. April 30, 2003.

16. Orthopaedic Grand Rounds. Lenox Hill Hospital. New York, NY. September 9, 2003.

17. Department of Podiatric Medicine. New York Hospital-Queens. Queens, NY. January 13, 2004.

18. Orthopaedic Grand Rounds. Lenox Hill Hospital. New York, NY. February 7, 2005.

19. Orthopaedic Grand Rounds - Boston University Medical Center. Boston MA. May 18, 2006.

20. Orthopaedic Grand Rounds – Lenox Hill Hospital. New York, NY. January 11, 2007.

21. Visiting Professor,_Mallinckrodt Institute of Radiology – Washington University in St. Louis, School of Medicine – Grand Rounds. St. Louis, MO. April 11-12, 2007.

22. Visiting Professor, Department of Orthopaedic Surgery, University of Pittsburgh, Pittsburgh, PA, September 25-26. 2007.

23. Orthopaedics Grand Rounds, Allegheny General Hospital, Pittsburgh, PA, October 15-16, 2007.

24. Visiting Professor, Department of Radiology, Henry Ford Hospital, Detroit, MI, February 28. 2008.

25. Combined Orthopaedic and Radiology Grand Rounds. Mayo Clinic, Rochester, MN. June 23, 2008.

26. Radiology Grand Rounds, Department of Radiology, Yale School of Medicine, New Haven, CT. February 5, 2009.

27. Orthopaedic Grand Rounds, University of Connecticut Health Center. Farmington, CT. May 21-22, 2009.

28. Rheumatology Grand Rounds, Hospital for Special Surgery. New York, NY. May 27, 2009.

29. Orthopaedic Grand Rounds, University of Oklahoma. Oklahoma City, OK. June 3, 2011

30. Visiting Professor, Sharp Hip Institute for Young Adults. San Diego, CA. June 7, 2011.

31. Visiting Professor, Royal Prince Alfred Hospital. Sydney, Australia. October 11, 2011.

M. BIBLIOGRAPHY

Articles in Professional Peer-Reviewed Journals

1. Naidich JB, Mossey, RT, Zuckerman AM, **Potter HG**. Osteoarthropathy of patients undergoing long-term hemodialysis. Crit Reviews Diag Imag 1989; 29(3):215-244.

2. Gould, ES, Javors BR, Morrison J, **Potter HG**. MR appearance of bilateral periscapular elastofibromas. J Computer Assist Tomog 1989; 13(4):701-703.

3. Gould ES, **Potter HG**, Bober SE. The role of routine percutaneous hip aspirations prior to prosthesis revision. Skeletal Radiol 1990; 19:427-430.

4. Gould ES, **Potter HG**, Huvos A, Furie R, Crystal KC. Arteriovenous malformation of then right lower extremity with associated intraosseous hemangiomatosis (case report). Skeletal Radiol 1991; 20:303-305.

5. Gould ES, Cooper JM, **Potter HG**, Lane L, Cruz-Vetrano W. Giant cell tumor of the hamate one (case report). Skeletal Radiol 1992; 21:335-338.

6. **Potter HG**, Schneider R, Ghelman B, Healey JH, Lane JM. Multiple giant cell tumors and Paget disease of bone: radiographic and clinical correlations. Radiology 1991; 180(1):261-64.

7. **Potter HG**, Moran MC, Schneider R, Sherman CH, Markisz, JA. Magnetic resonance imaging in transient osteoporosis of the hip. Clin Orthop Rel Res 1992; 280:223-229.

8. **Potter HG**, Pavlov H, Abrahams TG. The hallux sesamoid revisited. Skeletal Radiol 1992; 21:437-444.

9. **Potter HG**, Schneider R. Magnetic resonance imaging of the hip. Current Opinion in Orthopaedics 1993; 4:3-11.

10. Miller T, **Potter HG**, McCormack RR. Benign soft tissue masses of the wrist and hand: MRI appearances. Skelet Radiol 1994; 23:327-332.

11. **Potter HG**, Montgomery KD, Heise CW, Helfet DL. Magnetic resonance imaging of acetabular fractures: value in detecting femoral head injury, intraarticular fragments and sciatic nerve injury. Am J Roentgenol 1994; 163:881-886.

12. Deutsch A, Veltri DM, Altchek DW, **Potter HG**, Warren RF, Wickiewicz TL. Symptomatic intraarticular ganglia of the cruciate ligaments of the knee. Arthroscopy 1994; 10(2):219-23.

13. **Potter HG**, Hannafin JA, Morwessel R, DiCarlo E, O'Brien SJ, and Altchek DW. Magnetic resonance imaging of lateral epicondylitis: correlation with surgical and histopathologic findings. Radiology 1995; 196:43-46.

14. Westrich GH, Hannafin JA, **Potter HG**. Isolated rupture and repair of the popliteus tendon. Arthroscopy 1995; 11:628-632.

15. Gusmer PB, **Potter HG**. Imaging of shoulder instability. Clin Sports Med 1995; 14(4):777-795.

16. Laurencin CT, Paletta GA, **Potter HG**, and Wickiewicz TL. Posterior shoulder instability caused by lateral capsular disruption. J Shldr Elbow Surgery 1995; 4:391-394.

17. **Potter HG**, Montgomery KD, Padgett DE, Salvati EA, Helfet DL. Magnetic resonance imaging of the pelvis: new orthopaedic applications. Clin Orthop Rel Res 1995; 319:223-231.

18. Montgomery KD, **Potter HG**, Helfet DL. The use of magnetic resonance imaging to evaluate the deep venous system of the pelvis in patients with acetabular fractures. J Bone Joint Surg 1995; 77(A):1639-1649.

19. **Potter HG**, Rodeo SA, Wickiewicz TL, Warren RF. Magnetic resonance imaging of meniscal allografts: correlation with clinical and arthroscopic outcomes. Radiology 1996; 198:509-514.

20. Montgomery KD, Geerts WH, **Potter HG**, Helfet DL. Thromboembolic complications in patients with pelvic trauma. Clin Orthop Rel Res 1996; 329:68-87.

21. Gusmer PB, **Potter HG**, Schatz J, Wickiewicz TL, Altchek DW, O'Brien SJ, Warren RF. Labral injuries: accuracy of detection with unenhanced MR imaging of the shoulder. Radiology 1996; 200:519-524.

22. Rozbruch SR, Wickiewicz TL, DiCarlo EF, **Potter HG**. Osteonecrosis of the knee following arthroscopic laser meniscectomy. J Arthroscopic and Related Surgery 1996; 12(2):245-250.

23. Moorman CT, Silver SG, **Potter HG,** Warren RF. Proximal rupture of the biceps brachii with slingshot displacement into the forearm. J Bone Joint Surg 1996; 78A(11):1749-1752.

24. Warren RF, **Potter HG**. An intermeniscal fibrous band in a recreational runner. Arthroscopy 1996; 12(3):390-391.

25. Deutsch A, Altchek DW, Veltri DM, **Potter HG**, Warren RF. Traumatic tears of the subscapularis tendon: Clinical diagnosis, magnetic resonance imaging findings, and operative treatment. Am J Sports Med 1997; 25(1):13-22.

26. Gusmer PG, **Potter HG**, Donovan WD, O'Brien SJ. MR imaging of the shoulder after rotator cuff repair. Am J Roentgenol 1997; 168:559-563.

27. Gaary EA, **Potter HG**, Altchek DW. Medial elbow pain in the throwing athlete: MR evaluation. Am J Roentgenol 1997; 168:795-800.

28. **Potter HG**, Weiland AJ, Schatz JA, Paletta GA, Hotchkiss RN. The utility of magnetic resonance imaging in the diagnosis of posterolateral rotatory instability of the elbow. Radiology 1997; 204:185-189.

29. Schatz JA, **Potter HG**, Rodeo SA, Hannafin JA, Wickiewicz TL. Magnetic resonance imaging of anterior cruciate ligament reconstruction. Am J Roentgenol 1997; 169:223-228.

30. Montgomery KD, **Potter HG**, Helfet DL. Detection and management of proximal deep venous thrombosis in patients with acute acetabular fractures. J Orthop Trauma 1997; 11(5):330-336.

31. Simonian PT, Sussmann PS, Wickiewicz TL, **Potter HG**, van Trommel M, Weiland-Holland S, Warren RF. Popliteomeniscal fasciculi and the unstable lateral meniscus: Clinical correlation and MR diagnosis. Arthroscopy 1997; 13(5):590-596.

32. **Potter HG**, Asnis LJ, Weiland AJ, Hotchkiss RN, Peterson MGE, McCormack R, Jr. The utility of high resolution MR imaging in the evaluation of the triangular fibrocartilage complex of the wrist. J Bone Joint Surg 1997; 79(A):1675-1684.

33. van Trommel MF, **Potter HG**, Ernberg LA, Simonian PT, Wickiewicz TL. The use of noncontrast magnetic resonance imaging in evaluating meniscal repair: Comparison with conventional arthrography. Arthroscopy 1998; 14(1):2-8.

34. van Trommel MF, Simonian PT, **Potter HG**, Wickiewicz TL. Different regional healing rates utilizing the outside-to-inside technique for meniscal repair. Am J Sports Med 1998; 26(3):446-452.

35. **Potter HG**, Deland JT, Gusmer PB, Carson E, Warren RF. Magnetic resonance imaging of the Lisfranc ligament of the foot. Foot Ankle Int 1998; 19(7):438-446.

36. **Potter HG**, Linklater JA, Allen AA, Hannafin JA, Haas SB. Magnetic resonance imaging of articular cartilage in the knee: An evaluation with use of fast spin echo imaging. J Bone Joint Surg Am 1998; 80(A):1276-1284.

37. van Trommel MF, Simonian PT, **Potter HG**, Wickiewicz TL. Arthroscopically-aided lateral meniscal repair and reduction of lateral tibial plateau fracture, long term follow-up with MR imaging. The Knee 1998; 5(4):241-244.

38. MacGillivray JD, Fealy S, **Potter HG**, O'Brien SJ. Multiplanar analysis of acromion morphology. Am J Sports Med 1998; 26(6):836-840.

39. Slucky AV, **Potter HG**. Use of magnetic resonance imaging in spinal trauma: indications, techniques and utility. J Am Acad Orthop Surg 1998; 6(3):134-145.

40. Connell DA, **Potter HG**, Sherman M, Wickiewicz TL. Injuries of the pectoralis major muscle: Evaluation with MR imaging. Radiology 1999; 210:785-791.

41. Crockett HC, Wright JM, Madsen MW, Bates JE, **Potter HG**, Warren RF. Sacral stress fracture in a 20 year old NCAA division 1 basketball player after the use of a jumping machine. Am J Sports Med 1999; 27(4):526-528.

42. Connell DA, **Potter HG**, Wickiewicz TL, Altchek DA, Warren RF. High resolution magnetic resonance imaging of superior labral pathology: 102 surgically-confirmed cases. Am J Sports Med 1999; 27(2):208-213.

43. Beredjiklian P, **Potter HG**, Hotchkiss R. Prosthetic radial head components and proximal radial morphology: A mismatch. J Shoulder Elbow Surg 1999; 8(5):471-475.

44. Millett PJ, **Potter HG**, O'Malley MJ. Idiopathic pseudoaneurysm of the dorsalis pedis artery mimicking pigmented villonodular synovitis. Foot Ankle Int 1999; 20(1):42-43.

45. Connell DA, **Potter HG**. Magnetic resonance evaluation of the labral capsular ligamentous complex: A pictorial review. Australasian Radiology 1999; 43:419-426.

46. Salvati EA, Pellegrini Jr. VD, Sharrock NE, Lotke PA, Murray DW, **Potter HG**, Westrich GH. Recent advances in venous thromboembolic prophylaxis during and after total hip replacement. J Bone Joint Surg 2000; 82(A):252-270.

47. **Potter HG**. Posttraumatic and soft tissue dysfunction of the elbow. Clin Orthop 2000; 370:9-18.

48. Anderson K, Seneviratne AM, Izawa K, Atkinson BL, **Potter HG**, Rodeo SA. Augmentation of tendon healing in an intra-articular bone tunnel using a bone growth factor. Am J Sports Med 2001; 29:689-698.

49. Cole BJ, Rodeo SA, O'Brien SJ, Altchek D, Lee D, DiCarlo EF, **Potter H**. The anatomy and histology of the rotator interval capsule of the shoulder. Clin Orthop Rel Res 2001; 390:129-137.

50. Behr CT, **Potter HG**, Paletta GA. The relationship of the femoral origin of the anterior cruciate ligament and the distal femoral physeal plate in the skeletally immature knee. Am J Sp Med 2001; 29(6):781-787.

51. Gonzáles Della Valle A, Piccaluga F, **Potter HG**, Salvati EA, Pusso R. Pigmented villonodular synovitis of the hip. Clin Orthop Rel Res 2001; 388:187-199.

52. Rubel IF, **Potter HG**, Barie P, Kloen P, Helfet DL. Magnetic resonance venography to evaluate deep venous thrombosis in patients with pelvic and acetabular trauma. J Trauma 2001; 51(3):622.

53. Connell DA, Koulouris G, Thorn DA, **Potter HG**. Contrast-enhanced MR angiography of the hand. Radiographics 2002; 22:583-599.

54. Rubel IF, Kloen P, **Potter HG**, Helfet DL. MRI assessment of the posterior wall acetabular wall involvement in traumatic dislocation of the hip in children. Pediatr Radiol 2002; 32:435-439.

55. Tan V, Rothenfluh DA, Beredjiklian PK, **Potter HG**, Weiland AJ. Interosseous-lumbrical adhesions of the hand: Contribution of MR imaging to diagnosis and treatment planning. J Hand Surg Am 2002; 27(4):639-643.

56. **Potter HG**, Weinstein M, Allen AA, Wickiewicz TL, Helfet. Magnetic resonance imaging of the multiple-ligament injured knee. J Orthop Trauma 2002; 16(5):330-339.

57. **Potter HG**, Weiland AJ. Magnetic resonance imaging of triangular fibrocartilage complex lesions. J Hand Surg (Am) 2002; 27(2):363-364.

58. Sperling JW, **Potter HG**, Craig EV, Flatow E, Warren RF. MRI of the painful shoulder arthroplasty. J Shoulder Elbow Surg 2002; 11(4):315-321.

59. Ryan MG, Westrich GH, **Potter HG**, Sharrock N, Maun LM, Macaulay WB, Katkin P, Sculco TP, Salvati EA. Effect of mechanical compression on the incidence of proximal deep venous thrombosis as assessed by magnetic resonance venography. J Bone Joint Surg 2002; 84A(11):1998-2004.

60. Yacoubian SV, Nevins RT, Sallis JG, **Potter HG**, Lorich DG. Impact of MRI on treatment plan and fracture classification of tibial plateau fractures. J Orthop Trauma 2002; 16(9):632-637.

61. Sofka CM, **Potter HG**, Figgie M, Laskin R. Magnetic resonance imaging of total knee arthroplasty. Clin Orthop Rel Res 2003; 406:129-135.

62. Maier CF, Tan SG, Hariharan H, **Potter HG**. T_2 quantitation of articular cartilage at 1.5T. J Magn Reson Imaging 2003; 17(3):358-364.

63. Mintz DN, Tashjian GS, Connell DA, Deland JT, O'Malley M, **Potter HG**. Osteochondral lesions of the talus: A new magnetic resonance grading system with arthroscopic correlation. Arthroscopy 2003; 19(4):353-359.

64. Moorman III CT, Warren RF, Hershman EB, Crowe JF, **Potter HG**, Barnes R, O'Brien SJ, Guettler JH. Traumatic posterior hip subluxation in American football. J Bone Joint Surg 2003; 85A(7):1190-1196.

65. Cook SM, Pellicci PM, **Potter HG**. Use of magnetic resonance imaging in the diagnosis of an occult fracture of the femoral component after total hip arthroplasty. A case report. J Bone Joint Surg 2004; 86A(1):149-153.

66. Nielson JH, Sallis JG, **Potter HG**, Helfet DL, Lorich DG. Correlation of interosseous membrane tears to the level of the fibular fracture. J Orthop Trauma 2004; 18(2):68-74.

67. Benitez CL, Mintz DN, **Potter HG**. MR imaging of sternoclavicular joint trauma: A biomechanical discussion. Clin Imaging 2004; 28(1):59-63.

68. Brown WE, **Potter HG**, Marx RG, Wickiewicz TL, Warren RF. Magnetic resonance imaging appearance of cartilage repair in the knee. Clin Orthop Rel Res 2004; 422:214-223.

69. McCarty EC, Warren RF, Deng XH, Craig EV, **Potter HG**. Temperature along the axillary nerve during radiofrequency-induced thermal capsular shrinkage. Am J Sports Med 2004; 32(4):909-914.

70. Sofka CM, Lin J, Feinberg J, **Potter HG**. Teres minor denervation: Incidence on routine magnetic resonance imaging of the shoulder and clinical relevance. Skeletal Radiol 2004; 33(9):514-8.

71. **Potter HG**, Nestor BJ, Sofka CM, Ho ST, Peters LE, Salvati EA. Magnetic resonance imaging of total hip arthroplasty: Evaluation of periprosthetic soft tissue. J Bone Joint Surg Am 2004; 86:1947-1954.

72. Kelly BL, Shapiro GS, DiGiovanni CW, Buly RL, MD, **Potter HG**, Hannafin JA. Vascularity of the hip labrum: A cadaveric investigation. Arthroscopy 2005; 21(1):3-11.

73. Derksen WJ, Erkan D, **Potter HG**, Lockshin MD. Interferon induced digital artery vasculitis. J Rheumatol 2005; 32(1):191-192.

74. Gardner MK, Yacoubian S, Geller D, Suk M, Mintz D, **Potter H**, Helfet DL, Lorich DG. The incidence of soft tissue injury in operative tibial plateau fractures. J Orthop Trauma 2005; 19(2):79-84.

75. Westrich HG, Salvati EA, Sharrock N, **Potter HG**, Sánchez PM, Sculco TP. The effect of intraoperative heparin administered during total hip replacement on the incidence of proximal deep vein thrombosis assessed by magnetic resonance venography. J Arthroplasty 2005; 20(1):42-50.

76. Cunningham ME, Bueno R, **Potter HG**, Weiland AJ. Closed partial rupture of a common digital nerve in the palm: A case report. J Hand Surg 2005; 30(1):100-104.

77. Mintz DN, Hooper TR, Connell DA, Buly R, Padgett DE, **Potter HG**. Magnetic resonance imaging of the hip: detection of labral and chondral abnormalities using non-contrast imaging. Arthroscopy 2005; 21(4):385-393.

78. Deland JT, de Asla RJ, Sung IH, Ernberg LA, **Potter HG**. Posterior tibial tendon insufficiency: Which ligaments are involved? Foot Ankle Int 2005; 26(6):427-435.

79. Nielson JH, Gardner MJ, Peterson MGE, **Potter HG**, Sallis JG, Helfet DL, Lorich DG. Radiographic measurements do not predict syndesmotic injury in ankle fractures: An MRI study. Clin Orthop Rel Res 2005; 436:216-221.

80. Weiland DE, Walde TA, Leung JSJB, Sychterz CJ, Ho S, Engh CA, **Potter HG**. Magnetic resonance imaging in the evaluation of periprosthetic acetabular osteolysis: A cadaveric study. J Orthop Res 2005; 23(4):713-719.

81. Choi YS, **Potter HG**, Scher DM. A shearing osteochondral fracture of the humeral head following an anterior shoulder dislocation in a child. HSS Journal, 2005; 1(1):100-102.

82. **Potter HG**, Foo, LF, Nestor BJ. What is the role of magnetic resonance imaging in the evaluation of total hip arthroplasty? HSS Journal 2005; 1(1):89-93.

83. Walde TA, Weiland DE, Leung SB, Kitamura N, Synchterz CJ, Engh CA Jr, Claus AM, **Potter HG**, Engh CA Sr. Comparison of CT, MRI, and radiographs in assessing pelvic osteolysis: A cadaveric study. Clin Orthop Rel Res 2005; 437:138-144.

84. Mithoefer K, Williams RJ, Warren RF, **Potter HG**, Spock CR, Jones EC, Wickiewicz TL, Marx RG. Prospective evaluation of the microfracture technique for treatment of articular cartilage lesions in the knee. J Bone Joint Surg 2005; 87(9):1911-1920.

85. Leitzes AH, **Potter HG**, Amaral T, Marx RG, Lyman S, Widmann RF. Reliability and accuracy of MRI scanogram in the evaluation of limb length discrepancy. J Pediatr Orthop 2005; 25(6):747-749.

86. **Potter HG**, Foo LF. Magnetic resonance imaging of articular cartilage: Trauma, degeneration and repair. Am J Sports Med 2006; 34(4):661-677.

87. Sofka CM, **Potter HG**, Adler RS, Pavlov H. Musculoskeletal imaging update: Current applications of advanced imaging techniques to evaluate the early and long-term complications of patients with orthopedic implants. HSS Journal 2006; 2(1):73-77.

88. Glenn RE Jr, McCarty EC, **Potter HG**, Juliao SF, Gordon JD, Spindler KP. Comparison of fresh osteochondral autografts and allografts: A canine model. Am J Sports Med 2006; 34(7):1084-1093.

89. Hurd JL, **Potter HG**, Dua V, Ranawat CS. Sciatic nerve palsy after primary total hip arthroplasty. J Arthroplasty 2006; 21(6):796-802.

90. Kelly BT, **Potter HG**, Deng X, Pearle AD, Turner AS, Warren RF, Rodeo SA. Meniscal allograft transplantation in the sheep knee: evaluation of chondroprotective effects. Am J Sports Med 2006; 34:1464-1477.

91. Mithoefer K, Williams RJ III, Warren RF, **Potter HG**, Spick CR, Jones EC, Wickiewicz TL, Marx RG. Chondral resurfacing of articular cartilage defects in the knee with the microfracture technique. Surgical technique. J Bone Joint Surg 2006; 88(1) Pt 2:294-304.

92. Cohen S, Deodhar A, Kavanaugh A, **Potter HG**, Ruderman E, Shmerling RH, Weissman BN, Weisman M, Winalski C. Extremity magnetic resonance imaging in rheumatoid arthritis. Report of the American College of Rheumatology Extremity MRI Task Force. Arthritis & Rheumatism 2006; 54(4):1034-1047.

93. Shindle MK, Foo LF, Kelly BT, Khanna AJ, Domb BG, Farber A, Wanich T, **Potter HG**. Magnetic resonance imaging of cartilage in the athlete: Current techniques and spectrum of disease. J Bone Joint Surg 2006; 88A(4):27-46.

94. Purdue PE, Koulouvaris P, **Potter HG**, Nestor BJ, Sculco TP. The cellular and molecular biology of periprosthetic osteolysis. Clin Orthop Rel Res 2007; 454:251-61.

95. Kelly BT, Robertson W, **Potter HG**, Deng XH, Turner AS, Lyman S, Warren RF, Rodeo SA. Hydrogel meniscal replacement in the sheep knee: Preliminary evaluation of chondroprotective effects. Am J Sports Med 2007; 35(1):43-52.

96. Williams III, RJ, Warner KK, Petrigliano FA, **Potter HG**, Hatch J, Cordasco FA. MRI evaluation of isolated arthroscopic partial meniscectomy patients at a minimum five-year follow-up. HSS Journal 2007; 3(1):35-43.

97. Williams R III, Ranawat A, Carter, T, **Potter HG**. Fresh stored allografts for the treatment of osteochondral defects of the knee. J Bone Joint Surg 2007; 89(4):718-726.

98. Kang L, Rosen A, **Potter HG**, Weiland AJ. Rupture of the radial collateral ligament of the index metacarpophalangeal joint: Diagnosis and surgical treatment. J Hand Surg 2007; 32(6):789-794.

99. Salvati EA, Sharrock NE, Westrich G, **Potter HG**, Della Valle AG, Sculco TP. Three decades of clinical, basic and applied research on thromboembolic disease after THA: Rationale and clinical results of a multimodal prophylaxis protocol. Clin Orthop Rel Res 2007; 459:246-254.

100. **Potter HG**, Jawetz ST, Foo, LF. Imaging of the rotator cuff following repair: Human and animal models. J Shldr Elb Surg 2007; 16(5): 134-139S.

101. Rodeo SA, **Potter HG**, Kawamura, S, Turner AS, Kim, HJ, Atkinson, BL. Biologic augmentation of rotator cuff tendon healing using a mixture of osteoinductive growth factors: an experimental study in sheep. J Bone Joint Surg(Am) 2007; 89: 2485-97.

102. Choi YS, Cohen NA, **Potter HG** and Mintz D. Magnetic resonance imaging in the evaluation of osteochondritis dissecans of the patella. Skeletal Radiol 2007; 36(10): 929-93

103. Chudik S, Beasley L, **Potter HG**, Wickiewicz T, Warren R, Rodeo S. The influence of femoral tunnel technique on acute anterior cruciate ligament reconstruction in a skeletally immature canine model. Arthroscopy 2007; 23(12): 1309-1319.

104. Ghlove PA, Voellmicke KV, Guven M, **Potter HG**, Rodeo SA, Widmann RF. Arthrofibrosis of the knee following tibial spine fracture in children: A report of two complicated cases. HSS Journal 2008, 4: 14-19.

105. Choi YS, **Potter HG** and Chun TJ. Magnetic resonance imaging of cartilage repair in the knee and ankle. RadioGraphics 2008; 28:143-1059.

106. Dines JS, Fealy S, **Potter HG** and Warren RF. Outcomes of osteochondral lesions of the knee repaired with a bioabsorbable device. Arthroscopy 2008; 24(1):62-8.

107. Nho SJ, Foo LF, Green DM, Shindle MK, Warren RF, Wickiewicz TL, **Potter HG**, Williams III, RJ. MRI and Clinical Evaluation of patella resurfacing with press-fit osteochondral autograft plugs. Am J Sports Med 2008; 36(6):1101-1109.

108. Ballyns JJ, Gleghorn JP, Niebrzydowski V, Rawlinson J, **Potter HG**, Maher SA, Wright TM, Bonassar LJ. Image guided tissue engineering of anatomically shaped implants via MRI and micro-CT using injection molding. Tissue Engineering 2008;14(7):1195-1202.

109. Malchau H, **Potter HG**. How are wear-related problems diagnosed and what form of surveillance are necessary? J Amer Acad Orthop Surg 2008; 16(1): S14-S19.

110. Sofka CM, Ciavarra GA, Hannafin JA, Cordasco FA, **Potter HG**. Magnetic resonance imaging of adhesive capsulitis: correlation with clinical staging. HSS J 2008; 4(2):164-9.

111. Cooper JH, Ranawat AS, **Potter HG,** Foo LF, Jawetz ST, Ranawat CS. Magnetic Resonance Imaging in the diagnosis and management of wear-induced periprosthetic inflammation and osteolysis following total hip arthroplasty. J Arthroplasty 2009;24(5):661-7.

112. **Potter HG**, Chong LR. Magnetic resonance imaging assessment of chondral lesions and repair. J Bone Joint Surg (A) 2009; 91:126-31.

113. Pellicci PM, **Potter HG,** Foo LL, Boettner F. MRI shows biologic restoration of posterior soft tissue repairs after THA. Clin Orthop Relat Res, 2009; 467:940–945.

114. Crawford DC, Heveran CM, Cannon WD, Foo LF, **Potter HG**. Autologous Cartilage Tissue Implant (ACTI) NeoCart & [reg] for Treatment of Grade III Chondral Injury to the Femur. Prospective Clinical Safety Trial at 2 Years. Am J Sports Med, 2009; 37:1334-43.

115. Scanzello CR, Umoh E, Pessler F, Diaz-Torne C, Miles T, Dicarlo E, **Potter HG**, Mandl L, Marx R, Rodeo S, Goldring SR, Crow MK. Local cytokine profiles in knee osteoarthritis: elevated synovial fluid interleukin-15 differentiates early from end-stage disease. Osteoarthritis Cartilage. 2009;17(8):1040-8.

116. Lonner JH, Fehring TK, Hanssen AD, Pellegrini Jr VD, Padgett DE, Wright TM, **Potter HG**. Revision total knee arthroplasty: the preoperative evaluation. J Bone Joint Surg 2009; 91 (5):64-8.

117. Drakos MC, Rudzki JR, Allen AA, **Potter HG**, Altchek DW. Internal impingement of the shoulder in the overhead athlete. J Bone Joint Surg Am 2009; 91:2719-2728.

118. **Potter HG**, Schachar J. High resolution noncontrast MRI of the hip. J Magn Reson Imaging 2010; 31:268-278.

119. Dodson CC, Bedi A, Sahai A, **Potter HG**, Cordasco FA. Complete rotator cuff tendon avulsion and glenohumeral joint incarceration in a young patient: a case report. J Should Elbow Surg 2010;19(2):e9-e12.

120. Bedi A, Foo LF, Williams RJ, **Potter HG.** The Maturation of Synthetic Scaffolds for Osteochondral Donor Sites of the Knee: An MRI and T2-Mapping Analysis. Cartilage 2010; 1: 20-28.

121. Ballyns J, Cohen D, Malone E, Maher S, **Potter HG**, Wright T, Lipson H, Bonassar L. An optical method for evaluation of geometric fidelity for anatomically shaped tissue engineered constructs. Tissue Engineering. Part C, Methods 2010;16(4):693-703..

122. Koff MF, Chong LR, Virtue P, Chen D, Wang X, Wright T, **Potter HG**. Validation of cartilage thickness calculations using indentation analysis. J Biomechanical Engineering 2010; 132:041007,1-6.

123.Vasanth LC, Foo LF, **Potter HG**, Adler RS, Finzel KC, Pavlov H, Mandl LA. Using Magnetic Resonance Angiography to Measure Synovial Blood Vessels in Early Inflammatory Arthritis. J. Rheumat 2010; 37 (6): 1129-35.

124.Fortier LA., **Potter HG**., Rickey E.J, Schnabel LV., Ellsworth JR., Foo LF., Nixon A. Concentrated bone marrow aspirate improves full-thickness cartilage repair. Journal of Bone and Joint Surgery 2010; 92;1927-1937.

125.Minwook K., Foo LF., Uggen C., Lyman S., Ryaby JT., Moynihan DP., Grande DA, **Potter HG.**, Pleshko N. Evaluation of Early Osteochondral Defect Repair in a Rabbit Model Utilizing Fourier Transform–Infrared Imaging Spectroscopy, Magnetic Resonance Imaging, and Quantitative T2 Mapping. Tissue Engineering Part C: Methods. 2010; 16: 355-364.

126.Cooper J, Ranawat A, **Potter HG,** Koob T, Foo LF. Early Reactive Synovitis and Osteolysis after Total Hip Arthroplasty. Clin Orthop Relat Res 2010; 468(12): 3278-3285.

127.Drakos MC , Barker JU , Osbahr DC , Lehto S , Ruzki JR, **Potter HG**, Coleman SH, Allen AA, Altchek DW. Effective Glenoid Version in Professional Baseball Players. American Journal of Orthopedics 2010; 39(7):340-344.

128. Koff MF, Chong LR, Virtue P, Ying LL, Gholve P, Widmann R, **Potter HG.** Correlation of MRI and histological examination of physeal bars in a rabbit model. Journal of Pediatric Orthopaedics 2010;30(8):928-35.

129.Maher SA, Rodeo SA, Doty SB, Brophy R, **Potter HG,** Foo LF, Rosenblatt L, Deng X-H, Turner AS, Wright TM, Warren RF. Evaluation of a Porous Polyurethane Scaffold in a Partial Meniscal Defect Ovine Model. Arthroscopy 2010;26(11):1510-9.

130.Koch KM, Brau AC, Chen W, Gold GE, Hargreaves BA, Koff M, McKinnon GC, **Potter HG**, King KF. Imaging near metal with a MAVRIC-SEMAC hybrid. Magn Reson Med. 2011; 65(1):71-82.

131.Trattnig S, Winalski CS, Marlovits S, Jurvelin JS, Welsch GH, **Potter HG**. Magnetic Resonance Imaging of Cartilage Repair: A Review. Cartilage 2011; 2(1):5-26

132.Endo Y, Shubin Stein BE, **Potter HG**. Radiologic assessment of patellofemoral pain in the athlete. Sports Health 2011; 3(2): 195-210.

133.Maher SA, Rodeo SA, **Potter HG**, Bonassar, LJ, Wright TM Warren RF. A Pre-Clinical Test Platform for the Functional Evaluation of Scaffolds for Musculoskeletal Defects: The Meniscus. HSS J 2011;7(2):157-163.

134.Noyes FR, Chen RC, Westin SB, **Potter HG**. Greater than 10-year results of red-white longitudinal meniscus repairs in patients 20 years of age or younger. Am J Sports Med 2011;39(5):1008-17.

135. Kepler CK, Bogner EA, Hammoud S, Malcolmson G, **Potter HG**, Green DW. Zone of Injury of the Medial Patellofemoral Ligament After Acute Patellar Dislocation in Children and Adolescents. Am J Sports Med 2011;39(7):1444-9

136. Hayter CL, Koff MF, Shah P, Koch KM, Miller TT, Potter HG. MRI After Arthroplasty: Comparison of MAVRIC and conventional Fast Spin Echo Techniques. AJR 2011;197(3):W405-11.

137. Ranawat CS, Meftah M, **Potter HG**, Ranawat AS. The posterior approach in THR: assuring capsular stability. Orthopedics. 2011; 34(9):e452-5.

138. Potter HG. Commentary on an article by Richard B. Frobell, PhD: "Change in cartilage thickness, posttraumatic bone marrow lesions, and joint fluid volumes after acute ACL disruption: a two-year prospective MRI study of sixty-one subjects". J Bone Joint Surg 2011; 93(12):e71(1-2)

139. Hash TW, Maderazo AB, Haas SB, Saboeiro GR, Trost DW, **Potter HG**. Magnetic Resonance Angiography in the Management of Recurrent Hemarthrosis Following Total Knee Arthroplasty. Journal of Arthroplasty 2011; 26(8): 1357-1361.

140. Bowers AL, Bedi A, Lipman JD, **Potter HG**, Rodeo SA, Pearle AD, Warren RF, Altchek DW. Comparison of Anterior Cruciate Ligament Tunnel Position and Graft Obliquity With Transtibial and Anteromedial Portal Femoral Tunnel Reaming Techniques Using High-Resolution Magnetic Resonance Imaging. Arthroscopy. 2011;27(11):1511-22

141. **Potter HG**, Jain SK, Ma Y, Black BR, Fung S, Lyman S. Cartilage injury following acute, isolated ACL tear: Immediate and longitudinal effect with clinical/MRI follow up. Am J Sports Med. 2012 Feb;40(2):276-85.

142. Barber L, Koff MF, Virtue P, Lipman JP, Hotchkiss RJ, **Potter HG**. The use of MRI modeling to enhance osteochondral transfer in segmental Kienböck's. Cartilage 2012 3: 188-193.

143. Potter HG, Koff MF. MR Imaging Tools to Assess Cartilage and Joint Structures. HSS Journal 2012; 8(1): 29-32.

144. Hayter CL, Koff MF, **Potter HG**. Magnetic resonance imaging of the postoperative hip. J Magn Reson Imaging 2012 35(5):1013-25.

145. Hayter C, **Potter HG**. Magnetic Resonance Imaging of Cartilage Repair Techniques. Journal of Knee Surgery 2011, *in press*.

146. Heyse TJ, Chong LR, Davis J, Boettner F, Haas SB, **Potter HG**. MRI analysis of the component-bone interface after TKA. Knee 2011, *in press.*

147. Heyse TJ, Chong LR, Davis J, Haas SB, Figgie M, **Potter, H**. MRI diagnosis of patellar clunk syndrome following Total Knee Arthroplasty. HSS Journal 2011, *in press.*

148.Murakami AM, Hash TW, Hepinstall MS, Lyman S, Nestor BJ, **Potter HG**. Magnetic resonance imaging evaluation of rotational alignment and synovitis in painful total knee arthroplasty. J Bone Joint Surg, Br. 2012, *in press.*

149. Gold SL, Burge AJ, **Potter HG**. MRI of Hip Cartilage: Joint Morphology, structure and composition. Clin Orthop Rel Res 2012, *in press.*

150. Burge AJ, Gold SL, **Potter HG**. Imaging of sports-related midfoot and forefoot injuries. Sports Health 2012, *in press.*

151. Kwon YM, Jacobs JJ, Macdonald SJ, **Potter HG**, Fehring TK, Lombardi AV. Evidence-based understanding of management perils for metal-on-metal hip arthroplasty patients. J Arthroplasty. 2012, *in press.*

Books & Book Chapters

1. **Potter HG**, Ghelman B. Radiographic evaluation. In: Sculco, Thomas Ed. Surgical Treatment of Rheumatoid Arthritis. Philadelphia: CV Mosby, 1992; 23-43.

2. Schneider R, **Potter HG**. Diagnostic imaging techniques. In: Paget, Stephen, Ed. Manual of Rheumatology and Outpatient Orthopaedic Disorders. Boston: Little, Brown; 1993; 23-32.

3. Pavlov H, **Potter HG**. Imaging techniques applicable to athletically induced cervical spine trauma. Op Tech Sports Med 1993; 1:169-182.

4. Miller TT, Ghelman B, **Potter HG**: "Imaging of the Foot and Ankle". In: Nicholas, JA, and Hershman EB Eds. The Lower Extremity and Spine in Sports Medicine, 2nd edition. Mosby - Year Book, Inc. St. Louis, Mo., 1995; 385-409.

5. Math KR, Ghelman B, and **Potter HG**. Imaging of the Patellofemoral Joint. In: Scuderi, G, Ed. The Patella. New York: Springer-Verlag; 1995, 83-125.

6. **Potter HG**, Gusmer PB. Imaging of the elbow and shoulder. Current Opinion in Orthopaedics 1995; 6(IV):63-69.

7. **Potter HG**, Gusmer PB. Imaging of collateral ligament injuries of the knee. Op Tech Sports Med 1996; 4(3):158-165.

8. Montgomery KD, Geerts WH, **Potter HG**, Helfet DL. Thromboembolic complications in patients with pelvic trauma. Clin Orthop 1996; 329:68-87.

9. **Potter HG**, Schweitzer ME, Altchek DW. Advanced imaging in orthopaedics: current pitfalls and new applications. American Academy Orthopaedic Surg Instructional Course Lectures 1997; 46:521-529.

10. Montgomery KD, Geerts WH, **Potter HG**, Helfet DL. Practical management of venous thromboembolism following pelvic fractures. Orthop Clin North Am 1997; 28(3):397-404.

11. Leigh AC, **Potter HG**, and Wickiewicz TL. Thigh and knee injuries. In: Halpern B, Herring SA, Altchek D, Herzog R, Eds. Imaging in Musculoskeletal and Sports Medicine. Oxford: Blackwell Science 1997; 209-235.

12. Linklater J, **Potter HG**. Imaging of chondral defects. Op Tech Orthopaedics 1997; 7(4):279-288.

13. Decker MJ, **Potter HG.** Current concepts in MR imaging of the elbow and wrist. Applied Radiology 1998; April 27-36.

14. Linklater J, **Potter HG**. Emergent musculoskeletal MRI. Topics in Magnetic Resonance Imaging 1998; 9(4):1-23.

15. Slucky A, **Potter HG**. Use of magnetic resonance imaging in spinal trauma: Indications, Techniques, and Utility. J Am Acad Orthop Surg 1998; 6(3):134-145.

16. **Potter HG**, Math KR. Magnetic Resonance Imaging of the Hip. In: Callaghan J, Rosenberg A, Rubash H, Eds. The Adult Hip. Philadelphia: Lippincott-Raven, 1998; 393-408.

17. **Potter HG**. Radiographic Assessment of Shoulder Instability: MRI. In: Warren RF, Craig EV, and Altchek DW, Eds. The Unstable Shoulder. Philadelphia: Lippincott-Raven, 1999; 121-131.

18. **Potter HG.** Imaging Beyond Conventional Radiology. In: Beaty JH, Ed. Orthopaedic Knowledge Update 6. Rosemont, IL: American Academy of Orthopaedic Surgeons, 1999; 81-87.

19. Pavlov H, **Potter HG**, Ditchek J, Schneider R. Imaging of the Hindfoot and Ankle. In: Ranawat CS, and Positano RG, Eds. Disorders of the Heel, Rearfoot, and Ankle. Philadelphia: Churchill Livingstone, 1999; 19-57.

20. **Potter HG**. Imaging of the multiple ligament injured knee. In: Johnson DL, Ed. Clinics in Sports Medicine. Philadelphia: WB Saunders, 2000; 19(3):425-441.

21. **Potter HG**. Imaging. In: Rosenberg AG, Mabrey JD, Woolson ST, and Cole B, Eds. The Arthritic Knee (CD-ROM). Rosemont, IL: American Academy of Orthopaedic Surgeons, 2000.

22. **Potter HG**. Alternative Treatments for The Arthritic Knee: Cartilage Transplantation. Utility of Magnetic Resonance Imaging. In: The Arthritic Knee (CD-ROM). B. Cole, MD, Ed. Rosemont, IL: American Academy of Orthopaedic Surgeons, 2000.

23. **Potter HG**. Imaging. In Pellicci P, Tria AJ, and Garvin KL, Eds. Orthopaedic Knowledge Update. Hip and Knee Reconstruction 2. American Academy of Orthopaedic Surgeons. Rosemont, IL 2000; 75-81.

24. **Potter HG**. Magnetic resonance imaging of the unstable shoulder. Techniques in Shoulder and Elbow Surgery 2000; 1(1):25-38.

25. Hooper TR and **Potter HG**. Imaging of chondral defects. Operative Techniques in Orthopaedics. 2001; 11(2):76-82.

26. **Potter HG**, Sofka CM. Imaging of the athlete's elbow. In: Altchek DW and Andrews J, Eds. The Athlete's Elbow. Philadelphia: Lippincott Raven, 2001; pp. 59-80.

27. Sofka CM, **Potter HG**. Magnetic resonance imaging of the wrist. Semin Musculoskelet Radiol 2001; 5(3):217-226.

28. Sofka CM, **Potter HG**. MR imaging of joint arthroplasty, In: Karasick D, Schweitzer ME, White LM, Eds. Semin Musculoskelet Radiol. New York: Thieme, March 2002, Vol. 6(1), pp 79-85.

29. **Potter HG**, Sharon S, Adler RS. Imaging of the hip in athletes. Sports Medicine & Arthroscopy Review. Philadelphia: Lippincott Williams & Wilkins, 2002; 10:115-122.

30. Sofka CM, **Potter HG**. Imaging of elbow injuries in the child and adult athlete. In: Steinbach LS, Dudlick B, Eds. Radiologic Clinics of North America. Philadelphia: W.B. Saunders Co., 2002; 40(2):251-265.

31. **Potter HG**, Sofka CM, Hooper TR. Imaging of the adult knee. In: Callaghan JJ, Rosenberg AG, Rubash HE, Simonian PT and Wickiewicz TL, eds. The Adult Knee. Philadelphia, PA: Lippincott Williams & Wilkins, Dec. 2003 Vol. 2, pp. 355-366.

32. Kanstrup I, **Potter HG**. Imaging of sports injuries. In: Kjaer M, Krogsgaard, Magnusson, Engebretsen L, Roos H, Takala T and Woo SLY, eds. Textbook of Sports Medicine. Basic Science and Clinical Aspects of Sports Injury and Physical Activity. Malden, MA: Blackwell Science, Ltd. 2003, pp 501-526.

33. Ernberg LA, **Potter HG**. Radiographic evaluation of the acromioclavicular and sternoclavicular joints. Clin Sports Med 2003 Apr; 22(2):255-75.

34. Kaplan LJ, **Potter HG**. Magnetic resonance imaging of ligament injuries to the elbow. In: J. Beltran, Ed. MR Imaging of the Upper Extremity. Magn Reson Imaging Clin N Am. Philadelphia, PA. W.B. Saunders. 2004; Vol. 12(2), pp 221-232.

35. **Potter HG**, Ho S, Altchek DW. MRI of the elbow. In: Sports Injuries: **Potter HG**, Guest Editor, Karasick and Schweitzer, Eds. Seminars in Musculoskeletal Radiology. New York, NY. Thieme. 2004; Vol. 8(1), pp 5-16.

36. **Potter HG**, Birchansky SB. MRI of the shoulder: A tailored approach. In: Warren R.F., and Craig E., Eds. Optimizing MRI Techniques in Evaluation of Shoulder Disorders. Techniques in Shldr & Elb Surg. Philadelphia: Lippincott Williams & Wilkins; 2005:6(1), 43-56.

37. Sofka CM, **Potter HG**. Knee. In: Edelman, Hesselink and Zlatkin, Eds. Clinical Magnetic Resonance Imaging. 3rd Edition. Philadelphia, PA. Saunders/Elsevier, Inc; 2006: Vol 3(103), pp 3400-3435.

38. **Potter HG**, Foo LF. Magnetic resonance imaging of joint arthroplasty. Orthop Clin North Am 2006; 37(3):361-373.

39. Kaplan LJ, **Potter HG**. MR imaging of ligament injuries to the elbow. Radiol Clin North Am 2006; 44(4):583-594.

40. **Potter HG**, Tsou I. The adult hip: Magnetic resonance imaging. In: Callaghan, Rosenberg and Rubash, Eds. The Adult Hip, 2nd Edition, Vol. 1. Philadelphia: Lippincott Williams Wilkins, 2007; pp 409-422.

41. **Potter HG**, Foo LF. MRI of articular cartilage. In: Stoller DW, Ed. Magnetic Resonance Imaging in Orthopaedics and Sports Medicine, 3rd Edition. Philadelphia: Lippincott Williams and Wilkins, 2007; pp 1099-1130.

42. Sofka CM, **Potter HG.** Magnetic resonance imaging of athletic hip pain. Operative Techniques in Sports Medicine 2007; 15:157-164.

43. Black BR, Chong LR, **Potter HG**. Cartilage imaging in sports medicine. Sports Imaging and Arthroscopy Review 2009;17(1):68-80.

44. **Potter HG**, Chong LR, Sneag D. Magnetic Resonance Imaging of cartilage repair. Sports Med Arthrosc Rev, 2008;16(4):236-45.

45. **Potter HG,** Black BR, Chong LR. New techniques in articular cartilage imaging. Clinics in Sports Medicine 2009; 28:77-94.

46. Koff MF, **Potter HG.** Noncontrast MR Techniques and Imaging of Cartilage. Radiol Clin North Am. 2009; 47(3):495-504.

47. Shindle MK, Foo LF, Kelly BT, **Potter HG**. Articular cartilage. In: Khanna AJ, ed. Musculoskeletal MRI: Essentials for the Orthopaedic Surgeon. New York: Thieme; 2010; pp 353-369.

48. **Potter HG**, Schachar J, Jawetz S. Imaging of the elbow. Operative Techniques in Orthopaedics 2009;19:199-208.

49. Hash TW, **Potter HG.** Imaging of the throwing athlete. In: Dines JM, ElAttrache NS, Yocum LA, Altchek DW, Andrews J, Wilk KE, ed. Sports Medicine of Baseball. Philadelphia: Lippincott Williams and Wilkins, 2010, *in press.*

50. Jacobson JA, Holsbeeck MT, Cohen HL, Alvarez GE, Davis KW, Fessell DP, Kransdorf MJ, Lee KW, Morrisson WB, Oh TC, **Potter HG**, Romagnoli C, Schooley BM, Schweitzer ME, Steinbach LS, Vanderschueren GM, Zoga AC. Bone Disease V. Reston, VA: American College of Radiology; 2010; 53.

51. Hayter CL, **Potter HG**, Su EP. Imaging of Metal-on-Metal Hip Resurfacing. Orthop Clin N Am 2011; 42 195–205

52. **Potter HG**, Barrack RL. Imaging of the Hip and Knee. In: Glassman AH, Lachiewicz PF, Tanzer M, Ed. Orthopaedic knowledge update: Hip and knee reconstruction, Fourth edition. Rosemont, IL: American Academy of Orthopaedic Surgeons. 2011; 3-16.

53. Burge A, Gold SL, Kuong S, Potter HG. High resolution MR imaging of the lower extremity nerves. Neuroimaging Clinics 2012, *in press.*

Posters

1. Math KR, Katz DS, Ghelman B, **Potter HG**, Scuderi GR. The Patella: Anatomy, Position, Variants and Pathology. 81st Scientific Assembly and Annual Meeting of the Radiologic Society of North America. Chicago, IL. November 27, 1995. Awarded Certificate of Merit.

2. Page AE, O'Malley MJ, Deland JT, **Potter HG**. High Resolution Magnetic Resonance Imaging of the Forefoot. Annual Meeting of the American Academy of Orthopaedic Surgeons. Atlanta, GA. February 22, 1996.

3. Allen AA, Anisko EM, Panariello R, **Potter HG**, O'Brien SJ. Natural History and Co-Morbidity of the "Isolated" Medial Collateral Ligament Injury. 2nd World Congress on Sports Trauma/AOSSM 22nd Annual Meeting. Lake Buena Vista, FL. June 16, 1996.

4. Allen AA, Anisko EM, Panariello R, **Potter HG**, O'Brien SJ. Natural History and Co-Morbidity of the "Isolated" Medial Collateral Ligament Injury. 2nd World Congress on Sports Trauma/AOSSM 22nd Annual Meeting. Lake Buena Vista, FL. June 16, 1996.

5. Campbell BG, O'Malley BB, Jain S, Souweidane MM, **Potter HG**. Complications of epidural catheters and other paraspinal procedures. 83rd Scientific Assembly and Annual Meeting of the Radiologic Society North America. Chicago, IL. November 30 - December 5, 1997.

6. Shapiro GS, DiGiovanni W, Kelly BT, Hannafin JA, Buly R, **Potter H**, Warren RF. Vascularity of the Hip Labrum. Eastern Orthopaedic Association – 13th Anniversary Meeting. Vienna, Australia. October 13-17, 1999.

7. Coleman SH, O'Malley, **Potter HG**, Rao, R. Osteochondral lesions of the talus: functional outcome of forty-two cases based on treatment. Eastern Orthopaedic Association – 13th Anniversary Meeting. Vienna, Australia. October 13-17, 1999.

8. Coleman SH, O'Malley, **Potter HG**, Rao, R. Osteochondral lesions of the talus: functional outcome of forty-two cases based on treatment. Eastern Orthopaedic Association – 13th Anniversary Meeting. Vienna, Australia. October 13-17, 1999.

9. Macaulay W, **Potter HG**, Westrich GH, Saleh KJ, Sculco TP, Palmer K, Salvati EA. The incidence of early proximal venous thrombosis after total hip arthroplasty assessed by magnetic resonance venogram. American Academy of Orthopaedic Surgeons – 67th Annual Meeting Proceedings. Orlando FL. March 15-19, 2000.

10. Koh JL, **Potter HG**, Buly RL, Haas SB, Warren RF. Autologous chondrocyte implantation (ACI) of the knee: Early results. American Academy of Orthopaedic Surgeons – 67th Annual Meeting Proceedings. Orlando FL. March 15-19, 2000.

11. Coleman SH, **Potter HG**, Deland JT, O'Malley MJ. Osteochondral lesions of the talus: A correlation between operative treatment and clinical outcome using a new cartilage grading system. American Academy of Orthopaedic Surgeons – 67th Annual Meeting Proceedings. Orlando FL. March 15-19, 2000.

12. Tolo, ET, Weiland AJ, Altchek DW, **Potter HG**. Closed rupture of the flexor tendon pulleys in professional baseball pitchers. American Academy of Orthopaedic Surgeons – 68th Annual Meeting Proceedings. San Francisco, CA. February 28 – March 1, 2001.

13. Nielson JH, Sallis JG, **Potter HG**, Helfet DL, Lorich DG. Unsuspected ligamentous injuries in ankle fractures. American Academy of Orthopaedic Surgeons – 68th Annual Meeting Proceedings. San Francisco, CA. February 28 – March 1, 2001.

14. Ertl W, **Potter HG**, Helfet DL. Long-term follow-up of inferior vena cava filters in patients treated operatively for acetabular fractures: Minimum of 2 years. American Academy of Orthopaedic Surgeons – 68th Annual Meeting Proceedings. San Francisco, CA. February 28 – March 1, 2001.

15. Sofka C, Weinstein M**, Potter HG**. MRI of the multiple ligament injured knee. International Society for Magnetic Resonance in Medicine. Joint Annual Meeting. Glasgow, Scotland. April 21-27, 2001.

16. Petrigliano F, **Potter HG**, Hatch J, Williams RJ. Functional outcome and MRI evaluation of arthroscopic partial meniscectomy patients at a minimum five year follow-up. American Orthopaedic Society for Sports Medicine. Keystone, CO. June 28 – July 1, 2001.

17. Coleman S, Malizia R, **Potter HG**, MacGillvray J, Warren RF. Treatment of isolated articular cartilage lesions of the medial femoral condyle. A clinical and MR comparison of autologous chondrocyte implantation vs. microfracture. American Orthopaedic Society for Sports Medicine. Keystone, CO. June 28 – July 1, 2001.

18. Katkin PD, Maun LM, **Potter HG**, Ryan M, Salvati EA, Sculco TP, Shamrock NE, Westrich GH. Effect of incidence of proximal deep venous thrombosis as assessed by magnetic resonance venography. American Academy of Orthopaedic Surgeons – 69th Annual Meeting Proceedings. Dallas, TX. February 13-17, 2002.

19. Padgett DE, Hamilton WG, Marshall P, Molnar M, **Potter HG**. The flexion adduction sign in hip labral pathology. American Academy of Orthopaedic Surgeons – 69th Annual Meeting Proceedings. Dallas, TX. February 13-17, 2002.

20. Petrigliano FA, Williams RJ, **Potter HG**, Hatch J, Malazia R. Functional outcome and MRI evaluation arthroscopic partial meniscectomy patients at a minimum 5-year follow-up. American Academy of Orthopaedic Surgeons – 69th Annual Meeting Proceedings. Dallas, TX. February 13-17, 2002.

21. Maier CF, Tan SG, Hariharan H, **Potter HG**. T_2 quantification of articular cartilage at 1.5T. International Society for Magnetic Resonance in Medicine. Honolulu, Hawaii. May 18-24, 2002.

22. Buly R, Zelken J, Nofsinger C, Koh J, **Potter H**. Arthroscopic debridement of acetabular labral tears. American Academy of Orthopaedic Surgeons – 70th Annual Meeting Proceedings. New Orleans, LA. February 5-9, 2003.

23. Sallis JG, **Potter HG**, Helfet DL, Lorich DG. Syndesmotic instability in operative ankle fractures: An old problem evaluated with modern magnetic resonance imaging. American Academy of Orthopaedic Surgeons – 70th Annual Meeting Proceedings. New Orleans, LA. February 5-9, 2003.

24. Weiland DE, Walde TA, Leung SB, Ho S, Sychterz CJ, Engh CA, **Potter HG**. MRI in the assessment of pelvic osteolysis: A cadaveric study. Orthopaedic Research Society – 50th Annual Meeting. San Francisco, CA. March 7-10, 2004.

25. Shubin-Stein BE, Cordasco FA, Rodeo SA, Hannafin JA, **Potter HG**, Torzilli P, Warren RF. Enhanced tendon to bone healing: A pilot study comparing PLLA vs. TCP interference screws. American Academy of Orthopaedic Surgeons – 71st Annual Meeting Proceedings. San Francisco, CA. March 10-14, 2004.

26. **Potter HG**, Dugal T, West P, Calton E, Bi X, Camacho N. T_2 mapping of articular cartilage at clinical field strengths reflects collagen fiber orientation as confirmed by infrared imaging. 5th Symposium of the International Cartilage Repair Society. Gent, Belgium. May 26-29, 2004.

27. Mithöfer K, **Potter HG**, Spock CR, Marx RG, Warren RF, Williams RJ. Prospective evaluation of the microfracture technique for treatment of articular cartilage defects in the knee. 5th Symposium of the International Cartilage Repair Society. Gent, Belgium. May 26-29, 2004.

28. Williams RJ**, Potter HG**, Walsh C, Urquhart ER. A prospective analysis of knee cartilage defects treated with fresh osteochondral allografts. American Academy of Orthopaedic Surgeons – 72nd Annual Meeting Proceedings. Washington DC. February 23-27, 2005.

29. Klapach AS, MacGillivray JD, **Potter HG**, Altchek DW, Warren RF. The results of fasT-fix meniscal repair. The American Orthopaedic Society for Sports Medicine - 31st Annual Meeting. Keystone, CO. July 14-17, 2005.

30. Campbell SE, Bi XH, Foo LF, Camacho NP, Tamaroff ER, **Potter HG**. Quantitative T_2 mapping and Ft-IRIS of intact and enzymatically degraded cartilage: Alterations in structural anisotropy. 6th Symposium of the International Cartilage Repair Society. San Diego, CA. January 8-11, 2006.

31. **Potter HG**, Foo LF, Tamaroff E, Lyman S, Camacho NP, Kim M, Ryaby JT, Moynihan D, Grande DA. MRI quantitative T_2 mapping and Ft-IRIS of cartilage repair using a synthetic thrombin receptor-based peptide (TP-508) in a rabbit model. 6th Symposium of the International Cartilage Repair Society. San Diego, CA. January 8-11, 2006.

32. Tsou IYY, Foo LF, **Potter HG**. MR imaging of the reconstructed anterior cruciate ligament: Normal appearances and complications. 18th European Congress of Radiology, Vienna, Austria. March 3-7, 2006.

33. Shindle MK, Foo LF, Kelly BT, Domb BG, Farber A, Khanna AJ, **Potter HG**. Magnetic Resonance imaging of cartilage in the athlete: Current techniques and spectrum of disease. American Academy of Orthopaedic Surgeons (AAOS) – 73rd Annual Meeting Proceedings. Chicago, IL. March 22-26, 2006.

34. Choi YS, **Potter HG**, Chun TJ, Yang S, Choi KH. Bone marrow edema pattern of ankle and foot injuries on MR imaging. Radiologic Society of North America. 92nd Scientific Assembly and Annual Meeting. Chicago, IL. November 26-December 1, 2006.

35. Choi YS, **Potter HG**, Chun TJ. MR imaging of cartilage repair in the knee and ankle. 92nd Scientific Assembly and Annual Meeting. Chicago, IL. November 26-December 1, 2006

36. Nho S, Green DM, **Potter HG**, Maneypanda M, Shindle MK, Warren RF, Wickiewicz TL, Williams RJ. MRI and clinical evaluation of patella osteochondral autograft. American Academy of Orthopaedic Surgeons – 74th Annual Meeting Proceedings. San Diego, CA. February 14-18, 2007.

37. Foo LF, Jawetz SJ, Lejay H, **Potter HG**. Sources of quantitative error in T_2 mapping of articular cartilage. 15th Annual Meeting of the International Society for Magnetic Resonance in Medicine. Berlin, Germany. May 19-25, 2007.

38. Foo LF, Jawetz, Butts Pauly K, **Potter HG**. Comparison of optimized fast spin echo (FSE) magnetic resonance (RM) imaging to view angle tilt (VAT) FSE in the reduction of metallic susceptibility artifact surrounding arthroplasty. 15th Annual Meeting of the International Society for Magnetic Resonance in Medicine. Berlin, Germany. May 19-25, 2007.

39. Ballyns JJ, Cohen DL, Malone E, Maher SA, **Potter HG**, Wright TM, Lipson H, Bonassar. Evaluation of geometric fidelity for anatomically shaped tissue engineered constructs. Biomedical Engineering Society. St. Louis, MO. October 2-4, 2008.

40. Foo LF, Chong LR, Koff MF, Truncale K, Riley T, Semler E, Rodeo S, **Potter HG**. Quantitative MR imaging of cartilage repair in a goat model. 55th Annual Meeting of the Orthopaedic Research Society. Las Vegas, NV. February 22-25, 2009

41. Bedi A, Foo LF, Williams 3rd R, Cartilage Study Group, Potter **HG**. Assessment of synthetic scaffolds for osteochondral donor sites of the knee using MRI and T2 mapping: A longitudinal analysis. 55th Annual Meeting of the Orthopaedic Research Society. Las Vegas, NV. February 22-25, 2009

42. Koff MF, Chong LR, Virtue P, Ying LL, Gholve P, Widamn R, **Potter HG.** Correlation of MRI and histological examination of physeal bars in a rabbit model. 55th Annual Meeting of the Orthopaedic Research Society. Las Vegas, NV. February 22-25, 2009

43. Koff MF, Chong LR, Virtue P, Chen D, Wright T, **Potter HG.** Validation of Cartilage Thickness Calculations Using Indentation Analysis. International Society of Magnetic Resonance in Medicine 17th Scientific Meeting & Exhibition. Honolulu, HI. April 18-24, 2009.

44. Davisson T, Zhang R, Foo LF, Juda G, Masini M, Coyle S, Aponte C, **Potter HG**, Long M, Hawkins M. Allograft Sponge Fills Focal Defects After One Year in a Goat Model. 2009 World Congress on Osteoarthritis by OARSI. Montreal, Quebec. September 10-13, 2009.

45. Long M, Proch F; Zhang R, Koff MF, Foo LF, Campbell J, **Potter HG**, SchwartzH. Evaluations of avascular meniscal repair with a novel conduit manufactured from various bioabsorbable materials. 2009 World Congress on Osteoarthritis by OARSI. Montreal, Quebec. September 10-13, 2009.

46. Koff MF, Chong LR, Virtue P, Ying LL, Gholve P, Widamn R, **Potter HG.** Correlation of MRI and histological examination of physeal bars in a rabbit model. 56th Annual Meeting of the Orthopaedic Research Society. New Orleans, LA. March 6-9, 2010.

47. Koff M, Koch K, Juluri V, **Potter HG**. Magnetic Resonance Imaging of Periprosthetic Tissues in the Presence of Joint Arthroplasty. 56th Annual Meeting of the Orthopaedic Research Society. New Orleans, LA. March 6-9, 2010.

48. Green Kepler C, Green D, Bogner E, **Potter HG,** Hammoud S. MRI Evaluation of Medial Patellofemoral Ligament Injury after Primary Patellar Dislocation in Children. Annual Meeting of the Pediatric Orthopaedic Society of North America 2010. Waikoloa, Hawaii. May 4-7, 2010.

49. Koff MF, Fortier LA, Rodeo S, Maher S, El-Amin S, Shah P, Chen D, **Potter HG**. Temporal and Regional Changes of T2* in the Repaired Meniscus. 2011 Annual Meeting of the Orthopaedic Research Society. Long Beach, CA. Jan 13-16, 2011.

50. Hammoud S, Kepler C, **Potter HG,** Green DW. Intercondylar Notch Dimensions & Growth Patterns in Young Pediatric Patients. 2011 Annual AAOS Meeting. San Diego, CA. Feb 17-19, 2011.

51. Murakami A, Hash T, Hepinstall M, Lyman S, Nestor B, **Potter HG**. Magnetic Resonance Imaging Evaluation of Rotational Alignment in Painful Total Knee Arthroplasty. 2011 Annual AAOS Meeting. San Diego, CA. Feb 17-19, 2011.

52. Manuel J, Nestor B, Perino G, Purdue E, Padgett D, **Potter HG**. MRI in THA: A Prosepctive blinded Comparison of MRI with Histopathology of Retrieved Tissue. 2011 Annual AAOS Meeting. San Diego, CA. Feb 17-19, 2011.

53. Hayter CL, Koff MF, Koch KM, Shah P, Su EP, **Potter HG**. Magnetic Resonance Imaging of Metal-On-Metal Hip Resurfacing Implants. 2011 Annual ISMRM Meeting. Montreal, Quebec, Canada. May 10, 2011

54. Koch K, Koff M, **Potter HG**. Jacobian-Based Correction of 3D-MSI Images Near Implanted Metal Devices. 2011 Annual ISMRM Meeting. Montreal, Quebec, Canada. May 10, 2011

55. Koff MF, Shah P, Koch KM, **Potter HG**. Quantifying Image Distortion of Orthopedic Materials in Magnetic Resonance Imaging. 2012 Annual Meeting of the Orthopaedic Research Society, San Francisco CA, 4-7 Feb 2012.

56. Hayter CL, Koff MF, Shah P, Koch KM, Su EP, **Potter HG**. Magnetic Resonance Imaging of Metal on Metal Hip Resurfacing Implants. 2012 Annual Meeting of the Orthopaedic Research Society, San Francisco CA, 4-7 Feb 2012.

57. Hayter CL, Koff MF, Su EP, Koch KM, Shah P, Gold S, **Potter HG**. MRI findings in patients with unexplained pain following metal-on-metal total hip arthroplasty and hip resurfacing arthroplasty (ISMRM Merit Award: Magna Cum Laude). ISMRM 20th Annual Meeting and Exhibition. Melbourne, Australia. May 5-11, 2012.

58. Hayter CL, Koff MF, Gold S, Perino G, Koch KM, **Potter HG.** Measurement of concentrations of metal ions in pseudotumors close to metal-on-metal hips. (ISMRM Merit Award: Magna Cum Laude). ISMRM 20th Annual Meeting and Exhibition. Melbourne, Australia. May 5-11, 2012.

59. Koff MF, Shah P, Koch K, **Potter HG.** Quantification of image distortion of orthopedic materials in magnetic resonance imaging. ISMRM 20th Annual Meeting and Exhibition. Melbourne, Australia. May 5-11, 2012.

Invited Lectures

1. MRI of joints - 1992 Annual Meeting of the American Roentgen Ray Society. Orlando, FL. May, 1992.

2. Basic principles of MRI/evaluation of the knee - Core curriculum, Sports Medicine Service. September, 1993 - 1997.

3. Pitfalls of MR interpretation: Upper extremity - Core curriculum, Sports Medicine Service. September, 1993 - 1997.

4. Diagnostic imaging of the lumbar spine - 1993 Symposium on Diagnosis and Management, Greenwich Physical Therapy Center. Greenwich, CT. October, 1993.

5. Shoulder MRI - An emphasis on evaluation of the athletic shoulder - Metropolitan Shoulder Symposium, New York, NY. April 23, 1994.

6. Diagnostic imaging of the shoulder - 1994 Symposium in Diagnosis and Management of the Shoulder. Greenwich Physical Therapy Center. Greenwich, CT. October, 1994.

7. Shoulder MRI: Current status and new concepts - The Athletic Injuries of the Shoulder 1994. Workshop, American Orthopaedic Society for Sports Medicine, Lake Buena Vista, FL. December 8-10, 1994.

8. Magnetic resonance imaging of the pelvis and hip: Current status and new concepts - The Hip Society Winter Meeting/American Academy of Orthopaedic Surgeons, Orlando, FL. February 19, 1995.

9. Magnetic resonance imaging in orthopaedics: Current status and new concepts – Hellenic Medical Society of New York, New York Athletic Club. New York, NY. February 23, 1995.

10. Pitfalls of musculoskeletal magnetic resonance imaging - The Long Island Radiological Society. Woodbury, NY. May 8, 1995.

11. MRI in orthopaedics and rheumatology - New directions - Update in Rheumatology & Orthopedics, The Hospital for Special Surgery. New York, NY. May 11, 1995.

12. Shoulder and elbow problems in the elite athlete - First Annual Sports Medicine Update, The Hospital for Special Surgery. New York, NY. May 17-19, 1995.

13. Advanced imaging in orthopaedics: Current pitfalls and new applications - 63rd Annual Meeting of the American Academy of Orthopaedic Surgeons. Atlanta, GA. February 26, 1996.

14. Radiographs and MRI Imaging of the cervical spine of the injured athlete - 1996 American Academy of Orthopaedic Surgeons Shoulder Symposium. Vancouver, Canada. July 25, 1996.

15. Imaging of rotator cuff injury: MRI - 1996 American Academy of Orthopaedic Surgeons Shoulder Symposium. Vancouver, Canada. July 25, 1996.

16. MRI of the elbow - 1996 American Academy of Orthopaedic Surgeons Shoulder Symposium. Vancouver, Canada. July 28, 1996.

17. Glenohumeral instability: An imaging perspective - Radiology Grand Rounds. Morristown Memorial Hospital. Morristown, NJ. September 18, 1996.

18. Imaging in sports - The Active Woman: Orthopedic and Medical Care. The Women's Sports Medicine Center. Hospital for Special Surgery. New York, NY. September 27, 1996.

19. Imaging to help with the diagnosis of an infected TKR - VIII Annual Holiday Total Knee Course, Cornell University Medical College-Hospital for Special Surgery. New York, NY. December 5, 1996.

20. MRI of the elbow and wrist: Recent advances - 25th anniversary postgraduate course, Department of Radiology, Cornell University Medical College and The New York Hospital, Puerto Rico. January 26-31, 1997.

21. MR imaging of the hip - 25th anniversary postgraduate course, Department of Radiology, Cornell University Medical College and The New York Hospital, Puerto Rico. January 26 - 31, 1997.

22. MR imaging of the shoulder: Current status and imaging pitfalls - 25th anniversary postgraduate course, Department of Radiology, Cornell University Medical College and The New York Hospital, Puerto Rico. January 26 - 31, 1997.

23. Magnetic resonance imaging of failed ACL grafts - Instructional course, 64th Annual Meeting of the American Academy of Orthopaedic Surgeons. San Francisco, CA. February 15, 1997.

24. MR imaging of the rotator cuff and related disorders - MRI Symposia Basics to Advanced: What You Need to Know. Breckenridge, CO. March 21, 1997.

25. MR imaging of the unstable shoulder: Labrum, capsule, & cartilage - MRI Symposia Basics to Advanced: What You Need to Know. Breckenridge, CO. March 21, 1997.

26. MR of the elbow - MRI Symposia Basics to Advanced: What You Need to Know. Breckenridge, CO. March 21, 1997.

27. MR of the ankle and foot - MRI Symposia Basics to Advanced: What You Need to Know. Breckenridge, CO. March 21, 1997.

28. MR imaging of rotator cuff and related disorders - Comprehensive shoulder course, American Academy of Orthopaedic Surgeons. Bal Harbour, FL. April 3 - 6, 1997.

29. MR imaging of the unstable shoulder - Comprehensive shoulder course, American Academy of Orthopaedic Surgeons. Bal Harbour, FL. April 3 - 6, 1997.

30. Diagnosis and treatment of labral disorders of the shoulder - 23rd Annual Meeting of the American Orthopaedic Society for Sports Medicine. Sun Valley, ID. June 23, 1997.

31. The utility of MR imaging in assessing spinal disorders. 2nd Annual Spine Care In the Primary Care Practice. Hospital for Special Surgery. New York, NY. November. 15, 1997.

32. The infected total knee replacement. Imaging test: Confirm or confuse. IX Annual Holiday Total Knee Course. New York, NY. December 4, 1997.

33. MRI evaluation of shoulder instability. Arthroscopic and Reconstructive Surgery. Scottsdale, AZ. January 28, 1998.

34. An orthopaedist's primer for MRI in the evaluation of rotator cuff disease. Arthroscopic and Reconstructive Surgery. Scottsdale, AZ. January 28, 1998.

35. MRI of the elbow. 2nd Annual MRI Symposia Basics to Advanced: What You Need to Know. Steamboat Springs, CO. March 9, 1998.

36. MR imaging of the ankle and foot. 2nd Annual MRI Symposia Basics to Advanced: What You Need to Know. Steamboat Springs, CO. March 9, 1998.

37. MR imaging of the rotator cuff and related disorders. 2nd Annual MRI Symposia Basics to Advanced: What You Need to Know. Steamboat Springs, CO. March 9, 1998.

38. MRI of the shoulder. Memphis Roentgen Society Meeting. Memphis, TN. April 7, 1998.

39. High resolution orthopaedic magnetic resonance imaging with attention to articular cartilage. MRI Special Interest Group of Central New Jersey. New Brunswick, NJ. April 22, 1998.

40. MR imaging of the shoulder: What the therapist needs to know. The athlete's shoulder. Hospital for Special Surgery, Rehabilitation Department, Sports Medicine and Performance Research Center. New York, NY. May 9, 1998.

41. MRI of the elbow. Internal derangements of the joints: Advanced MR imaging. Course Director, Donald Resnick, MD. New York, NY. May 16, 1998.

42. MRI of the shoulder. Department of Orthopaedic Surgery Grand Rounds. Yale University. New Haven, CT. May 29, 1998.

43. The appropriate use of imaging techniques in the diagnosis of osteoarthritis. HSS Rheumatology network symposium series. Osteoarthritis: The most common musculoskeletal disorder. Hospital for Special Surgery. New York, NY. June 18, 1998.

44. MRI of shoulder instability. The American Orthopaedic Society for Sports Medicine 23rd Annual Meeting. Instructional Course: Diagnosis and treatment of disorders of the shoulder. Vancouver, BC. July 14, 1998.

45. Anatomy of the knee. MRI: Clinical State-of-the-art 1998. NYU Medical Center. NYU School of Medicine. New York, NY. October 12, 1998.

46. Ligaments of the knee. MRI: Clinical State-of-the-art 1998. NYU Medical Center. NYU School of Medicine. New York, NY. October 12, 1998.

47. MRI of the elbow. MRI: Clinical State-of-the-art 1998. NYU Medical Center. NYU School of Medicine. New York, NY. October 12, 1998.

48. MR evaluation of articular cartilage. Current concepts in knee reconstructive surgery. New York Medical College, Department of Orthopaedic Surgery. New York, NY. October 30, 1998.

49. MRI evaluation of rotator cuff disease. 80th Annual Meeting of the Hospital for Special Surgery Alumni Association. New York, NY. November 6, 1998.

50. Magnetic resonance imaging of failed ACL grafts. La chirurgia ortopedica scientific meeting. Naples, Italy. November 18, 1998.

51. Orthopaedic imaging. Salzburg Cornell Seminars, Salzburg, Austria. November 15-17, 1998.

52. Imaging of the infected knee. Tenth Annual Holiday Total Knee Course. New York, NY. December 3, 1998.

53. MR imaging of the rotator cuff and related disorders, Articular cartilage imaging: MR and MR imaging of the unstable shoulder. CUMC 27th Diagnostic Radiology Post-Graduate Course. Aruba. February 1-2, 1999.

54. Introductory MRI: Techniques with clinical applications. MRI of the elbow. ISMRM Seventh Scientific Meeting, Philadelphia, PA. May 23, 1999.

55. The knee: MRI of the meniscus. 8th Annual Current Issues of Magnetic Resonance Imaging in Orthopaedics and Sports Medicine, San Francisco, CA. August 29-September 1, 1999.

56. The knee: MR of the cruciate and collateral ligaments. 8th Annual Current Issues of Magnetic Resonance Imaging in Orthopaedics and Sports Medicine, San Francisco, CA. August 29-September 1, 1999.

57. Advances in shoulder imaging techniques. Current Concepts in Shoulder & Elbow Reconstructive Surgery, 7th Annual Symposium. New York Medical College, Westchester, NY. September 30, 1999.

58. Imaging of the athlete's shoulder. Hospital for Special Surgery Rehabilitation Seminar. Corning, NY. October 21, 1999.

59. Advanced imaging of total joint arthroplasty. Total Hip and Knee Symposium. Cabo San Lucas, Mexico. November 5-7, 1999.

60. Detection of deep venous thrombosis following total hip arthroplasty. Total Hip and Knee Symposium. Cabo San Lucas, Mexico. November 5-7, 1999.

61. MRI of the foot and ankle. Refresher Course: Body MR. 85th Scientific Assembly and Annual Meeting of the Radiological Society of North America. Chicago, IL. November 2, 1999.

62. High resolution noncontrast MR imaging. MRI of Internal Joint Derangements: Contrast Agents and High Resolution Imaging. International Society for Magnetic Resonance In Medicine. Eighth Scientific Meeting and Exhibition. Denver, CO. April 1-7, 2000.

63. MR imaging of athletic injuries in women. Diagnostic Evaluation of Musculoskeletal and Cartilage Injuries in Women. 3rd Annual Gulf Coast Woman's Imaging Conference. Pensacola, FL. April 7, 2000.

64. Imaging of articular disorders. Diagnostic Evaluation of Musculoskeletal and Cartilage Injuries in Women. 3rd Annual Gulf Coast Woman's Imaging Conference. Pensacola, FL. April 7, 2000.

65. MRI of the foot and ankle. Podiatric Medical Education Lecture. Wyckoff Heights Medical Center. Brooklyn, NY. April 25, 2000.

66. MRI of the shoulder. 2nd Annual Academic Congress. Hospital for Special Surgery Rehabilitation Network. New York, NY. May 5, 2000.

67. MRI of the shoulder. Joint & Soft Tissue Trauma Fellowship: Guest Lecture Series. West Point, NY. May 12, 2000.

68. The use Of MRI in the assessment of surgically-manipulated cartilage. MacArthur Cartilage Repair Workshop. Hospital for Special Surgery, New York, NY. May 13, 2000.

69. Allografts in Sports Medicine. 26th Annual Meeting of the American Orthopaedic Society for Sports Medicine. Sun Valley, ID. June 18, 2000.

70. MRI of rotator cuff and related disorders, MRI of shoulder instability, MRI of the elbow, MRI of the meniscus, MRI of the knee ligaments: Native and reconstructed, MRI of ankle and foot, and articular cartilage. 2nd Gold Coast Medical Imaging Conference. Gold Coast, Queensland. August 3-4, 2000.

71. MR of the cruciate and collateral ligaments and postoperative knee. 9th Annual Current Issues of Magnetic Resonance Imaging in Orthopaedics and Sports Medicine. San Francisco, CA. August 26, 2000.

72. MRI of the anterior cruciate ligament, MRI of ACL reconstruction, and MRI of articular cartilage. The ACL at the Beginning of the Third Millennium. Florence, Italy. October 3-7, 2000.

73. MR imaging of articular cartilage. Long Island Radiological Society. New York, NY. November 14, 2000.

74. Lane JM, Arendt EA, Meyers ER, Potter HG, Hannafin JA, Rudicel SA. Symposium: Imaging of lower extremity stress fractures. American Academy of Orthopaedic Surgeons – 68th Annual Meeting Proceedings. San Francisco, CA. February 28 - March 1, 2001.

75. Generation of the MR signal: orthopaedic applications. Science and Application of Bioengineering Technology. The Cooper Union Research Foundation. New York, NY. March 27, 2001.

76. Generation of the MR signal: orthopaedic applications. Science and Application of Bioengineering Technology. Cornell School of Chemical Engineering. Ithaca, NY. April 4, 2001.

77. MRI in surgical therapy of cartilage and ACL injuries. International Society For Magnetic Resonance in Medicine. Joint Annual Meeting. Glasgow, Scotland. April 21-27, 2001.

78. Magnetic resonance imaging of shoulder instability. Societa' Polispecialistica Italiana Dei Giovani Chirurghi. XIV Congresso Nazionale. Ischia, Italy. May 10-12, 2001.

79. MRI of the anterior cruciate ligament: Native and reconstructed. Societa' Polispecialistica Italiana Dei Giovani Chirurghi {SPIGC}. XIV Congresso Nazionale. Ischia, Italy. May 10-12, 2001.

80. MR evaluation of articular cartilage. International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine {ISAKOS}. Montreux, Switzerland. May 14-18, 2001.

81. Evaluation and management of articular cartilage injuries of the knee. Burks, RT, Gillogly SD, Wickiewicz TL, Potter HG. American Orthopaedic Society for Sports Medicine - 27th Annual Meeting. Keystone CO. June 28 - July 1, 2001.

82. MR of the meniscus. 10th Annual Current Issues of Magnetic Resonance Imaging in Orthopaedics and Sports Medicine. San Francisco, CA. August 26-29, 2001.

83. MRI of the knee ligaments. 10th Annual Current Issues of Magnetic Resonance Imaging in Orthopaedics and Sports Medicine. San Francisco, CA. August 26-29, 2001.

84. Introduction to MR imaging of the shoulder, Glenohumeral instability - An imaging perspective, MR imaging of rotator cuff and related disorders. "Shoulder Controversies" - Congress in Rome. Concordia Hospital. Rome, Italy. April 27, 2002.

85. MRI healing evaluation criteria of surgically treated chondral defects. 4th International Cartilage Repair Society. Toronto, Canada. June 15-18, 2002.

86. Articular cartilage lesions of the knee. American Orthopaedic Society for Sports Medicine – 28th Annual Meeting. June 30-July 3, 2002.

87. MRI of the meniscus. 11th Annual Current Issues of Magnetic Resonance Imaging in Orthopaedics and Sports Medicine. San Francisco, CA. August 25-28, 2002.

88. MRI of the cruciate and collateral ligaments, articular cartilage and the postoperative knee. 11th Annual Current Issues of Magnetic Resonance Imaging in Orthopaedics and Sports Medicine. San Francisco, CA. August 25-28, 2002.

89. Imaging studies of the shoulder. 10th Annual Current Concepts in Shoulder Reconstruction Surgery. Westchester, NY. October 24-25, 2002.

90. Imaging of articular cartilage. Hospital for Special Surgery 84th Alumni Association 84th Annual Meeting. New York, NY. November 7-8, 2002.

91. MRI of the hip: Native and reconstructed. MRI of the meniscus. MRI of articular cartilage. Wrist and hand, including MRA. MR Advances in Neuroradiology and Sports Medicine Imaging. Las Vegas, NV. February 28 – March 2, 2003.

92. MRI in the pediatric patient. Pediatric Musculoskeletal Disorders 2003: A Comprehensive Update for Pediatricians. Hospital for Special Surgery & Weill Medical College of Cornell University. New York, NY. March 21, 2003.

93. MR imaging of articular cartilage. The New York Roentgen Society – Spring Conference 2003. (Lecturer and Moderator). New York, NY. April 2-4, 2003.

94. Meniscal lesions: MRI and Articular cartilage: MRI. The International Institute for Continuing Medical Education, Inc. - Orthopaedics and Sports Imaging: Clinical Aspects and Imaging. New York, NY. April 4-6, 2003.

95. Potter HG, Herzog RJ, Adler RS. Skeletal radiology, diagnostic radiology, ultrasound, and MRI Interpretations: Shoulder, knee, spine, foot, and hand. Hospital for Special Surgery 1st Annual Orthopaedic Review Course. New York, NY. May 9-10, 2003.

96. Interpretation of shoulder MRI: What the therapist needs to know. Advances in the Management of the Athlete's Shoulder. Hospital for Special Surgery – Departments of Rehabilitation and Professional Education. New York, NY. May 16-17, 2003.

97. Imaging of bone. Tri-Institutional Program in Computational Biology and Medicine – Summer Course. Weill Medical College of Cornell University – Department of Physiology and Biophysics. August 13, 2003.

98. MRI of knee ligaments, cartilage injury and repair. 12th Annual Current Issues of Magnetic Resonance Imaging in Orthopaedics and Sports Medicine. San Francisco, CA. August 24-27, 2003.

99. Imaging in ACL reconstruction, rupture of the graft, and revision. The LCA Revision Surgery Course at Maddaloni. Naples, Italy. October 10, 2003.

100. MRI in early rheumatoid arthritis. Ultrasound & MRI in the Early Diagnosis of Joint Damage in Rheumatoid Arthritis. Hospital for Special Surgery. New York, NY. November 5, 2003.

101. MRI of cartilage: Native and repaired. Hospital for Special Surgery 85th Alumni Association 85th Annual Meeting. Hospital for Special Surgery, New York, NY. November 6-7, 2003.

102. The appropriate use of imaging techniques in the diagnosis of osteoarthritis. Osteoarthritis Update: The Most Common Musculoskeletal Disease. Hospital for Special Surgery, New York, NY. November 19, 2003.

103. Imaging of the athlete's shoulder. 23rd Annual Meeting of the Arthroscopic Association of North America. Orlando, FL. April 22-25, 2004.

104. MRI of the knee and shoulder. Instructional course lecture. American Academy of Orthopaedic Surgeons – 71st Annual Meeting Proceedings. San Francisco, CA. March 10-14, 2004.

105. MRI of the knee and shoulder. 2nd Annual Orthopaedic Basic Science Review Course. Hospital for Special Surgery, New York, NY. May 7-8, 2004.

106. MR imaging of total joint arthroplasty and MRI evaluation of cartilage injury, degeneration and repair. Combined "6th Annual Robert H. Frieberger, MD Lecture" with "Orthopaedic Imaging – A Multidisciplinary Approach". Hospital for Special Surgery, New York, NY. May 14-15, 2004.

107. Imaging and biomechanics of cartilage lesions. Keynote Address of the 5th Symposium of the International Cartilage Repair Society. Gent, Belgium. May 26-29, 2004.

108. Utility of imaging in basic, traditional, & clinical research. American Orthopaedic Society for Sports Medicine – 30th Annual Meeting. June 22-27, 2004.

109. Imaging of the hip. American Orthopaedic Society for Sports Medicine – 30th Annual Meeting. June 22-27, 2004.

110. Update on MRI technology. American Orthopaedic Society for Sports Medicine – 30th Annual Meeting. June 22-27, 2004.

111. MRI of cruciate and collateral ligaments, articular cartilage and the postoperative knee. 13th Annual Current Issues of Magnetic Resonance Imaging in Orthopaedics and Sports Medicine. San Francisco, CA. August 22-25, 2004.

112. MRI of cartilage. Franklin and Seidelmann's All Star Lecture Series 2004. September 15, 2004.

113. The effect of technology development of healthcare Outcome: Focus on osteoarthritis. AIG Heathcare Partners Annual Conference. Washington, DC. September 21, 2004.

114. MR imaging of menisci; MR imaging of the knee ligaments: Native and reconstructed; MR imaging of joint arthroplasty; MRI of the mid and forefoot. Orthopaedic Radiology 2004 – Harvard Medical School. Boston, MA. October 11-13, 2004.

115. Advanced imaging of rheumatoid arthritis. Hospital for Special Surgery - Alumni Association's 86th Annual Meeting. New York, NY. November 4-5, 2004.

116. Diagnostic imaging modalities in articular cartilage. Hospital for Special Surgery - Articular Cartilage Repair Strategies: A Comprehensive Review. New York, NY. December 3-4, 2004.

117. Current and future techniques in cartilage imaging. Advances in Cartilage Restoration 2005: Cells and Scaffolds. CHRISTUS Santa Rosa Health Care. San Antonio, TX. February 5, 2005.

118. Update on imaging technology. Future of Orthopaedics: Advancements that will affect how care is provided – OREF Symposium. American Academy of Orthopaedic Surgeons – 72nd Annual Meeting Proceedings. Washington DC. February 23-27, 2005.

119. MRI evaluation of the rotator cuff: current applications and future directions. MRI evaluation of cartilage injury, degeneration and repair. Magnetic Resonance Imaging Of The Knee And Shoulder. American Academy of Orthopaedic Surgeons – 72nd Annual Meeting Proceedings. Washington DC. February 23-27, 2005.

120. MRI of arthroplasty. MR imaging of articular cartilage. The 20th Annual Combined Orthopaedic Spring Symposium – Hawaii Orthopaedic Association. Honolulu, HI. April 15-16, 2005.

121. MRI of the knee and shoulder. Hospital for Special Surgery - 3rd Annual Orthopaedic Basic Science Review Course. New York, NY. May 6-7, 2005.

122. MR imaging of the hip. 118th Annual Meeting of the American Orthopaedic Association. Huntington Beach, CA. June 22-25, 2005.

123. T2 mapping of articular cartilage. The American Orthopaedic Society for Sports Medicine - 31st Annual Meeting. Keystone, CO. July 14-17, 2005.

124. Magnetic resonance imaging of the hip. The American Orthopaedic Society for Sports Medicine - 31st Annual Meeting. Keystone, CO. July 14-17, 2005.

125. Utility of imaging in basic, translational and clinical research. The American Orthopaedic Society for Sports Medicine - 31st Annual Meeting. Keystone, CO. July 14-17, 2005.

126. Upper and lower extremities and the spine. MR of the cruciate and collateral ligaments, and the postoperative knee. MRI of articular cartilage. 14th Annual Current Issues of Magnetic Resonance Imaging in Orthopaedics and Sports Medicine. San Francisco, CA. August 21-24, 2005.

127. MRI of osteoarthritis: Early disease detection to imaging of joint arthroplasty. 22nd Annual Interim Meeting of the Knee Society. New York, NY. September 8-10, 2005.

128. MRI of articular cartilage. MRI of painful total knee arthroplasty. 90th Congresso Nazionale della Società Italiana di Ortopedia e Traumatologia. Florence, Italy. October 7-14, 2005.

129. Imaging studies of the shoulder. Current Concepts in Reconstructive Shoulder Surgery. New York Medical College. Rye, NY. October 20-21, 2005.

130. MRI evaluation of cartilage injury, degeneration and repair. Imaging of Lesions. Hospital for Special Surgery - Alumni Association's 87th Annual Meeting. New York, NY. November 10-11, 2005.

131. MRI of the painful knee arthroplasty. 17th Annual Holiday Total Knee Course. New York, NY. December 7-9, 2005.

132. T2 mapping of articular cartilage. 6th Symposium of the International Cartilage Repair Society. San Diego, CA. January 8-11, 2006.

133. Update on imaging technology: Orthopaedic applications. National Association of Orthopaedic Nurses. Chicago IL. March 22, 2006.

134. MRI of the knee and shoulder. American Academy of Orthopaedic Surgeons – 73rd Annual Meeting Proceedings. Chicago, IL. March 22-26, 2006.

135. Skeletal radiology, diagnostic radiology, ultrasound, and MRI interpretations: Shoulder, knee and spine. **Potter HG**, Adler RS, Herzog RJ. Hospital for Special Surgery – 4th Annual Orthopaedic Basic Science Review Course. New York, NY. May 5-6, 2006.

136. MRI of the shoulder: Labrum, instability and postoperative changes. MRI of the wrist hand. MRI of cartilage & osteochondral injury. MRI of the knee: Menisci & postoperative findings. MRI of the ankle & foot. Orthopaedic peripheral MR arteriography: How, why & when. MRI techniques & protocols: Practical pearls & pitfalls. Advanced Orthopaedic Imaging at Wine Country – Emphasis on MRI. Sonoma, CA. May 12-14, 2006.

137. MRI of the post-operative knee. 4th Annual New York Radiology Review Course: Current Concepts. New York, NY. May 15-18, 2006.

138. MRI of cartilage disease. MRI of the hip. MRI of total joint arthroplasty. MRI of the elbow. 13th Annual Spring Sports Medicine Symposium – Red River Valley Sports Medicine Institute. Fargo, ND. June 1-2, 2006.

139. Hip arthroscopy. The American Orthopaedic Society for Sports Medicine - 31st Annual Meeting. Hershey, PA. June 29 - July 2, 2006.

140. MRI of the cruciate and collateral ligaments and the postoperative knee. Current and future techniques in cartilage imaging, degeneration and repair. 15th Annual Current Issues of Magnetic Resonance Imaging in Orthopaedics and Sports Medicine. San Francisco, CA. August 27-30, 2006.

141. Rotator cuff imaging: Techniques for humans and animal models. American Shoulder and Elbow Surgeons Open Scientific Meeting. Chicago, IL. August 16, 2006.

142. Practical orthopaedic imaging at 3T: Protocol issues and solutions. Current and future techniques in cartilage imaging at 3T: Injury, degeneration and repair. Stanford University – Radiology. 5th Annual Global Symposium on Clinical HF MRI. Las Vegas, NV. October 15-16, 2006.

143. MRI of foot and ankle disorders. 14th Annual Symposium - Current Concepts in Foot and Ankle Trauma and Reconstructive Surgery. New York Medical College. Rye, NY. October 26-27, 2006.

144. Advanced imaging techniques: When and what. Mt. Sinai Advanced Elbow Course. Mt. Sinai School of Medicine. New York, NY. November 4, 2006.

145. Imaging. Hospital for Special Surgery Alumni Association – 88th Annual Meeting. Hospital for Special Surgery. New York, NY. November 9, 2006.

146. Optimizing knee MRI interpretation: Practical pearls, future trends. MRI interpretation: Knee, shoulder & hip. Arthroscopic Association of North America - 25th Fall Course. Palm Desert, CA. November 9-11, 2006.

147. MRI of articular cartilage. MRI of Arthroplasty. National Diagnostic Imaging Symposium – World Class CME, Loma Linda University. Lake Buena Vista, FL. December 3-7, 2006.

148. MRI diagnosis in trauma. Osteomyelitis vs. Charcot advanced imaging. 2007 New York Podiatric Clinical Conference. New York, NY. January 19, 2007.

149. MRI of the knee and shoulder. American Academy of Orthopaedic Surgeons – 74th Annual Meeting Proceedings. San Diego, CA. February 14-18, 2007.

150. Functional imaging of the physis. Pediatric Orthopaedic Society of North America – AAOS Specialty Day. San Diego, CA. February 17, 2007.

151. Imaging of the painful total knee arthroplasty. The Knee Society/AAHKS 2007 Combined Specialty Day Meeting – AAOS Specialty Day. San Diego, CA. February 17, 2007.

152. Future directions in orthopaedic MR imaging. New York Roentgen Society – The New York Academy of Medicine. New York, NY. February 26, 2007.

153. MRI of articular cartilage: Trauma, degeneration and repair. New Hampshire Orthopaedic Institute – 7th Annual Winter Meeting. Stowe, VT. March 2-3, 2007.

154. MRI of articular cartilage: Trauma, degeneration and repair. American College of Radiology – DC Metropolitan Radiologic Society. Washington DC. March 22-23, 2007.

155. Advanced imaging of the physis. Operative Management of Pediatric Fractures - 3rd Annual Symposium. Hospital for Special Surgery. New York, NY. March 30, 2007.

156. MRI of cartilage repair. New York Roentgen Society – Annual Spring Meeting: Hot Topics and Radiology Review Course. New York, NY. April 22-28, 2007.

157. MRI in cartilage imaging: Injury, degeneration and repair – Moderator. 26th Annual Meeting of the Arthroscopic Association of North America. San Francisco, CA. April 28-29, 2007.

158. MRI of the knee and shoulder. Skeletal Radiology, Diagnostic Radiology, Ultrasound and MRI Interpretation: Shoulder, Knee and Spine. Hospital for Special Surgery – 4th Annual Orthopaedic Basic Science Course. New York, NY. May 4-5, 2007.

159. MRI of articular cartilage: Trauma, degeneration and repair. MRI of the wrist and hand. MRI of the hip: An update. MRI of the elbow: An update. 9th International Course – Advances in CT & MRI. Barcelona, Spain. May 9-11, 2007.

160. Upper extremity injuries in throwing athletes. MRI of Articular Cartilage: Injury, Degeneration and Repair. 15th Annual Meeting of the International Society for Magnetic Resonance in Medicine. Berlin, Germany. May 19-25, 2007.

161. MRI of articular cartilage repair. AAOS 2007 Cartilage Restoration of the Knee. Chicago, IL. June 8-9, 2007

162. MRI of the cruciate and collateral ligaments and the postoperative knee. Current and future techniques in cartilage imaging, degeneration and repair. 16th Annual Current Issues of Magnetic Resonance Imaging in Orthopaedics and Sports Medicine. San Francisco, CA. August 26-29, 2007.

163. Cartilage imaging techniques. Center for Biologics Evaluation and Research, Food and Drug Administration, Rockville, MD, September 27, 2007.

164. Current Concepts in MRI Interpretation of the Knee, Shoulder, and Hip. 26th Fall Course: Preliminary Program, Arthroscopy Association of North America. Orlando, Fl. November 3, 2007.

166. How are wear-related problems diagnosed and what forms of surveillance are necessary? 2007 AAOS/NIH Osteolysis and Implant Wear: Biological, Biomedical Engineering and Surgical Principles. Austin, TX. November 9, 2007.

167. Sports Imaging MR: Do You need an Arthrogram? RSNA 2007 Special Focus Session at the 93rd Scientific Assembly and Annual Meeting of the Radiological Society of North America. Chicago, IL. November 26, 2007

168. MRI of shoulder instability. MRI of the hip. MRI of arthroplasty. Contemporary Topics in Orthopedics- 17th Annual Maine Orthopedic Conference. Portland, ME. February 15, 2008

169. MRI of the knee and shoulder. American Academy of Orthopaedic Surgeons – 75th Annual Meeting Proceedings. San Francisco, CA. March 5-8, 2008

170. MRI of articular cartilage: clinical and non-clinical models. Generation of the MR signal. Cornell University College of Veterinary Medicine. Ithaca, NY. March 31, 2008.

171. MRI features of meniscal tears. MRI features of the post-menisectomy knee and post-meniscal repair. Masterclass:T2 mapping and MRI assessment of articular cartilage lesions pre-treatment and post-treatment. MRI of ACL injury. MRI after ACL reconstruction. MRI features of PCL and posterolateral corner injuries. MRI assessment of the problem TKR. The Second Current Concepts in Knee Surgery Symposium. The Emirates Stadium, London, UK. April 10-12, 2008.

172. Moderator: Clinical Update of MRIs and Ultrasound in Orthopaedics: How to Enhance your Interpretation of Diagnostic Studies. MRI of Articular Cartilage. 27th AANA Annual Meeting. Washington, D.C. April 26-27, 2008.

173. Shoulder Instability: Clinical considerations and imaging needs?: Conventional MRI in evaluation of shoulder instability. Clinical Science for Physicists and Engineers: Cartilage: from form to function. ISMRM 16th Scientific Meeting & Exhibition. Toronto, Canada. May 3-9, 2008.

174. State of the art techniques for assessing chondral lesion strategies and resurfacing procedures. AAOS/ORS Advanced Imaging and Computer Assisted Surgery of the Knee and Hip (AICKH) Research Symposium. Providence, RI. May 15-17, 2008.

175. The Great Debate: MR vs MR Arthrography. Protocol Shootout. Moderator: Interesting cases. MR of the cruciate and collateral ligaments, and postoperative knee. MR of articular cartilage.

17th Annual Current Issues of MRI in Orthopaedics and Sports Medicine. San Francisco, CA. August 24-27, 2008.

176. Keynote Lecture: State-of-the-art 3T imaging in orthopaedics. 7th International Symposium on High Field MR in Clinical Applications. Bonn, Germany. September 10-11,2008.

177. Current concepts in MRI interpretation of the knee, shoulder and hip. 27th Fall Course AANA. Phoenix, AZ. November 20-22, 2008.

178. Imaging of articular cartilage. AOSSM Post-Joint Injury Osteoarthritis Conference. New Orleans, LA. December 11-14.

179. State of the art in-vivo and ex-vivo imaging for tendon and ligament repair. AOSSM Ligament and Tendon Repair and Regeneration Think Tank. Miami, FL. January 24-25, 2009.

180. Moderator: Femoroacetabular impingement imaging. 55th Annual Meeting of the Orthopaedic Research Society. Las Vegas, NV. February 22-25, 2009.

181. Current and future techniques in cartilage imaging: injury, degeneration and repair. MRI evaluation of the rotator cuff. MRI for comparison of particle disease between fixed-bearing and rotating platform in TKA in the same patient. AAOS 2009 Annual Meeting. Las Vegas, NV. February 25-28, 2009.

182. MR imaging of cartilage injury and repair. MR imaging of the wrist. Post-operative and arthroplasty imaging with MRI. 18th Singapore Radiological Society Annual Scientific Meeting. Tan Tock Seng Hospital, Singapore, Singapore. March 26-29, 2009.

183. Moderator: Quantitative MR analysis of articular cartilage: MSK applications. Case-based teaching: MRI of the lower extremity. Clinical science for engineers: Cartilage from form to function. ISMRM 17th Scientific Meeting & Exhibition. Honolulu, HI. April 18-24, 2009.

184. Meniscal Tears: MR diagnosis. Ligaments: MR diagnosis. MR in femoroacetabular impingement. Extra-articular hip disorders: Pubalgia. Ankle ligaments, instability and OCDs. Ankle tendon disorders: MR diagnosis. Bone and cartilage injuries. Sports Medicine 2009: Advances in MRI and Orthopaedic Management. Boston, MA. June 14-15, 2009.

185. MRI of joint arthroplasty. MR of cruciate and collateral ligaments, and the postoperative knee. MR of articular cartilage. "Pardon the interruption" MR protocol panel discussion. Panel discussion: knee. 18th Annual Current Issues of MRI in Orthopaedics and Sports Medicine. San Francisco, CA. August 30-September 2, 2009.

186. Imaging of the lateral elbow. Imaging medial & anterior elbow (MRI and US). 2009 Combined Meeting of the ASSH/ASHT – Precourse 9. San Francisco, CA. September 3, 2009.

187. Application of MRI techniques. Post-Traumatic Arthritis of the Knee as a Model for the Study of Osteoarthritis. Chicago, IL. October 1-3, 2009.

188. Imaging techniques in the hip joint. International Society of Hip Arthroscopy 2009 Annual Scientific Meeting. New York, NY. October 9, 2009.

189. Osteolysis: andvances in MR imaging. Alumni Association 91st Annual Meeting. New York, NY. November 12-13, 2009.

190. Current concepts in MR interpretation of the knee, shoulder, and hip. 28th Fall Course AANA. Palm Dessert, CA. November 20-22, 2009.

191. Emerging techniques in MSK imaging. 95th RSNA Scientific Assembly and Annual Meeting. Chicago, IL. November 29-December 4, 2009.

192. Moderator: Imaging. 56th Annual Meeting of the Orthopaedic Research Society. New Orleans, LA. March 6-9, 2010.

193. Moderator: MR imaging of the postoperative joint and spine: clinical concerns and methodology for artifact reduction. Moderator: Shoulder and elbow imaging. Moderator: Clinical needs & technological solutions: osteoarthritis. Moderator: Inflammatory arthropathy. Talk: Wrist imaging. Postoperative hip: hardware, arthroplasty. Case-based knee. Bone and cartilage injury. Joint Annual Meeting ISMRM-ESMRMB 2010. Stockholm, Sweden. May 1-7, 2010.

194. Cartilage Imaging Methods. SMRT 19th Annual Meeting. Stockholm, Sweden. May 2, 2010.

195. MR Imaging of Hips Resurfacing- is it possible? Advanced Topics in Hip Resurfacing. Stockholm, Sweden. May 8, 2010.

196. MRI of articular cartilage-trauma, degeneration repair. MRI of Menisci. MRI of arthroplasty MRI shoulder instability. MRI rotator cuff 15th Annual Turkish Society Magnetic Resonance Meeting. Antalya, Turkey. May 19-21, 2010

197. MRI Interpretation for the Orthopaedic Surgeon. AOSSM 2010 Annual Meeting. Providence, Rhode Island. July 15, 2010.

198. MRI of joint arthroplasty. MR of cruciate and collateral ligaments, and the postoperative knee. MR of articular cartilage. “Pardon the interruption” MR protocol panel discussion. Panel discussion: knee. 19th Annual Current Issues of MRI in Orthopaedics and Sports Medicine. San Francisco, CA. August 29-September 1, 2010.

199. The future of cartilage imaging: dGEMRIC and beyond, What does advanced imaging tell us about MOM tissue reaction?, The utility of advanced imaging of the surrounding soft tissue envelope in ceramic on ceramic THA. Harvard Medical School 40th Annual Course 2010 Advances in Arthroplasty: Burning Issues and the Young Patient with Hip Disease: From Early Detection to Arthroplasty. Boston, Massachusetts. September 27-29, 2010.

200. Imaging of the Acutely Injured Joint: What Do the Findings Mean? 2010 Basic Science Forum. Baltimore, MD. October 14, 2010.

201. MRI Interpretation: Knee, Shoulder, & Hip. 29th Annual AANA Fall Course. Phoenix, Arizona. November 20, 2010.

202. Imaging cartilage well: keys to reproducible quality. AOSSM/NIH Post-Joint Injury Osteoarthritis Conference II. New Orleans, LA. December 2-5, 2010.

203. Imaging Tools to Assess Joint Structures. 2011 Segal North American Osteoarthritis Workshop: Chicago, IL. March 25-27, 2011.

204. Generation of the MR signal and application to orthopaedic imaging. Educational seminar. Cornell University College of Veterinary Medicine. Ithaca, NY. April 8, 2011.

205. Current clinical imaging in OA: use of imaging in clinical trials and in clinical practice. SD-6010 Pfizer Advisory Board Meeting. Pfizer Global Headquarters. New York, NY. April 15, 2011.

206. MRI of articular cartilage. Imaging around hardware. Sports imaging: athlete's elbow. Jornada Paulista de Radiologia: Congress of Radiology. Sao Paolo, Brazil. April 29-30, 2011.

207. Moderator: MR Evaluation of the athlete. Knee Ligaments. Reducing Metallic Susceptibility. Moderator: Commonly missed diagnoses in shoulder and knee MRI. ISMRM 19th Annual Meeting and Exhibition. Montreal, Quebec, Canada. May 8-13, 2011.

208. Imaging. HSS Osteoarthritis Summit: Frontiers in OA Research, Prevention, and Care. New York, New York. June 17, 2011.

209. MR imaging of the painful hip non arthritic hip. MR Imaging of a metal on metal joint arthroplasty. 9th Symposium on Joint Preserving and Minimally Invasive Surgery of the Hip. New York, New York. June 16-18, 2011.

210. Instructions in Reading MRI Scans. AOSSM 2011 Annual Meeting. San Diego, CA. July 7-10, 2011.

211. Pardon the Interruption: MR protocol panel discussion. MR of the cruciate and collateral ligaments and the postoperative knee. MR of articular cartilage. Panel discussion: knee. MR of joint arthroplasty. 20th Annual Current Issues of Magnetic Resonance Imaging in Orthopaedics and Sports Medicine. San Francisco, CA. August 28-31, 2011.

212. MRI of Hip Cartilage: Joint Morphology, Structure and Composition. Imaging of metal on metal arthroplasty. 41st Annual Advances in Arthroplasty Course: Optimizing Hip and Knee Arthroplasty Using Evidence-Based Medicine. Harvard Medical School, Mass General Hospital. Boston, Massachusetts. October 25-26, 2011.

213. Imaging protocols: CT MRI and US. What should be ordered and when? AAHKS 21st Annual Meeting: Advances in Arthroplasty. Dallas, Texas. November 4-6, 2011.

214. MR and MRA is vital. Moderator: Imaging the hip. Carl T. Brighton Workshop on Hip Preservation Surgery (ABJS). Tampa, FL. November 16-19, 2011

215. Morphological and quantitative MRI assessment of joint injury and early degeneration. Orthopaedic Research Society 2012 Annual Meeting. San Francisco, CA. February 7, 2012.

216. Imaging alternatives. The Painful metal on metal arthroplasty: evaluation and management. AAOS 2012 Annual Meeting. San Francisco, CA. February 8, 2012.

217. MRI primer for the orthopaedic surgeon. MRI-arthroscopy correlations of the shoulder, elbow, hip and knee: a case-based approach. AAOS 2012 Annual Meeting. San Francisco, CA. February 9, 2012.

218. MRI of the hip: Arthroscopic correlation**.** MRI-arthroscopy correlations of the shoulder, elbow, hip and knee: a case-based approach. AAOS 2012 Annual Meeting. San Francisco, CA. February 9, 2012.

219. MRI: Effects of knee OA on joint structure. HSS Conservation Management of Knee Osteoarthritis Symposium. New York, NY. March 9, 2012.

220. Advanced cartilage imaging. Moderator: Latest imaging advances. Annual Meeting of the Australasian musculoskeletal imaging group. Melbourne, Australia. May 5, 2012.

221. Joint replacement MRI. SMRT 21st Annual Meeting. Melbourne, Australia. May 6, 2012.

222. Osteochondral transfer: autograft, allograft & scaffolds. Clinical Perspective: Parametric mapping of cartilage. Moderator: Case- based teaching: Peripheral nerve imaging. Moderator: MSK MRI: Following surgical repair. ISMRM 20th Annual Meeting and Exhibition. Melbourne, Australia. May 5-11, 2012.

223. Quantitative MR analysis of articular cartilage and fibrocartilage: research applications. MRI arthroplasty correlations. American Orthopaedic Society for Sports Medicine 2012 Annual Meeting. Baltimore, MD. July 12-15, 2012.

Scientific Presentations

1. **Potter HG**. Multiple giant cell tumors and Paget disease of bone: radiographic and clinical correlations. Fourteenth Annual Skeletal Symposium. Sun Valley, ID. February 18-22, 1991.

2. **Potter HG**. MR imaging of acetabular fractures. 79th Scientific Assembly and Annual Meeting of the Radiologic Society of North America. Chicago, IL. November 28, 1993.

3. **Potter HG**. Magnetic resonance angiography of the pelvis. The Hip Society Summer Meeting. New York, NY. September 8-10, 1994.

4. **Potter HG**. Magnetic resonance angiography of the wrist and hand. 49th Annual Meeting of the American Society for Surgery of the Hand. Cincinnati, OH. October 29, 1994.

5. **Potter HG**. Magnetic resonance imaging of meniscal allografts: correlation with clinical and arthroscopic outcome. 80th Scientific Assembly and Annual Meeting of the Radiologic Society of North America. Chicago, IL. December 2, 1994.

6. **Potter HG**. Magnetic resonance imaging of lateral epicondylitis: correlation with surgical and histopathologic findings. 81st Scientific Assembly and Annual Meeting of the Radiologic Society of North America. Chicago, IL. November 27, 1994.

7. **Potter HG**. Evaluation of the rotator cuff: Current applications and imaging pitfalls. NY Roentgen Society Spring Conference. May 3, 1996.

8. **Potter HG**. MRI evaluation of failed ACL grafts. 78th Annual Meeting Hospital for Special Surgery Alumni Association. New York, NY. November 8, 1996.

9. **Potter HG**. The utility of magnetic resonance imaging in the diagnosis of posterolateral rotatory instability of the elbow. 82nd Scientific Assembly and Annual Meeting of the Radiologic Society of North America. Chicago, IL. December 4, 1996.

10. **Potter HG**. MR imaging of the Lisfranc ligament of the foot. Annual Meeting of the American Academy of Orthopaedic Surgeons, San Francisco, CA. February 13, 1997.

11. **Potter HG**. Controversies in MR imaging of the foot and ankle: Cartilage Imaging. Fifth Scientific Meeting of the International Society for Magnetic Resonance in Medicine. April 16, 1997.

12. **Potter HG**. MRI evaluation of the hip for lesions treatable by arthroscopy. The Hip Society Summer Meeting. September 13, 1997.

13. **A**nderson K, Rodeo SA, Seneviratne A, Izawa K, **Potter HG**, Atkinson B. Augmentation of tendon healing in an intraarticular bone tunnel using a bone growth factor. 26th Annual Meeting. American Orthopaedic Society for Sports Medicine. Sun Valley, ID. June 18, 2000.

14. **Potter HG**. Detection of deep venous thrombosis following total hip arthroplasty. The American Orthopaedic Association 111th Annual Meeting. June 5, 1998.

15. Yocoubian S, Nevins R, Sallis JG, **Potter HG**, Lorich DG. Advantages of MRI over CT and oblique x-rays in evaluating the fracture classification and soft tissue injuries in high-energy tibial plateau fractures. 61st Annual Meeting of American Fracture Association. Tucson AZ. May 13-16, 1999.

16. Yocoubian S, Nevins R, Sallis J, **Potter H**, Lorich D. Impact of MRI on treatment plan and fracture classification of tibial plateau fractures. Orthopaedic Trauma Association 15th Annual Meeting. October 15, 1999.

17. **Potter HG**. The utility of high resolution MRI in the assessment of surgically treated chondral defects. ACL Study Group Meeting. Rhodes, Greece. May 20-26, 2000.

18. Anderson K, Rodeo SA, Seneviratne A, Izawa K, **Potter HG**, Atkinson B. Augmentation of tendon healing in an intraarticular bone tunnel using a bone growth factor. 26th Annual Meeting. American Orthopaedic Society for Sports Medicine. Sun Valley, ID. June 18, 2000.

19. Coleman SH, **Potter HG**, Malizia RW, Haas SB, Warren RF. Autologous chondrocyte implantation: Clinical, magnetic resonance and surgical evaluation. The International Cartilage Repair Society Meeting. Stockholm, Sweden. April 27, 2000.

20. **Potter HG**. MRI and MRA following knee dislocation. 82nd Annual Meeting Hospital for Special Surgery Alumni Association. New York, NY. November 3, 2000.

21. Shapiro GS, DiGiovanni CW, Kelly BT, Buly R, **Potter HG**, Hannafin JA. Vascularity of the hip labrum: An anatomical study. American Academy of Orthopaedic Surgeons – 68th Annual Meeting Proceedings. San Francisco, CA. February 28 – March 1, 2001.

22. Nielson J, Sallis JG, **Potter HG**, Helfet D, Lorich D. New findings in operative ankle fractures through use of MRI. American Academy of Orthopaedic Surgeons – 68th Annual Meeting Proceedings. San Francisco, CA. February 28 – March 1, 2001.

23. Sperling JW, **Potter HG**, Craig EV, Flatow E, Warren RF. Evaluation of the painful shoulder arthroplasty. American Academy of Orthopaedic Surgeons – 68th Annual Meeting Proceedings. San Francisco, CA. February 28 – March 1, 2001.

24. **Potter HG.** Moderate TE FSE in joints: Clinical utility. International Society For Magnetic Resonance in Medicine. Joint Annual Meeting. Glasgow, Scotland. April 21-27, 2001.

25. Padgett DE, Hamilton WG, **Potter HG**, Marshall P. Clinical assessment of anterior labral tears of the hip. Hospital for Special Surgery Alumni Association – 83rd Annual Meeting. New York, NY. November 8-9, 2001.

26. Rodeo SA, Kim HJ, **Potter HG**, Campbell D, Turner S, Atkinson B. Augmentation of rotator cuff tendon healing using an osteoinductive growth factor. Hospital for Special Surgery Alumni Association – 83rd Annual Meeting. New York, NY. November 8-9, 2001.

27. McCarty EC, Warren RF, Craig EV, Deng XH, **Potter HG**, Thompson WO. Where is the axillary nerve at risk under the shoulder capsule? American Academy of Orthopaedic Surgeons – 69th Annual Meeting Proceedings. Dallas, TX. February 13-17, 2002.

28. Coleman SH, Malizia R, **Potter HG**, MacGillvray J, Warren R. Treatment of isolated articular cartilage lesions of the medial condyle – A clinical and MR comparison of autologous chondrocyte implantation versus microfracture. American Academy of Orthopaedic Surgeons – 69th Annual Meeting Proceedings. Dallas, TX. February 13-17, 2002.

29. **Potter HG**, Sofka CM, Peters LE, Salvati EA. Evaluation of total hip arthroplasty with magnetic resonance imaging. American Academy of Orthopaedic Surgeons – 69th Annual Meeting Proceedings. Dallas, TX. February 13-17, 2002.

30. Rodeo SA, Kim HJ, **Potter HG**, Campbell D, Turner S, Atkinson B. Augmentation of rotator cuff tendon healing using an osteoinductive growth factor: A study in sheep. American Academy of Orthopaedic Surgeons – 69th Annual Meeting Proceedings. Dallas, TX. February 13-17, 2002.

31. **Potter HG,** Brown W, Marx RG, Maier C, Warren RF, Wickiewicz TL. Stratification of cartilage injury following acute isolated ACL tear: Immediate effect and clinical/MR follow-up. Anterior Cruciate Ligament Study Group 2002. Big Sky, MT. March 2-8, 2002.

32. **Potter HG**, Brown W, Marx R, Nawal A, Warren R. Longitudinal evaluation of the magnetic resonance imaging appearance of cartilage repair. 4th International Cartilage Repair Society. Toronto, Canada. June 15-18, 2002.

33. Kelly BT, **Potter HG**, Pearle AD, Nofsinger CC, Deng XH, Kraus VB, Trumble TN, Billinghurst RC, Turner AS, Warren RF, Rodeo SA. Biochemical, biomechanical, histological, and radiographic indices of arthritis in an ovine post-meniscectomy model. Orthopaedic Research Society – 49th Annual Meeting. New Orleans, LA. February 2-4, 2003.

34. **Potter HG**. MRI of meniscus transplants. The 2003 Meniscus Transplantation Study Group Meeting. New Orleans, LA. February 6, 2003.

35. McCarty EC, Juliao SF, Glenn E, Gordon J, **Potter H**. Incorporation and function of fresh osteochondral allografts versus autografts. American Orthopaedic Society for Sports Medicine – 29th Annual Meeting. San Diego, CA. July 20-23, 2003.

36. McCarty EC, Juliao SF, Glenn E, Gordon J, **Potter H**. Incorporation and function of fresh osteochondral allografts versus autografts. 5th Symposium of the International Cartilage Repair Society. Gent, Belgium. May 26-29, 2004.

37. Kelly BT, **Potter HG**, Deng XH, Pearle AD, Turner AS, Warren RF, Rodeo SA. Meniscal allograft transplantation in the sheep knee: Evaluation of chondroprotective effects. Hospital for Special Surgery - Alumni Association's 86th Annual Meeting. New York, NY. November 4-5, 2004.

38. Warner KK, Williams RJ, Petrigliano FA, **Potter HG**, Hatch J, Cordasco FA. MRI evaluation of isolated arthroscopic partial meniscectomy at a minimum 5-Year follow-up in asymptomatic patients. Hospital for Special Surgery - Alumni Association's 86th Annual Meeting. New York, NY. November 4-5, 2004.

39. Mithöfer K, Archambault JM, Kawamura S, Turner SA, **Potter H**, Seeherman H, Rodeo SA. Biologic augmentation of experimental rotator cuff repair with rhBMP-12. Abstract #202

presented at the American Academy of Orthopaedic Surgeons – 72nd Annual Meeting Proceedings. Washington DC. February 23-27, 2005.

40. Kelly BT, **Potter HG**, Pearle AD, Dent XH, Warren RF, Turner AS, Rodeo SA. T_2 mapping of cartilage degeneration in an ovine post-meniscectomy model. Abstract #252 presented at the American Academy of Orthopaedic Surgeons – 72nd Annual Meeting Proceedings. Washington DC. February 23-27, 2005.

41. Gardner MJ, Yacoubian SV, Geller DS, Suk M, Mintz DN, **Potter H**, Helfet DL, Lorich DG. Soft tissue injury in operative tibial plateau fractures: An MRI study of 103 patients. Abstract #347 presented at the American Academy of Orthopaedic Surgeons – 72nd Annual Meeting Proceedings. Washington DC. February 23-27, 2005.

42. Gardner MJ, Yacoubian SV, Geller DS, Suk M, Mintz DN, **Potter H**, Helfet DL, Lorich DG. Prediction of soft tissue injuries in Schatzker II tibial plateau fractures. Abstract #349 presented at the American Academy of Orthopaedic Surgeons – 72nd Annual Meeting Proceedings. Washington DC. February 23-27, 2005.

43. Warner KK, Williams RJ, Petrigliano F, **Potter H**, Hatch JD, Cordasco FA. MRI evaluation of isolated arthroscopic partial meniscectomy at a minimum five year follow-up. Abstract #391 presented at the American Academy of Orthopaedic Surgeons – 72nd Annual Meeting Proceedings. Washington DC. February 23-27, 2005.

44. Mithöfer K, Williams, RJ, **Potter H**, Marx RG, Jones EC, Sheehan R, Wickiewicz TL, Warren RF. Prospective evaluation of the microfracture technique for isolated cartilage defects of the femur. Abstract #394 presented at the American Academy of Orthopaedic Surgeons – 72nd Annual Meeting Proceedings. Washington DC. February 23-27, 2005.

45. Kelly BT, **Potter H**, Pearle AD, Deng XH, Turner AS, Warren RF, Rodeo SA. Meniscal allograft transplantation in the sheep knee: Evaluation of chondroprotective effects. Abstract #395 presented at the American Academy of Orthopaedic Surgeons – 72nd Annual Meeting Proceedings. Washington DC. February 23-27, 2005.

46. McCarty EC, Glenn E, Juliao SJ, **Potter HG**, Ho ST, Gordon J, Spindler KP. Fresh osteochondral allograft versus autograft: Twelve month results in isolated canine knee defects. The American Orthopaedic Society for Sports Medicine - 31st Annual Meeting. Keystone, CO. July 14-17, 2005.

47. Williams RJ, Ranawat AS, **Potter HG**, Carter T, Warren RF. A prospective analysis of knee cartilage defects treated with fresh stored osteochondral allografts. 6th Symposium of the International Cartilage Repair Society. San Diego, CA. January 8-11, 2006.

48. Harnley HW, Williams RJ, Wickiewicz TL, Marx RG, **Potter HG**, Warren RF. Microfracture vs mosaicplasty: Clinical outcome at two years. American Academy of Orthopaedic Surgeons – 74th Annual Meeting Proceedings. San Diego, CA. February 14-18, 2007.

49. Cooper HJ, Ranawat AS, **Potter HG**, Ranawat CS. MRI in the diagnosis and management of periprosthetic inflammation and osteolysis following total hip arthroplasty. American Academy of Orthopaedic Surgeons – 74th Annual Meeting Proceedings. San Diego, CA. February 14-18, 2007.

50. Foo LF, Jawetz ST, Vasanth LC, Mandl LA, Adler RS, **Potter HG**. The use of magnetic resonance angiography (MRA) in the assessment of synovial disease in patients with early rheumatoid arthritis. 15th Annual Meeting of the International Society for Magnetic Resonance in Medicine. Berlin, Germany. May 19-25, 2007.

51. Foo LF, Jawetz ST, Williams RJ, **Potter, HG**. MRI and quantitative T_2 mapping of cartilage repair using synthetic biphasic acellular scaffold. 15th Annual Meeting of the International Society for Magnetic Resonance in Medicine. Berlin, Germany. May 19-25, 2007.

52. **Potter HG**, Maderazo A, Trost D, Saboeiro G and Haas SB. Magnetic resonance angiography in the management of spontaneous hemarthrosis following knee arthroplasty. 24th Annual Meeting of The Knee Society. Siena, Italy. September 5-6, 2007.

52. Davisson T, Zhang R, Foo LF, Juda G, Masini M, Coyle S, Aponte C, **Potter HG**, Long M, Monica H. Novel allograft sponge supports fill of osteochondral defects in caprine model. 55th Annual Meeting of the Orthopaedic Research Society. Las Vegas, NV. February 22-25, 2009

53. Fortier L, **Potter HG**, Rickey E, Schnabel L, Ellsworth J, Foo LF, Nixon A. Concentrated bone marrow aspirate improves full-thickness cartilage repair. 55th Annual Meeting of the Orthopaedic Research Society. Las Vegas, NV. February 22-25, 2009

54. Foo LF, Chong LR, Koff MF, Truncale K, Riley T, Semler E, Rodeo S, **Potter HG**. Quantitative MR imaging of cartilage repair in a goat model. 55th Annual Meeting of the Orthopaedic Research Society. Las Vegas, NV. February 22-25, 2009.

55. Koff MF, Takahashi A, **Potter HG**. Quantitative MRI of Fibrocartilage**.** ISMRM 17th Scientific Meeting and Exhibition. Honolulu, HI. April 18-24, 2009.

56. Koff MF, Chong LR, Virtue P, Ying L, Foo LF, **Potter HG**. MRI Analysis of Bone & Physeal Cartilage. ISMRM 17th Scientific Meeting and Exhibition. Honolulu, HI. April 18-24, 2009.

57. **Potter HG**, Koff MF, Juluri V, Su E. MR imaging of metal on metal surface replacements. Closed Scientific Meeting of the Hip Society. Palo Alto, CA. September 24-26, 2009.

58. **Potter HG**, Koff MF, Juluri V, Su E, Campbell G. MR imaging of metal on metal surface replacements._ The 2010 Hip Society/AAHKS Combined Specialty Day Meeting. New Orleans, LA. March 13, 2010.

59. Noyes FR, Chen R, Barber-Westin SD, **Potter HG**. Minimum Ten-Year Analysis of Red-White Longitudinal Meniscus Repairs Using 3T MRI and Clinical Parameters. 2010 AAOS Annual Meeting. New Orleans, LA. March 12, 2010.

60. Koff MF, Koch KM, **Potter HG.** Magnetic Resonance Imaging of Periprosthetic Tissues in the Presence of Joint Arthroplasty. Joint Annual Meeting ISMRM-ESMRMB 2010. Stockholm, Sweden. May 1-7, 2010.

61. Koff MF, **Potter HG.** Ultrashort Echo Imaging (UTE) of Rotator Cuff Repair in an Ovine Model. Joint Annual Meeting ISMRM-ESMRMB 2010. Stockholm, Sweden. May 1-7, 2010.

62. KM Koch, KF King, MF Koff, **HG Potter**. MAVRIC Imaging Near Metal Implants with Improved Spatial Resolution and Reduced Acquisition Time. Joint Annual Meeting ISMRM-ESMRMB, Stockholm, Sweden, 1-7 May 2010, p.892.

63. Noyes FR, **Potter HG,** Chen RCY, Barber Westin SD. Minimum Ten Year Analysis of Red-White Longitudinal Meniscus Repairs Using 3T MRI and Clinical Parameters. AOSSM 2010 Annual Meeting. Providence, Rhode Island. 15 July, 2010.

64. **Potter HG** MRI in THA: A Prospective Blinded Comparison of MRI with Histopathology of Retrieved Tissue 2010 Summer Meeting of the Hip Society. New York, New York. 24 September, 2010.

65. Hammoud S, Kepler C, **Potter HG**, Green DW. Bone Marrow Edema Patterns of the Knee in Symptomatic Pediatric Patients. 2011 Annual AAOS Meeting. San Diego, CA. Feb 17-19, 2011.

66. Petrigliano F, Su H, Foo LF, Solsky I, Wickiewicz T, Rodeo S, Warren R, **Potter HG**, Williams R. Use of a Biphasic Scaffold for the Treatment of Isolated Osteochondral Defects of the Knee. 2011 Annual AAOS Meeting. San Diego, CA. Feb 17-19, 2011

67. **Potter HG**. MRI and CT for Evaluation of Complications after THA. 2011 AAOS Annual Meeting: Specialty Day. San Diego, CA. February 19, 2011.

68. Koff MF, Hayter CL, Shah P, Koch KM, Miller TT, **Potter HG**. Magnetic Resonance Imaging of Arthroplasty: Comparison of MAVRIC and Conventional Fast Spin Echo Techniques. 2011 Annual ISMRM Meeting. Montreal, Quebec, Canada. May 10, 2011.

69. Pownder S, Koff MF, James A, Gebhard HH, Hartl R, Bowles RD, Bonassar LJ, **Potter HG.** Morphologic and Quantitative Mapping of Biological Disc Contructs in a Rat Tail Model. 2011 Annual ISMRM Meeting. Montreal, Quebec, Canada. May 11, 2011.

70. Pownder S, Koff MF, Fortier L, Castiglione E, Saska R, Bradica G, Novakofski K, **Potter HG**. Quantitative and Morphologic Evaluation of Cartilage Repair in an Equine Model. 2011 Annual ISMRM Meeting. Montreal, Quebec, Canada. May 11, 2011.

71. Hayter C, **Potter HG,** Padgett DE, Perino G, Nestor BJ MRI Assessment of Wear-Induced Synovitis.2011 Annual ISMRM Meeting. Montreal, Quebec, Canada. May 10, 2011.

72. Koff MF, Fortier LA, Rodeo SA, Takahashi A, Maher S, Delos D, Shah P, **Potter HG**. Temporal and Regional Changes of T2* in the Repaired Meniscus. 2011 Annual ISMRM Meeting. Montreal, Quebec, Canada. May 10, 2011.

73. Koff MF, Fortier L, Rodeo S, Shah P, Romero B, Pownder S, Williams R, Mahr S, **Potter HG**. Correlations of meniscal T2* with multiphoton microscopy and changes of articular cartilage T2 in an ovine model of meniscal repair. ISMRM 20th Annual Meeting and Exhibition. Melbourne, Australia. May 5-11, 2012.

74. Koch K, Koff MF, Chen W, **Potter HG**. Extracting phase contrast from MAVRIC images near metal implants. ISMRM 20th Annual Meeting and Exhibition. Melbourne, Australia. May 5-11, 2012.

Abstracts

1. Montgomery KD, Helfet DL, **Potter HG**. Magnetic resonance (MR) imaging of acetabular fractures. Orthopaedic Transactions 17(2):424.

2. Montgomery KD, **Potter HG**, Heise C, Helfet DL. The evaluation of acetabular fractures with magnetic resonance (MR) imaging. Orthopaedic Transactions 18(3):723-724.

3. Montgomery KD, **Potter HG**, Helfet DL. The use of magnetic resonance imaging to evaluate deep venous system of the pelvis in patients with acetabular fractures. Orthopaedic Transactions 18(4):1034-1035.

4. Gerwin M, **Potter HG**, Weiland AJ, Hotchkiss RN, McCormack RR. The use of MRI in the evaluation of disorders of the wrist. Orthopaedic Transactions 18(4):1090-1091.

5. MacGillivray JD, Fealy S, **Potter H**, O'Brien J. Three-dimensional analysis of acromial morphology: a classification system with clinical correlations. Orthopaedic Transactions 19(1): 43.

6. Field LD, Deutsch A, Altchek DW, **Potter HG**, O'Brien SJ. Diagnosis of partial thickness rotator cuff tears using magnetic resonance imaging. Orthopaedic Transactions 19(2):457.

7. Speer KP, Paletta GA, Pavlov H, **Potter HG**, et al. The degenerative supraspinatus: A correlative investigation. Orthopaedic Transactions 19(2):456-457.

8. Montgomery KD, **Potter HG**, Helfet DL. Detection and management of proximal deep venous thrombosis in patients with acute acetabular fractures. Orthopaedic Transactions 19(3):738.

9. Bisson L, Kalainov D, **Potter H**, DeCarlo E, O'Malley M, Hannafin J. Achilles tendon disorders: Correlation between MRI, surgery, and histopathology. Orthopaedic Transactions 19(4):713-714.

10. Montgomery KD, **Potter HG**, Helfet DL. Detection and management of proximal deep venous thrombosis in patients with acute acetabular fractures. Orthopaedic Transactions 19(4):738.

11. Rodeo S, **Potter H**, Wickiewicz T, Warren R. Magnetic resonance imaging of meniscal allografts: Correlation with early outcome. Orthopaedic Transactions 19(4):754.

12. **Potter HG**, Hannafin JA, Morwessel RM, DiCarlo EF, O'Brien SJ, Altchek DW. Lateral epicondylitis: Correlation of MR imaging, surgical, and histopathologic findings. Abstracted in 1997 Year Book of Hand Surgery.

13. **Potter HG**, Linklater JM, Allen AA, et al. Magnetic resonance imaging of articular cartilage in the knee: An evaluation with the use of fast-spin-echo imaging. Abstracted in 1999 Year Book of Sports Medicine.

14. Connell DA, **Potter HG**, Sherman MF, et al. Injuries of the pectoralis major muscle: evaluation with MR imaging. Radiology 1999; 210:785-791. Abstracted in 2000 Year Book of Sports Medicine.

15. Connell DA, **Potter HG**, Wickiewicz TL, et al. High resolution magnetic resonance imaging of superior labral lesions: 102 cases confirmed at arthroscopic surgery. Am J Sports Med 1999; 27(2):208-213. Abstracted in 2000 Year Book of Sports Medicine.

16. Duncan NO, Walker PS, **Potter HG**. Customized resurfacing of the knee – Design of the shell knee replacement. Advances in Bioengineering ASME 2001; BED 51:1-2.

CURRICULUM VITAE

JO A. HANNAFIN, M.D., Ph.D.

A. DATE OF BIRTH: June 3, 1955

CITIZENSHIP: United States of America

LICENSURE: New York State 172771
Connecticut 039752

FAMILY: John P. Brisson (spouse)
Andrew H. Brisson, Caitlin P. Brisson, Connor A. Brisson (children)

B. ADDRESS: (home) 8 Carissa Lane
Greenwich, Connecticut 06830
mdrow@aol.com

(office) 535 East 70th Street
New York, New York 10021
Tel: (212) 606-1469
Fax: (212) 535-9519
hannafinj@hss.edu

C. EDUCATION

Brown University — 1973-1977
Providence, Rhode Island
Sc. B. Aquatic Biology with Departmental Honors

Dartmouth College — 1977-1979
Hanover, New Hampshire
Post graduate coursework

Albert Einstein College of Medicine — 1979-1985
Bronx, New York
M.D., M.S., Ph.D. Physiology and Biophysics

D. PROFESSIONAL EXPERIENCE

<u>Post Graduate Training:</u>

Research Assistant — 1977-1979
Dartmouth College

Internship in General Surgery — 1985-1986
Montefiore Medical Center
Albert Einstein College of Medicine

Residency in Orthopaedic Surgery — 1986-1990
Montefiore Medical Center
Albert Einstein College of Medicine

Research Fellow Laboratory for Comparative Orthopaedic Research Hospital for Special Surgery	1990-1991
Sports Medicine and Shoulder Fellow Hospital for Special Surgery	1991-1992

Academic Appointments

Director of Orthopaedic Research Hospital for Special Surgery	2003 - present
Professor of Orthopaedic Surgery Weill Medical College of Cornell University	2005 - present
Associate Professor of Orthopaedic Surgery Weill Medical College of Cornell University	2000 - 2005
Associate Director Laboratory for Soft Tissue Research Hospital for Special Surgery	1992 - 2007
Assistant Professor of Orthopaedic Surgery Weill Medical College of Cornell University	1999 - 2000
Assistant Professor of Surgery (Orthopaedics) Cornell University Medical College	1996 - 1999
Instructor in Surgery (Orthopaedics) Cornell University Medical College	1992 - 1996
Senior Clinical Associate in Surgery (Orthopaedics) Cornell University Medical College	1991 - 1992

Hospital Appointments:

Attending Orthopaedic Surgeon Hospital for Special Surgery	2005 - Present
Attending Surgeon (Orthopaedics) New York Hospital	2005 - Present
Associate Scientist Hospital for Special Surgery	1996 - Present
Orthopaedic Director, Women's Sports Medicine Center Hospital for Special Surgery	1995 - Present
Associate Attending Orthopaedic Surgeon Hospital for Special Surgery	2000 - 2005
Associate Attending Surgeon (Orthopaedics) New York Hospital	2000 - 2005
Assistant Attending Orthopaedic Surgeon	1992 - 2000

Hospital for Special Surgery

Assistant Attending Surgeon (Orthopaedics) New York Hospital	1993 - 2000
Assistant Scientist Hospital for Special Surgery	1992 -1996
Junior Attending Orthopaedic Surgeon The Hospital for Special Surgery	1991 -1992
Surgeon (Orthopaedics) New York Hospital	1991 – 1992
Clinical Assistant Attending Orthopaedic Surgeon Montefiore Medical Center Albert Einstein College of Medicine	1990 -1991

The Einstein Quarterly Journal of Biology and Medicine

Editor-in-Chief	1984-1985
Associate Editor	1983-1984
Editorial Board Member	1982-1985

E. BOARD CERTIFICATION

American Board of Orthopaedic Surgery Certification	1/1/95 - 12/31/05
American Board of Orthopaedic Surgery Recertification	1/1/05 - 12/31/14
American Board of Orthopaedic Surgery Subspecialty Certification in Sports Medicine	1/1/10 – 12/31/19

F. PROFESSIONAL MEMBERSHIPS

American Academy of Orthopaedic Surgeons
American Orthopaedic Society for Sports Medicine
AOA
Orthopaedic Research Society
Ruth Jackson Orthopaedic Society
Herodicus Society
American Medical Association
American Medical Women's Association
New York State Medical Society
Women's Medical Association of New York
United States Rowing Sports Medicine Society

G. HONORS AND AWARDS

Summer Fellow of the Maine Heart Association Mt. Desert Island Biological Laboratory Salsbury Cove, Maine	1976
Sigma Xi	1977
NIH Medical Scientist Training Program Fellow	1979-1985
Alpha Omega Alpha	1985

Selznick Award for Excellence in Research Montefiore Medical Center Albert Einstein College of Medicine	1990
NIH Postdoctoral Fellow The Hospital for Special Surgery	1990-1992
Phillip D. Wilson Award for Excellence in Research The Hospital for Special Surgery	1992
Orthopaedic Research Society New Investigator Recognition Award	1993
Elected to the Herodicus Society	1998
O'Donoghue Award for Excellence in Research American Orthopaedic Society for Sports Medicine	1998
Outstanding Woman in Science Award New York Academy of Sciences	1999
Congress of International Society of Arthroscopy, Knee Surgery and Traumatology "Back Pain in Intercollegiate Rowers", 3rd prize	2001
Irish America Magazine Top 100 Award	2003
Jack Kelly Award, US Rowing	2004
Alexandra Kirkley Honorary Lectureship The Forum, San Diego CA,	2004
Elected to the American Orthopaedic Association	2004
University of Iowa Ruth Jackson Lectureship Award (Outstanding contribution in the advancement of women and women's health issues in orthopaedic surgery)	2005
Phillip D. Wilson Award for Excellence in Research The Hospital for Special Surgery (faculty co-PI)	2006
James Garrick Sports Medicine Lectureship Seattle, Washington	2008
Orthopaedic Research Society Women's Leadership Forum Award	2009
Castle and Connolly Guide Top Doctors New York Magazine Best Doctors	1994-2011 1994-2011
Women's Health, Top Doctors for Women	2009-2010
Einstein-Montefiore Orthopaedics Distinguished Alumnus Award	2010
Honorary Medical Officer, City of New York Fire Department	2010

H. INSTITUTIONAL RESPONSIBILITIES

Teaching: Resident and fellow sports medicine and basic science core curriculum

Supervision of resident research projects

Faculty advisor: Samuel Taylor, M.D., (orthopaedic resident 2008-2013)
Moira McCarthy, M.D., (orthopaedic resident 2008-2013)

Haydee Brown, M.D. (orthopaedic resident 2006-2011)
Carolyn Hettrick, M.D., M.P.H. (orthopaedic resident, 2005-2010)
Katherine Bardzick, M.D. (orthopaedic resident, 2003-2008)
Leslie Beasley, M.D. (orthopaedic resident, 1999-2004)
Deborah Faryniarz, M.D. (orthopaedic resident, 1996-2001)

Faculty advisor for medical students:
Stephen Koehler (2008 summer research, Mt Sinai)
Sophie Bartisch (2005, Weill Medical College, Cornell)
Sarah Snelgrove, (2000, Weill Medical College, Cornell)
Amy Abbott (1999, Weill Medical College, Cornell)
Amy McClean (1999 Weill Medical College, Cornell)

,

Faculty, Anatomy Course (Lower Limb), 1997, 1998, 1999
Cornell University Medical College

Module Director: "Regulation of Musculoskeletal Tissue Injury and Repair
Advanced Biomedical Science Course, 2006, 2007, 2008, 2009
Weill Medical College of Cornell University

Administrative: Director of Orthopaedic Research, Hospital for Special Surgery (2003 - present)

Department of Orthopaedic Surgery Promotions Committee (2003- present)

Professional Safety Committee (2006 – present)

Research Division Appointments and Promotions Committee (2003-present)

Research Committee of the Board of Trustees (2003-present)

Faculty Research Council, HSS (2003- present)

Resident Appraisal Committee, HSS (2001-present)

Orthopaedic Director, Women's Sports Medicine Center, HSS (1994-present)

Residency Selection Committee (1994-2004, 2010-2015)

Clinical Research Compliance Committee, HSS (2005 – 2008)

Alumni Affairs Committee (2003-2006)

Committee on Graduate Medical Education, HSS (2003-2006)

Physician Member, Board of Trustees, Hospital for Special Surgery (2003-2005)

Authorship Committee, HSS (2000-2005)

Clinical Research Task Force, HSS (2001-2003)

Medical Board, Hospital for Special Surgery
Member-at-large (2000-2001), Secretary (2001-2002)
Chair, Nominating Committee (2003, 2002)

Orthopaedic Surgery Quality Assurance Committee, HSS (1994-2000)

Institutional Review Board, HSS (1993-1999)

Research: Chair, Orthopaedic Clinical Research Panel, HSS (2003- present)

Resident Research Committee, HSS (2003- present)

Independent laboratory program in ligament mechanotransduction

Clinical:
Hospital based orthopaedic practice (outpatient, inpatient, surgical).

I. RESEARCH SUPPORT

"The Dialysis Disequilibrium Syndrome:
An Experimental Model in the Elasmobranch"
Maine Heart Association, Principal Investigator, 6/76-9/76 ($1000)

"Solute Transport by Bovine Chondrocytes in Monolayer Culture"
Resident Research Grant, Orthopaedic Research and Education Foundation
Principal Investigator, 8/89-12/90 ($15,000)

"The Effect of Mechanical Load on Solute Transport in Bovine Fibroblasts"
NIH MAMDC Development and Feasibility Grant
Principal Investigator (25%effort), 7/93-6/96 ($150,000)

“The Effect of Blood and Blood Components on Immature and Mature Cartilage Biology”
NY Chapter Arthritis Foundation: Arthritis and Sports Related Injuries Program
Co-Investigator (5% effort as orthopaedic consultant), 7/94-6/95 ($20,000)

“Analysis of Extracellular Matrix in Shoulder Capsule in Patients with Multidirectional Instability of the Shoulder”
Foundation for Sports Medicine Education and Research.
Scott Rodeo M.D., PI; Co-PI (faculty advisor), 7/95-6/96 ($14,850)

“Immunolocalization of Cytokines in Adhesive Capsulitis”
Arthroscopy Association of North America
Scott Rodeo, M.D. Principal Investigator; Co-investigator (faculty advisor),
7/95-6/96 ($6000)

“Characterization of Canine Ligament Fibroblasts”
Institute for Sports Medicine Research
Jo A. Hannafin, M.D., Ph.D., Principal Investigator
1/97-1/99 ($30,000)

“Meniscal Repair: Tissue Welding Using Purified Fibrinogen and an Ultraviolet Laser”
Arthroscopy Association of North America
Struan Coleman, MD, Principal Investigator; Co-investigator (Faculty Advisor)
7/97-6/98 ($20,000)

"Meniscal Repair in an Ovine Model: The Role of Hepatocyte Growth Factor"
Institute for Sports Medicine Research
Chisa Hidaka, MD, Principal Investigator, Co-investigator (faculty advisor)
7/99-6/00 ($47,000)

"Mechanotransduction and Matrix Turnover in Ligament Fibroblasts"
Institute for Sports Medicine Research
Jo A. Hannafin, M.D., Ph.D. Principal Investigator
12/03-12/04 ($64,000)

"Mechanotransduction and Matrix Turnover in ACL"
NIAMS RO1 AR049339-01A2
Jo A. Hannafin, M.D., Ph.D., Principal Investigator
8/20/05 – 7/31/09 (one year extension) ($1,122,000)

"Adhesive Capsulitis: A Quantitative Analysis of Myofibroblast Proliferation"
Joseph M. Lane, MD Resident Research Grant,
Katherine Vadasdi, M.D. (Principal Investigator)
Jo A. Hannafin, M.D., Ph.D., Faculty Advisor
3/07 – 3/08 ($15,000)

"Multi-center ACL Revision Study (MARS)"
American Orthopaedic Society for Sports Medicine (AOSSM)
Kurt Spindler (PI)
Jo A. Hannafin, M.D., Ph.D., Unpaid collaborator
1/1/2006 – 12/31/2008

"Role of Mechanotransduction in Modulation of MMP and TIMP in Human ACL Fibroblasts"
Joseph M. Lane, MD Resident Research Grant
Haydee C. Brown, M.D. (Principal Investigator)
Jo A. Hannafin, M.D., Ph.D., Faculty Advisor
6/10-6/11 ($15,000)

J. PATENTS

United States Patent 6060474
Method for Preventing Scar Formation
Williams, Riley J. and Hannafin Jo A.

United States patent # 6187742
Method for Healing and Repair of Connective Tissue Attachments
Wozney, John M, Rodeo, Scott A, Hannafin, Jo A, and Warren, Russell F.

K. EXTRAMURAL PROFESSIONAL RESPONSIBILITIES

The American Orthopaedic Society for Sports Medicine
- Board of Directors, 2007-2015
  - President, 2013-2014
  - President-Elect, 2012-2013
  - Vice President, 2011-2012
  - Secretary, 2008-2011
  - Secretary Elect, 2007-2008
  - Budget and Finance Committee, 2012-2014
  - Committee on Committees, 2011-2014

The American Orthopaedic Society for Sports Medicine
- STOP Steering Committee, 2008-2012
- Youth Sports Safety Committee, 2008-2012
- Enduring Education Committee, 2006-2010
  - Chair, 2006-2010
- Education Council, 2006-2010
- Council of Delegates, 2005 – 2008
- Self Assessment Exam Committee, 2004-2005
- Research Committee, 1999–2005
  - Chair, 2001-2004
  - Research Awards Subcommittee 1999-2005
    - Chair, 2000, 2001
  - Young Investigator Grant Subcommittee, 1999-2004
- Ad Hoc Committee on Education, 2001-2004
- Chair, AOSSM Research Design Meeting, 2003, 2004
- Planning Committee, Consensus Conference on Non-Contact ACL Injury, 2004
- Curriculum Committee, 2001-2004
- Nominating Committee, 2001
- Chair, Research Conference on the Non-Contact ACL, 2002
- AOSSM Representative, Team Physician Consensus Conference, 2003
- Abstract Review: Basic Science, AOSSM Summer Meeting, 2001

NIH Study Section:
- Member, SBSR Study Section (2007-2011)
- Ad Hoc Member, SBSR Study Section (2005-2007)
- Ad Hoc Member, Musculoskeletal Rehabilitation Sciences (2004-2005)
- Member Special MRS Study Section, ZRG1 MOSS-F (2005)
- Member, Special Emphasis Panel SRG SBSR (2006-2007)

Orthopaedic Research and Education Foundation:
- Board of Trustees (2006-2012)
- Educational Grants Committee (2008- 2012)
- Vice Chair, Development (2008-2009)
- Nominating Committee (2008, 2009, 2010, 2011)
- ORS/OREF/AAOS Grant Writing Workshop Faculty 2006, 2007

Herodicus Society
- Executive Committee 2011-2012
- Secretary, 2009-2010
- Nominating Committee 2006-2007

Orthopaedic Research Society
- Subspecialty Chair, Shoulder and Elbow, Program Committee, 2007-2009
- Nominating Committee, 2008-2009
- ORS Program Committee, 1996-1997

American Academy of Orthopaedic Surgeons:
- Clinician-Scientist Committee, 2001-2006
- Clinician Scientist Development Program, 2003, 2004
- Biological Implants Committee, 1997-2000
- Subcommittee on Women's Health Issues, 2000
- NIH-AAOS Symposium on Women in Sports: Planning Committee, 1998-1999
- Orthopaedic Knowledge Update: Sports Medicine, Section Editor, 1997-1999

Ruth Jackson Orthopaedic Society:
- Grant Review Committee, 2006-2011
- Membership Committee, Chair 1997-2000

FISA (International Rowing Federation)
Medical Commission, 2000-present
FISA Forum, Chair, Planning Committee, Sports Medicine, Milan, Italy 2005

National Rowing Foundation:
Board of Trustees, 1998-present
Vice President, 2004 - present

US Rowing Association
Sports Medicine & Science Committee, 1992-present
Team Physician, 1994-present
US Rowing/USOC High Performance Enhancement Team, 2002-2008

Women's Sports Foundation:
Medical Advisory Board, 1996-2006

Editorial Review: Journal of Shoulder and Elbow Surgery
Journal of Orthopaedic Research
American Journal of Sports Medicine
Journal of Bone and Joint Surgery
Journal of the American Academy of Orthopaedic Surgeons
Clinical Orthopaedics and Related Research

Editorial Board: Bone & Joint: The Newsletter on Musculoskeletal Medicine, 2003-2004

Planning Committee: 1st International Conference on Prevention of Sports Injury, Norway, 2005
2nd International Congress On prevention of Sports Injury, Norway, 2008

L. SPORTS COVERAGE

Resident Team Physician, Football Public School Athletic League, Bronx, NY	1987-1990
Physician, New York City Marathon	1990
Team Coverage, Sports Medicine Fellow	1990-1992
New York-New Jersey Knights New York Football Giants New York METS Baseball St. Johns University Sports Teams	
Assistant Team Physician, New York METS Baseball	1992-1996
Team Physician, New York Power (WUSA)	2000-2003
New York Liberty (WNBA)	
Head Team Physician	2005-present
Team Physician, United States Rowing Team	1994-present
World Championships, Indianapolis, Indiana	1994
World Championships, Tampere, Finland	1995
World Championships, Aigubelette, France	1997
World Championships, St. Catherine, Ontario	1999
Olympic Qualification Regatta, Lucerne, Switzerland	2000
World Championships, Lucerne, Switzerland	2001
Pan American Games, Dominican Republic	2003
Olympic Games, Athens, Greece	2004
World Championships, Munich, Germany	2007
Olympic Games, Atlanta Georgia	
Physician, Athletes Medical Services, Rowing Venue	1996
United States Olympic Committee	
Physician, US Olympic Training Center, Colorado Springs	2002
Team Physician, Pan American Games, Dominican Republic	2003
Team Physician, Olympic Games, Athens Greece	2004
FISA Medical Commission	
Chief Medical Officer, FISA Championships, Seville, Spain	2002
Chief Medical Officer, FISA World Cup Regatta, Munich, Germany	2004
Chief Medical Officer, FISA World Cup Regatta, Eton, England	2005
Chief Medical Officer, FISA World Cup Regatta, Munich, Germany	2006
Chief Medical Officer, FISA World Cup Regatta, Vienna, Austria	2007
Chief Medical Officer, Junior/Senior World Championships, Austria	2008
Chief Medical Officer, U23 World Championships, Czech Republic	2009
Chief Medical Officer, FISA World Cup Regatta, Munich, Germany	2010
Chief Medical Officer, FISA Junior World Championships, England	2011
FISA medical Officer, Olympic Games, London, England	2012

M. BIBLIOGRAPHY

Scientific Articles:

1. Forster, R.P., Hannafin, J.A. and Goldstein, L. (1978) Osmoregulatory role of amino acids in the brain in the elasmobranch, Raja erinacea. Comp. Biochem. Physiol. 60A: 25-30.

2. Forster, R.P., and Hannafin, J.A. (1979) Influence of genetically determined atropinesterase on atropine inhibition of the "smoke (dive) reflex" in rabbits. Gen. Pharm. 10: 41-46.

3. Prusch, R.D., and Hannafin, J.A. (1979) Calcium distribution in Amoeba proteus. J.Gen. Physiol. 74: 511-521.

4. Prusch, R. D. and Hannafin, J.A. (1979) Sucrose uptake by pinocytosis in Amoeba proteus and the influence of external calcium. J. Gen. Physiol. 74: 523-535.

5. Forster, R.P., and Hannafin, J.A. (1980) Osmotic and cell volume regulation in atrium and ventricle of the elasmobranch skate, Raja erinacea. Comp. Biochem. Physiol. 65: 445-451.

6. Forster, R.P. and Hannafin, J.A. (1980) Taurine uptake in atrium myocardium by a sodium-dependent, B-amino acid system in the elasmobranch, Raja erinacea. Comp. Biochem. Physiol. 67C: 107-113.

7. Hannafin, J. A., Kinne-Saffran, E., Friedman, D., and Kinne, R. (1983) Presence of a sodium-potassium-chloride cotransport system in the rectal gland of Squalus acanthias. J. Membrane Biol. 75: 73-83.

8. Kinne, R., Hannafin, J.A., Koenig, B., and Kinne-Saffran, E. (1984) Mode of action of loop diuretics in chloride transporting epithelia. Proceed. First International Congress on Diuretics. In: Diuretics. Jules B. Puschett (ed.) Elsevier Science Publishing Co., pp. 447-449.

9. Hannafin, J.A., and Kinne, R. (1985) Active chloride transport in rabbit thick ascending limb of the Henle's loop and elasmobranch rectal gland: chloride fluxes in isolated plasma membranes. J. Comp. Physiol. (London) 155(4): 415-421.

10. Kinne, R., Hannafin, J.A., and Koenig, B. (1985) Illuminating the blackbox: focus on membranes. Curr. Eye Res. 4(4): 309-316.

11. Kinne, R., Hannafin, J.A., and Koenig, B. (1985) Role of NaCl KCl co-transport systems in active chloride absorption and secretion. Ann N.Y. Acad. Sci. 456: 198-206.

12. Kinne, R. Koenig, B., Hannafin, J.A., Kinne-Saffran, E., Scott, D.W., and Zierold, K. (1985) The use of membrane vesicles to study the NaCl/KCl cotransporter involved in active transepithelial chloride transport. Pflugers Arch. 405 (suppl. 1):5101-5105.

13. Kinne, R., Kinne-Saffran, E., Hannafin, J.A., Koenig, B., Schultz, J., and Vickerman, B. (1985) Role of sodium cotransport systems in epithelial transport. Ann. N.Y. Acad. Sci. 435: 39-47.

14. Sobel, M., Geppert, M.J., Hannafin, J.A., Bohne, W.H.O., and Arnoczky, S.P. (1992) The microvascular anatomy of the peroneal tendons. Foot and Ankle 13(8): 469-472.

15. Geppert, M.J., Sobel, M., and Hannafin, J.A., (1993) Microvasculature of the tibialis anterior tendon. Foot and Ankle 14(5): 261-264.

16. Hannafin, J.A., and Arnoczky, S.P. (1994) The effect of cyclic and static tensile loading on water content and solute diffusion in canine flexor tendons - An in-vitro study. J. Orthop. Res 12: 350-356.

17. Speer, K.P., Hannafin, J.A., Altchek, D.W., and Warren, R.F. (1994) An evaluation of the shoulder relocation test. Am. J. Sports Med. 22(2): 177-183.

18. Arnoczky, S.P., Cooper, T.G., Stadermaier, D.M., and Hannafin, J.A. (1994) Magnetic resonance signals in healing menisci: An experimental study in dogs. Arthroscopy, 10(5): 552-557.

19. Potter, H.G., Hannafin, J.A., Morwessel, R.M., DeCarlo, E.F., O'Brien, S.J., Altchek, and D.W. (1995) Lateral epicondylitis: Correlation of MR imaging, surgical, and histopathologic findings. Radiology, 196:43-46.

20. Westrich, G.H., Hannafin, J.A. and Potter, H.G. (1995) Isolated rupture and repair of the popliteus tendon. Arthroscopy 11(5): 628-632.

21. Hannafin, J.A., Arnoczky, S.P., and Torzilli, P., (1995) The effect of stress deprivation and cyclic tensile loading on the histology and material properties of canine flexor tendon; An in-vitro study. J. Orthop. Res, 13(6): 907-914.

22. Murrell, G.C., Dolan, M.M., Jang, D., Szabo, S., Warren, R.F., Hannafin, J.A. (1996) Nitric oxide: An important articular free radical. JBJS, 78A(A): 265-274.

23. Hannafin, J.A., and Schelkun, P.H. (1996) How I manage tennis and golfer's elbow. Phys Sportmed Feb 24(2):63-68, 71.

24. Schatz, J.A., Potter, H.G., Rodeo, S.A., Hannafin, J.A., and Wickiewicz, T.L. (1997) MR imaging of anterior cruciate ligament reconstruction. Am J Radiology 169:223-228.

25. Hung, C.T., Allen, F.D., Pollack, S.R., Attia, E.T., Hannafin, J.A., and Torzilli, P.A., (1997) Intracellular calcium response of anterior cruciate and medial collateral ligament fibroblasts to fluid-induced shear stress. Cellular Signaling 9(8): 587-594.

26. Murrell, G.A., Szabo, C., Hannafin, J.A., Jang, D. Dolan, M.M., Deng X.H., Murrell, D. F., Warren, R.F. (1997) Modulation of tendon healing by nitric oxide. Inflammation Res. 46(1): 19-27.

27. Rodeo, S.A., Hannafin, J.A., Tom, J., Warren, R.F., Wickiewicz, T.L (1997). Immunolocalization of cytokines and their receptors in adhesive capsulitis of the shoulder. J.Orthop.Res.15(3):427-436.

28. Warner, J.J.P., Bowen, M.K., Deng, X. -H., Hannafin, J.A., Arnoczky, S.P., Warren, R.F. (1998) Articular contact patterns of the normal glenohumeral joint. J Shoulder Elbow Surg. 7(4): 381-388.

29. Potter, H.G., Linklater, J.M., Allen, A.A., Hannafin, J.A., Haas, S.B. (1998) Magnetic resonance imaging of articular cartilage in the knee: An evaluation with use of fast-spin-echo imaging. JBJS Am. 80(9): 1276-1284.

30. Murrell, GA, Jang, D., Deng, X-H., Hannafin, J.A., Warren, R.F. (1998) Effects of exercise on Achilles tendon healing in a rat model. Foot & Ankle Int. 19(9): 598-603.

31. Hannafin, J.A., Bhargava, M.M., Attia, E.A., Warren, R.F. (1999) Characterization of chemotactic migration and growth kinetics of canine knee ligament fibroblasts. J. Orthop. Res. 17(3): 398-404.

32. Bhargava M.M., Attia, E.A., Murrell, G.A.C., Dolan, M.M., Warren, R.F., Hannafin, J.A. (1999) The effect of cytokines on the proliferation and migration of bovine meniscal cells. Am J. Sports Med. 27(5): 636-643.

33. Bhargava, M.M., Beavis, A.J., Edberg, J.C., Warren, R.F., Attia, E.A., and Hannafin, J.A. (1999) Differential expression of integrin subunits in canine knee ligament fibroblasts. J Orthop. Res. 17(5):748-754.

34. Vad, V.V., and Hannafin, J.A. (2000) Frozen shoulder in women: Evaluation and management. J. Musculoskeletal Med. 17(1):13-28.

35. Beasley, L., Faryniarz, D.A., and Hannafin, J.A. (2000) Multidirectional instability of the shoulder in the female athlete. Clinics in Sports Medicine: The Athletic Woman, 19(2):331-349.

36. Hannafin, J.A. and Chiaia, T.A. (2000) Adhesive Capsulitis: A Treatment Approach. Clin. Orthop. Rel. Res. 372:95-109.

37. Anderson, K., Marx, R., Warren, R.F., and Hannafin, J.A. (2000) Chondral injury following meniscal repair with a biodegradable implant. A case report. Arthroscopy 16(7):749-753.

38. Tsuzaki, M., Brigman, B.E., Yamamoto, J. Lawrence, W.T., Simmons, J.G., Mohapatra, N.K., Lund, P.K., Van Wyk, J., Hannafin, J.A., Bhargava, M.M., Banes, A.J. (2000) Insulin-like growth factor-I is expressed by avian flexor tendon cells. JOR 18(4):546-556.

39. Strickland, S., and Hannafin, J.A. (2000) Frozen Shoulder. Current Opinion in Orthopaedics, 11:271-275.

40. Abbott, A.E., and Hannafin, J.A. (2001) Stress fracture of the clavicle in a female lightweight rower: A case report and review of the literature. AJSM 29(3):370-3372.

41. Marx, R.G., Saint-Phard, D., Callahan, L.R., Chu, J., Hannafin, J.A. (2001) Stress fracture sites related to underlying bone health in athletic females. Clin J Sports Med 11(2):73-76.

42. Suzuki, K., Attia, E.A., Hannafin, J.A., Rodeo, S.A., Warren, R.F., and Bhargava, M.M. (2001) The effect of cytokines on the migration of fibroblasts derived from different regions of the canine shoulder capsule. JSES 10(1):62-67.

43. Williams, R.J., Attia, E.A., Wickiewicz, T., and Hannafin, J.A. (2001) The effect of ciprofloxacin on tendon, paratenon and capsular fibroblast metabolism. Am. J. Sports Med. 28(3):364-369.

44. Hidaka, C, Ibarra, C, Hannafin, J.A., Torzill, P.A., Quitoriano, M, Jen, S.S., Warren, R.F., Crystal, R.G. (2002) Formation of vascularized meniscal tissue by combining gene therapy with tissue engineering. Tissue Eng 8(1):93-105.

45. Teitz, CC, O'Kane, J, Lind, B.K, and Hannafin, J.A. (2002) Back pain in intercollegiate rowers. AJSM 30(5):674-679.

46. Strickland, S.M., Belknap, T.W., Turner, S.A., Wright, T.M., and Hannafin, J.A. (2003) Lack of hormonal influences on mechanical properties of sheep knee ligaments. AJSM 31(2):210-215).

47. Seneviratne, A, Attia, E.A., Rodeo, S.R., Williams, R., Hannafin, J.A. (2004) The effect of estrogen on ovine anterior cruciate ligament fibroblasts: cell proliferation and collagen synthesis. AJSM 32(7):1613-1618.

48. Wahl, C.J., Warren, R.F., Adler, R.S., Hannafin, J.A., and Hansen, B. (2004) Internal coxa saltans (snapping hip) as a result of overtraining: A report of three cases in professional athletes. AJSM 32(5):1302-1309.

49. Kelly, B.T., Shapiro, G.S., DiGiovanni, C.W., Buly, R.L., Potter, H.G., Hannafin, J.A. (2005) Vascularity of the hip labrum: A cadaveric study. Arthroscopy 21(1):3-11.

50. Thornton, S.J., Rogers, J.R., Prickett, W.D., Dunn, W.R., Allen, A.A., and Hannafin, J.A. (2005) Treatment of recalcitrant lateral epicondylitis with suture anchor repair. AJSM 33(10):1538-1564.

51. El Chaar, M., Attia, E., Chen, J., Hannafin, J.A., Poppas, D.P., and Felsen, D. (2005) Cyclooxygenase-2 inhibitor decreases extracellular matrix synthesis in stretched renal fibroblasts. Exp Nephrology 100(4):50-55, Epub 2005.

52. Bhargava, M.M., Kinne-Saffran, E., Kinne, R.K.H., Warren, R.F., and Hannafin, J.A. (2005) Characterization of sulfate, proline and glucose transport systems in anterior cruciate and medial collateral ligament cells. Can J Physiol Pharm 83(11):1025-1030.

53. Bhargava, M.M., Hidaka, C., Hannafin, J.A., Doty, S., and Warren, R.F. (2005) Effects of hepatocyte growth factor and platelet derived growth factor on the repair of meniscal defects in vitro. In Vitro Cell Develop Biol – Animal (8-9):305-310.

54. Hannafin, J.A., Attia, E.A., Henshaw, R. and Bhargava, M.M. (2006) Effect of cyclic strain and plating matrix on cell proliferation and integrin expression by ligament fibroblasts grown on different matrices. J Orthop Res 24(2):149-158.

55. Henshaw, D.R., Attia, E.A., Bhargava, M.M., and Hannafin, J.A. (2006) Canine ACL fibroblast integrin expression and cell alignment in response to cyclic tensile strain in 3-dimensional collagen gels. J Orthop Res (3):481-490.

56. Brand, R.A. and Hannafin, J.A. (2006) The environment of the successful clinician-scientist. Clin Orthop Relat Res 449:67-71.

57. Griffin, L.Y., Arendt, E.A., Beynnon, B.D., Demaio, M., Dick, R.W., Engebretsen, L., Garrett, W.E., Hannafin, J.A. et al. (2006) Understanding and preventing non-contact anterior cruciate ligament injuries: A review of the Hunt Valley II meeting, January 2005. Am. J. Sports Med. 34(9):1512-1532.

58. Faryniarz, D.A., Bhargava, M., Lajam, C., Attia, E.T., and Hannafin, J.A. (2006) Quantitation of estrogen receptors and relaxin binding in human anterior cruciate ligament fibroblasts. In Vitro Cell Dev Biol Anim 42(7):176-181.

59. Sheridan, M.A. and Hannafin, J.A., (2006) Upper Extremity: Emphasis on Frozen Shoulder. Orthop Clin NA 37(4):531-539.

60. Battaglia, M., Cordasco, F., Hannafin, J.A.., Rodeo, S.A., O'Brien, S.J., Altchek, D.W., Wickiewicz, T., Warren, R.F. (2007) Results of revision anterior cruciate ligament surgery. Am. J. Sports Med. (35(12):2057-2066.

61. Marx, R.G., Malizia, R.W., Kenter, K., Wickiewicz, T.L., Hannafin, J.A. (2007) Intra-articular corticosteroid injection for the treatment of idiopathic adhesive capsulitis of the shoulder. HSS Journal 3(2): 202-207.

62. Sofka, C.M., Ciavarra, G.A., Hannafin, J.A., Cordasco, F.A., Potter, H.G. (2008) Magnetic resonance imaging of adhesive capsulitis: Correlation with clinical staging. HSS Journal 4(2):164-169. Epub 2008 Aug 20.

63. Templeton,K.J., Hame, S.J., Hannafin, J.A., Griffin, L.Y., Tosi, L.L. (2008) Sports Injuries in Women: Sex and gender Based Differences in Etiology and Prevention. In: *Instructional Course Lecture* 57:539-552.

64. Mikulic, P., Smoljanovic, T., Bojanic, I., and Hannafin, J. (2009) Does 2000-m rowing ergometer performance time correlate with final rankings at the World Junior Rowing Championships? A case study of 398 elite junior rowers. J Sports Science 27(4):361-366.

65. Smoljanovic, T., Bojanic, I., Hannafin, J.A., Hren, D., Delimar, D., Pecina, M. (2009) Traumatic and overuse injuries among international elite junior rowers. AJSM 37(6):1193-1199, Epub 2009 Mar 19.

66. Chiaia T.A., Maschi, R.A., Stuhr, R.M., Rogers, J.R., Sheridan, M.A., Callahan, L.R., Hannafin, J.A. (2009) A musculoskeletal profile of elite female soccer players. HSS Journal 5:186-192, Epub March 17, 2009.

67. Mikulic, P., Smoljanovic, T., Bojanic, I., and Hannafin, J.A (2009) Relationship between 2000-m

rowing ergometer performance times and World Championship rankings in elite-standard rowers. J Sports Science 27(9):907-913.

68. Attia, E., Brown, H.C., Henshaw,R., George, S., Hannafin, J.A. (2010) Patterns of gene expression in a rabbit partial anterior cruciate ligament transection model: The potential role of mechanical forces. AJSM 38:348-356; Epub December 4, 2009.

69. The MARS Group (J.A. Hannafin, contributing author) (2010). Descriptive epidemiology of the Multicenter ACL revision Study (MARS) cohort. AJSM 38:1979-1986.

70. Nevaiser, A.S., and Hannafin, J.A. (2010) Adhesive capsulitis: A review of current treatment. AJSM 38(11)2346-2356; Epub January 28, 2010.

71. Hettrich, C.M., Rodeo, S.A., Hannafin, J.A., Ehteshami, J., and Shubin Stein, B.E. (2011) The effect of muscle paralysis using Botox on the healing of tendon to bone in a rat model. J Shoulder Elbow Surg, 20(5):688-697, Epub December 29, 2010.

72. Wright, V., Attia, E., Brown, H., Bhargava, M., and Hannafin, J.A. (2011) Activation of MKK3/6, SAPK and ATF-2/c-JUN in ACL fibroblasts grown in 3 Dimension collagen gels in response to application of cyclic strain. J Orthop Res 29(3):397-402, Epub Sept 30, 2010.

73. Rakovac, M., Smoljanovic, T., Bojanic, I., Hannafin, J.A., Hren, D., and Thomas, P (2011) Body size changes in elite junior rowers: 1997-2007. Coll. Anthropol. 35(1):1-5.

74. Borchers, J.R., Kaeding, C.K., Pedroza, A.D., Huston, L.J., Spindler, K.P., Wright, R.W. and the MARS Group (J.A.Hannafin, contributing author) (2011) Intra-articular findings in primary and revision anterior cruciate ligament reconstruction surgery. A comparison of the MOON and MARS study groups. AJSM 39(9):1889-1893, Epub June 6, 2011.

75. Hosea, T.M. and Hannafin, J.A. (2012) Rowing Injuries. Sports Health (in press)

76. Taylor, S., and Hannafin, J.A. (2012) Elbow tendinopathy. Sports Health (in press)

77. Attia, E.A., Bhargava, M., Brown, H, Bohnert, K., and Hannafin, J.A. (in review) Characterization of total and active matrix metalloproteinases 1, 3, and 13 synthesized and secreted by ACL fibroblasts in 3D collagen gels. JOR.

78. Sherman, P., Rogers, J., Saint Phard, D., Callahan, L.R., and Hannafin, J.A. (in review) Atypical stress fracture sites predict bone health in active women. JBJS Am.

BOOK CHAPTERS and REVIEW ARTICLES

1. Arnoczky, S.P., Hannafin, J.A., and Hashimoto, J. (1993) Replacing the Anterior Cruciate Ligament - What Does It Take? In: *Intra-articular Reconstruction of the Anterior Cruciate Ligament*. Angus Stover (Ed.), Butterworth-Heinman Ltd. Oxford.

2. Hannafin, J.A. (1994) Upper Extremity Injuries. In: *Medical and Orthopaedic Issues of Active and Athletic Women.* Rosemary Agostini (Ed.) Hanley and Belfus Inc., Philadelphia, PA.

3. Hannafin, J.A., Pedowitz. R.A., Hidaka, C, and Garrett, W.E. (1994) Pathophysiology and Healing of Musculoskeletal Tissues. In: *Orthopaedic Knowledge Update-Sports Medicine*, American Academy of Orthopaedic Surgeons, Rosemont, Ill

4. Hannafin, J.A. (1997) Musculoskeletal Health and Disorders: Early Years/Young Adult. In: *Textbook of Women's Health*, L.A. Wallis (Ed.), Lippincott-Raven Publishers, New York, NY.

5. Hannafin, J.A. and Allen, A. (1999) Frozen Shoulder. In: *Textbook of Orthopaedics*, E. V. Craig (Ed.), Williams and Wilkins, Media, PA.

6. Callahan, L.R. and Hannafin, J.A. (2000) The Female Athlete. In: *Manual of Rheumatology and Outpatient Orthopedic Disorders,* S.A. Paget, A. Gibofsky, J.F. Beary (Eds.) Lippincott, Williams & Wilkins, Philadelphia, PA.

7. Hannafin, J.A. (2000) Rowing. In: *International Olympic Committee Encyclopaedia of Sports Medicine: Women in Sport*, B. L. Drinkwater (Ed.), Blackwell Science Ltd., Oxford, United Kingdom.

8. Stuhr, R., Callahan, L.R. and Hannafin, J.A. (2000) Gender Differences in Athletes. In: *Athletic Training and Sports Medicine, 3rd Edition,* R.C. Schenck (Ed.), American Academy of Orthopaedic Surgeons, Rosemont, IL.

9. Hannafin, J.A., and Hosea, T.M. (2001) Sports Epidemiology: Oar Sports. In: *Principles and Practice of Primary Care Sports Medicine*, W. Garrett, D.T. Kirkendall, D.L. Squire (Eds.) Lippincott, Williams and Wilkins, Philadelphia, PA.

10. Hannafin, J.A., Faryniarz, D.A., Beasley, L.S. (2001) Upper Extremity Injuries: Shoulder. In: *Women's Health in Sports and Exercise*, W.E. Garrett, G.E. Lester, J. McGowan, D.T. Kirkendall (Eds.) American Academy of Orthopaedic Surgeons, Rosemont, IL.

11. Hosea, T.M. and Hannafin, J.A (2002) Rowing. In: *The Female Athlete*, M.L. Ireland and A. Nattiv (eds), Saunders, Philadelphia, PA.

12. Hannafin, J.A. (2003) Adhesive Capsulitis. In: *Operative Arthroscopy, Third Edition,* J.B. McGinty, S.S. Burkhart, R.W. Jackson, D.H. Johnson, J.C. Richmond (Eds). Lippincott, Williams and Wilkins, New York, NY.

13. Callahan, L.R. Hannafin, J.A., and Sheridan, N. (2005) The Female Athlete. In: *Manual of Rheumatology and Outpatient Orthopedic Disorders,* S.A. Paget, A. Gibofsky, J.F. Beary (Eds.) Lippincott, Williams & Wilkins, Philadelphia, PA

14. Tomlinson, D.P., and Hannafin, J.A. (2009) Arthroscopic Treatment of Shoulder Stiffness and Calcific Tendonitis of the Rotator Cuff. In: *The Shoulder, Fourth Edition,* C.A. Rockwood, F.A. Matsen, M.A. Wirth and S.B. Lippitt, Saunders Elsevier, Philadelphia, PA.

15. Demorest, R.A. and J.A.Hannafin (2011) Women in Sports: Female Issues. In: *Praeger Handbook of Sports Medicine and Athlete Health Volume 2,* Praeger, ABC-CLIO, LLC, Santa Barbara, CA.

16. Templeton,K.J., Hame, S.J., Hannafin, J.A., Griffin, L.Y., Tosi, L.L. (2011) Sports Injuries in Women: Sex and gender Based Differences in Etiology and Prevention. In: *Instructional Course Lectures Sports Medicine 2,* pages 225-238, AAOS, Rosemont, IL.

17. Hannafin, J.A. (2011) Commentary: Section 4, Miscellaneous Sports Related Conditions. In: *Instructional Course Lectures Sports Medicine 2*, pages 222-223, AAOS, Rosemont, IL. 57:539-552.

BOOKS

Say Goodbye to Knee Pain. Jo A. Hannafin, MD, PhD and Marian Betancourt
Pocket Books, Simon and Shuster, New York, New York, 2007.

VISITING PROFESSORSHIPS and KEYNOTE LECTURES

Department of Orthopaedic Surgery, University of Pittsburgh Medical Center, 2002

Department of Orthopaedic Surgery, Harvard University School of Medicine, 2002

Department of Orthopaedic Surgery, Albert Einstein College of Medicine, 2002

Comparative Orthopaedics Day, College of Veterinary Medicine and University Health Sciences School of Medicine, University of Missouri-Columbia, 2003

Shoulder Service, Department of Orthopaedic Surgery, Mt. Sinai School of Medicine, 2003

Alexander Kirkley Lectureship, The Forum, 2004

Department of Orthopaedic Surgery and Rehabilitation, University of Vermont, 2004

Department of Orthopaedic Surgery, Mt. Sinai School of Medicine, 2004

Department of Orthopaedic Surgery, Columbia University School of Medicine, 2005

Department of Orthopaedic Surgery, University of Iowa, Ruth Jackson Lectureship, 2005

Department of Orthopaedic Surgery, Mayo Clinic, 2005

Department of Orthopaedic Surgery, Cleveland Clinic, 2008

Department of Orthopaedic Surgery, University of Washington, James Garrick Lectureship, 2008

Department of Orthopaedic Surgery, Brown University, Murray S. Danforth Oration, 2009

American Physician Scientists Association, Keynote Lecture, New York, 2009

Tria Orthopaedic Center /University of Minnesota Sports Medicine Conference Guest Lecturer, 2012

Richard J. Herzog, M.D., F.A.C.R.

Curriculum Vitae
July 18, 2012

HOME ADDRESS:		59 Fourth Ave. Apt # 6B New York, NY 10003 Phone - 212-529-4112
OFFICE ADDRESS:		Hospital for Special Surgery Department of Radiology and Imaging 535 East 70th Street New York, NY 10021 Phone – 212-774-2251 Fax – 212-774-7833 herzogr@hss.edu

EDUCATION:	1963 - 1967	B.S. with distinction, Zoology University of Michigan
	1967 - 1971	School of Medicine, University of Michigan

POSTGRADUATE TRAINING AND FELLOWSHIP APPOINTMENTS:

1971 - 1972	Intern in Internal Medicine, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania
1972 - 1975	Resident in Diagnostic Radiology, University of California San Francisco, San Francisco, California
1975 - 1976	Fellowship and Instructorship, Gastrointestinal Radiology, University of California San Francisco, San Francisco, California

PRIOR CLINICAL APPOINTMENTS:

1976 - 1983	Full-time Radiologist at Sequoia Hospital, Redwood City, California. A member of Sequoia Radiologists Medical Group, Inc.
1983 - 1984	Radiologic Consultant to Sports Orthopedic and Rehabilitation Medicine Associates, Portola Valley, California
1984 - 1993	Radiologist - Marin Radiology Medical Group Inc., Novato, California
1993 - 2000	Associate Professor of Radiology Department of Radiology Musculoskeletal and MRI Sections University of Pennsylvania Medical Center Philadelphia, Pennsylvania
1994 - 2000	Teleradiology - Section Chief Department of Radiology University of Pennsylvania Medical Center Philadelphia, Pennsylvania
1998 - 2000	Associate Professor of Orthopaedic Surgery Department of Orthopaedic Surgery University of Pennsylvania Medical Center Philadelphia, Pennsylvania

CURRENT CLINICAL APPOINTMENTS:

2000 -	Professor of Radiology Weill Medical College of Cornell University New York, NY
2000 -	Attending Radiologist New York Weill Cornell Medical Center New York, NY
2000 -	Chief, Division of Teleradiology Attending Radiologist Department of Radiology and Imaging Hospital for Special Surgery New York, NY

2011-	Director, Spinal Imaging Department of Radiology and Imaging Hospital for Special Surgery New York, NY
2000-	Senior Scientist Clinician Investigator Hospital for Special Surgery New York, NY

HOSPITAL AND ADMINISTRATIVE APPOINTMENTS:

1976 - 1981	Clinical Instructor, Department of Radiology University of California San Francisco, San Francisco, California
1976 - 1983	Full-time Radiologist, Sequoia Hospital, Redwood City, California
1981 - 1993	Assistant Clinical Professor, Musculoskeletal Section Department of Radiology University of California San Francisco, San Francisco, California
1993 - 2000	Associate Professor of Radiology Musculoskeletal Section Department of Radiology University of Pennsylvania Medical Center, Philadelphia, Pennsylvania
1994 - 2000	Director of Teleradiology Department of Radiology University of Pennsylvania Medical Center Philadelphia, Pennsylvania
1994 - 7	Medical Staff, Department of Radiology Philadelphia VA Medical Center Philadelphia, Pennsylvania
1996 - 2000	Medical Staff, Department of Radiology Presbyterian Hospital Philadelphia, Pennsylvania
2000 -	Medical Staff, Dept of Radiology and Imaging Hospital for Special Surgery New York, NY

2000 -	Medical Staff, Department of Radiology New York-Presbyterian Hospital New York, NY

University of Pennsylvania - Radiology Faculty Committees

1993 - 1994	Resident Education
1993 - 1994	PACS

University of Pennsylvania Medical Center Faculty Committees

1995 - 2000	Telecommunications Faculty Committee

Hospital for Special Surgery Faculty Committees

2000 -	Institutional Review Board
2003	PACS
2011 -	HSS Spine Care Institute
2012 -	HSS Outside Images Task Force

SPECIALTY CERTIFICATION:

1972	Diplomate, National Board of Medical Examiners
1975	American Board of Radiology (Written and Oral Examinations)

ACTIVE LICENSURE:

State	Number	Expiration Date
New York	206121-1	6/30/14
Ohio	35-06-3884	10/1/14
Infection Control	4H2KG3-00-02	3/25/13
DEA	BH3057850	10/31/12

National Provider Identifier # 1548263338

MEMBERSHIP IN PROFESSIONAL AND SCIENTIFIC SOCIETIES:

National Societies: Alpha Omega Alpha

American College of Radiology

North American Spine Society:
Member of the Committees on –
Nomenclature - 1992-93, 97-98
Diagnostics - 1992- 7
Nonoperative Care - 2002- 2004

State Societies: New York Radiological Society

AWARDS, HONORS AND MEMBERSHIP IN HONORARY SOCIETIES:

1969	Research Fellow, Michigan Heart Association
1971	Member, Alpha Omega Alpha
1972 - 1975	VA Research Fellow
1977	Certificate of Recognition from the American Registry of Diagnostic Medical Sonographers
1996, 1999	Selected one of Philadelphia's "Top Docs" by Philadelphia Magazine
1998	Elected American College of Radiology Fellow
2004 - Current	Best Doctors in America database
2009	ISSLS Prize for Lumbar Spine Research
2009	North American Spine Society - Top Research Papers
2011	North American Spine Society - Top Research Papers

INSTITUTIONAL RESPONSIBILITIES: PERCENT EFFORT

a. Teaching (e.g., specific teaching functions, courses taught) (20%)
b. Clinical Care (60%)
c. Administrative duties, including committees (10%)
d. Research (10%)

EDITORIAL POSITIONS:

1992 - 95	Editorial Review Board, *American Journal of Orthopedics*
1993 - Current	Associate Editorial Board, *Spine*
1994 - 2001	Editorial Review Board, *Journal of the AAOS*

SCIENTIFIC AND MEDICAL ADVISORY BOARDS:

1987 - 1994	Resonex
1988, 1990	3M International Advisory Council for Radiology
1988 - 1994	Cemax Medical Advisory Board
1990 - 1993	Steadman Sports Medicine Foundation
1990 - 1993	Philips Medical Systems
1992 - 1993	Otsuka Electronics
1994	American College of Radiology - Expert panel on Neuroimaging
1997, 2000	American College of Radiology - CPI Musculoskeletal Panel

Radiologic Consultant:

1983 - 1993	San Francisco 49ers Football Team
1990 - 1992	Zimmer
1990 - 1993	San Francisco Ballet Company
1991 - 1994	W.L. Gore & Associates, Inc.
1992 - 1993	Cleveland Indians Baseball Team
1992 - 2005	Kansas City Chiefs Football Team
1994 - 1998	General Electric Medical Systems Workstation development

1998 - current Medtronic/Sofamor-Danek

RESEARCH GRANTS:

1. **NIAMS** (National Institute of Arthritis and Musculoskeletal and Skin Conditions) Part of the Multidisciplinary Clinical Research Center grant application. **Principal Investigator: Anna N.A. Tosteson, ScD.** Center for the Evaluation Clinical Sciences. Dartmouth Medical School

2. **NIAMS**/Dartmouth Spine Patient Outcome Research Trial (**SPORT**) – **Principal Investigator: James N. Weinstein, DO**. **MS** Center for the Evaluative Clinical Sciences. Dartmouth Medical School.

BIBLIOGRAPHY:

Peer Reviewed Original Papers:

1. **Herzog RJ**, Nelson JA, Staubus AE: Saturation kinetics of iopanoate in dogs with an intact enterohepatic circulation, before and after phenobarbital induction. Invest. Radiol. Vol. II, No.1, 32-38. January/February, 1976.

2. **Herzog RJ**, Nelson JA: The role of cholecystokinin in radiographic opacification of the gallbladder. Invest. Radiol. Vol. II, No. 5, September/October, 1976.

3. **Herzog RJ**, Hanelin L, Margulis AR: Benign lesions of the stomach simulating malignancy. JAMA 238 (7): August 15, 1977.

4. Brasch RC, deLorimer AA, **Herzog RJ**, et al: Extragonadal endodermal sinus (yolk sac) tumor. Pediatric Radiolog. 7:115-118, 1978.

5. Saal JA, Saal JS, **Herzog RJ**: The natural history of lumbar intervetebral disc extrusions treated nonoperatively. Spine 15:683-686, July 1990.

6. **Herzog RJ**, Wiens JJ, Dillingham MF, Sontag MJ: Normal cervical spine morphometry and cervical spinal stenosis in asymptomatic professional football players - plain film radiography, multiplanar computed tomography, and magnetic resonance imaging. Spine 16(6S):S178-S186, 1991.

7. **Herzog RJ**, Kaiser JA, Saal JA, Saal JS: The importance of the posterior epidural fat pad in lumbar central canal stenosis. Spine 16(6S):S227-S233, 1991.

8. Saal JA, Firtch W, Saal JS, **Herzog RJ**: The value of somatosensory evoked potential testing for upper lumbar radiculopathy - a correlation of electrophysiologic and anatomic data. Spine 17, 6S, June 1992.

9. **Herzog RJ**: Magnetic Resonance Imaging of the Elbow. Magnetic Resonance Quarterly 9:188-210, 1993.

10. **Herzog RJ**, Silliman JF, Hutton K, Rodkey W, Steadman JR: The Clinical Evaluation of Asymptomatic Athletic Individuals with Chronic Anterior Cruciate Ligament Insufficiency - Plain Film Radiography and Magnetic Resonance Imaging (MRI). American Journal of Sports Medicine 22:204-210, 1994.

11. Modic MT, **Herzog RJ**. Spinal Imaging Modalities. Spine 19:1764-1765, 1994

12. **Herzog RJ**. Efficacy of Magnetic Resonance Imaging of the Elbow. Medicine and Science in Sports and Exercise. 26:1193-1202. 1994.

13. **Herzog RJ**. The Goal of Spinal Imaging. Spine 19:2486-2488, 1994

14. Rubin DA, **Herzog RJ**. MRI of Articular Cartilage Injuries in the Knee. In Drez D, Delee J (eds): Operative Techniques in Sports Medicine. W.B. Saunders. 1995; 3:87-95.

15. **Herzog RJ**, Guyer RD, Graham-Smith A, Simmons ED. Magnetic Resonance Imaging - Use in Patients with Low Back Pain or Radicular Pain. Spine 20:1834-1838, 1995

16. Simmons ED, Guyer RD, Graham-Smith A, **Herzog RJ.** Radiographic Assessment for Patients with Low Back Pain. Spine 20:1839-1841, 1995

17. **Herzog RJ**, Marcotte PJ. Assessment of Spinal Fusion - A critical evaluation of imaging techniques. Spine 21:1114-1118, 1996.

18. Slipman CW, Sterenfeld EB, Chou LH, **Herzog RJ**, Vresilovic E. The value of radionuclide imaging in the diagnosis of sacroiliac joint syndrome. Spine 21:2251-2254, 1996

19. **Herzog, RJ**. The Radiologic Assessment for a Lumbar Disc Herniation. Spine 21:19S-31S, 1996.

20. Andersson GBJ, Brown MD, Dvorak J, **Herzog RJ,** et al. Consensus Summary on the Diagnosis and Treatment of Lumbar Disc Herniation. Spine 21:75S-78S, 1996.

21. Uri DS, Kneeland JB, **Herzog RJ.** Os acromiale: Evaluation of markers for identification on sagittal and coronal oblique MR images. Skeletal Radiology 26:31-34, 1997.

22. **Herzog RJ**. Magnetic Resonance Imaging of the Elbow. Oper Tech in Sports Med 5:19-32, 1997.

23. Andersen RE, Wadden TA, **Herzog RJ**. Changes in bone mineral content in obese dieting women. Metabolism 46:857-861, 1997.

24. **Herzog, RJ**. MRI of the Shoulder. JBJS 79-A: 934-953, 1997.

25. Slipman CW, Sterenfeld EB, Chou LH, **Herzog RJ**, Vresilovic EJ. The Predictive Value of Provocative Sacroiliac Joint Stress Maneuvers in the Diagnosis of Sacroiliac Joint Syndrome. Arch Phys Med Rehab 79:288-292, 1998.

26. **Herzog RJ**, Slipman CW. Unknown Case #1. Spine 23:1287-1288, 1998.

27. Sher JS, Ionatti JP, Williams GR, **Herzog RJ**, et al. The effect of shoulder magnetic resonance imaging on clinical decision making. J Shoulder Elbow Surg 1998; 7:205-209, 1998.

28. Chan PSH, Kneeland JB, Gannon FH, Luchetti WT, **Herzog RJ**. Identifcation of the vascular and avascular zones of the human meniscus using magnetic resonance imaging: Correlation with histology. Arthroscopy. 14:820-823, 1998.

29. Dockery WD, **Herzog RJ.** Unknown Case. Spine 24:82, 1999.

30. Slipman CW, Rogers DP, Lipetz JS **Herzog R**, Vresilovic E. An Unusual Extraspinal Cause of Bilateral Leg Pain. Arch Phys Med Rehab 80:721-724, 1999.

31. Lee J, Brookenthal K, Ramsey M, Kneeland JB, **Herzog RJ.** MRI Imaging Assessment of the Pectoralis Major Myetendinous Unit: An MR Imaging: Anatomic Correlative Study with Surgical Correlation. Am Journal Roentgen 174:1371-1375, 2000.

32. **Herzog RJ**. Unknown Case. Spine 25:1315-1316, 2000.

33. Slipman CW, Lipetz JS, **Herzog RJ**, Vresilovic EJ. Nonsurgical Treatment for Radicular Pain of Zygapophyseal Joint Cyst Origin: Therapeutic Selective Nerve Root Block. Arch Phys Med Rehab 81:1119-1122, 2000.

34. Slipman CW, Patel RK, Zhang L, Vreslovic EJ, Lenrow DA, Shin CH**, Herzog RH**. Side of Symptomatic Annular Tear and Site of Low Back Pain. Spine 26:E165-169, 2001.

35. Homan BM, Gittins ME, **Herzog RJ.** Preoperative Magnetic Resonance Imaging Diagnosis of the Floating Anterior Inferior Glenohumeral Ligament. Arthroscopy 18:542-546, 2002.

36. Brown WE, **Herzog RJ.** Unknown Case. Spine 27:1687-1688, 2002.

37. Simmons ED, Guyer RD, Graham-Smith A, **Herzog R**. Radiographic assessment for patients with low back pain. The Spine Journal. 3:3S-5S, 2003.

38. **Herzog RJ**, Ghanayem AJ, Guyer RD, et al. Magnetic resonance imaging: use in patients with low back or radicular pain. The Spine Journal. 3:6S-10S, 2003.

39. Schofferman J, Reynolds J, **Herzog R**, et al. Failed back surgery: etiology and diagnostic evaluation. The Spine Journal. 3:5; 400-404, 2003.

40. Huang RC, Shapiro GS, Lim M, Sandhu HS, Lutz GE and **Herzog, RJ**. Cervical epidural abscess after cervical epidural injection. Spine.29:1; E7-E9, 2004.

41. Iannotti JP, Hennigan S, **Herzog R**, et al. Latissimus Dorsi Tendon Transfer for Irreparable Posterosuperior Rotator Cuff Tears. JBJS 88A:342-348, 2006.

42. Codsi MJ, Hennigan S, **Herzog R**, et al. Latissimus Dorsi Tendon Transfer for Irreparable Posterosuperior Rotator Cuff Tears. JBJS Surgical Techniques 89A, Supp2, Part 1:1-9, 2007.

43. Lurie JD, Tosteson AN, et al. including **Herzog R.** Reliability of Magnetic Resonance Imaging Readings for Lumbar Disc Herniation in the Spine Patient - Outcomes Research Trial (SPORT). Spine 33:9; 991-998, 2008.

44. Lurie JD, Tosteson AN, et al. including **Herzog R.** Reliability of Magnetic Resonance Imaging Features of Lumbar Spinal Stenosis. Spine 33:14; 1605-1610, 2008.

45. Carrino JA, Lurie JD, et al. including **Herzog R.** Lumbar Spine: Reliability of MR Imaging Findings. Radiology 250:1; 161-170, 2009.

46. Carragee EJ. Don AS, et al. including **Herzog R.** Does Discography Cause Accelerated Progression of Degeneration Changes in the Lumbar Disc. Spine 33:21; 2338-2345, 2009

47. **Herzog RJ.** Accessory Plantaris Muscle: Anatomy and Prevalence. HSS Journal 7:52-56, 2011

48. Pak KI, Hoffman DC, **Herzog RJ,** Lutz GE. Percutaneous Intradiscal Aspiration of a Lumbar Vacuum Disc Herniation: A Case Report. HSS Journal 7:89-93, 2011

49. Back JD, **Herzog RJ** and Lutz GE. A rare anomaly of the course of the vertebral artery. The Spine Journal. 11:681-2, 2011

Non-Peer Reviewed Publications

Review Articles:

1. **Herzog RJ**: Imaging of the Knee. J. of Orthopaedic Review, December, 1992.

2. **Herzog RJ**: The Assessment of Ligamentous Dysfunction of the Knee with MRI. GOTS Journal, pg. 17-23. Thieme-Verlag, May, 1993.

Editorials, Reviews:

3. **Herzog RJ**. Gallstone migration and pancreatitis. New England Journal of Medicine 290:1201-C, 1974.

4. **Herzog RJ**. Point of View - Gadolinium-Enhanced Characteristics of Magnetic Resonance Imaging in Distinguishing Herniated Intervertebral Disc Versus Scar in Dogs. Spine 19:2095, 1994.

5. **Herzog RJ**. Point of View - Quantitative Magnetic Resonance Imaging of the Lumbar Spine. Spine; 20:2366, 1995.

6. **Herzog RJ**. Point of View - Nonoperative management of herniated cervical intervertebral disc with radiculopathy. Spine 21:1883, 1996.

7. **Herzog RJ.** Point of View - Magnetic resonance imaging evaluation of the adolescent patient with idiopathic scoliosis before spinal instrumentation and fusion. Spine 22:858, 1997.

8. **Herzog RJ**. Point of View - Idiopathic scoliosis. Spine 24:2010, 1999.

Book Chapters:

9. **Herzog RJ:** State of the Art Imaging in Spinal Disorders. In JA Saal, (ed): Neck and Back Pain, Physical Medicine and Rehabilitation State of the Art Review Series. Philadelphia, Hanley & Belfus, Inc.2:221-269, June 4, 1990.

10. **Herzog RJ**: Magnetic Resonance Imaging of the Spine. In JW Frymoyer, J Weinstein, JP Kostuick, TB Ducker, NM Hadler, (eds): The Adult Spine: Principles and Practice. New York, Raven Press, Chapter 23, 1991.

11. Heithoff K, **Herzog RJ**: Computed Tomographic Imaging of the Spine. In JW Frymoyer, J Weinstein, JP Kostuick, TB Ducker, NM Hadler, (eds): In The Adult Spine: Principles and Practice. New York, Raven Press, 1991.

12. **Herzog RJ**: Selection and utilization of imaging studies for disorders of the lumbar spine. In Physical Medicine and Rehabilitation Clinics of North America,Vol (2); 1:7-59,1991.

13. Heithoff K, **Herzog RJ**: CT and MRI Evaluation of the Spine. In GF Findlay, R Owen, (eds): Surgery of the Spine. Edinburgh, Blackwell Scientific Publications of Great Britain, Chapter 7, 1992.

14. **Herzog RJ**: Clinical Efficacy of CT Evaluation of the Spine. In J Weinstein, (ed): Clinical Efficacy and outcome in the Diagnosis and Treatment of Low Back Pain. Raven Press, Chapter 10, 1992.

15. **Herzog RJ**: Diagnostic Imaging: An Evaluation of Efficacy. In Orthopaedic Knowledge Update IV. American Academy of Orthopaedic Surgeons, 1992.

16. **Herzog RJ:** The radiologic evaluation for lumbar disc disease and spinal stenosis in patients with back or radicular symptoms. In AAOS Instructional Course Lectures; Chapter 10, Volume XL1, 1992.

17. Rubin DA, Dalinka MK, **Herzog RJ**: Imaging of Shoulder Instability. In Sartoris DJ (ed): Principles of Shoulder Imaging. McGraw-Hill. 1994.

18. **Herzog RJ**. Radiologic Imaging of the Spine. In Weinstein J, Rydevik B, Sonntag VKH (eds): The Essential Spine. Raven Press. Chapter 7, 1995.

19. **Herzog RJ,** Kneeland JB: The role of Radiologic Imaging in Disability evaluation. In Demeter SL, Smith GH, Andersson GJ (eds): Disability Evaluation. Mosby. 1996.

20. **Herzog RJ**. The Role of Magnetic Resonance Imaging in the Assessment of Disk Degeneration and Diskogenic Pain. In Weinstein JN, Gordon SL (eds): Low Back Pain - A Scientific and Clinical Overview. AAOS. 1996.

21. Fardon DF, **Herzog RJ,** et al. Nomenclature of Lumbar Disk Disorders. In Orthopaedic Knowledge Update - Spine. American Academy of Orthopaedic Surgeons, 1997.

22. Zeinrich SJ, Heithoff KB, **Herzog RJ**: Computed Tomography of the Spine. In JW Frymoyer (ed): The Adult Spine: Principles and Practice. 2nd Ed. Philadelphia-New York, Lippincott-Raven, 1997.

23. Boden SD, Lee RR, **Herzog RJ**: Magnetic Resonance Imaging of the Spine. In JW Frymoyer (ed): The Adult Spine: Principles and Practice. 2nd Ed. Philadelphia-New York, Lippincott-Raven, 1997.

24. Cole AJ, **Herzog RJ:** The Lumbar Spine: Imaging Options. In Cole A, Herring S (ed): The Low Back Pain Handbook. Philadelphia, Hanley & Belfus, Inc. 1997.

25. **Herzog RJ.** Radiologic Imaging in Rehabilitation. In Kibler B, Herring S, Press J (eds): Functional Rehabilitation of Sports and Musculoskeletal Injuries. Aspen Press. 1998.

26. **Herzog RJ**. MRI of the Shoulder. AAOS Instructional Course Lectures Vol 47. 1998

27. **Herzog RJ**. MRI of the Spine. In Fardon D and Garfin S (ed) OKU:Spine, 2nd ed. AAOS. 2000

28. **Herzog RJ**. Radiologic Imaging in Spinal Stenosis. AAOS Instructional Course Lectures Volume 50. 2001.

29. **Herzog RJ**, Kneeland JB: The role of radiologic imaging in disability evaluation. In Demeter SL, Smith GH, Andersson GJ (eds): Disability Evaluation. Second Edition. Mosby. 2003.

30. Cole AJ, **Herzog RJ:** The Lumbar Spine: Imaging Options. In Cole A, Herring S (ed): The Low Back Pain Handbook. Second Edition. Philadelphia, Hanley & Belfus, Inc. 2003.

Book Editor:

1. Halpern B, Herring S, Altchek D, **Herzog RJ**. Eds. Imaging in Musculoskeletal and Sports Medicine. Blackwell Scientific Publications, Inc. 1997.

PRESENTATIONS: Original Research

January 18-24, 1992	"The Clinical Evaluation of Asymptomatic Athletic Individuals with Chronic ACL Insufficiency - Plain Film Radiography and Magnetic Resonance Imaging (MRI)" and "MRI Evaluation of ACL Injuries," Herzog RJ, et al. International Anterior Cruciate Ligament Study Group Vail, Colorado
November 30, 1992	Kinematic MR Imaging Evaluation of Shoulder Instability and Impingement Herzog RJ, et al. Annual Meeting Radiological Society of North America Chicago, Illinois
November 1, 1993	Sacroiliac Joint Syndrome: The Diagnostic Value of Single Photon Emission Computed Tomography Slipman CW, Sterenfeld E, Pauza K, Herzog RJ, Vresilovic EJ. 55th Annual Assembly of the American Academy of PM&R
February 23, 1996	Magnetic Resonance Imaging of the Shoulder: Clinical Impact. Sher JS, Williams GR, Ianotti JP, Kneeland RB, Herzog RJ, Patel N. 63rd Annual Meeting American Academy of Orthopaedic Surgeons Atlanta, Georgia
May 4-9, 2009	Does discography cause accelerated progression of degenerative changes in the lumbar disc: A ten year cohort-controlled study. Carragee E, Don A, Hurwitz E, Cuellar J, Carrino J, Herzog R. ISSLS - 2009 Annual Congress Miami, Florida
November 11-13, 2009	Does discography cause accelerated progression of degenerative changes in the lumbar disc: A ten year cohort-controlled study. Carragee E, Don A, Hurwitz E, Cuellar J, Carrino J, Herzog R. North American Spine Society - 24th Annual Meeting San Francisco, CA

December 2-5, 2011	Does discography cause accelerated progression of degenerative changes in the lumbar disc: A ten year cohort-controlled study. Carragee E, Don A, Hurwitz E, Carrino J, Herzog R. North American Spine Society - 26th Annual Meeting San Francisco, CA

POSTER PRESENTATIONS:

November 1994	Hochman M, Herzog RJ. Differential Diagnosis of Posterolateral Knee Pain Radiological Society of North America Chicago, Illinois

LECTURES BY INVITATION: 2002 - Present

Feb 13-17, 2002	Faculty – Instructional Courses 1. Lumbar Spine – The Herniated Disc 2. Lumbar Spine – Spinal Stenosis 69th Annual Meeting American Academy of Orthopaedic Surgeons Dallas, TX
March 15, 2002	Visiting Professor - Summa Health System, NE Ohio Universities College of Medicine. Akron OH Presentations: 1. MRI - lumbar spinal stenosis. 2. MRI - lumbar disc herniation. 3. MRI - muscle and tendon injuries
Oct 29-Nov 2, 2002	North American Spine Society Faculty - Failed Back Surgery Symposium: Radiologic evaluation. Montreal, Canada
Feb 5-9, 2003	Faculty – Instructional Courses 1. Lumbar Spine – The Herniated Disc 2. Lumbar Spine – Spinal Stenosis 70th Annual Meeting American Academy of Orthopaedic Surgeons New Orleans, LA

May 9-10, 2003	Orthopaedic Review Course - Hospital for Special Surgery Faculty - Radiologic evaluation of the spine New York, NY
May 20, 2003	Physiatry Grand Rounds – Radiologic evaluation of failed back surgery syndrome. Hospital for Special Surgery. New York, NY
June 16, 2003	Radiology Grand Rounds - Radiologic evaluation of failed back surgery syndrome. University of Maryland, Baltimore, Maryland.
Aug 10, 2003	North American Spine Society Faculty - Recent Advances in Imaging the Spine and Neural Elements. Chicago, IL
May 7-9, 2004	Second Annual Orthopaedic Basic Science Review Course - Hospital for Special Surgery Faculty - Radiologic evaluation of the spine New York, NY
May 14-15, 2004	Orthopaedic Imaging - A Multidisciplinary Approach Hospital for Special Surgery Faculty - Back pain in the Athlete New York, NY
June 4, 2004	Non-Surgical Care of the Lumbar Spine Hospital for Special Surgery Faculty - The Role of Imaging Studies New York, NY
April 30, 2005	Postop Evaluation of the Lumbar Spine Simmons Surgical Society Waldorf Astoria New York, NY
May 6-7, 2005	Third Annual Orthopaedic Review Course Hospital for Special Surgery Faculty - Radiologic evaluation of the spine New York, NY
Sept 27, 2005	Postoperative Evaluation of the Lumbar Spine North American Spine Society 20th Annual Meeting Philadelphia, PA

May 5-6, 2006	Fourth Annual Orthopaedic Review Course Hospital for Special Surgery Faculty - Radiologic evaluation of the spine New York, NY
Sept 26-30, 2006	Postoperative Evaluation of the Lumbar Spine North American Spine Society 21st Annual Meeting Seattle, WA
Feb 26, 2007	Imaging of the Spine NY Roentgen Society New York, NY
May 4, 2007	Fifth Annual Orthopaedic Review Course Hospital for Special Surgery Faculty - Radiologic evaluation of the spine New York, NY
June 16, 2007	MRI - Basics, Shoulder, Elbow and Knee 4th Annual Sports Medicine Conference Summa Health System Akron, OH
June 25-29, 2007	Summer Musculoskeletal Radiology Practicum in the Tetons New York University School of Medicine Faculty - MRI of the shoulder

June 2012

Name: Theodore T. Miller, MD, FACR

Office Address: Department of Radiology and Imaging
Hospital for Special Surgery
535 E. 70th Street
NY, NY 10021

Home: 714 Forest Ave.
Mamaroneck, NY 10543

Office Phone: (212) 606-1127

Cellular Phone: (914) 844-8937

Email: millertt@hss.edu

Place/Date of Birth: New York, NY March 1, 1961

Education:

1983 B.A. University of Pennsylvania (magna cum laude)
1987 M.D. Vanderbilt University School of Medicine

Postdoctoral Training:

Internships and Residencies:

1987-1988 Intern in Pathology, New York Hospital, New York, NY
1988-1992 Resident in Radiology, Mt. Sinai Hospital, New York, NY
1991-1992 Chief Resident, Department of Radiology, Mt. Sinai Hospital, New York, NY

Clinical Fellowship:

1992-1993 Fellow in Musculoskeletal Radiology, Hospital for Special Surgery, NY, NY

Licensure and Certification:

1988 National Board of Medical Examiners
1988 New York State license #175132
1993 American Board of Radiology

Academic Appointments:

1992 - 1993 Fellow in Radiology, Cornell University Medical College
1993 - 1996 Assistant Professor of Radiology, Columbia University College of Physicians and Surgeons
1996 - 2000 Assistant Professor of Radiology, New York University School of Medicine
2000 - 2006 Associate Professor of Radiology, NYU School of Medicine
2006 - Assistant Professor of Radiology, Weill Medical College of Cornell University
2008 - Professor of Radiology, Weill Medical College of Cornell University

Hospital Appointments:

1993 - 1996	Attending Radiologist, Columbia-Presbyterian Medical Center, New York, NY
1994 - 1996	Consultant for Orthopedic Radiology, Harlem Hospital Center, New York, NY
1996 - 2006	Associate Attending Radiologist, North Shore University Hospital
2000 - 2006	Associate Attending Radiologist, Long Island Jewish Medical Center
2006 -	Attending Radiologist, Hospital for Special Surgery, NY, NY

Honors and Awards:

1987	The Roentgen Award, Vanderbilt University School of Medicine
1991	The Corinne Farrell Prize for Best Paper on Bone Tumors ("Transarticular Invasion of Joints..."), International Skeletal Society
1999	*Radiology* Editor's Recognition Award for Reviewing with Distinction
2000	*Radiology* Editor's Recognition Award for Reviewing with Distinction
2001	*Radiology* Editor's Recognition Award for Reviewing with Special Distinction
2001	RSNA Editorial Fellowship
2002	*Radiology* Editor's Recognition Award for Reviewing with Special Distinction
2003	*Radiology* Editor's Recognition Award for Reviewing with Special Distinction
2005	RSNA certificate of Excellence in Design ("Sonography of the Pediatric Knee")
2006	The Presidents Medal, International Skeletal Society
2006	RSNA certificate of Merit ("Shoulder Impingement Syndromes")
2007	Fellowship, American College of Radiology
2010	Founders' Lecturer, International Skeletal Society, Athens, Greece
2010	Fellowship, New York Academy of Medicine
2011	Lodwick Prize, Massachusetts General Hospital Department of Radiology
2012	18th Annual Hyman R. Senturia Lecturer, Mallinckrodt Institute of Radiology, Washington University, St. Louis, MO

Hospital Committee Assignments:

1993 - 1996	Resident Admissions Committee, Department of Radiology, Columbia-Presbyterian Medical Center
1994 - 1996	Chair, Peer review committee, Department of Radiology, Columbia-Presbyterian Medical Center
1998 - 2006	Academic Affairs Committee, Department of Radiology, North Shore University Hospital
1998 - 2000	Alternate (non-voting) member: Research, Clinical Investigation and Publication Committee, North Shore University Hospital
1999 - 2006	Research Committee, Department of Orthopedic Surgery, Long Island Jewish Medical Center
2001	Chair, Ad hoc committee on CT Screening Examinations, Department of Radiology, North Shore University Hospital
2006 - 2008	Pharmacy and Therapeutics Committee, Hospital for Special Surgery, NY
2006 - 2008	Utilization Management Committee, Hospital for Special Surgery, NY
2007 - 2012	Fellowship Selection Committee, Dept. of Radiology and Imaging, Hosp. for Special Surg.
2007 -	CME Committee, Hospital for Special Surgery, NY
2008 - 2012	Resident Education Committee, New York Hospital, NY

2008 - 2012	Director of Resident and Medical Student Education, Dept of Radiology and Imaging, Hospital for Special Surgery, NY
2008 - 2012	Medical Student Advisory Committee, Hospital for Special Surgery, NY
2009 -	By-laws Committee, Hospital for Special Surgery, NY
2010	Nominating Committee, Hospital for Special Surgery, NY

Memberships and Committee Assignments in Professional Societies:

1988 -	New York Roentgen Society
1988 -	New York State Radiological Society
1988 -	Radiological Society of North America
1989 -	American Roentgen Ray Society
1993 -	American College of Radiology
1994 - 1998	ad hoc Committee on Health Care Reform, NY State Radiological Society
1996 - 2006	Long Island Radiological Society
1998 -	Society of Skeletal Radiology
1998 -	International Skeletal Society
1998 -	Committee on Standards, Ethics and Peer Review in Radiologic Practice New York State Radiological Society
2000 -	American Institute of Ultrasound in Medicine
2000, 2002	Educational Subcommittee, American Roentgen Ray Society
2001 -	Musculoskeletal Ultrasound Society
2001 - 2005	Membership Committee, Society of Skeletal Radiology
2003 - 2005	Chair, Membership Committee, Society of Skeletal Radiology
2003 -	Oral panel, Musculoskeletal section, American Board of Radiology
2004 -	Musculoskeletal Radiology panel, ACR Radiology In-training Examination
2004 -	Committee on Education, New York State Radiological Society
2005 -	Refresher Course Committee, International Skeletal Society
2005 - 2008	Liaison Committee, International Skeletal Society
2005 - 2006	Educational Exhibit Committee, International Skeletal Society
2005 -	Chair, Musculoskeletal educational exhibit panel, RSNA
2005- 2007	Musculoskeletal RadLex committee, RSNA
2006- 2007	Vice-President, New York Roentgen Society
2007 - 2009	Closed Program Committee, International Skeletal Society
2007 - 2008	Membership Committee, International Skeletal Society
2007	ACR alternate councilor, NY State Radiological Society
2007 -	Chair, Electronic Education Committee, International Skeletal Society
2007 - 2008	President-elect, New York Roentgen Society
2008 - 2009	President, New York Roentgen Society
2008 - 2010	Treasurer, Society of Academic Bone Radiologists
2008 -	Sponsorship Committee, International Skeletal Society
2010 - 2012	Secretary, Society of Academic Bone Radiologists
2010 -	Rules Committee, International Skeletal Society
2012 -	Member-at-large, Executive Committee, International Skeletal Society
2012 -	President-elect, Society of Academic Bone Radiologists

Editorial Duties:

Editorial Board:

2002 - 2007	Seminars in Musculoskeletal Radiology
2003 - 2009	Skeletal Radiology
2004 - 2006	Radiology (Associate Editor)
2005 -	RadioGraphics
2007 - 2010	Radiology (Consultant to the Editor)
2008 -	The Spine Journal (Associate Editor)

Guest Editor:
Seminars in Musculoskeletal Radiology. Foot and Ankle Imaging, vol. 6, n. 2, 2002
Seminars in Musculoskeletal Radiology. An Update on Imaging of Joint Replacements vol. 10, n. 1, 2006

Editorial Fellow:

2001	Radiological Society of North America

Manuscript reviewer:

1997 - 2000	American Journal of Roentgenology
1997 -	Radiology
1999 -	RadioGraphics
1999 -	Arthritis and Rheumatism
2000 -	Journal of Clinical Ultrasound
2000 -	Skeletal Radiology
2001	Mayo Clinic Proceedings
2002 -	Pediatric Radiology
2002 -	The Spine Journal
2005	Clinical Anatomy
2006	Journal of MRI
2006 -	Clinical Orthopedics and Related Research
2007	Physical Medicine and Rehabilitation
2008 -	Journal of Ultrasound in Medicine
2009 -	HSS Journal
2011 -	American Journal of Roentgenology

Educational exhibit reviewer:

1998 - 1999	MR Imaging Panel, RSNA annual meeting, Chicago, IL
2000 -	Musculoskeletal Panel, RSNA annual meeting, Chicago, IL
2005 -	International Skeletal Society

Scientific Program Committee:

2000 - 2003	International Society of Magnetic Resonance in Medicine
2001 - 2004	American Institute of Ultrasound in Medicine
2007 -	Radiological Society of North America
2007 - 2009	American Institute of Ultrasound in Medicine

2011 - American Roentgen Ray Society

Moderator Duties

1999 Tendon Injuries, International Skeletal Society, Seattle, WA
2000 Lower Extremity MRI, American Roentgen Ray Society, Washington, D.C.
2000 MRI of the Knee: Part I, International Skeletal Society, Barcelona, Spain
2000 Musculoskeletal Intervention I, Radiological Society of North America, Chicago, IL
2001 Musculoskeletal Sonography, American Institute of Ultrasound in Medicine, Orlando, FL
2001 Musculoskeletal Intervention I, Radiological Society of North America, Chicago, IL
2002 Musculoskeletal: Lower Extremity, American Roentgen Ray Society, Atlanta, GA
2002 Closed Session, International Skeletal Society, Geneva, Switzerland
2002 Musculoskeletal Ultrasound, International Skeletal Society, Geneva, Switzerland
2002 Musculoskeletal Intervention, Radiological Society of North America, Chicago, IL
2003 Musculoskeletal Session, NY Radiology Review Course, NY, NY
2003 Hip imaging, Radiological Society of North America, Chicago, IL
2004 Glenohumeral Joint, American Roentgen Ray Society, Miami, FL
2004 Foot and Ankle Imaging, International Skeletal Society, Malta
2004 Musculoskeletal Session, NY Radiology Review Course, NY, NY
2004 Shoulder Anatomy and Pathology, Musculoskeletal Ultrasound Society, Bologna, Italy
2004 Shoulder, Radiological Society of North America, Chicago, IL
2005 Musculoskeletal Session, NY Radiology Review Course, NY, NY
2005 Closed Session, International Skeletal Society, Singapore
2005 Controversies in Imaging, International Skeletal Society, Singapore
2005 MR Imaging, NY State Society of Orthopaedic Surgeons Symposium, NY, NY
2006 Elbow and Hand, International Skeletal Society, Vancouver
2007 Bone and Soft Tissue Tumors, Radiological Society of North America, Chicago, IL
2008 Closed Session VII: Miscellaneous Lesions, International Skeletal Society, New Delhi, India
2008 Arthroplasty, International Skeletal Society, New Delhi, India
2008 Foot and Ankle, Radiological Society of North America, Chicago, IL
2009 Muscle, Tendon, Peripheral Nerve, Radiological Society of North America, Chicago, IL
2010 Knee, Radiological Society of North America, Chicago, IL
2011 Sports Injuries, European Society of Skeletal Radiology, Crete, Greece
2011 Benign Bone-forming Lesions, International Skeletal Society, Members' session, San Diego
2011 Musculoskeletal Imaging, NY Roentgen Society Annual Meeting, NY, NY
2011 Muscles, Tendons, Nerves, Radiological Society of North America, Chicago, IL
2012 Intervention and Treatment, European Society of Skeletal Radiology, Innsbruck, Austria

Principal Clinical and Hospital Service Responsibilities:

2001 - 2006 Chief of Musculoskeletal Radiology, North Shore - Long Island Jewish Health System (North Shore University Hospital, Long Island Jewish Medical Center, North Shore Imaging Associates, PC)

Major Administrative Responsibilities:

1996 – 2006 Director, North Shore Imaging Associates, P.C., Great Neck, NY
2003 – 2006 Program Director, Musculoskeletal Fellowship, North Shore – LIJ Health System
2008 - 2012 Director, Resident and Medical Student Education, Dept. of Radiology and Imaging, Hospital for Special Surgery

Teaching Experience:

1993 - 1996	Monthly resident teaching conferences, Department of Radiology, Columbia University College of Physicians and Surgeons
1994	Preceptor, "Introduction to Radiology" course for second-year medical students Columbia University College of Physicians and Surgeons
1994	Visiting Professor, Department of Radiology, Harlem Hospital
1996	Visiting Professor, Department of Radiology, Lenox Hill Hospital
1996	Visiting Professor, Department of Radiology, North Shore University Hospital
1996	Preceptor for resident's project "Imaging Techniques for Evaluation of Foreign Bodies" (awarded the Ross Golden Award for Resident Research) Department of Radiology, Columbia-Presbyterian Medical Center
1996 - 2006	Bimonthly resident teaching conferences, Department of Radiology, North Shore University Hospital
1997	Visiting Professor, Department of Radiology, Jacobi Hospital - Einstein College of Medicine
1996 - 1997	Preceptor, "Introduction to Radiology" course for third-year medical students Cornell University Medical College
1999	Visiting Professor, Department of Radiology, Long Island Jewish Medical Center
1999	Visiting Professor, Department of Radiology, Thomas Jefferson Univ. Hosp.
2000 - 2006	Monthly resident teaching conferences, Department of Radiology, Long Island Jewish Medical Center
2000 - 2006	Monthly spine conference, Department of Orthopedics, North Shore-LIJ Health Sys.
2001	Visiting Professor, Department of Radiology, Winthrop University Medical Center, Mineola, NY
2001	Hands-on Faculty, Musculoskeletal US Workshop, AIUM annual meeting Orlando, FL
2001	Hands-on Faculty, Musculoskeletal US Society meeting, Washington, DC
2002	Visiting Professor, Department of Radiology, Maimonides Med. Cntr, Brooklyn, NY
2002	Hands-on musculokeletal sonography, Dept. of Radiology, Jacobi Med. Center, Bronx, NY
2003	Visiting Professor, Department of Radiology, Stony Brook Health Sciences Center Stony Brook, NY
2003	Hands-on Faculty, Musculoskeletal US Society meeting, Washington, DC
2003 - 2006	Monthly Radiology-Rheumatology conference, Dept of Rheumatology, NSUH
2004	Visiting Professor, Department of Radiology, North Central Bronx Hospital, NY
2004	Visiting Professor, Department of Radiology, Maimonides Med. Cntr, Brooklyn, NY
2004	Hands-on Faculty, Musculoskeletal US Society meeting, Bologna, Italy
2005	Demonstration of sonography of the hand / wrist - Musculoskeletal US course, Thomas Jefferson University Hospital, Phila, PA
2005	Faculty, hands-on scanning session - Musculoskeletal US course, Thomas Jefferson University Hospital, Phila, PA
2005	Visiting Professor, Department of Radiology, SUNY Downstate Medical Center

2005	Hands-on Faculty, Musculoskeletal US, Jefferson Leading Edge Course, Atlantic City, NJ
2005	Hands-on Faculty, Musculoskeletal US, International Skeletal Society, Singapore
2005	Hands-on Faculty, Musculoskeletal US Society meeting, Orlando, FL
2005	Lectures to Orthopedic Surgery Residents, Long Island Jewish Hospital
2006	Visiting Professor, Dept. of Radiology, Columbia-Presbyterian Medical Center, NY, NY
2006	Case review teaching sessions, International Skeletal Society Regional Outreach Program, Manila, Philippines
2006	Hands-on Faculty, Musculoskeletal US Society meeting, Seoul, Korea
2006	Hands-on Faculty, Musculoskeletal US, International Skeletal Society, Vancouver
2006	Hands-on Faculty, Sonographically-guided Musculoskeletal Intervention, Refresher course, RSNA annual meeting, Chicago
2007	Guest Lecturer, Musculoskeletal US course, Univ. of Michigan, Captiva Island, FL
2007	Hands-on Faculty, Musculoskeletal US course, Univ. of Michigan, Captiva Island, FL
2007	Hands-on Faculty, American Institute of Ultrasound in Medicine, annual meeting, NY
2007	Visiting Professor, Dept. of Radiology, St. Luke's –Roosevelt Hospital, NY
2007	Hands-on Faculty (live models), "Hands-on Musculoskeletal Ultrasound: Diagnostic and Interventional Techniques", American Institute of Ultrasound in Medicine, Mayo Clinic, Rochester, MN
2007	Hands-on Faculty (interventional and diagnostic techniques), "Hands-on Musculoskeletal Ultrasound: Diagnostic and Interventional Techniques", American Institute of Ultrasound in Medicine, Mayo Clinic, Rochester, MN
2007	Hands-on Faculty, Musculoskeletal US Society meeting, Paris, France
2007	Visiting Professor, Department of Radiology, U. of British Columbia, Canada
2007	Hands-on Faculty, Sonographically-guided Musculoskeletal Intervention, Refresher course, RSNA annual meeting, Chicago
2008	Visiting Professor, Department of Radiology, U. of Maryland, Baltimore, MD
2008	Hands-on Faculty (interventional and diagnostic techniques), "Hands-on Musculoskeletal Ultrasound: Diagnostic and Interventional Techniques", American Institute of Ultrasound in Medicine, Mayo Clinic, Rochester, MN
2008	Visiting Professor, Department of Radiology, Brigham and Women's Hospital, Boston, MA
2008	Visiting Professor, Department of Radiology, Massachusetts General Hospital, Boston, MA
2009	Visiting Professor, Department of Radiology, SUNY Stony Brook, NY
2009	Visiting Professor, Department of Radiology, University of Wisconsin, WI
2009	Hands-on Faculty, Ultrasound, European Society of Skeletal Radiology, Genoa, Italy
2009	Case Presentation Panel, European Society of Skeletal Radiology, Genoa, Italy
2009	Visiting Professor, Department of Radiology, Vanderbilt Medical Center, Nashville, TN
2010	Visiting Professor, Department of Radiology, SUNY Stony Brook, NY
2010	Guest Lecturer, 5th Annual Leeds Sports Course, Leeds, England
2011	Visiting Professor, Department of Radiology, Beth Israel Medical Center, NY, NY
2011	Hands-on Faculty, Musculoskeletal Ultrasound Course, University of Leiden, Leiden, Holland
2011	Hands-on Faculty, Shoulder Ultrasound, International Skeletal Society, San Diego
2011	Film Quiz Panel Member, European Society of Skeletal Radiology, Crete, Greece
2012	Visiting Professor, Department of Radiology, University of Nebraska, Omaha, NE
2012	Visiting Professor, Department of Radiology, Columbia-Presbyterian Medical Center, NY
2012	Visiting Professor, Mallinckrodt Institute of Radiology, Washington Univ., St. Louis
2012	Hands-on Faculty, Shoulder and Elbow US, Massachusets General Hospital Sports Imaging Course, Boston, MA
2012	Hands-on Faculty, Upper Extremity US, European Society of Skeletal Radiology, Innsbruck,

	Austria
2012	Film Quiz Panel Member, European Society of Skeletal Radiology, Innsbruck, Austria

Course Director:

2006	4th Annual New York Radiology Review Course, International Institute for Continuing Medical Education, The Hilton Hotel, NY, NY
2007	Hot Topics and Radiology Review, New York Roentgen Society, NY, NY
2007	Emergency Radiology, International Institute for Continuing Medical Education, The Helmsley Park Hotel, NY, NY
2009	Hot Topics and Radiology Review, New York Roentgen Society, NY, NY

Invited Lectures:

1.	1995	"Diseases of the Chest and Musculoskeletal System"- Quizmaster, New York Roentgen Society
2.	1995	"Musculoskeletal Applications of MRI" - Symposium on MRI, Stamford Hospital
3.	1996	"Conditions Affecting Joints" - Quizmaster, New York Roentgen Society
4.	1996	"Imaging Occult Fractures" - Current Techniques in Lower Extremity Trauma Course, Department of Orthopedic Surgery, Columbia-Presbyterian Medical Center, Parker Meridien Hotel, New York
5.	1996	"Rheumatologic Applications of MRI" - Grand Rounds, Department of Rheumatology, North Shore University Hospital
6.	1996	"MRI of the Shoulder, Elbow, and Foot" - Department of Radiology, Holy Name Hospital, Teaneck, NJ
7.	1997	"Imaging Methods for Assessing Bone Mineral Density" - Grand Rounds, Division of Orthopedic Surgery, North Shore University Hospital
8.	1998	"MR Imaging of Infection" - NY Roentgen Society Spring Meeting
9.	1999	"MR Imaging of Osteomyelitis" - International Skeletal Society, Seattle, WA
10.	1999	"Imaging of Musculoskeletal Infection" - Grand Rounds, Department of Radiology, Roosevelt Hospital, NY
11.	2000	"MRI and Ultrasound of the Musculoskeletal System: When to Pulse, When to Sound" - Grand Rounds, Department of Radiology, Long Island College Hospital
12.	2000	"MR Imaging of Anatomy and Injuries of the Posterolateral Aspect of the Knee" - Grand Rounds, Department of Radiology, Hospital for Special Surgery, NY
13.	2000	"Sonography of Sports-related Injuries" - Advanced Seminars in Ultrasound Diagnosis, Department of Radiology, North Shore University Hospital, Crowne Plaza Hotel, New York
14.	2000	"MRI of the Knee: The Posterolateral Corner" - International Skeletal Society, Barcelona, Spain
15.	2000	"Osteomyelitis" - MRI: Clinical State of the Art, Dept of Radiology, NYU Med Cntr
16.	2000	"Knee" - workshop, MRI: Clinical State of the Art, Department of Radiology, NYU Medical Center, NY, NY
17.	2001	"Sonography of Sports Injuries" - Grand Rounds, Department of Orthopedic Surgery, Long Island Jewish Medical Center
18.	2001	"The Posterolateral Corner of the Knee" - New York Roentgen Society, Annual Meeting, NY, NY
19.	2001	"Musculoskeletal Sonography" – Grand Rounds, Dept. of Rheumatology, Montefiore Medical Center

20.	2001	"Imaging Work-up of Occult Fracture, Nonunion, Infection" - Current Techniques in Upper and Lower Extremity Trauma Course, Department of Orthopedic Surgery, Columbia-Presbyterian Medical Center, NY Marriott Marquis Hotel
21.	2001	"Variations in the Practice of Lumbar Discography in the United States" – International Skeletal Society, Quebec, Canada
22.	2001	"Sonography of the Elbow" – Musculoskeletal Ultrasound Society, Washington, D.C.
23.	2001	"Non-Vascular Causes Of Lower Extremity Pain" - Advanced Seminars in Ultrasound Diagnosis, Department of Radiology, North Shore University Hospital, Crowne Plaza Hotel, New York
24.	2001	"Imaging of Back Pain" - Nassau Surgical Society, Marriott Hotel, Long Island, NY
25.	2002	"Normal US Anatomy and Techniques: Shoulder" – Orthopedic Imaging Course, Plaza Hotel, NY, NY
26.	2002	"Rotator Cuff Disease: US" - Orthopedic Imaging Course, Plaza Hotel, NY, NY
27.	2002	"Normal US Anatomy and Techniques: Elbow" – Orthopedic Imaging Course, Plaza Hotel, NY, NY
28.	2002	"Elbow Lesions: US" - Orthopedic Imaging Course, Plaza Hotel, NY, NY
29.	2002	"Normal US Anatomy and Techniques: Wrist" – Orthopedic Imaging Course, Plaza Hotel, NY, NY
30.	2002	"Wrist Lesions: US" - Orthopedic Imaging Course, Plaza Hotel, NY, NY
31.	2002	"Elbow Imaging" – NY Roentgen Society Annual Meeting, NY, NY
32.	2002	"Sonography of Elbow Abnormalities" – New Issues Forum, American Roentgen Ray Society, Atlanta, GA
33.	2002	"Comparative Elbow Imaging: MRI and US" – Grand Rounds, Dept. of Radiology, Hospital for Special Surgery, NY, NY
34.	2002	"Upper extremity imaging: What's new" – Sports Injuries of the Upper Extremity, American Society for Surgery of the Hand, Marriott Marquis, NY, NY
35.	2002	"Imaging of the cervical spine" – Common Disorders of the Cervical Spine and Upper Extremity: An Evidence Based Approach, North Shore University Hospital, NY
36.	2002	"Sonography of the Shoulder" - International Skeletal Society, Geneva, Switzerland
37.	2002	"MR imaging of the Diabetic Foot" - MRI: Clinical State of the Art, Department of Radiology, NYU Medical Center, NY, NY
38.	2002	"Upper extremity trauma" – Emergency Radiology, International Institute for Continuing Medical Education, Inc., Plaza Hotel, NY, NY
39.	2002	"Lower extremity trauma" – Emergency Radiology, International Institute for Continuing Medical Education, Inc., Plaza Hotel, NY, NY
40.	2002	"Imaging the Diabetic Foot", Radiology Lecture Series, North Shore University Hospital at Glen Cove, Glen Cove, NY
41.	2003	"Sonography of the Knee" – Orthopedics and Sports Imaging Course, International Institute for Continuing Medical Education, Inc., Plaza Hotel, NY, NY
42.	2003	"Sonography of the Hip" - Orthopedics and Sports Imaging Course, International Institute for Continuing Medical Education, Inc., Plaza Hotel, NY, NY
43.	2003	"Sonography of the Ankle and Foot" - Orthopedics and Sports Imaging Course, International Institute for Continuing Medical Education, Inc., Plaza Hotel, NY, NY
44.	2003	"Imaging Evaluation of the Prosthetic Hip" - Orthopedics and Sports Imaging Course, International Institute for Continuing Medical Education, Inc., Plaza Hotel, NY, NY
45.	2003	"Developmental Dysplasia of the Hip" - Orthopedics and Sports Imaging Course, International Institute for Continuing Medical Education, Inc., Plaza Hotel, NY, NY
46.	2003	"Regional Sports Injuries" – Radiology Review Course, International Institute for Continuing Medical Education, Inc., Marriot Marquis Hotel, NY, NY

47.	2003	"Imaging of Spinal Disorders" - Common Disorders of the Lumbar Spine and Lower Limb: An Evidence Based Approach, North Shore University Hospital, NY
48.	2003	"Imaging Evaluation of the Prosthetic Hip" – International Skeletal Society, San Francisco, CA
49.	2003	"Normal Variants Simulating Disease" – Emergency Radiology Course, International Institute for Continuing Medical Education, Plaza Hotel, NY, NY
50.	2003	"Sonography of the Elbow" – Musculoskeletal Ultrasound Society, Washington, DC
51.	2003	"Sonography of Sports Injuries" – Department of Radiology, Tel Aviv Medical Center, Tel Aviv, Israel
52.	2004	"MRI and Sonography of the Musculoskeletal System: When to pulse, when to sound" – Controversies in Musculoskeletal Imaging, NYU School of Medicine
53.	2004	"MRI and CT of the Musculoskeletal System: When to ionize, when to excite" – Controversies in Musculoskeletal Imaging, NYU School of Medicine
54.	2004	"Imaging case studies" – Grand Rounds, Dept of Rheumatology, North Shore University Hospital
55.	2004	"Regional Sports Injuries" – Radiology Review Course, International Institute for Continuing Medical Education, Inc., Plaza Hotel, NY, NY
56.	2004	"Symptomatic Normal Variants of the Foot" – International Skeletal Society, Malta
57.	2004	"Sonography of the Elbow" – Musculoskeletal Ultrasound Society, Bologna, Italy
58.	2004	"Normal Variants Simulating Disease" – Emergency Radiology Course, International Institute for Continuing Medical Education, Plaza Hotel, NY, NY
59.	2004	"Sonography of Sports Injuries" – Dept of Radiology, Maimonides Med. Cntr, Brooklyn, NY
60.	2004	Miller TT, Kahn LB. Gout of the Spine. International Skeletal Society (closed session), Malta
61.	2005	"Ultra-low Friction Total Hip Arthroplasty" – Society of Skeletal Radiology, Orlando, FL
62.	2005	"Pathogenesis of Rotator Cuff Tear: A Reevaluation" – New York Roentgen Society, NY, NY
63.	2005	"Sonography of Tendon Injuries" – Sports Medicine Imaging Course, Hospital for Joint Diseases, NY
64.	2005	"MR v. US of the Musculoskeletal System" – Annual Meeting, New York Roentgen Society, NY
65.	2005	"MR Imaging of Regional Sports Injuries" - Radiology Review Course, International Institute for Continuing Medical Education, Inc., Plaza Hotel, NY, NY
66.	2005	"US of Shoulder Pathology" – Musculoskeletal US course, Thomas Jefferson University Hospital, Phila, PA
67.	2005	"US of the hand and wrist" - Musculoskeletal US course, Thomas Jefferson University Hospital, Phila, PA
68.	2005	"Musculoskeletal US / MR correlation" - Musculoskeletal US course, Thomas Jefferson University Hospital, Phila, PA
69.	2005	"US of the knee" - Musculoskeletal US course, Thomas Jefferson University Hospital, Phila, PA
70.	2005	"US of Shoulder Pathology" – The Leading Edge in Diagnostic Ultrasound Conference, Thomas Jefferson University, Atlantic City, NJ
71.	2005	"US of the elbow" – The Leading Edge in Diagnostic Ultrasound Conference, Thomas Jefferson University, Atlantic City, NJ
72.	2005	"US of the hand and wrist" – The Leading Edge in Diagnostic Ultrasound Conference, Thomas Jefferson University, Atlantic City, NJ

73.	2005	"Musculoskeletal US / MR correlation" - The Leading Edge in Diagnostic Ultrasound Conference, Thomas Jefferson University, Atlantic City, NJ
74.	2005	"MRI and Sonography of Rheumatoid Arthritis" – Summer Rheumatology Symposium, Maryland Society for the Rheumatic Diseases, Cambridge, MD
75.	2005	"MRI and sonography of the elbow" – Musculoskeletal Ultrasound Society annual meeting, Orlando, FL
76.	2005	"Disorders of the extensor mechanism of the knee" – International Skeletal Society, Singapore
77.	2005	"Sonography of the elbow" - International Skeletal Society, Singapore
78.	2005	"Radiographic Evaluation of Bone Tumors", Annual Conference on Common Orthopaedic Problems in Children, Schneider Children's Hospital, Long Island Jewish Medical Center, NY
79.	2005	"US and MRI of the Elbow", Musculoskeletal US Society, Orlando, FL
80.	2005	"Normal Variants Simulating Disease" – Emergency Radiology Course, International Institute for Continuing Medical Education, Plaza Hotel, NY, NY
81.	2005	"Subtle Fractures often Missed" – Emergency Radiology Course, International Institute for Continuing Medical Education, Plaza Hotel, NY, NY
82.	2005	"MR Imaging of the Elbow", Refresher Course, RSNA Annual Meeting, Chicago
83.	2006	"MR Imaging of the Knee" – Dept. of Radiology, Columbia-Presbyterian Medical Center, NY, NY
84.	2006	"MR Imaging of Shoulder Impingement"- Grand Rounds, Dept. of Radiology, Columbia-Presbyterian Medical Center, NY, NY
85.	2006	"MR and Sonography of Arthritis" - International Skeletal Society Regional Outreach Program, Manila, Philippines
86.	2006	"Imaging of Infection" - International Skeletal Society Regional Outreach Program, Manila, Philippines
87.	2006	"Symptomatic Normal Variants Simulating Disease" - International Skeletal Society Regional Outreach Program, Manila, Philippines
88.	2006	"MR and Sonography of Sports Injuries" – Asian Musculoskeletal Radiology Society, Manila, Philippines
89.	2006	"Sonography of Wrist Injuries" – Asian Musculoskeletal Radiology Society, Manila, Philippines
90.	2006	"Imaging of Infection" – Department of Radiology, Asan Medical Center, Seoul, Korea
91.	2006	"MR and Sonography of Arthritis" – Korean Musculoskeletal Radiology Society, Seoul National University Medical Center, Seoul, Korea
92.	2006	"Impingement Syndromes of the Shoulder" – Grand Rounds, Dept. of Radiology, Maimonides Medical Center, Brooklyn, NY
93.	2006	"Sonography of Shoulder Pathology" - Musculoskeletal US course, Thomas Jefferson University Hospital, Phila, PA
94.	2006	"Sonography of Elbow Abnormalities" - Musculoskeletal US course, Thomas Jefferson University Hospital, Phila, PA
95.	2006	"MRI v. Sonography of Sports Injuries" - Musculoskeletal US course, Thomas Jefferson University Hospital, Phila, PA
96.	2006	"Rotator cuff tears: Etiologies revisited" – Grand Rounds, Dept of Radiology, Hospital for Special Surgery, NY, NY
97.	2006	"New Concepts in Total Hip Replacement" – Annual meeting, New York Roentgen Society, NY, NY
98.	2006	"MR imaging and Sonography of Arthritis" – Grand Rounds, Division of Rheumatology, North Shore University Hospital, Lake Success, NY

99. 2006 "Update on Imaging of Arthritis" – NY Radiology Review Course, International Institute for Continuing Medical Education, Marriott Eastside Hotel, NY, NY
100. 2006 "Sonography of the Shoulder" – NYU Sports Medicine Imaging Course, NY, NY
101. 2006 "Normal Variants Simulating Disease" – Department of Radiology, St. Mary's Catholic Medical Center, Seoul, Korea
102. 2006 "MR Imaging of Shoulder Impingement" - Department of Radiology, St. Mary's Catholic Medical Center, Seoul, Korea
103. 2006 "Sonography of Elbow Disorders" – Musculoskeletal Ultrasound Society, Seoul, Korea
104. 2006 "Sonography of Elbow Disorders" - International Skeletal Society, Vancouver
105. 2006 "MR Imaging at 1.5T: Why We Should Do It" - International Skeletal Society, Vancouver
106. 2006 "Sonography of the Hip and Knee"- Society of Radiologists in Ultrasound, San Francisco
107. 2006 "Normal Variants Simulating Disease" – Emergency Radiology Course, International Institute for Continuing Medical Education, Marriott Hotel Eastside, NY, NY
108. 2006 "Subtle Fractures" – Emergency Radiology Course, International Institute for Continuing Medical Education, Marriott Hotel Eastside, NY, NY
109. 2006 "MR Imaging of the Elbow", Refresher Course, RSNA Annual Meeting, Chicago
110. 2007 "Ultra-low Friction Hip Arthroplasty" – Grand Rounds, Department of Radiology and Imaging, Hospital for Special Surgery, NY
111. 2007 "Rotator Cuff Pathology" - Musculoskeletal US course, U. of Michigan, Captiva Island, FL
112. 2007 "Elbow Sonography" - Musculoskeletal US course, Univ. of Michigan, Captiva Island, FL
113. 2007 "Imaging the Young Athlete" - Sports Medicine of the Young Athlete Course, Hospital for Special Surgery, NY, NY
114. 2007 "MRI of the Elbow" – RSNA Highlights Course, Phoenix, AZ
115. 2007 "Sonography of the Elbow" - American Institute of Ultrasound in Medicine, annual meeting, NY, NY
116. 2007 "Sonography and MR Imaging of Sports Injuries" - Dept. of Radiology, St. Luke's – Roosevelt Hospital, NY
117. 2007 "MR Imaging of the Foot and Ankle" – Nassau County Podiatry Association, Great Neck, NY
118. 2007 "Sonography of Shoulder Pathology" – The Leading Edge in Diagnostic Ultrasound Conference, Thomas Jefferson University, Atlantic City, NJ
119. 2007 "Sonography of Elbow Anatomy and Pathology" - The Leading Edge in Diagnostic Ultrasound Conference, Thomas Jefferson University, Atlantic City, NJ
120. 2007 "Sonography of Abnormalities of the Hand and Wrist" - The Leading Edge in Diagnostic Ultrasound Conference, Thomas Jefferson University, Atlantic City, NJ
121. 2007 "MRI and Sonography of the Musculoskeletal System: An Evidence Based Approach" - The Leading Edge in Diagnostic Ultrasound Conference, Thomas Jefferson University, Atlantic City, NJ
122. 2007 "Morphologic and Functional Imaging of Musculoskeletal Infection" – Society of Nuclear Medicine, Washington, DC
123. 2007 "Ultrasound-guided Shoulder Procedures" - Hands-on Musculoskeletal Ultrasound: Diagnostic and Interventional Techniques, American Institute of Ultrasound in Medicine, Mayo Clinic, Rochester, MN
124. 2007 "Common Elbow Disorders" - Hands-on Musculoskeletal Ultrasound: Diagnostic and Interventional Techniques, American Institute of Ultrasound in Medicine, Mayo Clinic, Rochester, MN
125. 2007 "Common Wrist and Hand Disorders" - Hands-on Musculoskeletal Ultrasound: Diagnostic and Interventional Techniques, American Institute of Ultrasound in Medicine, Mayo Clinic,Rochester, MN

126. 2007 "Common Knee Disorders" - Hands-on Musculoskeletal Ultrasound: Diagnostic and Interventional Techniques, American Institute of Ultrasound in Medicine, Mayo Clinic, Rochester, MN
127. 2007 "Sonography of the Elbow: Normal Anatomy" - Musculoskeletal Ultrasound Society, Paris, France
128. 2007 "Sonography of Lateral Elbow Pain" - Musculoskeletal Ultrasound Society, Paris, France
129. 2007 "Rotator Cuff Tears: Etiologies Revisited" – Grand Rounds, Department of Radiology, Vancouver General Hospital, Vancouver, Canada
130. 2007 "Sonography of the elbow: Anatomy and Pathology" – International Skeletal Society, Budapest, Hungary
131. 2007 "Normal variants simulating disease" - Emergency Radiology course, International Institute for Continuing Medical Education, The Helmsley Park Hotel, NY, NY
132. 2008 "Sonography of the Musculoskeletal System" – Dept. of Radiology, U. of Maryland
133. 2008 "Imaging of Hip Arthroplasty" – Grand Rounds, Dept. of Radiology, U of Maryland
134. 2008 "MR Imaging of the Diabetic Foot" – Beth Israel Deaconess MRI course, Puerto Rico
135. 2008 "Femoroacetabular Impingement" - Beth Israel Deaconess MRI course, Puerto Rico
136. 2008 "MRI v. US of the Shoulder" - Beth Israel Deaconess MRI course, Puerto Rico
137. 2008 "MSK MRI at Low Field v. 1.5T v. 3T" - Beth Israel Deaconess MRI course, Puerto Rico
138. 2008 "Etiology of Rotator Cuff Tears" – Grand Rounds, Department of Radiology and Imaging, Hospital for Special Surgery
139. 2008 "Femoroacetabular Impingement" – Annual Spring Meeting, NY Roentgen Society, NY, NY
140. 2008 "Imaging with the Experts – MSK" – American College of Radiology, Washington, DC
141. 2008 "Sonography of Elbow Ligaments" – European Society of Skeletal Radiology, Galway, Ireland
142. 2008 "Ultrasound-guided Shoulder Procedures" - Hands-on Musculoskeletal Ultrasound: Diagnostic and Interventional Techniques, American Institute of Ultrasound in Medicine, Mayo Clinic, Rochester, MN
143. 2008 "Common Elbow Disorders" - Hands-on Musculoskeletal Ultrasound: Diagnostic and Interventional Techniques, American Institute of Ultrasound in Medicine, Mayo Clinic, Rochester, MN
144. 2008 "Common Wrist and Hand Disorders" - Hands-on Musculoskeletal Ultrasound: Diagnostic and Interventional Techniques, American Institute of Ultrasound in Medicine, Mayo Clinic, Rochester, MN
145. 2008 "Common Knee Disorders" - Hands-on Musculoskeletal Ultrasound: Diagnostic and Interventional Techniques, American Institute of Ultrasound in Medicine, Mayo Clinic, Rochester, MN
146. 2008 "Introduction to Musculoskeletal Imaging" – Department of Orthopedics core curriculum series, Hospital for Special Surgery
147. 2008 "Femoroacetabular Impingement" – Grand Rounds, Dept of Radiology and Imaging, HSS
148. 2008 "Femoroacetabular Impingement and Imaging of Labral Tears" – Long Island Radiological Society
149. 2008 "MR Imaging and Sonography of Sports Injuries" – Grand Rounds, Dept of Radiology, Brigham and Women's Hospital, Boston, MA
150. 2008 "MR Imaging and Sonography of Sports Injuries" – Grand Rounds, Dept of Radiology, Massachusetts General Hospital, Boston, MA
151. 2008 "US of Elbow Anatomy and Pathology" – International Skeletal Society, New Delhi, India
152. 2008 "Case Presentation - Elbow and Hand" – International Skeletal Society, New Delhi, India
153. 2008 "MRI and US of Hip and Knee Arthroplasty" – International Skeletal Society, New Delhi, India

154. 2009 "MR Imaging and Sonography of Sports Injuries" – Grand Rounds, Dept of Radiology, SUNY Stony Brook, NY
155. 2009 "MR Imaging and Sonography of Sports Injuries" – Grand Rounds, Dept of Radiology, University of Wisconsin, Madison, WI
156. 2009 "Imaging of Hip Arthroplasty" – Dept of Radiology, University of Wisconsin, Madison, WI
157. 2009 "Osteomyelitis and Septic Arthritis" – International Diagnostic Course, Davos, Switzerland
158. 2009 "Introduction to Musculoskeletal Imaging" – Department of Orthopedics core curriculum series, Hospital for Special Surgery
159. 2009 "Sonography of Elbow Anatomy and Pathology" - The Leading Edge in Diagnostic Ultrasound Conference, Thomas Jefferson University, Atlantic City, NJ
160. 2009 "Sonography of Abnormalities of the Hand and Wrist" - The Leading Edge in Diagnostic Ultrasound Conference, Thomas Jefferson University, Atlantic City, NJ
161. 2009 "MRI and Sonography of the Musculoskeletal System: An Evidence Based Approach" - The Leading Edge in Diagnostic Ultrasound Conference, Thomas Jefferson University, Atlantic City, NJ
162. 2009 "Ultrasound of the Hip: Lateral and Posterior Aspects" – European Society of Skeletal Radiology, Genoa, Italy
163. 2009 "Musculoskeletal Ultrasound" – International Diagnostic Course, Anavyssos, Greece
164. 2009 "Musculoskeletal Infection" - International Diagnostic Course, Anavyssos, Greece
165. 2009 "Etiologies of Rotator Cuff Tears" – Department of Radiology, Vanderbilt Medical Center, Nashville, TN
166. 2009 "Nerve Entrapment Syndromes of the Elbow" – International Skeletal Society, Washington, DC
167. 2009 "Interesting Cases" – Society of Academic Bone Radiologists, Boston, MA
168. 2009 "Sonography of Hip Arthroplasty" – Annual Spring Meeting, NY Roentgen Society, NY
169. 2010 "Sonography of Sports Injuries" - Imaging Grand Rounds, ProHealth, Inc, Lake Success, NY
170. 2010 "Imaging of Hip Arthroplasty" – Grand Rounds, Dept of Radiology, SUNY Stony Brook, NY
171. 2010 "Current Status of Weight-bearing Surfaces in Arthroplasty" – Founders' Lecture, International Skeletal Society, Athens, Greece
172. 2010 "Facet Joint Arthrosis and Mimickers" - International Skeletal Society, Athens, Greece
173. 2010 "Facet Joint Arthrosis and Mimickers" – Grand Rounds, Dept. of Radiology and Imaging, Hospital for Special Surgery
174. 2010 "Knee: Internal Derangement and Osteochondral Injury" – 5th Annual Leeds Sports Course, Leeds, England
175. 2010 "Capsulolabral Injuries of the Shoulder" – 5th Annual Leeds Sports Course, Leeds, England
176. 2010 "Rotator Cuff Tears and Impingement Syndromes" – 5th Annual Leeds Sports Course, Leeds, England
177. 2010 "Sports Injuries of the Elbow and Wrist"– 5th Annual Leeds Sports Course, Leeds, England
178. 2010 "Imaging of the Medial and Posterior Aspects of the Ankle" – 92nd Annual Alumni Meeting, Hospital for Special Surgery, NY
179. 2010 "Current Status of Weight-bearing Surfaces in Arthroplasty" – Grand Rounds, Dept. of Radiology and Imaging, Hospital for Special Surgery
180. 2011 "Current Status of Weight-bearing Surfaces in Arthroplasty" – Grand Rounds, Dept. of Radiology, Beth Israel Medical Center, NY, NY
181. 2011 "Sonography of the Wrist: Normal Anatomy and Pathology" – Musculoskeletal Ultrasound Course, University of Leiden, Leiden, Holland
182. 2011 "Sonography of Normal Hip Anatomy" - Musculoskeletal Ultrasound Course, University of Leiden, Leiden, Holland
183. 2011 "Sonography of Upper Extremity Nerves" - Musculoskeletal Ultrasound Course, University of Leiden, Leiden, Holland

184. 2011 "Dynamic Sonographic Evaluation of Supraspinatus Tears and Subluxing Biceps Tendon" - European Society of Skeletal Radiology, Crete, Greece
185. 2011 "Ultrasound of the Shoulder: Beyond the Rotator Cuff" - European Society of Skeletal Radiology, Crete, Greece
186. 2011 "Shoulder Ultrasound: Interesting Cases" – International Skeletal Society Ultrasound course, San Diego
187. 2011 "Soft Tissue Injuries of the Throwing Elbow" – International Skeletal Society, Refresher course, San Diego
188. 2011 "Facet Joint Arthrosis and Mimickers" - International Skeletal Society, Refresher course, San Diego
189. 2012 "Sonography of Sports Injuries" - Dept of Radiology, Univ. of Nebraska, Omaha, NE
190. 2012 "Current Status of Artificial Bearing Surfaces" – Nebraska Radiological Society, Omaha
191. 2012 "Current Status of Artificial Bearing Surfaces" – Dept. of Radiology, Columbia-Presbyterian Medical Center, NY
192. 2012 "Current Status of Artificial Bearing Surfaces" – Royal College of Radiology/British Society of Skeletal Radiology, Leeds, UK
193. 2012 "MRI of Menisci" – Royal College of Radiology/British Society of Skeletal Radiology, Leeds, UK
194. 2012 "MRI of Cartilage" – Royal College of Radiology/British Society of Skeletal Radiology, Leeds, UK
195. 2012 "MRI of the Triangular Fibrocartilage Complex and Intrinsic Ligaments of the Wrist" –
Royal College of Radiology/British Society of Skeletal Radiology, Leeds, UK
196. 2012 "Sonography of Sports Injuries" - Mallinckrodt Institute of Radiology, Washington University, St. Louis
197. 2012 "Current Status of Artificial Bearing Surfaces" – 18th annual Hyman R. Senturia Lecture, Mallinckrodt Institute of Radiology, Washington University, St. Louis
198. 2012 "Imaging of the Knee: Menisci and Cartilage" – refresher course lecture, ARRS annual meeting, Vancouver, CA
199. 2012 "US of the Elbow" – Massachusetts General Hospital Sports Imaging Course, Boston, MA
200. 2012 "Shoulder Instability" - Massachusetts General Hospital Sports Imaging Course, Boston, MA
201. 2012 "MRI v. US of the Shoulder" - Massachusetts General Hospital Sports Imaging Course, Boston, MA
202. 2012 "US-guided Interventional Procedures" - Massachusetts General Hospital Sports Imaging Course, Boston, MA
203. 2012 "Sonography of the Hand and Wrist: Normal Tendon Anatomy" - European Society of Skeletal Radiology, Innsbruck, Austria
204. 2012 "Sonography of Nerve Compression in the Elbow: Ulnar nerve, PIN, AIN" - European Society of Skeletal Radiology, Innsbruck, Austria

Grant:

1997 Indirect MR-arthrography of the Shoulder -- $2,500.00, sponsored by Nycomed Amersham, Inc.

Patent:

1996 Temporary Vena Cava Filter - U.S. Patent # 5,549,626, (licensing rights assigned to Hospital for Special Surgery)

Bibliography [Peer-reviewed]:

1. Lowenfels AB, Miller TT. Alcohol and Trauma. Annals of Emergency Medicine 1984; 13: 1056-1060.

2. Abdelwahab IF, Miller TT, Hermann G, et al. Transarticular Invasion of Joints by Bone Tumors: Hypothesis. Skeletal Radiology 1991; 20:279-283.

3. Miller TT, Mendelson DS, Wu L, Halton KP. Seminoma of the Testis Presenting as an Ulcerating Mass of the Duodenum. Clinical Imaging 1992; 16:201-203

4. Miller TT, Hermann G, Abdelwahab IF. Intraosseous Pneumatocyst of the Ilium. JCAT 1992; 16:1002-1003.

5. Hermann G, Abdelwahab IF, Miller TT, et al. MRI Features Differentiating Benign from Malignant Soft Tissue Tumors: Radiopathologic Correlation. Br J of Radiol 1992; 65:14-20.

6. Miller TT, Abdelwahab IF, Hermann G, Morgello S. Case Report 735 (Vertebral Osteosarcoma). Skeletal Radiology 1992; 21:277-279.

7. Miller TT, Cole PE, Kazam E, et al. Post-Traumatic Renal Infarction versus Tumor: A Helpful Angiographic Finding. Clinical Imaging 1992; 16:129-133.

8. Miller TT, Caldwell G, Kaye JJ, et al. MR Imaging of Deferoxamine-Induced Bone Dysplasia in an 8 year-old female with Thalassemia Major. Pediatric Radiology 1993; 23:523-524.

9. Miller TT, Norton KI, Rosh JR. Case report 765 (Skeletal Abnormalities Associated with Von Gierke's Disease). Skeletal Radiology 1993; 22:200-202.

10. Miller TT, Palestro CJ, Groisman GM, et al. Choledochal Cyst: Preoperative Sonographic and Scintigraphic Assessment. Clin Nuc Med 1993; 18:1001-1002.

11. Miller TT, Hermann G, Abdelwahab IF, et al. MRI of Malignant Fibrous Histiocytoma: Analysis of 13 cases with Pathologic Correlation. Skeletal Radiology 1994; 23:271-275.

12. Miller TT, Potter HG, McCormack, Jr. RR. Benign Soft Tissue Masses of the Wrist and Hand: MRI Appearances. Skeletal Radiology 1994; 23:327-332.

13. Levin TL, Miller TT, Berdon WE, et al. MR Signal Characteristics of Cadaver Bone Allografts in Three Children with Primary Bone Tumors Treated with Limb Salvage Therapy. Pediatric Radiology 1994; 24:488-490.

14. Miller TT, Staron RB, Feldman F, et al. MRI of the Symptomatic Accessory Tarsal Navicular Bone. Radiology 1995;195:849-853.

15. Miller TT, Staron RB, Feldman F. Patellar Height on Sagittal MRI of the Knee. AJR 1996; 167:339-341 (also see reply to letter to the editor AJR 1997; 168:1111)

16. Miller TT, Staron RB, Koenigsberg T, Levin TL, Feldman F. MR Imaging of Baker Cysts: Association with Internal Derangement, Effusion, and Degenerative Arthropathy. Radiology 1996; 201:247-250 (see also reply to letter to the editor Radiology 1997; 203:577-578)

17. Miller TT, Gladden P, Staron RB, Henry J, Feldman F. Posterolateral Stabilizers of the Knee: Anatomy and Injuries Assessed with MR Imaging. AJR 1997; 169:1641-1647.

18. Miller TT, Bucchieri J, Joshi A, Staron RB, Feldman F. Pseudodefect of the Talus: An Anatomic Pitfall of Ankle MRI. Radiology 1997; 203:857-858

19. Miller TT, Staron RB, Feldman F, Cepel E. Meniscal Position on Routine MR Imaging of the Knee. Skeletal Radiology 1997; 26:424-427.

20. Miller DH, Miller TT, Schultz E, Toledano B. Dislocation of the Second through Fifth Carpometacarpal Joints. Emergency Radiology 1997; 4:172-176.

21. Miller TT, Randolph Jr. DA, Staron RB, Feldman F, Cushin S. Fat-Suppressed MR Imaging of Musculoskeletal Infection: Gadolinium-enhanced T1WI versus Fast T2-Weighted Techniques. Skeletal Radiology 1997; 26:654-658.

22. Sahin-Akyar G, Miller TT, Staron RB, McCarthy D, Feldman F. Gradient Echo versus Fat-suppressed Fast Spin-Echo MR Imaging of Rotator Cuff Tears. AJR 1998; 171:223-227.

23. Miller TT, Shapiro MA, Schultz E, Crider R, Paley D. Sonography of Patellar Abnormalities in Children. AJR 1998; 171: 739-742.

24. Lee L, Miller TT, Schultz E, Toledano B. Scapulothoracic Dissociation. Am J Orthopedics 1998; 27:699-702.

25. Miller TT, Shubin Stein BE, Staron RB, Feldman F. Relationship of the Meniscofemoral Ligaments of the Knee to Lateral Meniscal Tears: MR Imaging Evaluation. Am J Orthopedics1998; 27:729-732.

26. Schultz E, Miller TT, Boruchov SD, Schmell ES, Todedano B. Incomplete Intertrochanteric Fractures of the Proximal Femur. Radiology 1999; 211:237-240.

27. Staron RB, Greenspan R, Miller TT, Bilezikian J, Shane E, Haramati N. Operator-dependent Errors in Computerized Bone Densitometric Analysis. Radiology 1999; 211:467-470.

28. Khan AM, Ryan MG, Meinhard BP, Miller T. Use of a Custom Retrograde Intramedullary Rod for the Management of Distal Femoral Nonunion: A Report of Two Cases. Am J Orthopedics 1999; 28:361-364.

29. Miller TT. MR-arthrography of the Shoulder and Hip after Fluoroscopic Landmarking. Skeletal Radiology 2000; 29:81-84.

30. Miller TT, Adler RS. Sonography of Distal Biceps Tendon Tears. AJR 2000; 175:1081-1086.

31. Hill NB, Bucchieri JS, Shon FG, Miller TT, Rosenwasser MP. MRI of the Medial Collateral Ligament of the Elbow: A Cadaver Model. J of Shoulder and Elbow Surgeons 2000; 9:418-422.

32. Langenwalter II PE, Boxt MA, Boxt LM, Miller TT. A Sea Otter (*Enhydra lutris*) Femur with Imbedded Projectile Point Fragment from a Late Prehistoric Camp Site in Long Beach, California. Pacific Coast Archaeological Society Quarterly 2001; 37: 47-55.

33. Miller TT. Sonography of Injury of the Posterior Cruciate Ligament of the Knee. Skeletal Radiology 2002; 31:149-154.

34. Miller TT, Shapiro MA, Schultz E, Kalish PE. Epicondylitis: Sonography versus MR Imaging. Journal of Clinical Ultrasound 2002; 30:193-202.

35. Miller TT, Pavlov H, Gupta M, Schultz E, Greben C. Isolated Injury of the Cuboid Bone: A Potentially Subtle Cause of Foot Pain. Emergency Radiology 2002; 9:272-277.

36. Miller-Pisacano R, Miller TT. Sonography of Apophyseal Avulsions of the Pelvis: Comparison with MR Imaging. AJR 2003; 181:223-230.

37. Dalal A, Miller TT, Kenan S. Sonographic Detection of Elastofibroma Dorsi. J Clin Ultrasound 2003; 31:375-8.

38. Kaushik S, Miller TT, Nazarian L. Spectral Doppler sonography of musculoskeletal soft tissue masses. J Ultrasound Medicine 2003; 22:1333-1336

39. Katz DS, Wagner HJ, Grampp S, Miller TT, Frush DP, Peh WC, Applegate K. The RSNA Editorial Fellowship: editorial fellows' perspective. Radiology. 2003; 226:309-11.

40. Roberts D, Miller TT, Erlanger SM. Sonography of synovial chondromatosis of the knee. J Ultrasound Med. 2004; 23:707-9.

41. Moosikasuwan J, Miller TT, Math KR, Schultz E. Shifting bone marrow edema of the knee. Skeletal Radiology 2004; 33:380-385

42. Miller TT, Adler R, Friedman L. Sonography of tears of the ulnar collateral ligament of the elbow. Skeletal Radiology 2004; 33:386-391

43. Wank R, Miller TT, Shapiro J. Sonographically guided peritendinous injection of the iliopsoas tendon after total hip replacement. J Clin Ultrasound. 2004;32:354-7.

44. Segal A, Miller TT, Krauss ES. Fabellar Snapping as a cause of Knee Pain after Total Knee Replacement. AJR 2004; 183:352-4.

45. Levin D, Nazarian L, Miller TT, et al. Sonographic detection of lateral epicondylitis of the elbow. Radiology 2005; 237:230-234

46. Weinberg J, Miller TT, Handelsman JE, Kahn LB, Godfried DH, Kenan S. Periosteal chondrosarcoma in a 9 year old girl with osteochondromatosis. Skeletal Radiol 2005; 34:539-542

47. Moosikasuwan JB, Miller TT, Burke B. Clinical, radiologic, and sonographic evaluation of the rotator cuff. Radiographics 2005; 25:1591-1607

48. Miller TT. Imaging of Knee Arthroplasty. Eur J Radiology 2005; 54:164-177.

49. Palestro CJ, Love C, Miller TT. Infection and musculoskeletal conditions: Imaging of musculoskeletal infections. Best Pract Res Clin Rheumatol. 2006; 20:1197-218

50. Palestro CJ, Love C, Miller TT. Diagnostic imaging tests and microbial infections. Cellular Microbiology 2007; 9:2323-33.

51. Walz DM, Miller TT, Chen S, Hofman J. Delamination Tears of the Rotator Cuff. Skeletal Radiology 2007; 36:411-6.

52. Miller TT. Radiographic Evaluation of Bone Tumors. Radiology 2008; 246:662-74.

53. Opsha O, Malik A, Baltazar R, Primakov D, Beltran S, Miller TT, Beltran J. MRI of the rotator cuff and internal derangement. Eur J Radiol. 2008; 68:36-56.

54. Miller TT. MR Imaging of the Knee. Sports Med Arthrosc. 2009; 17:56-67.

55. Chang A, Miller TT. Imaging of Tendons. Sports Health 2009; 1: 293-300

56. Miller TT, Reinus WR. Nerve entrapment syndromes of the elbow, forearm, and wrist. AJR Am J Roentgenol. 2010; 195:585-94.

57. Kazam JK, Nazarian LN, Miller TT, Sofka CM, Parker L, Adler RS. Sonographic evaluation of femoral trochlear cartilage in patients with knee pain. J Ultrasound Med. 2011; 30:797-802

58. Wilde GE, Miller TT, Schneider R, Girardi FP. Sacral fractures after lumbosacral fusion: a characteristic fracture pattern. AJR Am J Roentgenol. 2011;197:184-8.

59. Hayter CL, Koff MF, Shah P, Koch KM, Miller TT, Potter HG. Magnetic Resonance Imaging of arthroplasty: comparison of MAVRIC and conventional fast spin echo techniques. AJR Am J Roentgenol. 2011;197(3):W405-11.

60. Miller TT. Imaging of hip arthroplasty. Eur J Radiol. 2011 Apr 27. [Epub ahead of print]

61. Hayter CL, Miller TT, Adler RS. A comparative analysis of two dimensional versus three dimensional ultrasound imaging of the supraspinatus tendon. J Ultrasound Med. 2012; 31:449-53.

62. Hayter CL, Gold SL, Koff MF, Perino G, Nawabi DH, Miller TT, Potter HG. MRI Findings in Painful Metal-on-metal Hip Arthroplasty. AJR (in press)

63. Shah NP, Miller TT, Stock H, Adler RS. Sonography of Supraspinatus Tendon Pathology in the Neutral versus Crass and Modified Crass Positions: A Prospective Study. J Ultrasound Med (in press).

64. Plodkowski A, Hayter C, Miller TT, Nguyen J, Potter H. The sensitivity and specificity of lamellated hyperintense synovitis for infection on MRI of knee arthroplasty. Radiology (in peer review)

65. Endo Y, Miller TT, Saboeiro GR, Cook P. Lumbar discal cyst: Diagnostic discography followed by therapeutic CT-guided aspiration and injection. Skeletal Radiology (in peer review)

Non Peer-reviewed Articles:

1. Miller TT. Elbow Imaging. Orthopedic Clinics of North America 1999; 30:21-36.

2. Miller TT. Invited commentary: Ultrasound of Nerve Entrapments in Osteofibrous Tunnels. RadioGraphics 2000; 20 (special issue): S213-S216.

3. Miller TT. Painful Accessory Bones of the Foot. Seminars in Musculoskeletal Radiology 2002; 6: 153-161.

4. Miller TT. Imaging of Total Hip Arthroplasty. Contemporary Diagnostic Radiology 2004; 27 (12): 1-.

5. Miller TT. Imaging of Disc Disease and Degenerative Spondylosis of the Lumbar Spine. Seminars in Ultrasound, CT, and MR 2004; 25:506-522.

6. Miller TT. Abnormalities in and around the Hip: MR Imaging versus Sonography. MRI Clinics of North America 2005; 13:799-809.

7. Miller TT. Sonography of Joint Replacements. Seminars in Musculoskeletal Radiology 2006; 10:79-85.

8. Miller TT. Imaging of Hip Arthroplasty. Seminars in Musculoskeletal Radiology 2006; 10: 30-46.

9. Moosikasuwan J, Miller TT, Dines DM. Imaging of the painful shoulder in throwing athletes. Clinics in Sports Medicine 2006; 25:433-43.

10. Miller TT. Sonography of Muscle and Tendon Injuries of the Lower Extremity. US Clinics of North America 2007; 2:595-616

11. Miller TT. Imaging of the Medial and Lateral Ligaments of the Knee. Seminars in Musculoskeletal Radiology 2009; 13:340-52

Book:

Miller TT, Schweitzer ME, eds. Diagnostic Musculoskeletal Imaging. New York: McGraw-Hill, 2005

Book Chapters:

1. Miller TT, Ghelman B, Potter HG. CT and MR Imaging of the Foot and Ankle. In: Nicholas JA, Hershman EB, eds. The Lower Extremity and Spine in Sports Medicine. 2nd ed. St. Louis, MO: C.V. Mosby, 1994

2. Finzel K, Miller TT. Imaging the Musculoskeletal System. In: Dee R, ed. Principles of Orthopedic Practice. 2nd ed. New York: McGraw-Hill, 1997

3. Miller TT. Soft Tissue Tumors. In: Miller TT, Schweitzer ME, eds. Diagnostic Musculoskeletal Imaging. New York: McGraw-Hill, 2005

4. Miller TT. Infection. In: Miller TT, Schweitzer ME, eds. Diagnostic Musculoskeletal Imaging. New York: McGraw-Hill , 2005

5. Miller TT. The Knee. In: Miller TT, Schweitzer ME, eds. Diagnostic Musculoskeletal Imaging. New York: McGraw-Hill, 2005

6. Miller TT. The Elbow. In: Miller TT, Schweitzer ME, eds. Diagnostic Musculoskeletal Imaging. New York: McGraw-Hill, 2005

7. Levin TL, Miller TT. The Hip. In: Miller TT, Schweitzer ME, eds. Diagnostic Musculoskeletal Imaging. New York: McGraw-Hill, 2005

8. Levin TL, Miller TT. Miscellaneous Conditions of Bone. In: Miller TT, Schweitzer ME, eds. Diagnostic Musculoskeletal Imaging. New York: McGraw-Hill, 2005

9. Staron RB, Miller TT. Bone Densitometry. In: Miller TT, Schweitzer ME, eds. Diagnostic Musculoskeletal Imaging. New York: McGraw-Hill, 2005

10. Miller TT. MR Imaging of the Knee. In: Insall and Scott. Surgery of the Knee, 4th edition, Phila: Churchill Livingstone, 2006

11. Miller TT**.** Elbow. In Manaster BJ. Diagnostic and Surgical Imaging Anatomy: Musculoskeletal. Salt Lake City: Amirsys, 2006

12. Chen Q, Beltran J, Miller TT. Shoulder: Technical Aspects, Normal Anatomy, Common Variants, and Basic Biomechanics. In Pope T, Morrison W, Beltran J, Bloem H, Wilson D, eds. Imaging of the Musculoskeletal System. Philadelphia: Elsevier, 2008

13. Beltran J, Shankman S, Miller TT. Elbow: Technical Aspects, Normal Anatomy, Common Variants, and Basic Biomechanics. In Pope T, Morrison W, Beltran J, Bloem H, Wilson D, eds. Imaging of the Musculoskeletal System. Philadelphia: Elsevier, 2008

14. Miller TT. Internal Derangement of the Knee: Tendon Injuries. In Pope T, Morrison W, Beltran J, Bloem H, Wilson D, eds. Imaging of the Musculoskeletal System. Philadelphia: Elsevier, 2008

15. Miller TT. MR Imaging of the Knee. In Pedowitz RA, Resnick DL, Chung CB, eds. MRI in Orthopaedic Sports Medicine. NY: Springer, 2008

16. Miller TT, Sofka CM. Imaging of Soft Tissue Tumors. In Bonakdapor A, Reinus W, Khurana JS, eds. Diagnostic Imaging of Musculoskeletal Diseases. New York: Springer, 2009

17. Miller TT, Schweitzer ME. Imaging of Musculoskeletal Infections. Musculoskeletal Diseases 2009-2012. Hodler J, von Schultess GK, Zollikofer CL, eds. Milan: Springer, 2009.

Proceedings of Meetings:

1. Ateshian GA, Cohen ZA, Kwak SD, Wang VM, Ahmad CS, Kelkar R, Raimondo RA, Feldman F, Miller TR(sic), Mun IK, Bigliani LU, Mow VC, Peterfy CG. Determination of *In Situ* Contact Areas in Diarthrodial Joints by MRI. Proceedings of Advances in Bioengineering, American Society of Mechanical Engineers, Bioengineering Division 1995; 31: 225-226.

2. Friedberg EB, Miller TT, Staron R, Feldman F. Imaging Techniques for Evaluation of Foreign Bodies. Proceedings of the AUR 1996, p. 40.

3. Leone VJ, Miller TT, Shapiro MA, Enker IP. MR Imaging of Cervical Spine Stenosis in Flexion and Extension. Proceedings of the North American Spine Society 1999, p. 21-22.

4. Miller TT. Variations in the Practice of Lumbar Discography in the United States. Proceedings of the Society of Skeletal Radiology 2000, p. 28.

5. Dines J, Dines D, Nickols J, Miller T, Elattrache N, Uggen C Hart, C Zafont B, Grande D. rhPDGF-BB Enhances Rotator Cuff Tendon Healing in a Sheep Model. Orthopedic Research Society, 2008, paper 316

Educational Exhibits:

Posters

1. Schultz E, Miller TT, Gupta M, Zimmer J. Imaging of Groin Pain. Radiological Society of North America, Chicago, IL, 1997 (chosen for category 1 CME credit) and American Society of Emergency Radiology, St. Petersburg, FL, 1998

2. Hermann G, Abdelwahab IF, Kenan S, Klein MJ, Miller TT, Feldman F. Non-Hodgkin Lymphoma of the Musculoskeletal System: Radio-Pathologic Correlation. Radiological Society of North America, Chicago, IL, 1999 and American Roentgen Ray Society, Washington D.C, 2000

3. Miller TT, Trapp KM, Rokito SE. Sonography of Normal Elbow Anatomy: A Cadaveric Study. Radiological Society of North America, Chicago, IL, 2001 (chosen for category 1 CME credit)

4. Miller TT, Pavlov H, Karasick D. Painful Bony Variants of the Foot. Radiological Society of North America, Chicago, IL, 2002

5. Hermann G, Sebes JI, Umans HR, Feldman F, Miller TT, Klein M, Singson R. Imaging of Gout and Related Crystal Deposition Arthropathies: Pathologic Correlation. Radiological Society of North America, Chicago, IL, 2002 (chosen for category 1 CME credit) (awarded Certificate of Merit)

6. Grimaldi G, Miller TT, Harcke HT, Grissom L. Sonography of the Pediatric Knee. Radiological Society of North America, Chicago, IL, 2005 (awarded Certificate of Excellence in Design)

7. Kaushik S, Miller TT. Abnormalities of the Popliteal Fossa of the Knee. Radiological Society of North America, Chicago, IL, 2005

8. Primakov D, Baltazar R, Miller TT, Beltran J, Zlatkin M. Shoulder Impingement Syndromes.. Radiological Society of North America, Chicago, IL, 2006 (chosen for category 1 CME credit) (awarded Certificate of Merit)

9. Love C, Miller TT, Siripun L, Rini JN, Palestro CJ. Diagnosing Musculoskeletal Infection: Integrating Functional and Morphologic Imaging. Radiological Society of North America, Chicago, IL, 2007

10. Dines J, Dines D, Nickols J, Miller T, Elattrache N, Uggen C Hart, C Zafont B, Grande D. rhPDGF-BB Enhances Rotator Cuff Tendon Healing in a Sheep Model. Orthopedic Research Society, San Francisco, CA, 2008

Computer Presentations:

1. Gupta M, Razack N, Schultz E, Miller TT. Multimodality Evaluation of Wrist Trauma: A Computer-based Teaching File. Radiological Society of North America, Chicago, IL, 1998 (chosen for category 1 CME credit)

2. Razack N, Gupta M, Miller TT, Schultz E, Black K. Multimodality Evaluation of Ankle Trauma: A Computer-based Teaching File. Radiological Society of North America, Chicago, IL, 1998 (chosen for category 1 CME credit)

3. Moosikasuwan J, Burke B, Miller TT. Rotator Cuff Tears: Clinical, Radiographic, and Sonographic Findings. Radiological Society of North America, Chicago, IL, 2003

4. Wank R, Miller TT, Parnell J. MR Imaging Assessment of Patterns of Degenerative Arthritis in the Knee and Their Relationship to Meniscal Tear and Meniscal Extrusion. American Roentgen Ray Society, New Orleans, LA, 2005

5. Gyftopoulos S, Rosenberg ZS, Miller T, Schweitzer ME. Plain Radiograph, CT, US, And MRI Features Of The Normal And Abnormal Proximal Rectus Femoris Musculotendinous Unit. American Roentgen Ray Society, Orlando, FL, 2007

6. Shah NP, Miller TT, Stock H, Adler RS. Sonography of the Supraspinatus Tendon: Neutral versus Crass and Modified Crass Positions. American Roentgen Ray Society, Chicago, IL, 2011

7. Moreno Y, Adler RS, Miller TT, Saboeiro G. Visualization of Posterior Tendon Pathology after Ultrasound-guided Tendon Sheath Injection. RSNA, Chicago, IL, 2011

8. Hayter C, Miller TT, Adler RS. A comparative analysis of two dimensional versus three dimensional ultrasound imaging of the supraspinatus tendon. RSNA, Chicago, IL, 2011.

Scientific Abstracts:

1. Feldman F, Staron RB, Miller T, Rubin S, Zwass A. MRI of Occult Isolated Acetabular Insufficiency or Stress Fractures. AJR 1994; 162 (suppl):165-166.

2. Feldman F, Staron RB, Miller T, Zwass A, Cushin S. Oncogenic Osteomalacia. AJR 1995; 164 (suppl):138.

3. Staron RB, Miller TT, Greenspan R, Gandolfo L, Glucksman W, Shane E, Zwass A. Radiographic Findings of Spinal Osteopenia: Are they Useful? AJR l996;166 (suppl): 174.

4. Feldman F, Staron RB, Miller T, Zwass A. MRI of Paraendocrine-Related Musculo-skeletal Symptoms. AJR 1996; 166 (suppl): 136.

5. Hill NB, Bucchieri JS, Miller T, Rosenwasser MP, Shon FG. MRI of the Medial Collateral Ligament of the Elbow: A New Method. Orthopaedic Transactions 1997; 21: 99

6. Miller TT, Shapiro MA, Schultz E, Malone D. Blood Flow within Benign Musculoskeletal Cystic and Complex Cystic Masses: Assessment with Power Doppler Sonography. AJR 1999; 172 (suppl):103

7. Miller DH, Miller TT, Schultz E. Locations of Pathology of the Supraspinatus Tendon: Assessment with MR Imaging. AJR 1999; 172 (suppl):3

8. Miller TT. Sonography of Tendon and Ligament Injuries of the Elbow. Radiology 1999; 213 (suppl):291.

9. Math KR, Schneider R, Miller TT, et al. Transient Osteoporosis of the Knee: Spectrum of Imaging Abnormalities. Radiology 1999; 213 (suppl):112.

10. Miller TT, Pavlov H, Gupta M, Schultz E, Greben C. Isolated Injury of the Cuboid as a Potentially Subtle Cause of Foot Pain. AJR 2000; 174 (suppl): 60-61.

11. Umans HR, Miller TT, Hermann G, et al. Distinctive Magnetic Resonance Imaging Patterns of Gout in the Extremities. Radiology 2001; 221 (suppl): 524

12. Miller TT, Brandoff J, Fealy S. Incidence of Semimembranosus-Tibial Collateral Bursitis: MR Imaging Evaluation. Radiology 2002; 225 (suppl): 656

.

13. Levin D, Nazarian LN, McShane JM, Field RI, O'Kane PL, Miller TT. Sonographic Detection of Symptomatic Lateral Epicondylitis of the Elbow. Radiology 2002; 225 (suppl): 605.

14. Moosikasuwan J, Miller TT. Indirect Signs of Anterior Cruciate Ligament Tears – A Meta-analysis. AJR 2003; 180 (suppl);72-73

15. Kaushik S, Miller TT. Posterior Joint Capsule Edema: A Secondary Sign of Injury of Cruciate Ligaments and Posterolateral Stabilizers. Radiology 2003; 229 (suppl): 437

16. Hong R, Miller TT, Schultz E. MR Imaging Analysis of Acromial Morphology in the Coronal Oblique Plane. AJR 2004; 182 (suppl):57

17. Hong R, Miller TT, Schultz E. MR Imaging Analysis of Acromioclavicular Arthrosis in the Coronal Oblique Plane. AJR 2004; 182 (suppl):58

18. Hong R, Miller TT, Schultz E. MR Imaging of Humeral Head Cysts and their Relationship to Rotator Cuff Disease. AJR 2004; 182 (suppl):57

19. Love C, Rini JN, Miller TT, Nunez RF, Palestro CJ. Diagnosing spinal osteomyelitis with coincidence-detection FDG PET and magnetic resonance imaging. Eur J Nucl Med 2004; 31 (suppl 2): (p)445

20. Walz DM, Miller TT. MR Imaging Description and Analysis of Delamination Tears of the Rotator Cuff. AJR 2005; 184 (suppl): 14

21. Miller JH, Miller TT, Adler RS. Sensitivity of Imaging Modalities for Detecting Calcium Hydroxyapatite in a Soft Tissue Phantom (abstr). In: Radiological Society of North America scientific Assembly and Annual Meeting Program. Oak Brook, Ill: Radiological Society of North America, 2009; 500

22. Wilde G, Miller TT, Schneider R, Girardi F. Sacral Fractures after Fusion. Radiological Society of North American, 2010.

23. Burton L, Miller TT, Adler RS, Scher D. Sonography of Congenital Vertical Talus. Radiological Society of North American, 2010.

24. Koff MF, Hayter CL, Shah P, Koch KM, Miller TT, Potter HG. Magnetic Resonance Imaging of arthroplasty: comparison of MAVRIC and conventional fast spin echo techniques. International Society of Magnetic Resonance in Medicine

25. Miller, JH, Miller TT. Effect of Contrast Density, Time, and Mixing Technique on Layering in Myelography: An In Vitro Model. American Roentgen Ray Society, Chicago, IL, 2011

26. Hayter CL, Miller TT, Bogner EA, Potter HG. MR imaging findings of infection following knee arthroplasty: The positive predictive value of a lamellated synovitis. Skeletal Radiol 2011;40(8): 1122.

27. Miller BD, Miller TT. Experimental Fractures of the Greater Tuberosity: Assessment of Reader Experience Using Three Modalities. American Roentgen Ray Society, Vancouver, CA, 2012 (upcoming)

Abstracted Articles:

1. Miller et al. MR Imaging of Deferoxamine-Induced Bone Dysplasia in an 8 year-old Female with Thalassemia Major. Year Book of Diagnostic Radiology 1995, pp. 454-457.

2. Miller et al. MRI of the Symptomatic Accessory Tarsal Navicular Bone. Year Book of Podiatric Medicine 1996, pp. 28-30.

3. Miller et al. MRI of the Symptomatic Accessory Tarsal Navicular Bone. Foot and Ankle International 1996; 17:300.

4. Miller et al. Patellar Height on Sagittal MR Imaging of the Knee. Practical Reviews in Radiology (audio tape) 1996; 22 (4).

5. Miller et al. MR Imaging of Baker Cyst. Practical Reviews in Radiology (audio tape) 1996; 22(6).

6. Miller et al. Sonography of Patellar Abnormalities in Children. Year Book of Diagnostic Radiology 1999, pp. 190-193.

Scientific Presentations:

1. Miller TT, et al. The Floating Meniscus. American Roentgen Ray Society, 1995.

2. Miller TT, et al. MRI of Symptomatic Accessory Tarsal Navicular Bones. Radiological Society of North American, 1995.

3. Miller TT, et al. Pseudodefect of the Talus: An Anatomic Pitfall of Ankle MRI. American Roentgen Ray Society, 1996.

4. Miller TT, et al. Evaluation of Musculoskeletal Infection using Gadolinium-enhanced fat-suppressed T1-weighted sequences vs. non-enhanced Fat-suppressed Fast T2-weighted Techniques. American Roentgen Ray Society, 1996.

5. Miller TT, et al. Relationship of the Meniscofemoral Ligaments of the Knee to Lateral Mensical Tears: MR Imaging Evaluation. Radiological Society of North American, 1996.

6. Miller TT, et al. Injuries of the Posterolateral Stabilizers of the Knee: Assessment with MR Imaging. American Roentgen Ray Society, 1997.

7. Sahin-Akyar G, et al. (Miller TT presenting). Gradient Echo vs. Fat-suppressed Fast Spin-echo Imaging of Rotator Cuff Pathology: Surgical Correlation. Radiological Society of North American, 1997.

8. Schultz E, et al. (Miller TT presenting). Diagnosis and Management of Incomplete Intertrochanteric Fractures. Radiological Society of North American, 1997.

9. Miller TT, et al. Blood Flow within Benign Musculoskeletal Cystic and Complex Cystic Masses: Assessment with Power Doppler Sonography. American Roentgen Ray Society, 1999.

10. Miller TT, et al. Sonography of Tendon and Ligament Injuries of the Elbow. Radiological Society of North American, 1999.

11. Miller TT, et al. Sonography of Distal Biceps Tendon Tears. American Roentgen Ray Society, 2000.

12. Miller TT, et al. Isolated Injury of the Cuboid: A Potentially Subtle Cause of Foot Pain. American Roentgen Ray Society, 2000.

13. Miller TT. Variations in the Practice of Lumbar Discography in the United States. Society of Skeletal Radiology, 2000.

14. Umans HR, et al. (Miller TT presenting). Distinctive Magnetic Resonance Imaging Patterns of Gout in the extremeties. Radiological Society of North American, 2001.

15. Miller TT. The Great Fainters: My Experiences with Patients who Didn't Like Needles. Society of Skeletal Radiology, 2002.

16. Miller TT, et al. Incidence of Semimembranosus-Tibial Collateral Bursitis: MR Imaging Evaluation. Radiological Society of North American, 2002.

17. Miller TT, et al. Shifting Bone Marrow Edema of the Knee: The MR Imaging Appearance of Regional Migratory Osteoporosis. Society of Skeletal Radiology, 2003.

18. Miller TT, et al. Experimental Fractures of the Greater Tuberosity of the Humerus: Assessment of Reader Experience using Radiography, CT, and Sonography. Society of Skeletal Radiology, 2004.

19. Miller TT. Meniscal Imaging: A Survey of Protocols of Members of the SSR. Society of Skeletal Radiology, 2005.

20. Miller JH, Miller TT. Sensitivity of Imaging Modalities for Detecting Calcium Hydroxyapatite in a Soft Tissue Phantom. Society of Academic Bone Radiologists, Santa Fe, NM, 2010

21. Miller, JH, Miller TT. Effect of Contrast Density, Time, and Mixing Technique on Layering in Myelography: An In Vitro Model. Society of Academic Bone Radiologists, Santa Fe, NM, 2010

Scientific Poster Presentations

1. Hayter C, Miller TT, Adler RS. A comparative analysis of two dimensional versus three dimensional ultrasound imaging of the supraspinatus tendon. Radiological Society of North America, Chicago, IL, 2011

2. Moreno Y, Miller TT, Saboiero GR, Adler RS. Visualization of Posterior Tibial Tendon Pathology after Ultrasound-guided Tendon Sheath Injection. Radiological Society of North America, Chicago, IL, 2011

* * *

IRS Department of the Treasury
Internal Revenue Service

P.O. Box 2508
Cincinnati OH 45201

In reply refer to: 0248421964
Nov. 16, 2011 LTR 4168C E0
13-1624135 000000 00
00018054
BODC: TE

NEW YORK SOCIETY FOR THE RELIEF OF
RUPTURED & CRIPPLED MAINTAINING
THE HOSPITAL FOR SPECIAL SURGERY
% PAYROLL DEPT
535 E 70TH ST
NEW YORK NY 10021-4823

003262

Employer Identification Number: 13-1624135
Person to Contact: MS. MITCHELL
Toll Free Telephone Number: 1-877-829-5500

Dear TAXPAYER:

This is in response to your Nov. 04, 2011, request for information regarding your tax-exempt status.

Our records indicate that you were recognized as exempt under section 501(c)(3) of the Internal Revenue Code in a determination letter issued in JANUARY 1946.

Our records also indicate that you are not a private foundation within the meaning of section 509(a) of the Code because you are described in section(s) 509(a)(1) and 170(b)(1)(A)(iii).

Donors may deduct contributions to you as provided in section 170 of the Code. Bequests, legacies, devises, transfers, or gifts to you or for your use are deductible for Federal estate and gift tax purposes if they meet the applicable provisions of sections 2055, 2106, and 2522 of the Code.

Please refer to our website www.irs.gov/eo for information regarding filing requirements. Specifically, section 6033(j) of the Code provides that failure to file an annual information return for three consecutive years results in revocation of tax-exempt status as of the filing due date of the third return for organizations required to file. We will publish a list of organizations whose tax-exempt status was revoked under section 6033(j) of the Code on our website beginning in early 2011.

0248421964
Nov. 16, 2011 LTR 4168C E0
13-1624135 000000 00
00018055

NEW YORK SOCIETY FOR THE RELIEF OF
RUPTURED & CRIPPLED MAINTAINING
THE HOSPITAL FOR SPECIAL SURGERY
% PAYROLL DEPT
535 E 70TH ST
NEW YORK NY 10021-4823

If you have any questions, please call us at the telephone number shown in the heading of this letter.

Sincerely yours,

S. A. Martin, Operations Manager
Accounts Management Operations

IRS Department of the Treasury
Internal Revenue Service
P.O. Box 2508
Cincinnati OH 45201

003262.138308.0018.001 1 AT 0.365 532

NEW YORK SOCIETY FOR THE RELIEF OF
RUPTURED & CRIPPLED MAINTAINING
THE HOSPITAL FOR SPECIAL SURGERY
% PAYROLL DEPT
535 E 70TH ST
NEW YORK NY 10021-4823

003262

CUT OUT AND RETURN THE VOUCHER AT THE BOTTOM OF THIS PAGE IF YOU ARE MAKING A PAYMENT, EVEN IF YOU ALSO HAVE AN INQUIRY.

The IRS address must appear in the window.
0248421964
BODCD-TE

Use for payments
Letter Number: LTR4168C
Letter Date : 2011-11-16
Tax Period : 000000

131624135

NEW YORK SOCIETY FOR THE RELIEF OF
RUPTURED & CRIPPLED MAINTAINING
THE HOSPITAL FOR SPECIAL SURGERY
% PAYROLL DEPT
535 E 70TH ST
NEW YORK NY 10021-4823

INTERNAL REVENUE SERVICE
P.O. Box 2508
Cincinnati OH 45201

131624135 TS NEWY 00 2 000000 670 00000000000

FINANCIAL STATEMENTS

New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery
Years Ended December 31, 2011 and 2010
With Report of Independent Auditors

Ernst & Young LLP

Ernst & Young

New York Society for the Relief of
the Ruptured and Crippled, Maintaining
the Hospital for Special Surgery

Financial Statements

Years Ended December 31, 2011 and 2010

Contents

Ernst & Young LLP
5 Times Square
New York, NY 10036-6530

Tel: +1 212 773 3000
Fax: +1 212 773 6350
www.ey.com

Report of Independent Auditors

The Board of Trustees
New York Society for the Relief of the
Ruptured and Crippled, Maintaining
the Hospital for Special Surgery

We have audited the accompanying statements of financial position of New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery (the "Hospital") as of December 31, 2011 and 2010, and the related statements of operations, changes in net assets, and cash flows for the years then ended. These financial statements are the responsibility of the Hospital's management. Our responsibility is to express an opinion on these financial statements based on our audits.

We conducted our audits in accordance with auditing standards generally accepted in the United States. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. We were not engaged to perform an audit of the Hospital's internal control over financial reporting. Our audits included consideration of internal control over financial reporting as a basis for designing audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Hospital's internal control over financial reporting. Accordingly, we express no such opinion. An audit also includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements, assessing the accounting principles used and significant estimates made by management, and evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery at December 31, 2011 and 2010, and the results of its operations, changes in its net assets and its cash flows for the years then ended in conformity with U.S. generally accepted accounting principles.

As discussed in Note 1 to the accompanying financial statements, the Hospital changed its method of accounting for estimated insurance claims receivables and estimated insurance claims liabilities with the adoption of Accounting Standards Update No. 2010-24, *Presentation of Insurance Claims and Related Insurance Recoveries*, effective January 1, 2010.

Ernst & Young LLP

April 18, 2012

New York Society for the Relief of
the Ruptured and Crippled, Maintaining
the Hospital for Special Surgery

Statements of Financial Position

	December 31 2011	December 31 2010
	(In Thousands)	
Assets		
Current assets:		
Cash and cash equivalents	**$ 43,870**	$ 47,757
Receivables:		
Patient care, less allowance for doubtful accounts (2011 – $5,643; 2010 – $6,413)	**66,672**	55,222
Insurance claims receivable	**16,188**	12,667
Other	**11,956**	9,804
Total receivables	**94,816**	77,693
Investments	**172,625**	168,968
Inventories	**4,897**	2,664
Prepaid expenses and other current assets	**3,697**	3,072
Pledges receivable	**8,917**	9,980
Assets limited as to use	**9,458**	–
Due from affiliates – net	**7,576**	8,303
Total current assets	**345,856**	318,437
Insurance claims receivable, net of current portion	**48,046**	41,466
Other noncurrent assets	**5,732**	3,597
Due from affiliates – net	**11,115**	11,014
Pledges receivable	**22,599**	15,584
Deferred financing costs, less accumulated amortization (2011 – $6,643; 2010 – $5,953)	**8,327**	9,017
Assets limited as to use	**45,253**	44,580
Long-term investments	**76,277**	66,093
Interest in The Hospital for Special Surgery Fund, Inc.	**13,662**	10,485
Property, plant and equipment – net	**363,279**	325,682
Total assets	**$ 940,146**	$ 845,955

	December 31	
	2011	**2010**
	(In Thousands)	
Liabilities and net assets		
Current liabilities:		
Accounts payable and accrued expenses	**$ 57,864**	$ 49,834
Accrued salaries and related liabilities	**11,962**	10,851
Current portion of long-term debt	**15,503**	14,909
Due to third-party payors – net	**3,500**	3,540
Insurance claims liabilities	**16,188**	12,667
Other current liabilities	**14,337**	10,061
Total current liabilities	**119,354**	101,862
Long-term debt	**221,103**	213,093
Insurance claims liabilities, net of current portion	**48,046**	41,466
Other noncurrent liabilities, including accrued retirement benefits and due to third-party payors – net	**128,793**	76,479
Total liabilities	**517,296**	432,900
Commitments and contingencies		
Net assets:		
Unrestricted	**218,843**	227,555
Temporarily restricted:		
Specific purpose	**35,722**	35,598
Plant replacement and expansion	**46,549**	40,717
Research	**28,865**	27,140
Total temporarily restricted	**111,136**	103,455
Permanently restricted	**92,871**	82,045
Total net assets	**422,850**	413,055
Total liabilities and net assets	**$ 940,146**	$ 845,955

See accompanying notes.

New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery

Statements of Operations

	Year Ended December 31 2011	2010
	(In Thousands)	
Operating revenue		
Net patient service revenue	**$ 576,290**	$ 536,835
Other operating revenue	**66,514**	58,729
Net assets released from restrictions for operations	**17,912**	21,088
Total operating revenue	**660,716**	616,652
Operating expenses		
Salaries and wages	**252,823**	228,599
Employee benefits	**81,814**	70,311
Supplies and other	**234,933**	220,339
Interest expense	**9,986**	8,805
Depreciation and amortization	**36,116**	32,640
Bad debt expense	**2,654**	6,548
Total operating expenses	**618,326**	567,242
Operating income before research operations and change in unrestricted interest in The Hospital for Special Surgery Fund, Inc.	**42,390**	49,410
Research operations:		
Net assets released from restrictions for research operations	**30,478**	30,277
Operating expenses, including depreciation (2011 – $2,342; 2010 – $2,436)	**33,443**	32,889
Net research operations	**(2,965)**	(2,612)
Change in unrestricted interest in The Hospital for Special Surgery Fund, Inc.	**3,177**	3,373
Operating income	**42,602**	50,171
Other changes in unrestricted net assets		
Net assets released from restrictions for capital expenditures	**4,370**	2,373
Change in net unrealized gains and losses on investments	**(609)**	4,719
Net assets reclassification	**(337)**	1,741
Change in defined benefit pension and other postretirement plan liability to be recognized in future periods	**(54,738)**	(11,953)
(Decrease) increase in unrestricted net assets	**$ (8,712)**	$ 47,051

See accompanying notes.

New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery

Statements of Changes in Net Assets

Year Ended December 31, 2011

	Unrestricted	Temporarily Restricted: Specific Purpose	Temporarily Restricted: Plant	Temporarily Restricted: Research	Total Temporarily Restricted	Permanently Restricted	Total
	(In Thousands)						
Net assets at December 31, 2010	**$ 227,555**	**$ 35,598**	**$ 40,717**	**$ 27,140**	**$ 103,455**	**$ 82,045**	**$ 413,055**
Decrease in unrestricted net assets	**(8,712)**	**–**	**–**	**–**	**–**	**–**	**(8,712)**
Contributions, including research grants	**–**	**18,975**	**10,029**	**32,959**	**61,963**	**10,826**	**72,789**
Investment activity, including net investment income of $1,802, net realized gain of $158 and change in net unrealized gains and losses and equity in earnings of alternative investments of ($3,819)	**–**	**(1,010)**	**8**	**(857)**	**(1,859)**	**–**	**(1,859)**
Net assets reclassification	**–**	**141**	**–**	**196**	**337**	**–**	**337**
Net assets released from restrictions for:							
Research operations	**–**	**–**	**–**	**(30,478)**	**(30,478)**	**–**	**(30,478)**
Capital expenditures	**–**	**(70)**	**(4,205)**	**(95)**	**(4,370)**	**–**	**(4,370)**
Operating expenses	**–**	**(17,912)**	**–**	**–**	**(17,912)**	**–**	**(17,912)**
Total net assets released from restrictions	**–**	**(17,982)**	**(4,205)**	**(30,573)**	**(52,760)**	**–**	**(52,760)**
Total change in net assets	**(8,712)**	**124**	**5,832**	**1,725**	**7,681**	**10,826**	**9,795**
Net assets at December 31, 2011	**$ 218,843**	**$ 35,722**	**$ 46,549**	**$ 28,865**	**$ 111,136**	**$ 92,871**	**$ 422,850**

See accompanying notes.

New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery

Statements of Changes in Net Assets

Year Ended December 31, 2010

		Temporarily Restricted			Total		
	Unrestricted	**Specific Purpose**	**Plant**	**Research**	**Total Temporarily Restricted**	**Permanently Restricted**	**Total**
				(In Thousands)			
Net assets at December 31, 2009	$ 180,504	$ 32,003	$ 40,541	$ 19,715	$ 92,259	$ 75,860	$ 348,623
Increase in unrestricted net assets	47,051	–	–	–	–	–	47,051
Contributions, including research grants	–	21,798	2,356	28,563	52,717	6,185	58,902
Investment activity, including net investment income of $1,587, net realized loss of $2,308 and change in net unrealized gains and losses and equity in earnings of alternative investments of $14,679	–	3,368	20	10,570	13,958	–	13,958
Net assets reclassification	–	(349)	–	(1,392)	(1,741)	–	(1,741)
Net assets released from restrictions for:							
Research operations	–	–	(200)	(30,077)	(30,277)	–	(30,277)
Capital expenditures	–	(134)	(2,000)	(239)	(2,373)	–	(2,373)
Operating expenses	–	(21,088)	–	–	(21,088)	–	(21,088)
Total net assets released from restrictions	–	(21,222)	(2,200)	(30,316)	(53,738)	–	(53,738)
Total change in net assets	47,051	3,595	176	7,425	11,196	6,185	64,432
Net assets at December 31, 2010	$ 227,555	$ 35,598	$ 40,717	$ 27,140	$ 103,455	$ 82,045	$ 413,055

See accompanying notes.

New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery

Statements of Cash Flows

	Year Ended December 31 2011	2010
	(In Thousands)	
Cash flows from operating activities		
Change in net assets	**$ 9,795**	$ 64,432
Adjustments to reconcile change in net assets to net cash provided by operating activities:		
Change in unrestricted interest in The Hospital for Special Surgery Fund, Inc.	**(3,177)**	(3,373)
Depreciation and amortization	**38,458**	35,076
Amortization of bond premium	**(32)**	–
Change in defined benefit pension and other postretirement plan liability to be recognized in future periods	**54,738**	11,953
Change in net unrealized gains and losses on investments and equity in earnings of alternative investments	**6,036**	(19,794)
Realized (gains) losses on investments	**(468)**	2,001
Contributions to permanently restricted net assets	**(10,826)**	(6,185)
Contributions restricted to acquisition of plant assets – net	**(10,029)**	(2,356)
Employer contributions to pension plan	**(19,800)**	(14,000)
Changes in operating assets and liabilities:		
Receivables, net	**(13,602)**	(3,230)
Net due from affiliates	**26**	1,047
Pledges receivable, net	**(5,952)**	5,052
Accounts payable and accrued expenses and accrued salaries and related liabilities	**9,141**	168
Current amount due to third-party payors	**(40)**	970
Other noncurrent liabilities, including due to third-party payors	**17,376**	16,940
Other assets and liabilities, net	**(717)**	1,545
Net cash provided by operating activities	**70,927**	90,246
Cash flows from investing activities		
Additions to property, plant and equipment	**(75,365)**	(70,622)
Net increase in investments	**(19,233)**	(47,191)
Net (increase) decrease in assets limited as to use	**(9,707)**	3
Net cash used in investing activities	**(104,305)**	(117,810)
Cash flows from financing activities		
Principal payments on long-term debt	**(16,014)**	(13,488)
Proceeds from long-term borrowings	**31,182**	41,903
Net (decrease) increase in construction payable	**(6,532)**	3,057
Contributions restricted to acquisition of plant assets – net	**10,029**	2,356
Contributions to permanently restricted net assets	**10,826**	6,185
Net cash provided by financing activities	**29,491**	40,013
Net (decrease) increase in cash and cash equivalents	**(3,887)**	12,449
Cash and cash equivalents at beginning of year	**47,757**	35,308
Cash and cash equivalents at end of year	**$ 43,870**	$ 47,757

See accompanying notes.

New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery

Notes to Financial Statements

December 31, 2011

1. Organization and Significant Accounting Policies

Organization

The accompanying financial statements include the accounts of New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery (the "Hospital"), but do not include the Hospital's separately incorporated affiliates: HSS Properties Corporation ("Properties"), The Hospital for Special Surgery Fund, Inc. ("Fund"), HSS Horizons, Inc. ("Horizons"), HSS Ventures, Inc. and Medical Indemnity Assurance Company, Ltd. ("MIAC").

In 1998, The Society of the New York Hospital and The Presbyterian Hospital in the City of New York ("Presbyterian") merged to form the New York Presbyterian Hospital ("NYPH"). Subsequently, the Hospital, NYPH and the Joan and Sanford I. Weill Medical College and Graduate School of Medical Sciences of Cornell University ("Cornell") agreed to restructure their relationship, prompted in large measure by regulatory and operational issues raised by the addition of Presbyterian, a hospital with an established orthopedics department. The restructuring resulted in a Corporate Relationship Agreement (the "Agreement") that reaffirms and continues the Hospital's medical and clinical affiliation with NYPH by permitting and requiring the Hospital to continue to function as the principal orthopedic and rheumatology facility for NYPH at its East 68-East 70 Street facility (East Campus).

Under the Agreement, the Hospital became a membership corporation, with the five Hospital members elected by an NYPH affiliate, subject to specific affiliation guidelines for each of the five member positions that require three of the Hospital members to come from the Hospital's Board of Trustees (with one of the three to also serve on the Board of the NYPH affiliate). The members have the authority to elect the Hospital's Board of Trustees, as nominated by the Governance Committee of the Hospital's Board of Trustees or by a member. As a result of certain procedural elements of the Agreement, the Hospital has not had any significant changes in the nominating process for, or in the composition of, its Board of Trustees. The Agreement did not involve a merger of the institutions and the Hospital's net assets remain under the Hospital's control.

1. Organization and Significant Accounting Policies (continued)

As part of the restructuring, the Hospital executed an agreement with Cornell that established the orthopedics department at the Hospital as the Department of Orthopedics at Cornell. Additionally, the Hospital, NYPH and Cornell have developed a tri-partite agreement pertaining to the academic affiliation of the institutions, which maintains and enhances the historical clinical and academic relationship among the parties.

Cash and Cash Equivalents

The Hospital considers highly liquid financial instruments purchased with a maturity of three months or less, excluding those held in its investment portfolio and assets limited as to use, to be cash equivalents. The Hospital invests in money market funds and maintains its cash deposits with certain financial institutions. Total deposits maintained at these institutions exceed the amount insured by Federal agencies and, therefore, bear a risk of loss. Cash and cash equivalents includes approximately $0.7 million of amounts held in escrow for various purposes at December 31, 2011 and 2010.

Net Patient Service Revenue and Receivables for Patient Care

Net patient service revenue and patient accounts receivable from third-party programs for which the Hospital receives payment under various reimbursement formulae or negotiated rates are stated at the estimated net amounts realizable and receivable from such payors, which are generally less than the Hospital's established billing rates. See Note 2 for additional information relative to third-party payor programs.

The amount of the allowance for doubtful accounts is based upon management's assessment of historical and expected net collections, business and economic conditions, trends in health care coverage and other collection indicators. Additions to the allowance for doubtful accounts result from the provision for bad debts. Accounts written off as uncollectible are deducted from the allowance for doubtful accounts.

1. Organization and Significant Accounting Policies (continued)

Performance Indicator

The statements of operations include operating income as the performance indicator. Excluded from the performance indicator are net assets released from restrictions for capital expenditures, net unrealized gains on investments and unrealized losses on securities included in accounts not managed by external parties, net assets reclassification and change in defined benefit pension and other postretirement plan liability to be recognized in future periods.

Charity Care and Community Benefit

The mission of the Hospital is to provide the highest quality patient care, improve mobility and enhance the quality of life for all and to advance the science of orthopedic surgery, rheumatology and their related fields through research and education. The Hospital does this regardless of race, color, creed, sexual orientation or ethnic origin.

Consistent with its mission, the Hospital invests significant amounts for the benefit of its local, national and international communities through patient care, education, research and other community benefit activities. The calculation of community benefits is consistent with the guidelines prescribed by the Internal Revenue Service.

The Hospital maintains a financial assistance program that provides full or partial uncompensated care to eligible patients. The eligibility threshold is 500% of the Federal Poverty Guidelines, which is in excess of the New York State minimum requirements of 300%. As the collection of amounts determined to qualify as financial assistance is not pursued, such amounts are not reported as a component of net patient service revenue. Costs of providing financial assistance are estimated by multiplying the total charges incurred by the patients that qualify for financial assistance by a ratio of historical expenses to charges as derived from the Hospital's accounting records.

1. Organization and Significant Accounting Policies (continued)

The Hospital also provides health care services to patients with government sponsored means-tested insurance (Medicaid) at amounts less than the estimated costs of those services. Losses from Medicaid insurance are estimated by multiplying the total charges incurred by the patients by a ratio of historical expenses to charges as derived from the Hospital's accounting records. The Hospital then subtracts revenue received from all sources for these patients to determine the un-reimbursed cost of providing patient care to patients with Medicaid insurance.

In addition to providing health care services to Medicaid patients at a loss, the Hospital also provides services to Medicare patients at a loss. The loss related to providing services to Medicare patients is calculated in a similar manner as described above for Medicaid patients.

The Hospital is a preeminent provider of education in the field of musculoskeletal medicine for physicians and allied health professionals. The community benefit represents estimated costs in excess of amounts reimbursed by third-party payors such as direct medical education from the Medicare program.

The Hospital is a leader in the advancement of research in musculoskeletal diseases. The Hospital's community benefit in research represents fully allocated amounts used for basic, translational and clinical research from governmental, other not-for-profit and Hospital resources. Community benefit for research is estimated using historical allocation percentages from the Hospital's accounting records.

The Hospital also participates in numerous other community activities, including social service, outreach and education to patients and the general public. The community benefit is derived from actual expenditures, less amounts funded from outside sources.

1. Organization and Significant Accounting Policies (continued)

The following is a summary of the Hospital's community benefit for providing financial assistance, support of governmental sponsored insurance programs, health professions education, research and other community benefit activities. Amounts for activities as reported below are based on estimated and actual data, subject to changes in estimates upon finalization of the Hospital's cost report and other government filings:

	2011	2010
	(In Thousands)	
Financial assistance (charity care), net (see below)	**$ 4,133**	$ 4,115
Un-reimbursed cost of means-tested government sponsored health care (Medicaid)	**2,323**	2,559
Health professions education	**26,411**	26,909
Research	**37,391**	35,868
Other community benefit activities	**2,238**	1,792
	72,496	71,243
Un-reimbursed cost of providing Medicare sponsored health care	**10,026**	10,153
	$ 82,522	$ 81,396

Funds received to offset financial assistance provided are included above and totaled approximately $1.1 million and $0.7 million for the years ended December 31, 2011 and 2010, respectively.

1. Organization and Significant Accounting Policies (continued)

Investments and Investment Income

The Hospital maintains a pooled investment program for certain investments held by the Hospital, Fund and Properties. Investments consist of money market mutual funds, equity mutual funds, including exchange-traded funds, marketable equity securities, U.S. Government obligations, fixed income mutual funds, alternative investments and cash and cash equivalents. All investments are carried at fair value based on quoted market prices (except alternative investments).

Alternative investments (nontraditional, not readily marketable securities) consist of common collective trust funds, event-driven funds, multi-strategy hedge funds, emerging market debt funds, global hedge funds and private equity funds. Alternative investment interests generally are structured such that the investment pool holds a limited partnership interest or an interest in an investment management company. The investment pool's ownership structure does not provide for control over the related investees and the investment pool's financial risk is limited to the carrying amount reported for each investee, in addition to any unfunded capital commitment. Future funding commitments for alternative investments aggregated approximately $3.6 million at December 31, 2011 for the investment pool.

Individual investment holdings within the alternative investments include non-marketable and market-traded debt and equity securities and interests in other alternative investments. The investment pool may be exposed indirectly to securities lending, short sales of securities and trading in futures and forward contracts, options and other derivative products. Alternative investments often have liquidity restrictions under which the pooled investment capital may be divested only at specified times. The liquidity restrictions range from approximately several months to eight years. Liquidity restrictions may apply to all or portions of a particular invested amount.

1. Organization and Significant Accounting Policies (continued)

Alternative investments included in the investment pool are stated in the accompanying statements of financial position based upon net asset values derived from the application of the equity method of accounting. Alternative investments held by the defined benefit pension plan are stated in the accompanying statements of financial position at fair value based upon, as a practical expedient, net asset values derived from the application of the equity method of accounting. Financial information used by the Hospital to evaluate its alternative investments is provided by the investment manager or general partner and includes fair value valuations (quoted market prices and values determined through other means) of underlying securities and other financial instruments held by the investee, and estimates that require varying degrees of judgment. The financial statements of the investee companies are audited annually by independent auditors, although the timing for reporting the results of such audits does not coincide with the Hospital's annual financial statement reporting.

There is uncertainty in determining values of alternative investments arising from factors such as lack of active markets (primary and secondary), lack of transparency into underlying holdings and time lags associated with reporting by the investee companies. As a result, there is at least a reasonable possibility that estimates will change.

Investment income, including realized, and the net change in unrealized, gains and losses and equity in earnings of alternative investments, earned on permanently and temporarily restricted net assets upon which restrictions have been placed by donors, is added to temporarily restricted net assets or reduces unrestricted net assets in the event a donor restricted endowment fund falls below the level of the original principal donation and related accumulation of temporarily restricted net assets, if any, have been used. This accounting policy is not intended to create a liability of the unrestricted fund (see Note 10). All other investment income is reflected in the accompanying statements of operations. The net change in unrealized gains and losses is excluded from the performance indicator, unless deemed to be an other than temporary decline in fair value or if the unrealized loss pertains to securities included in accounts managed by external parties, in which case the amount is included within the performance indicator. See Note 3 for additional information relative to investments.

1. Organization and Significant Accounting Policies (continued)

Pledges

Pledges (promises to give) are enforceable, but unsecured and derived from individuals, corporations and foundations. Allowances for uncollectible amounts are provided to reflect pledges at their estimated realizable value based on management's review of individual pledges and historical collection percentages. Outstanding pledges receivable, net of present value allowances (based on a range of interest rates of 0.9% to 4.5%) of approximately $2.4 million and $2.5 million at December 31, 2011 and 2010, respectively, are due to be collected at December 31 over the following periods:

	2011	**2010**
	(In Thousands)	
Less than one year	**$ 10,608**	$ 11,790
One to five years	**22,779**	14,265
Greater than five years	**2,598**	3,332
	35,985	29,387
Less allowance for uncollectible amounts	**4,469**	3,823
	31,516	25,564
Less current portion	**8,917**	9,980
	$ 22,599	$ 15,584

Assets Limited as to Use

Assets limited as to use represent assets whose use is restricted for specific purposes under terms of agreements, donor stipulations or are internally designated. Such assets consist of money market mutual funds, U.S. Government obligations and cash and cash equivalents.

Deferred Financing Costs

Deferred financing costs represent costs incurred to obtain financing for construction and renovation projects at the Hospital. Amortization of these costs is provided using the effective interest method over the term of the related debt. Amortization expense was approximately $690,000 and $707,000 for the years ended December 31, 2011 and 2010, respectively. See Note 5 for additional information related to debt-related matters.

1. Organization and Significant Accounting Policies (continued)

Property, Plant and Equipment

Property, plant and equipment purchased are carried at cost and those acquired by gifts and bequests are carried at fair value established at the date of acquisition. The carrying amounts of assets and the related accumulated depreciation and amortization are removed from the accounts when such assets are disposed of and any resulting gain or loss is included in operations. See Note 4 for additional information relative to property, plant and equipment.

Depreciation and Amortization

Depreciation and amortization of all depreciable assets is computed using the straight-line method over the estimated useful life of the asset or the lesser of the estimated useful life of the asset or lease term.

Temporarily and Permanently Restricted Net Assets

Temporarily restricted net assets are those whose use by the Hospital has been limited by donors to a specific time period or purpose. Permanently restricted net assets have been restricted by donors to be maintained by the Hospital in perpetuity.

Contributions

Contributions, including unconditional promises to give cash and other assets, are reported at fair value on the date received. The gifts are reported as either temporarily or permanently restricted support if they are received with donor stipulations that limit the use of the donated assets. When a donor restriction expires, that is, when a stipulated time restriction ends or purpose restriction is accomplished, temporarily restricted net assets are reclassified to unrestricted net assets and reported in the statements of operations and statements of changes in net assets as net assets released from restrictions. Donor-restricted contributions whose restrictions are met within the same year as received are reflected in temporarily restricted net assets and net assets released from restrictions in the accompanying financial statements.

1. Organization and Significant Accounting Policies (continued)

Inventories of Supplies

Inventories, consisting mainly of supplies, are stated at the lower of average cost or market determined by the first-in, first-out method.

Assets Held by Related Organizations

The Hospital recognizes its accumulated interest in the unrestricted net assets of Fund as beneficial interest in net assets held by related organization in its statements of financial position and also recognizes the periodic change in such interest in its statements of operations.

Use of Estimates

The preparation of the financial statements in conformity with U.S. generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, such as estimated uncollectibles for accounts receivable for services to patients, the fair values of alternative investments, insurance claims liabilities and receivables and estimated receivables from and payables to third-party payors, and the disclosure of contingent assets and liabilities at the date of the financial statements. Estimates also affect the reported amounts of revenue and expenses during the reporting period. The allowance for doubtful accounts, the fair value of investments that are not readily marketable, insurance claims liabilities and receivables and the estimated net amount due to third-party payors, among other accounts, require significant use of estimates. Actual results could differ from those estimates. Management believes that amounts recorded based on estimates and assumptions are reasonable and any differences between estimates and actual should not have a material effect on the Hospital's financial position.

1. Organization and Significant Accounting Policies (continued)

Tax Status

The Hospital is a Section 501(c)(3) organization exempt from Federal income taxes under Section 501(a) of the Internal Revenue Code and is exempt from New York state and local income taxes.

Change in Accounting Principle

In 2011, the Hospital adopted Financial Accounting Standards Board Accounting Standards Update No. 2010-24, *Presentation of Insurance Claims and Related Insurance Recoveries* ("ASU 2010-24"). ASU 2010-24 clarifies that, for medical malpractice claims and similar contingent liabilities, a health care entity, such as the Hospital, should not net insurance recoveries against related claims liabilities and that claims liabilities should be determined without consideration of insurance recoveries. Health care entities that are indemnified for these liabilities should recognize insurance receivables at the same time that they recognize the liabilities, measured on the same basis as the liabilities, subject to the need for a valuation allowance for uncollectible amounts. In the accompanying financial statements, the Hospital has recognized claims liabilities and insurance receivables of approximately $64.2 million ($16.2 million current and $48.0 million long term) as of December 31, 2011 and $54.1 million ($12.7 million current and $41.4 million long term) as of December 31, 2010, respectively. The Hospital's statement of financial position for 2010 has been restated to reflect the adoption of this accounting pronouncement, which had no effect on the Hospital's net assets.

2. Net Patient Service Revenue and Receivables for Patient Care

Net patient service revenue is reported at the estimated net realizable amounts due from patients, third-party payors and others for services rendered and includes estimated future retroactive revenue adjustments. Retroactive adjustments are considered in the recognition of revenue on an estimated basis in the period the related services are rendered and such adjustments are recorded in future periods as they become known or as years are no longer subject to audits, reviews and investigations. During 2011 and 2010, prior year settlements and adjustments were not significant.

2. Net Patient Service Revenue and Receivables for Patient Care (continued)

Non-Medicare Reimbursement

In New York State, hospitals and all non-Medicare payers, except Medicaid, workers' compensation and no-fault insurance programs, negotiate hospitals' payment rates. If negotiated rates are not established, payors are billed at hospitals' established charges. Medicaid, workers' compensation and no-fault payors pay hospital rates promulgated by the New York State Department of Health. Effective December 1, 2009, the New York State payment methodology was updated such that payments to hospitals for Medicaid, workers' compensation and no-fault inpatient services are based on a statewide prospective payment system, with retroactive adjustments; prior to December 1, 2009, the payment system provided for retroactive adjustments to payment rates, using a prospective payment formula. Outpatient services also are paid based on a statewide prospective system that was effective December 1, 2008. Medicaid rate methodologies are subject to approval at the Federal level by the Centers for Medicare and Medicaid Services ("CMS"), which may routinely request information about such methodologies prior to approval. Revenue related to specific rate components that have not been approved by CMS is not recognized until the Hospital is reasonably assured that such amounts are realizable. Adjustments to the current and prior years' payment rates for those payors will continue to be made in future years.

Medicare Reimbursement

Medicare pays hospitals for most inpatient and outpatient services under its respective national prospective payment systems, and uses other, generally fee schedule based methodologies, for payment for other services. Federal regulations provide for certain adjustments to current and prior years' payment rates, based on industry-wide and Hospital-specific data.

The Hospital has established estimates, based on information presently available, of amounts due to or from Medicare and non-Medicare payers for adjustments to current and prior years' payment rates, based on industry-wide and Hospital-specific data. Medicare cost reports, which serve as the basis for final settlement with the Medicare program, have been audited by the Medicare fiscal intermediary and settled through 2006. Other years remain open for audit and

2. Receivables for Patient Care and Net Patient Service Revenue (continued)

settlement as are numerous issues related to the New York State Medicaid program for prior years. As a result, there is at least a reasonable possibility that recorded estimates will change by a material amount when open years are settled and additional information is obtained. The current Medicaid, Medicare and other third-party payor programs are based upon extremely complex laws and regulations that are subject to interpretation. Noncompliance with such laws and regulations could result in fines, penalties and exclusion from such programs. The Hospital is not aware of any allegations of noncompliance that could have a material adverse effect on the financial statements and believes that it is in compliance, in all material respects, with all applicable laws and regulations.

There are various proposals at the Federal and State levels that could, among other things, significantly reduce payment rates or modify payment methods. The ultimate outcome of these proposals and other market changes, including the potential effects of health care reform that have been enacted by the Federal government, cannot presently be determined.

Future changes in the Medicare and Medicaid programs and any reduction of funding could have an adverse effect on the Hospital. Additionally, certain payors' payment rates for various years have been appealed by the Hospital. If the appeals are successful, additional income applicable to those years might be realized.

The Hospital grants credit without collateral to its patients, most of whom are insured under various third-party agreements. The significant concentrations of accounts receivable for services to patients include 13.8% from government-related programs at December 31, 2011 (13.0% from government-related programs at December 31, 2010).

In 2011, approximately 22.1% of the Hospital's net patient service revenue was derived from the Medicare program (approximately 23.3% in 2010).

3. Investments and Assets Limited as to Use

The Hospital maintains a pooled investment program for certain investments owned by the Hospital, Fund and Properties. The Hospital's pro rata share of the pooled investment program and its pro rata share of investment income, including realized, and the net change in unrealized, gains and losses and equity in earnings of alternative investments, are reflected in the accompanying financial statements.

Investments, including the pooled investment program pertaining to the Hospital, were as follows at December 31:

	2011	2010
	(In Thousands)	
Money market mutual funds	**$ 78,507**	$ 93,584
Marketable equity securities	**10,071**	6,394
Equity mutual funds	**58,629**	47,100
U.S. Government obligations	**–**	791
Fixed income mutual funds	**22,756**	22,901
Alternative investments:		
Hedge funds:		
U.S. equity large/small cap	**11,318**	10,828
International equity	**8,462**	9,161
Long/short equity	**25,141**	16,068
Multi-strategy	**22,574**	18,404
Real assets	**3,222**	3,456
Private equity	**8,222**	6,374
	248,902	235,061
Less current portion	**172,625**	168,968
	$ 76,277	$ 66,093

Additionally, a portion of Fund's investment portfolio represents net assets received by Fund on behalf of the Hospital which are due to the Hospital. These investments and related investment income, including change in net unrealized gains and losses and equity in earnings of alternative investments, are reflected in the accompanying financial statements within the amounts due from affiliates (approximately $17.2 million in 2011 and $18.5 million in 2010).

3. Investments and Assets Limited as to Use (continued)

The composition of assets limited as to use at December 31, at fair value, is as follows:

	2011	2010
	(In Thousands)	
Money market mutual funds	**$ 24,726**	$ 20,676
U.S. Government obligations	**24,851**	23,631
Cash and cash equivalents	**5,134**	273
	54,711	44,580
Less current portion of assets limited as to use	**9,458**	–
	$ 45,253	$ 44,580

	2011	2010
	(In Thousands)	
Mortgage reserve funds	**$ 21,200**	$ 19,728
Equipment loans	**5,134**	273
Restricted assets – capital campaign (building)	**20,456**	20,489
Restricted assets – future campus expansion	**7,921**	4,090
	54,711	44,580
Less current portion of assets limited as to use	**9,458**	–
	$ 45,253	$ 44,580

4. Property, Plant and Equipment

A summary of property, plant and equipment is as follows at December 31:

	2011	2010
	(In Thousands)	
Land and land improvements	**$ 2,006**	$ 1,995
Buildings and improvements	**464,323**	375,642
Furniture and equipment	**282,543**	238,465
	748,872	616,102
Less accumulated depreciation and amortization	**390,699**	353,297
	358,173	262,805
Construction-in-progress	**5,106**	62,877
	$ 363,279	$ 325,682

The Hospital is undergoing a construction and renovation project. The project scope includes the addition of new space, as well as the renovation of existing space. The project provides for additional inpatient beds, operating rooms, physician offices, magnetic resonance imaging units and other expanded ancillary and support space.

At December 31, 2011, the Hospital had capital commitments of approximately $11.2 million related to the construction and renovation project, and certain other capital projects.

In 2010, the Hospital removed from its accounts, furniture and equipment with an historical cost of approximately $47.9 million, which was fully depreciated and no longer in use.

Rent expense, the majority of which is paid to Properties, was approximately $26.4 million in 2011 and $22.8 million in 2010.

5. Debt-related Matters

Long-term Debt

Long-term debt consisted of the following at December 31:

	2011	2010
	(In Thousands)	
Insured mortgage loan (1998)[a]	**$ –**	$ 68,233
Insured mortgage loan (2011)[a]	**64,238**	–
Insured mortgage loan (2005)[b]	**50,893**	52,375
Insured mortgage loan (2009)[c]	**79,308**	67,034
Construction payable[d]	**–**	6,532
Commercial mortgage loan[e]	**9,849**	11,256
Tax-exempt loans[f]	**26,901**	19,390
Taxable loans[g]	**2,541**	3,182
	233,730	228,002
Unamortized bond premium, net of accumulated amortization of $32 in 2011	**2,876**	–
Less current portion of long-term debt	**15,503**	14,909
	$ 221,103	$ 213,093

(a) In December 1994, the Hospital entered into a $94.763 million mortgage loan agreement with the New York State Dormitory Authority (the "Dormitory Authority") to finance a portion of the Hospital's major construction and modernization project. The mortgage loan is insured under the provisions of the Federal Housing Administration ("FHA") 242 Program. In September 1996, the Hospital obtained an additional mortgage loan with the Dormitory Authority, which is also insured under the provisions of the FHA 242 Program, of $7.6 million to finance the construction of four additional operating suites.

During 1998, the outstanding mortgage loans were refinanced, resulting in a consolidated mortgage loan with an interest rate of 6.08%, reduced from 7.15% (the original 1994 mortgage) and 6.68% (the additional 1996 mortgage).

5. Debt-related Matters (continued)

In November 2011, the mortgage loan was restructured. The modified mortgage loan bears interest at an annual rate of 3.835%. The amount due under the loan and its duration were not affected by this modification. Monthly principal and interest payments of approximately $594,000 are due during each of the ensuing 12 years, with final payment due no later than January 1, 2023. The mortgage loan may be prepaid at any time after June 30, 2021. The mortgage loan is collateralized by certain of the Hospital's property and equipment. In connection with the restructuring, the Hospital recorded approximately $2.9 million of mortgage premium as a component of long-term debt. The mortgage premium is being amortized over the remaining term of the loan using the effective interest method. This restructuring and assignment did not change the loan's status as an insured loan under the FHA 242 Program.

The provisions of the loan and related agreements require the Hospital to establish and maintain a mortgage reserve fund and to maintain specified current, debt service coverage, and other financial ratios. The mortgage reserve fund approximated $17.0 million and $16.4 million at December 31, 2011 and 2010, respectively. At December 31, 2011 and 2010, the Hospital met the various financial ratio and mortgage reserve funding requirements.

(b) In October 2005, the Hospital entered into a $57.605 million mortgage loan agreement with the Dormitory Authority to finance a portion of the first phase of the Hospital's major expansion and renovation project. The mortgage loan is insured under the provisions of the FHA 241 program.

The mortgage loan bore interest at 6.50% from December 1, 2006 through February 28, 2007 and 5.55% from March 1, 2007 to June 1, 2008. Following the final endorsement of the mortgage loan on June 5, 2008, the permanent interest rate was set at 4.80% effective June 1, 2008. In 2008, the Dormitory Authority granted the Hospital a mortgage interest credit of $240,000 by reason of accumulated earnings surpluses on deposits in the debt service fund held by the bond trustee for the Dormitory Authority tax-exempt bonds which funded the FHA mortgage loan. After taking into account these credits, the effective rate for 2008 was 4.87%. Monthly principal payments commenced on January 1, 2007 and, through May 31, 2008, were

5. Debt-related Matters (continued)

calculated based on the full mortgage loan amortized over 25 years at a 4.93% interest rate. Following the final endorsement of the mortgage loan, monthly principal and interest payments of approximately $330,000 are due during each of the ensuing 23 years, with final payment due no later than December 1, 2031. The mortgage loan may be prepaid after February 15, 2015. The mortgage loan is collateralized by certain of the Hospital's property and equipment.

The provisions of the loan and related agreements require the Hospital to fund quarterly a mortgage reserve fund. The mortgage reserve fund approximated $4.1 million and $3.3 million at December 31, 2011 and 2010, respectively (see mortgage reserve funding requirements below). The Hospital is also required to maintain specified current, debt service coverage, and other financial ratios. At December 31, 2011 and 2010, the Hospital met the various financial ratio and mortgage reserve funding requirements.

(c) In December 2009, the Hospital entered into a $79.308 million mortgage loan agreement with the Dormitory Authority to finance a portion of the second phase of the Hospital's major expansion and renovation project. The mortgage loan is insured under the provisions of the FHA 241 program. At December 31, 2011, the full amount was drawn on the mortgage loan and included in long-term debt in the statement of financial position at December 31, 2011.

The annual interest rate on the mortgage loan was 8.25%, payable monthly from January 1, 2010 through January 1, 2012. Commencing on February 1, 2012, monthly principal and interest payments of $514,868 are due (with interest charged at the expected rate of 6.08% per annum) during the next 25 years, with the final payment due no later than January 1, 2037. However, since final endorsement of the mortgage loan has not yet occurred, the interest rate until final endorsement may be increased to 6.60%. The mortgage loan may be prepaid after August 15, 2019. The mortgage loan is collateralized by certain of the Hospital's property and equipment.

5. Debt-related Matters (continued)

The provisions of the loan and related agreements require the Hospital to fund a mortgage reserve fund beginning in 2012 (see mortgage reserve funding requirements below). The Hospital is also required to maintain specified current, debt service coverage, and other financial ratios. At December 31, 2011 and 2010, the Hospital met the various ratio requirements.

As required by the terms of the mortgage loan and related agreements, the Hospital has obtained from a commercial bank two irrevocable letters of credit for various purposes, aggregating approximately $21.7 million and $25.9 million at December 31, 2011 and 2010, respectively. One of the letters of credit (negative arbitrage) expired in February 2012 and is no longer required under the terms of financing. The other letter of credit (equity) has been extended through February 2013 as required through the completion of the project. These letters of credit are collateralized by securities having a market value of approximately $20.5 million at December 31, 2011 and 2010, respectively.

(d) The construction payable represents liabilities related to the second phase of the Hospital's major expansion and renovation project that the Hospital financed through its 2009 FHA insured mortgage loan.

(e) In November 2000, the Hospital entered into a mortgage construction loan agreement with a commercial bank to finance a portion of the renovation of its research facilities. During 2004, the loan converted to a permanent loan amortized over 15 years. The mortgage loan is collateralized by a first mortgage lien on the Caspary Research Building and also by marketable securities held by the Hospital and Fund (having a total fair value of approximately $9.4 million at December 31, 2011) which have been pledged to reduce the interest rate. The variable interest rate is reduced to the extent that there is additional investment collateral pledged to the bank. The variable interest is calculated based on the bank's quarterly money market rates plus 65 basis points (0.95% at December 31, 2011). The provisions of the mortgage loan require that the Hospital maintain specified financial ratios. As of December 31, 2011 and 2010, the Hospital met the various financial ratio requirements.

5. Debt-related Matters (continued)

(f) The Hospital has balances outstanding under tax-exempt financing agreements under the Dormitory Authority Tax-Exempt Leasing Program relating primarily to equipment purchases with some associated construction and soft costs. The following is a summary of the loans, for which the related equipment serves as collateral:

Origination Year	Original Loan Amount	Monthly Principal and Interest Payments	Fixed Interest Rates	Final Payment
2005	$ 19.4 million	$ 390,100	3.11%	December 2011
2008	5.0 million	74,997	2.68	November 2014
2009	6.0 million	92,686	3.68	October 2015
2010	6.7 million	99,299	2.16	October 2016
2011	16.0 million	234,465	1.78	July 2017

(g) In 2009, the Hospital entered into a $3.87 million financing agreement with a commercial bank to finance certain equipment and related construction and soft costs. The loan bears interest at a rate of 6.1% and provides for monthly principal and interest payments of $64,056 with final payment due no later then August 2015. The loan is collateralized by the financed equipment.

Interest paid on all debt was approximately $13.3 million and $11.7 million in 2011 and 2010, respectively, which includes capitalized interest of approximately $3.2 million and $2.8 million in 2011 and 2010, respectively.

5. Debt-related Matters (continued)

Annual principal payments on all debt, mortgage premium amortization and required mortgage reserve funding requirements for each of the next five years and thereafter are as follows:

	Principal Payments	Mortgage Premium Amortization	Total	Mortgage Reserve Funding Requirements
	(In Thousands)			
2012	$ 15,109	$ 394	$ 15,503	$ 928
2013	15,722	388	16,110	1,912
2014	16,184	360	16,544	1,986
2015	15,465	329	15,794	2,062
2016	14,328	298	14,626	2,129
Thereafter	156,922	1,107	158,029	7,292
Total obligations	$ 233,730	$ 2,876	$ 236,606	$ 16,309

6. Other Operating Revenue

A summary of the components of other operating revenue is as follows for the years ended December 31:

	2011	**2010**
	(In Thousands)	
Physician practice revenue and overhead recovery	**$ 59,349**	$ 49,360
Investment income	**1,248**	923
Net realized gains on investments	**310**	307
Operating component of change in net unrealized gains and losses on investments and equity in (losses) earnings of alternative investments	**(1,608)**	396
Royalty income	**1,030**	1,360
Rebates and discounts	**1,386**	1,254
Dietary income	**1,027**	972
Other	**3,772**	4,157
	$ 66,514	$ 58,729

7. Insurance Coverage

The Hospital maintained commercial insurance for professional and general liabilities prior to March 1976 and for workers' compensation coverage prior to March 1980. Subsequent to those dates, those coverages have been purchased by the Hospital from commercial carriers that reinsure the majority of the primary portions of such coverages with MIAC, a Cayman Islands corporation organized by the Hospital in 1981 and licensed under Cayman Islands law to conduct an insurance business. Effective June 15, 2003, MIAC commenced to directly insure a buffer layer between the primary and excess positions of certain of such coverages. MIAC also reinsures the primary professional liability coverage of the majority of Hospital physicians and directly insures a buffer layer above the primary portion of such coverage. The Hospital, which in March 1981 had purchased for $10,000 all of the outstanding stock of MIAC, transferred its interest in MIAC to the Hospital's affiliate, Fund, as of January 1, 1985.

The Hospital has guaranteed payment of certain of MIAC's obligations incident to MIAC's existing professional, general liability and workers' compensation reinsurance commitments to the extent that MIAC's reserves might require such support.

At December 31, 2011 and 2010, MIAC's reserves, which have been evaluated by an independent actuarial firm, approximated $72.9 million and $62.9 million, respectively. At December 31, 2011 and 2010, total assets approximated $82.0 million and $71.8 million, respectively. Underwriting income approximated $20.8 million and $20.6 million for 2011 and 2010, respectively. MIAC's net operating results for the years ended December 31, 2011 and 2010 were not significant.

8. Benefit Plans

The Hospital maintains a noncontributory cash balance defined benefit pension plan (the "Plan") that covers substantially all employees of the Hospital and its affiliates. The Hospital's funding policy is to contribute amounts to the Plan sufficient to meet the minimum funding requirements pursuant to the Employee Retirement Income Security Act of 1974, plus such additional amounts as the Hospital may deem appropriate from time to time.

8. Benefit Plans (continued)

Contributions are intended to provide not only for benefits attributed to service to date but also for those expected to be earned in the future. The assets of the Plan consist primarily of money market mutual funds, fixed and equity mutual funds, fixed income mutual funds, alternative investments and cash and cash equivalents.

In 2009, the Hospital amended the Plan to implement a "soft freeze" effective January 1, 2010. Any new employees hired after October 15, 2009 will not be eligible to participate in the Plan. In addition, existing employees had the option to remain active in the Plan or freeze their status, with new benefits accruing to a new defined contribution plan effective January 1, 2010. The soft freeze did not constitute a curtailment of the Plan.

In addition to providing pension benefits, the Hospital provides certain health care and life insurance benefits for certain retired employees through a defined benefit postretirement plan. The Hospital accrues the obligation to provide postretirement health care and other welfare benefits during the years in which employees provide service.

The Hospital recognizes the funded status (i.e., the difference between the fair value of plan assets and the projected benefit obligations) of the defined benefit plans in its statements of financial position.

Net unrecognized actuarial losses and the net unrecognized prior service costs at the reporting date will be subsequently recognized in the future as net periodic benefit cost pursuant to the Hospital's accounting policy for amortizing such amounts. Further, actuarial gains and losses that arise in subsequent periods and are not recognized as net periodic benefit cost in the same periods will be recognized as a component of unrestricted net assets.

Included in other changes in unrestricted net assets at December 31, 2011 and 2010 are the following amounts that have not yet been recognized in net periodic benefit cost:

	2011	2010
	(In Thousands)	
Unrecognized actuarial loss	**$ (134,814)**	$ (80,020)
Unrecognized prior service cost	**(288)**	(344)
	$ (135,102)	$ (80,364)

8. Benefit Plans (continued)

The actuarial loss and prior service cost included in other changes in unrestricted net assets at December 31, 2011 and expected to be recognized in net periodic benefit cost during the year ending December 31, 2012 are as follows (in thousands):

Unrecognized actuarial loss	$ 9,659
Unrecognized prior service credit	56
	$ 9,715

The following tables provide a reconciliation of the changes in each of the plans' projected benefit obligation and fair value of plan assets as of December 31:

	Pension Plan		Postretirement Plan	
	2011	**2010**	**2011**	**2010**
	(In Thousands)			
Reconciliation of the projected benefit obligation				
Obligation at beginning of year	**$ 139,534**	$ 110,935	**$ 4,014**	$ 4,001
Service cost	**9,060**	7,541	**42**	37
Interest cost	**7,792**	6,764	**171**	190
Actuarial loss	**55,377**	18,256	**1,947**	93
Benefit payments, net	**(7,350)**	(3,962)	**(381)**	(307)
Obligation at end of year	**$ 204,413**	$ 139,534	**$ 5,793**	$ 4,014
Reconciliation of fair value of plan assets				
Fair value of plan assets at beginning of year	**$ 97,693**	$ 77,839	**$ –**	$ –
Actual gain on plan assets	**5,358**	9,816	**–**	–
Employer contributions	**19,800**	14,000	**381**	307
Plan participants' contributions	**–**	–	**356**	279
Benefit payments	**(7,350)**	(3,962)	**(737)**	(586)
Fair value of plan assets at end of year	**$ 115,501**	$ 97,693	**$ –**	$ –

8. Benefit Plans (continued)

The following table provides the amounts recognized as liabilities in the statements of financial position at December 31:

	Pension Plan		Postretirement Plan	
	2011	**2010**	**2011**	**2010**
	(In Thousands)			
Funded status				
Unfunded status at end of year	**$ (88,912)**	$ (41,841)	**$ (5,793)**	$ (4,014)

The following table provides the components of the net periodic benefit cost for each of the plans for the years ended December 31:

	Pension Plan		Postretirement Plan	
	2011	**2010**	**2011**	**2010**
	(In Thousands)			
Service cost – benefits earned during the year	**$ 9,060**	$ 7,541	**$ 42**	$ 37
Interest cost on projected benefit obligations	**7,792**	6,764	**171**	190
Expected return on plan assets	**(7,979)**	(7,706)	**–**	–
Accretion (amortization) of prior service cost	**67**	67	**(11)**	(11)
Recognized actuarial loss	**5,026**	4,126	**125**	104
Net periodic benefit cost	**$ 13,966**	$ 10,792	**$ 327**	$ 320

The accumulated benefit obligation for the plans as of December 31, 2011 and 2010 was approximately $203.1 million and $138.0 million, respectively.

8. Benefit Plans (continued)

Prior service costs are amortized on a straight-line basis over the average remaining service period of active participants. Gains and losses in excess of 10% of the greater of the benefit obligations and the market-related value of assets are amortized over the average remaining service period of active participants. The weighted-average assumptions used in the measurement of the Hospital's benefit obligations at December 31 were:

	Pension Plan		Postretirement Plan	
	2011	**2010**	**2011**	**2010**
Discount rate	**4.50%**	5.75%	**4.00%**	4.50%
Rate of increase in compensation levels	**4.00**	4.00	**–**	–

The weighted-average assumptions used in the measurement of the Hospital's net periodic benefit cost for the years ended at December 31 were as follows:

	Pension Plan		Postretirement Plan	
	2011	**2010**	**2011**	**2010**
Discount rate	**5.75%**	6.00%	**4.50%**	5.00%
Expected long-term rate of return on plan assets	**7.00**	8.00	**–**	–
Rate of increase in compensation levels	**4.00**	4.00	**–**	–

8. Benefit Plans (continued)

The Plan's weighted-average asset allocations at December 31, 2011 and 2010, by asset category, are as follows:

	2011	**2010**
Asset category:		
Money market mutual funds	**6%**	14%
Equity mutual funds	**10**	8
Fixed income mutual funds	**51**	44
Alternative investments	**33**	34
Total	**100%**	100%

To develop the expected long-term rate of return on plan assets assumption, the Hospital considered the historical return and the future expectations for returns for each asset class, as well as the target asset allocation of the pension portfolio.

The defined benefit pension plan's investment objectives are to achieve long-term growth in excess of long-term inflation and to provide a rate of return that meets or exceeds the actuarial expected long-term rate of return on Plan assets over a long-term time horizon. In order to minimize the risk, the Plan aims to minimize the variability in yearly returns. The Plan also aims to diversify its holding among sectors, industries, and companies.

The assets of the Plan are managed in accordance with the Employee Retirement Income Security Act of 1974. The assets of the Plan are measured at fair value in accordance with the policies discussed in Note 1. Refer to Note 15 for fair value measurement information related to the defined benefit plan asset categories noted in the table above.

The Hospital expects to make contributions of approximately $25.8 million to the plans during 2012.

8. Benefit Plans (continued)

Benefit payments, which reflect expected future service, as appropriate, are expected to be paid as follows:

	Pension Plan	Postretirement Plan
	(In Thousands)	
2012	$ 10,160	$ 425
2013	9,854	441
2014	10,413	460
2015	10,373	423
2016	10,478	382
2017 to 2021	60,247	1,833

Assumed health care cost trend rates have a significant effect on the amounts reported for the defined benefit postretirement plans. A 1% change in assumed health care cost trend rates would have the following effects relating to the postretirement plans:

	2011		**2010**	
	1% Increase	**1% Decrease**	**1% Increase**	**1% Decrease**
	(In Thousands)			
Effect on total of service and interest cost components of net periodic postretirement benefit cost	**$ 2**	**$ (1)**	$ 2	$ (2)
Effect on the health care component of the accumulated postretirement benefit obligation	**14**	**(19)**	41	(45)

The Hospital also provides pension benefits to certain employees through a defined contribution plan. Pension expense related to this plan was approximately $5.3 million and $4.2 million for the years ended December 31, 2011 and 2010, respectively.

9. Functional Expenses

The Hospital provides musculoskeletal health care and related services, including research and graduate medical education. It is not practicable to separately identify the expenses relating to each of the Hospital's programs. Expenses related to primary services were as follows:

	Year Ended December 31 2011	2010
	(In Thousands)	
Health care and related services	**$ 546,004**	$ 498,104
Research operations	**33,443**	32,889
General and administrative	**72,322**	69,138
	$ 651,769	$ 600,131

10. Permanently Restricted Net Assets

Permanently restricted net assets are restricted as follows at December 31:

	2011	2010
	(In Thousands)	
Assets to be held in perpetuity, the income from which is restricted for research	**$ 73,119**	$ 64,865
Assets to be held in perpetuity, the income from which is restricted for other specific purposes	**19,342**	16,770
Assets to be held in perpetuity, the income from which is unrestricted as to use	**410**	410
	$ 92,871	$ 82,045

10. Permanently Restricted Net Assets (continued)

Changes in endowment investments for the year ended December 31, 2011 are as follows:

	Unrestricted	Temporarily Restricted	Permanently Restricted	Total
	(In Thousands)			
Endowment investments, beginning balance	**$ 1,354**	**$ 26,974**	**$ 77,790**	**$ 106,118**
Total investment return	**(41)**	**(3,327)**	**–**	**(3,368)**
Contributions	**–**	**–**	**10,864**	**10,864**
Appropriation of endowment investments for expenditure	**–**	**(3,627)**	**–**	**(3,627)**
Endowment investments, ending balance	**$ 1,313**	**$ 20,020**	**$ 88,654**	**$ 109,987**

Changes in endowment investments for the year ended December 31, 2010 are as follows:

	Unrestricted	Temporarily Restricted	Permanently Restricted	Total
	(In Thousands)			
Endowment investments, beginning balance	$ 1,145	$ 16,725	$ 72,208	$ 90,078
Total investment return	209	12,437	–	12,646
Contributions	–	–	5,582	5,582
Appropriation of endowment investments for expenditure	–	(2,188)	–	(2,188)
Endowment investments, ending balance	$ 1,354	$ 26,974	$ 77,790	$ 106,118

Permanently restricted net assets represent endowments that have been restricted by donors to be maintained in perpetuity. The Hospital follows the requirements of the New York Prudent Management of Institutional Funds Act ("NYPMIFA") passed into law effective September 2010 as they relate to its permanently restricted net assets. Prior to the enactment of the law, the Hospital followed the requirements of the Uniform Management of Institutional Funds Act ("UMIFA"). The Hospital has interpreted NYPMIFA, which did not have a significant effect on the Hospital's endowment policies that were in effect prior to the enactment, as requiring the preservation of the fair value of the original gift, as of the gift date, of the donor-restricted endowment fund absent explicit donor stipulations to the contrary. The Hospital classifies as permanently restricted net assets the original value of the gifts donated to the permanent endowment and the original value of subsequent gifts to the permanent endowment. Returns on

10. Permanently Restricted Net Assets (continued)

the permanent endowment are used in accordance with the direction of the applicable donor gift. Returns on permanently restricted net assets are classified as temporarily restricted net assets until the amounts are appropriated for expenditure in accordance with a manner consistent with the standard of prudence prescribed by NYPMIFA. In accordance with NYPMIFA, the Hospital considers the following factors in making a determination to appropriate or accumulate donor-restricted endowment funds: (1) the duration and preservation of the fund; (2) the purposes of the donor-restricted endowment fund; (3) general economic conditions; (4) the possible effect of inflation and deflation; (5) where appropriate and circumstances would otherwise warrant, alternatives to expenditure of the endowment fund, giving due consideration to the effect that such alternatives may have on the institution; (6) the expected total return from income and the appreciation of investments; (7) other resources of the Hospital; and (8) the investment and spending policies of the Hospital. The Hospital has adopted investment and spending policies for endowment assets that attempt to provide a predictable stream of funding to programs supported by its endowment.

Under Hospital policy, as approved by the Board of Trustees, the endowment assets are invested in a manner to provide that sufficient assets are available as a source of liquidity for the intended use of the funds, achieve the optimal return possible within the specified risk parameters, prudently invest assets in a high-quality diversified manner and adhere to the established guidelines.

To satisfy its long-term rate-of-return objectives, the Hospital relies on a total return strategy in which investment returns are achieved through both capital appreciation (realized and unrealized) and current yield (interest and dividends). The Hospital targets a diversified allocation that places a greater emphasis on equity-based investments to achieve its long-term return objectives within prudent risk constraints.

The Hospital's permanently restricted endowment funds are managed according to endowment and similar fund policies that guide investment of donations, spending and distribution of total return investment income. The policies also provide the guidelines for setting the annual endowment spend rate (5% for 2011 or income if the fair value is below the original endowment donation) and the treatment of any investment returns in excess of the annual spending rate. The 5% endowment spend rate is calculated on the year-end average three-year rolling fair value of each endowed fund. Any excess investment returns beyond the spending rate, to the extent available, are added to temporarily restricted funds and classified appropriately.

10. Permanently Restricted Net Assets (continued)

The Hospital distributes the investment income earned on the endowment funds as required for the donor-restricted purpose of the endowment assets held in perpetuity.

From time to time, the fair value of assets associated with individual donor restricted endowment funds may fall below the level of the original principal donation. Deficiencies of this nature that are reported in unrestricted net assets were $0.5 million as of December 31, 2011 and $0.1 million as of December 31, 2010. The change in deficiencies resulted from unfavorable investment market performance during 2011. The Hospital is not required to restore such deficiencies but will, as required, make prudent decisions on use of the income of such funds. Such income, if not used currently, will be added to the principal of the funds in the future.

11. United States Public Health Service Research Grants

Expenditures and overhead allocations charged to United States Public Health Service research grants are subject to audit by the funding agencies. It is management's opinion that adjustments, if any, will not be materially different from recorded amounts. The revenue from these grants is included in net assets released from restrictions for research operations.

12. Bicknell Trust

The Hospital's institutional research funds are the beneficiary of income from the Bicknell Trust. The fair value of investments in the trust was approximately $30.7 million and $34.1 million at December 31, 2011 and 2010, respectively. Income received from this trust was approximately $1.6 million and $1.4 million in 2011 and 2010, respectively, and is recorded directly in the research funds (temporarily restricted net assets).

13. Transactions with Affiliates

Fund is a not-for-profit corporation organized under the Not-for-Profit Corporation Law of the State of New York for the purpose of supporting the charitable, educational, and scientific purposes of the Hospital and other related health care organizations.

13. Transactions with Affiliates (continued)

Fund and Properties purchase certain administrative, general and plant services from the Hospital. Amounts charged for these services (approximately $4.4 million and $3.8 million in 2011 and 2010, respectively) are determined principally on the basis of allocated costs. Fund provides certain fundraising services to the Hospital valued at approximately $5.4 million in 2011 and $4.8 million in 2010, respectively. The methodology used to allocate costs is based on a formula of historical contributions received. Amounts due to and from the Hospital for these services are reimbursed in the normal course of business. Additionally, Properties leases various facilities to the Hospital. Rental expense under these arrangements amounted to approximately $25.8 million and $22.0 million for the years ended December 31, 2011 and 2010, respectively.

At December 31, amounts due from the Hospital's affiliates are as follows:

	2011	2010
	(In Thousands)	
Fund	**$ 1,062**	$ 713
Properties	**408**	126
Horizons	**2,790**	2,703

In addition to the amounts above (and as discussed in Note 3), a portion of Fund's investment portfolio represents net assets received by Fund on behalf of the Hospital which are due to the Hospital (approximately $17.2 million in 2011 and $18.5 million in 2010).

Amounts due to and from affiliates generally are not interest-bearing, except for the amount due from Horizons, for which interest is charged at the prime rate.

13. Transactions with Affiliates (continued)

Following is a summary of consolidated financial information for Fund as of December 31, 2011 and 2010 and for the years then ended:

	2011	2010
	(In Thousands)	
Total assets	**$ 171,832**	$ 156,688
Total liabilities	**$ 130,105**	$ 123,192
Total net assets (unrestricted)	**$ 41,727**	$ 33,496
Operating revenue	**$ 59,561**	$ 54,816
Operating expenses	**$ 51,692**	$ 51,281

The Hospital is not responsible for the debts or obligations of its affiliates, nor are such affiliates responsible for the debts or obligations of the Hospital other than as disclosed in Notes 5 and 7.

14. Contingencies

The Hospital is a defendant in certain legal actions arising out of the normal course of its operations, the final outcome of which cannot presently be determined. Hospital management is of the opinion that the ultimate liability, if any, with respect to all of these matters will not have a material effect on the Hospital's financial position.

15. Fair Value Measurements

For assets and liabilities required to be measured at fair value, the Hospital measures fair value based on the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. Fair value measurements are applied based on the unit of account from the Hospital's perspective.

The unit of account determines what is being measured by reference to the level at which the asset or liability is aggregated (or disaggregated) for purposes of applying other accounting pronouncements.

15. Fair Value Measurements (continued)

The Hospital follows a valuation hierarchy that prioritizes observable and unobservable inputs used to measure fair value into three broad levels, which are described below:

> *Level 1* – Quoted prices (unadjusted) in active markets that are accessible at the measurement date for identical assets or liabilities. The fair value hierarchy gives the highest priority to Level 1 inputs.
>
> *Level 2* – Observable inputs that are based on inputs not quoted in active markets, but corroborated by market data.
>
> *Level 3* – Unobservable inputs are used when little or no market data is available. The fair value hierarchy gives the lowest priority to Level 3 inputs.

A financial instrument's categorization within the valuation hierarchy is based upon the lowest level of input that is significant to the fair value measurement. In determining fair value, the Hospital uses valuation techniques that maximize the use of observable inputs and minimize the use of unobservable inputs to the extent possible and considers nonperformance risk in its assessment of fair value.

15. Fair Value Measurements (continued)

Financial instruments, including the defined benefit plan assets, carried at fair value as of December 31, 2011 are classified in the table below in one of the three categories described above:

	Level 1	Level 2	Level 3	Total
	(In Thousands)			
Cash and cash equivalents	**$ 49,004**	**$ –**	**$ –**	**$ 49,004**
Marketable equity securities [a]	**10,071**	**–**	**–**	**10,071**
Money market mutual funds [b]	**110,013**	**–**	**–**	**110,013**
Equity mutual funds [c]	**69,519**	**–**	**–**	**69,519**
Fixed income mutual funds [d]	**82,118**	**–**	**–**	**82,118**
U.S. Government obligations [e]	**24,851**	**–**	**–**	**24,851**
Alternative investments:				
Hedge funds:				
U.S. equity large/small cap [f]	**–**	**7,991**	**–**	**7,991**
International equity [g]	**–**	**6,491**	**–**	**6,491**
Long/short equity [h]	**–**	**8,739**	**–**	**8,739**
Multi-strategy [i]	**–**	**11,707**	**–**	**11,707**
Real assets [j]	**–**	**1,036**	**–**	**1,036**
Private equity [k]	**–**	**–**	**2,505**	**2,505**
	$ 345,576	**$ 35,964**	**$ 2,505**	**$ 384,045**

Financial instruments, including the defined benefit plan assets, carried at fair value as of December 31, 2010 are classified in the table below in one of the three categories described above:

	Level 1	Level 2	Level 3	Total
	(In Thousands)			
Cash and cash equivalents	$ 47,757	$ –	$ –	$ 47,757
Marketable equity securities [a]	6,394	–	–	6,394
Money market mutual funds [b]	128,418	–	–	128,418
Equity mutual funds [c]	54,468	–	–	54,468
Fixed income mutual funds [d]	66,050	–	–	66,050
U.S. Government obligations [e]	24,422	–	–	24,422
Alternative investments:				
Hedge funds:				
U.S. equity large/small cap [f]	–	6,162	–	6,162
International equity [g]	–	4,865	–	4,865
Long/short equity [h]	–	7,226	–	7,226
Multi strategy [i]	–	11,494	–	11,494
Real assets [j]	–	2,807	–	2,807
Private equity [k]	–	–	737	737
	$ 327,509	$ 32,554	$ 737	$ 360,800

15. Fair Value Measurements (continued)

(a) Includes large cap common stock of corporations primarily domiciled in the United States.

(b) Includes investments in mutual funds that invest primarily in short-term debt securities, including U.S. Treasury bills, commercial paper and certificates of deposit.

(c) Includes investments in domestic and international equity mutual funds and exchange traded funds.

(d) Investment in a fixed income mutual fund that maintains a diverse portfolio of short-term high quality bonds actively managed across the mortgage backed security, U.S. Treasury, corporate and international fixed income sectors.

(e) Includes units of U.S. Treasury notes and Treasury bills with maturities ranging from three months to five years.

(f) Hedge funds and common collective trust funds of common stock of corporations primarily domiciled in the United States.

(g) Hedge funds of common stock of corporations primarily domiciled outside of the United States, including emerging market countries.

(h) Hedge fund investments consisting primarily of publicly traded equity holdings with both long and short positions.

(i) Hedge fund investments that are designed to provide returns largely independent of overall market movement, with lower correlations to domestic stock and bond markets. Underlying strategies can include credit, event driven, relative value and various arbitrage strategies.

(j) Hedge funds of real estate and natural resource investments.

(k) Venture capital, buyout and distressed debt partnerships.

The Hospital's alternative investments, excluding alternative investments in the defined benefit plan, are reported using the equity method of accounting and, therefore, are not included in the table above (see Note 1).

15. Fair Value Measurements (continued)

The following is a description of the Hospital valuation methodologies for assets measured at fair value. Fair value for Level 1 is based upon quoted market prices. Fair value for Level 2 is based on quoted prices for similar instruments in active markets, quoted prices for identical or similar instruments in markets that are not active, and model-based valuation techniques for which all significant assumptions are observable in the market or can be corroborated by observable market data for substantially the full term of the assets. Inputs are obtained from various sources, including market participants, dealers and brokers. Level 3 assets consist of private equity investments held by the defined benefit plan, the valuation for which is described in Note 1. The methods described above may produce a fair value that may not be indicative of net realizable value or reflective of future fair values. Furthermore, while the Hospital believes its valuation methods are appropriate and consistent with other market participants, the use of different methodologies or assumptions to determine the fair value of certain financial instruments could result in a different estimate of fair value at the reporting date.

The following table is a rollforward for financial instruments, included in the defined benefit plan, classified by the Hospital in Level 3 of the valuation hierarchy defined above:

	Fair Value Measurements Using Significant Unobservable Inputs (Level 3)	
	2011	**2010**
	(In Thousands)	
Fair value at January 1	**$ 737**	$ 410
Actual return on plan assets held at end of year	**(45)**	97
Purchases, sales, and settlements, net	**1,813**	230
Fair value at December 31	**$ 2,505**	$ 737
Change in unrealized gains and losses related to financial instruments held at December 31	**$ (45)**	$ 97

15. Fair Value Measurements (continued)

The following is a summary of investments, including alternative investments reported using the equity method, and the nature of restrictions on the Hospital's ability to redeem its investments at the measurement date, any unfunded capital commitments and investments strategies of the investees as of December 31, 2011, including the defined benefit plan:

	Carrying Value	Unfunded Commitments	Redemption Notice Period	Funds Availability
	(In Thousands)			
U.S. equity large/small cap	$ 19,309	$ –	0 days – 30 days	30 days to 2 years
International equity	14,953	–	0 days – 120 days	30 days to 2 years
Long/short equity	33,880	–	0 days – 180 days	3 months to 2 years
Multi-strategy	34,281	–	60 days – 120 days	3 months to 3 years
Real assets	4,258	–	0 days – 45 days	3 months to 6 months
Private equity	10,727	6,198	n/a	5 years to 10 years
	$ 117,408	$ 6,198		

The carrying values and fair values of the Hospital's financial instruments that are not required to be carried at fair value are as follows at December 31:

	2011		2010	
	Fair Value	Carrying Value	Fair Value	Carrying Value
	(In Thousands)			
Long-term debt	**$ 235,895**	**$ 236,606**	$ 218,544	$ 228,002

The fair value of the Hospital's long-term debt is based on discounted cash flow analyses, using current borrowing rates for similar types of debt.

16. Events Subsequent to December 31, 2011

Subsequent events have been evaluated through April 18, 2012, which is the date the financial statements were issued. Other than as disclosed in Note 5, no subsequent events have occurred that require disclosure in or adjustment to the financial statements.

Ernst & Young LLP

Assurance | Tax | Transactions | Advisory

About Ernst & Young
Ernst & Young is a global leader in assurance, tax, transaction and advisory services. Worldwide, our 152,000 people are united by our shared values and an unwavering commitment to quality. We make a difference by helping our people, our clients and our wider communities achieve their potential.

For more information, please visit www.ey.com.

Ernst & Young refers to the global organization of member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. This Report has been prepared by Ernst & Young LLP, a client serving member firm located in the United States.

Quotation Number: P7-C146605 V 2

Hospital For Special Surgery
535 E 70th St
New York NY 10021-4823

Attn: Edward White
535 E 70th St
New York NY 10021

Date: 08-01-2012

Item No.	Qty	Catalog No.	Description
	1		**Optima MR450w 1.5T with GEM**
1	1	S4500WP	Optima MR450w with GEM 1.5T MR System - 34/150

Optima MR450w with GEM 1.5T MR System - 34/150

Patient expectations of MR have shifted in recent years, as patients have begun to demand a better, more comfortable scanning experience. Increasing the size of the bore is a good first step, but it's only the beginning. The right system should overcome traditional limitations of wide-bore MR, offering both excellent images and a user-friendly experience. Patients should be more comfortable during their scan, and clinicians more comfortable in making a diagnosis. All the while, organizations should expect their MR system to help them deliver solid financial returns, maintain a high standard of patient safety, and increase the quality of their care.

The Optima MR450w with GEM 1.5T MRI scanner from GE Healthcare offers a range of new functionality, provides a more patient-friendly environment and is a clinical workhorse system for practices of all sizes and specialties.

OpTix RF Receive Chain: GE's innovative Optical RF receive technology improves signal detection while simultaneously reducing electrical noise. By locating the receiver electronics on the side of the magnet and close to the origin of the MR signal, interference from external noise sources is reduced thus improving image quality and SNR. The result is a 27% SNR improvement over previous generation, non-optical systems for volumetric scanning.

The use of optical transmission reduces the cabling footprint over conventional copper cable designs and enables high channel count configurations without requiring additional space. The OpTix technology can seamlessly route signals from any coil port to the receiver using a dynamic switching RF hub. To enable the simultaneous use of multiple coils, there are multiple high-density coil connections ports conveniently located where the detachable table docks to the scanner.

- Sampling Bandwidth 80MHz.
- Surface coil Receive ports 136.

Volume Reconstruction Engine 2.0 (VRE): The backbone of any high-channel count receiver system is the reconstruction architecture. The Optima MR450w utilizes the latest dual-core 2.6 GHz processing technology with the VRE 2.0 recon architecture. With its 36 GB of memory, acquisition-to-disk technology, and 13000 2D FFT/s frame rate, the VRE delivers the processing power to quickly reconstruct high-resolution 3D volumetric data.

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description

eXtreme Gradient Platform: The powerful gradient performance of the Optima MR450w system enables high resolution and fast acquisitions. The gradient platform includes the eXtreme Gradient Driver (XGD) and the optimized large field of view gradient coil. The eXtreme Gradient Driver (XGD) is housed within a single cabinet to simplify installation. Each axis is driven by a dedicated power supply and amplifier to ensure consistent performance for all image orientations. By incorporating a water-cooled architecture, this system supports continuous peak operation with a 100% duty cycle and excellent stability for both long-term serial studies and advanced applications.

- Peak Gradient Amplitude of 34 mT/m
- Peak Gradient Slew Rate of 150 T/m/s
- Peak XGD Current 660 Amps.
- Peak XGD Voltage 1650 Volts.

Gradient systems have historically been defined in terms of peak amplitude (mT/m) and slew rate of the generated field (T/m/s). While these parameters are important in achieving high temporal resolution parameters such as TR's and TE's, applications such as fMRI, PROPELLER, TRICKS, and spectroscopy rely more heavily on gradient fidelity, accuracy, and

reproducibility. Fidelity is defined as the degree to which an electronics system accurately and reproducibly amplifies an input signal. Applied to MR gradient systems, gradient fidelity refers to the system's ability to generate requested waveforms. The high fidelity of the Optima MR450w gradients is achieved through the use of an innovative design of the digital control architecture within the gradient amplifier. This architecture has two digital control paths.

- Dedicated active feedback loop to regulate current errors.
- Innovative feed-forward model to match amplifier output to gradient coil.

Gradient subsystem gradient fidelity, accuracy, reproducibility parameters:

- Maximum integrated error: 0.48 ppmFS-s.
- Shot-to-shot: 0.16 ppmFS-s.
- Symmetry error: 0.32 ppmFS-s.

MR450w GEM Express Patient Table with IntelliTouch Technology: The fully detachable GE Express Patient Table incorporates the Liberty Docking System to improve safety, exam efficiency, and patient comfort over fixed-table solutions.

Easily docked and undocked by a single operator, the patient table is simple to move in and out of the exam room for patient transport and preparation. These become vital features in those instances where multiple patient transfers can negatively impact patient care or when emergency evacuation is required; the table can be

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description

undocked and removed from the scan room in under 30 seconds with just one technologist. In time-sensitive situations there is no need to remove or disconnect surface coils as the system can automatically disconnect the coils for you.

Express Patient Table Comfort: The fully detachable table may help reduce patient anxiety and provide personal discretion by enabling patients to prepare for the exam in a private space. This is particularly important for patients undergoing a breast evaluation.

To improve patient comfort and safety, the GEM Suite includes a unique set of Patient Comfort pads. The pads are designed with variable density foam that uniquely compresses based on patient geometry and weight. Certain sections of the GEM Suite pads are designed to compress more easily than others and this optimal design may minimize pressure points and improve patient comfort.

In addition, the pads are made with UltraFresh protective coating, are strong, fluid-proof, air tight, and easily cleanable. An anti-skid undersurface reduces pad movement on the table and thus may simplify patient setup and egress.

Symmetric Scan: To help reduce patient anxiety, the GEM Express Patient Table is designed to accommodate head first or feet-first imaging for all neurologic, cardiac, abdominal, spinal, and peripheral vascular exams, as well as the majority of musculoskeletal imaging. Whole body imaging may also be completed in either patient orientation. All breast imaging is completed feet first.

Symmetrically positioned within the patient supporting cradle are three high-density coil connection ports. One at each end of the patient cradle, and another one embedded under the covers to connect the GEM Posterior Array. This design enables all components of the GEM Suite to support either patient orientation and helps ensure the most comfortable patient position. Two additional coil connection ports are included on the scanner docking mechanism.

Ergonomics: With one hand and with one simple motion, the integrated arm boards and IV pole can be optimally positioned to support the patient for injections or transportation. This unique capability of the Optima Express Table

also makes it ideally suited for multi-station exams with no scan room intervention, such as peripheral vascular (run-off) imaging.

- Patient table drive: Automated, power driven vertical and longitudinal.
- Longitudinal speed: 30 cm/sec (fast) and 0.5 cm/sec (slow).
- Total cradle length: 211 cm.
- Positioning accuracy: +/- 0.5 cm.
- Maximum patient weight for lift, scanning, and when mobile: 227 kg (500 lbs).

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description

IntelliTouch patient positioning: The Optima MR450w has automated many routine tasks to both simplify patient preparation, and gain productivity. With IntelliTouch Technology, the technologist simply touches the side of the patient table and then a highlighted button to efficiently complete the following:

- Landmark the patient.
- Activate the surface coil.
- Center the patient in the bore.
- Start scanning.
- Acquire, process and network images.

For those patients where pinpoint alignment is desired, laser alignment lights may be used for either the selection or confirmation of landmark position.

Additional tables may be purchased for use with the scanner. With a second table, the next patient can be fully prepared for the exam outside the magnet room while the current patient is being scanned, thus maximizing system utilization and productivity.

This GEM Express Patient Table is only compatible with the Optima MR450w with GEM system and cannot be docked to any other type of GE scanner. Multiple GEM Express Patient Tables may be used with a single system to enhance scanner productivity and workflow. All GEM Suite surface coil components (GEM Posterior Array, GEM Head/Neck Unit, GEM Anterior Array, GEM Peripheral Vascular Arrays) and other optional surface coils are sold as separate items with separate catalog numbers.

Optimally designed for patient safety, patient comfort, and efficient workflow, the external features of the Optima MR450w also provide an aesthetically pleasing look and feel that can reduce patient anxiety. The wide open flare of the covers increase the effective bore size and may reduce patient anxiety when entering the scan room or magnet bore. With patient-optimized lighting and air conditioning, the system can be ideally set for each individual, increasing their control of the environment.

Express Exam and ScanTools: The Express Exam and ScanTools includes a comprehensive suite of workflow features, advanced applications, and parallel imaging capabilities to enable the user to harness the Simply Powerful capabilities of the scanner efficiently and effectively.

The automated workflow features of the Express Exam interface includes the Modality Worklist, Protocol Library, AutoStart, AutoScan, AutoVoice, Linking, and Inline Processing that complete much of the work for the user.

Modality worklist: The modality worklist (MWL) provides an automated method of obtaining exam and protocol information for a patient directly from a DICOM Worklist server. For sites with full DICOM connectivity, once a patient has been selected from

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description

the MWL, a new session is opened on the host interface and the relevant exam details are highlighted for the user. The protocol may be selected well in advance of the patient's arrival at the MR suite thereby simplifying exam preparation and reducing necessary work by the technologist during the time-critical procedure.

Protocol libraries and properties: The MR system provides the user with complete control of protocols for simple prescription, archiving, searching, and sharing. The protocols are
organized into two main libraries, a GE optimized set that are included with the system, and Site Authored.

ProtoCopy: Standard is the ProtoCopy feature which enables a complete exam protocol to be shared with the click of a mouse. The exam protocol can originate from either a library or previously acquired exam. This enables routine archive of protocols for emergency backup and simple management of libraries across multiple systems.

Workflow Manager: Once a protocol has been selected for an exam, it is automatically loaded into the Workflow Manager. The Workflow Manager controls image prescription, acquisition, processing, visualization and networking and may fully automate these steps, if requested.

AutoStart: With AutoStart, once the landmark position has been set and the technologist leaves the room the Workflow Manager will automatically start the first acquisition in the exam.

Linking: Linking automates the prescription of images for each series in an exam. Once the targeted anatomical region has been located the Linking feature combines information from a prescribed imaging series to all subsequent series in the Workflow Manager.

AutoScan: With AutoScan enabled, the Workflow Manager will sequentially go through the list of prescribed series without any user interaction.

AutoVoice: The AutoVoice feature ensures that consistent and repeatable instructions are presented to the patient for each and every exam. User selectable, pre-recorded instructions are presented at defined points in the acquisition. The AutoVoice feature includes instructions in over 14 languages and the user can create and include their own unique voice instructions for local needs.

Inline processing: For certain tasks, the user must accept the results, or complete additional steps prior to saving the images to the database In these cases the data is automatically loaded into the appropriate tool, then the system will await further instruction by the user.

Inline viewing: Inline viewing allows the user to conveniently view, compare, and

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description

analyze images without having to switch to the Browser. Simply select the series to view from the Workflow Manager and the images are displayed along with standard image display tools.

Image fusion: To better visualize tissue and contrast, multiple images from separate acquisitions can be overlaid on one another. High-resolution anatomical images can be automatically fused with functional data or parametric maps for improved visualization by the user. The data is registered using translation and rotation and distortion correction to ensure accurate fusion.

Spin Echo: The single echo gold standard for generating T1, proton density and T2 images.

Fast Spin Echo (FSE), Fast Spin Echo-XL (FSE-XL): Uses a train of spin echoes to reduce total acquisition times and provide high resolution datasets. The XRB gradient performance allows for very short echo spacing, thus maintaining image resolution and SNR even in long echo train acquisitions.

Fast Recovery Fast Spin Echo (FRFSE): is an extension of the Fast spin Echo sequence and incorporates an additional refocusing pulse and 90 degree excitation at the end of the echo train.

FLAIR: T1 and T2 Fluid Attenuated Inversion Recovery (FLAIR) pulse sequences have been designed expressly for neuro applications. FLAIR allows suppression of signal from cerebrospinal fluid (CSF).

Double/Triple IR: These pulse sequences are included to allow black-blood imaging for studies of cardiac morphology. Triple IR adds fat suppression to black-blood imaging.

3DFRFSE: A sequence for creating high resolution, three-dimensional T2-weighted images of all anatomies and is especially useful for MR cholangiopancreatography (MRCP) studies.

Single-Shot Fast-Spin Echo (SSFSE): An ultra fast technique that permits complete image acquisition following a single RF excitation. It can acquire slices in less than one second, making it an excellent complement to T2-weighted brain and abdominal imaging and MRCP studies.

GRE, FGRE, SPGR, FSPGR: This suite of gradient echo techniques uses short TR and TE times to generate Proton Density, T1, T2, T2* tissue contrast, or a combination thereof, in far less time than conventional spin echo acquisitions. The ultra-short TR and TE times possible with these sequences also ensure the performance needed for state-of-the-art vascular and contrast-enhanced MRA studies.

2D and 3D Dual Echo Gradient Echo: A vital tool for abdominal imaging. This variation on conventional gradient echo provides a pair of images for which the signals from

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description

water and fat either are in-phase or out-of-phase. By design, all of the images acquired within a single breath-hold are in perfect registration.

2D and 3D Time of Flight (TOF), 2D-Gated TOF: TOF Imaging and Enhanced 3DTOF Imaging are all ideal for MR angiography. Based on conventional gradient echo scanning, time of flight imaging techniques rely primarily on flow-related enhancements to distinguish moving from stationary spins.

2D Phase Contrast (2DPC), 3D Phase Contrast (3DPC): These techniques demonstrate flow velocities and directional properties in vessels and other moving fluids such as cerebral spinal fluid and aortic flow. These acquisitions provide the data for quantitative flow analysis.

2D MERGE: Multiple Echo Recombined Gradient Echo (MERGE) uses multiple echoes to generate high-resolution images of the C-spine with excellent gray-white matter differentiation. By combining early echoes with high SNR and late echoes with improved contrast, the result is improved cord contrast within the spinal column.

3D MERGE: The 3D MERGE sequence has been optimized to generate clear tissue contrast in the cervical spine. The high in-plane resolution and thin slices enable excellent image reformats for better tissue visualization for all angles.

COSMIC (Coherent Oscillatory State acquisition for Manipulation if Image Contrast): COSMIC is a 3D imaging technique specifically tailored for cervical spine evaluation. The unique fluid-weighted contrast yields improved visualization of the cervical nerve roots and intervertebral disks. The high resolution images are easily reformatted for better tissue visualization from any orientation.

2D FIESTA: FIESTA (Fast Imaging Employing STeady-state Acquisition) is designed to produce high SNR images extremely rapidly. The technique features an extremely short TR and fully balanced gradients to rephase the transverse magnetization at the end of each TR interval. For very short TR sequences, the signal intensity depends strongly on the ratio T2/T1 and is largely independent of TR. As result, this pulse sequence accentuates the contrast of spins with a high T2/T1 ratio, such as CSF, water and fat while suppressing the signal from tissues with low T2/T1 ratio, such as muscle.

2D FatSat FIESTA: With the added capability to suppress the signal from fat, this sequence generates excellent contrast between the vasculature and surrounding tissues.

3D FIESTA: The 3D FIESTA technique is especially useful for the rapid acquisition of high spatial-resolution images of static structures such as cochlea, internal auditory canal, or joints.

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description

3D FatSat FIESTA: 3D FatSat FIESTA is advanced software designed for imaging of the coronary arteries. The use of VAST (Variable Sampling in Time) technology greatly shortens breath-holding requirements or allows for higher spatial resolution.

BRAVO (BRAin VOlume Imaging): This IR-prepared T1-weighted 3D Gradient Echo imaging technique affords isotropic, whole-brain coverage with 1x1x1 mm resolution. Coupled with parallel imaging, this sequence produces superior gray white matter contrast in just 2 to 3 minutes.

SPECIAL: Spectral Inversion at Lipids is a spectral spatial inversion technique for fat saturation in 3D FGRE pulse sequences.

LAVA: LAVA is a three-dimensional (3D) spoiled gradient echo technique designed specifically to image the liver with unprecedented definition, coverage, and speed in a single breath hold . Excellent fat suppression, through a version of the SPECIAL technique customized for the liver, is one of the reasons for the high definition of anatomical structures. The coverage and speed of LAVA are the result of short TR, innovative use of partial k-space acquisition, and advanced parallel imaging.

For improved tissue contrast, LAVA is compatible with Flex imaging. The LAVA Flex acquisition will provide a water-only, fat-only, in-phase and out of phase data sets in a single acquisition and produce images with significantly reduced chemical shift and susceptibility artifacts.

FastCINE: This pulse sequence is included specifically for studies of cardiac function. Through the use of retrospective gating, it allows full R-R coverage with high multi-phase temporal resolution for excellent visualization of myocardial wall motion.

iDrive Pro: iDrive Pro brings real-time interactive imaging to the MR system, making it easier to generate detailed diagnostic information on just about any anatomy, including organs that are subject to motion artifacts, such as spine, heart, diaphragm and GI tract. The iDrive Pro technique allows the user to change scan parameters on the fly, during scanning, to evaluate the results immediately.

SmartPrep: SmartPrep uses a special tracking pulse sequence to monitor the MR signal through a user-prescribed volume to detect the arrival of an injected contrast bolus and to trigger the acquisition when the contrast agent has arrived in the target tissue. Use of SmartPrep provides optimum timing of contrast enhancement.

EchoPlanar: EchoPlanar imaging enables rapid imaging required for such studies as functional brain mapping. Both EchoPlanar and FLAIR EchoPlanar techniques make it easier to generate neuro studies from patients who cannot or will not stay still long enough for conventional techniques.

Diffusion EchoPlanar Imaging: This Diffusion Weighted Single Shot Echo-Planar

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description

Imaging (EPI) technique is especially useful for detecting acute and hyper-acute stroke. Its functionality includes Single Shot EPI and FLAIR EPI, Multi-NEX capability, isotropic Diffusion-Weighting imaging and on-line image processing. To enhance body diffusion, Adiabatic SPectral Inversion Recovery (ASPIR) and STIR saturation techniques are supported.

Array Spatial Sensitivity Encoding Technique: ASSET imaging option is an image-based parallel imaging technique used to speed data acquisition. For temporally sensitive acquisitions, ASSET reduces image blurring and motion, enables greater anatomical coverage, and reduces SAR. Parallel imaging acceleration factors up to 3.0 are supported in one dimension depending on the coil selected.

Auto-Calibrating Reconstruction (ARC): Is a GE exclusive self-calibrated parallel imaging technique that eliminates breath-hold mismatch errors by imbedding the calibration data within the scan data. In addition, this unique reconstruction permits small FOV imaging by minimizing focal parallel imaging artifacts from the exam. Supporting both 1D and 2D acceleration, ARC supports high acceleration factors for reduced scan time.

Parallel imaging is supported across all anatomies with acceleration factors that are dependent on the phased-array coils utilized.

Automated 3D Distortion Correction: Included is automated 3D distortion correction software that corrects for spatial distortions induced by non-linearities in the gradient field. The process is completely automated and is imbedded with the MR data reconstruction process. It is compatible with 2D and 3D imaging acquisitions.

IVI: The Interactive Vascular Imaging (IVI) user interface allows operators to quickly remove background from MRA images in order to generate angiographic and maximum intensity projections (MIP) in multiple scan planes.

Multi-Projection Volume Reconstruction (MPVR): MPVR provides quick and easy generation of reformations through any 3D MR data sets.

FuncTool Performance: This package enables advanced MR-image post-processing using a wide range of sophisticated algorithms, including eADC maps, correlation coefficients for mapping of motor strip and visual/auditory stimuli, NEI (Negative Enhancement Integral), MTE (mean time to enhance), Positive Enhancement Integral, Signal Enhancement Ratio, Maximum Slope Increase, Maximum Difference Function, Diffusion Tensor Post-Processing, (requires DTI option), 3D CSI Post Processing.

MR Pasting: Combine images from separate acquisitions into a single series with MR Pasting. MR Pasting is an image analysis software package that facilitates the display and filming of multiple station MR data sets in body applications (total spine, total body), as well as peripheral MR angiography data. MR Pasting will automatically

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description
			register and combine multiple acquisition stations into a single image of covered anatomy.
			BrainSTAT software for time course analysis: The BrainSTAT post-processing application automatically generates parametric maps for neuro Blood Flow, Blood Volume, Mean Transit Time, and Time to Peak signal intensity. A Gamma Variant fitting algorithm is used to automatically estimate the arterial input function, then calculate the quantitative values for the four parametric maps.
			R2* Tool: Generate quantitative relaxation maps with the R2 Star (R2*) analysis tools in Functool. With the Express Exam workflow, this feature can automatically generate R2* maps (in units of Hz) and T2* maps (in units of milliseconds) after the multi-echo data has been acquired.
			Also included is the host computer, keyboard, mouse, monitor, and a quadrature transmit/receive RF head coil.
2	1	M7000ZR	Optima MR450w with GEM Magnet Design

Optima MR450w with GEM Magnet Design

To improve the patient experience and provide high image quality, no other component of an MRI system has greater impact than the magnet. The Optima MR450w system features a short, wide bore magnet that delivers a large field of view. The magnet geometry has been optimized to reduce patient anxiety by providing more space in the bore and more exams with the patient's head outside of the magnet. The 50cm field of view provides uniform image quality and can reduce exam times since fewer acquisitions may be necessary to cover large areas of anatomy. Complemented by GE's active shielding technology, the Optima MR450w has very flexible installation specifications to provide easy siting. And with zero-boil-off magnet technology, helium refills are effectively eliminated, thus reducing operating costs and maximizing uptime.

Magnet:

- Manufactured by GE Healthcare.
- Operating field strength 1.5T (63.86 MHz).
- Active magnet shielding.
- Zero boil-off Cryogens.
- Magnet length 145cm.
- Patient Aperture 76 cm.
- Patient Bore Diameter 70cm.
- Patient Bore Length 105cm.
- Maximum Field of View 50 cm x 50 cm x 50 cm.

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description
			Magnet Homogeneity: Typical ppm and Guaranteed ppm shown. • 10cm DSV 0.007 and 0.02. • 20cm DSV 0.035 and 0.06. • 30cm DSV 0.11 and 0.18. • 40cm DSV 0.5 and 0.7. • 45cm DSV 1.2 and 1.6. • 50x50x45cm 2.3 and 3.6. • 50cm DSV 3.3. DSV = Diameter Spherical Volume. Homogeneity for an elliptical volume of 50cm (x,y) by 45cm (z) dimension volume is shown for reference. Fringe field (axial x radial): • 5 Gauss = 4.0 m x 2.5 m. • 1 Gauss = 6.2 m x 3.7 m. Quiet Technology: GE has implemented Quiet Technology on critical components of the Optima MR system to reduce acoustic noise and improve the patient environment. This technology enables full use of the eXtreme Gradient Platform for excellent image quality, while maintaining a safe environment for the patient. The technology encompasses the gradient coil, RF body coil, and magnet mounting.
3	1	S4500WL	Optima MR450w Preinstallation Collector Optima MR450w Preinstallation Collector The Preinstallation Collector delivers to the site in advance of the magnet and main electronic components. This facilitates the later delivery and installation of supporting electronics. The following are the main components in the Preinstallation collector: • Heat exchange cabinet for distribution of chilled water. • Primary Penetration wall panel for support of the penetration cabinet. • Secondary Penetration wall panel for support of gradient filters, helium cables, and chilled air and water. • Helium cryocooler hose kit. • Cabinet Dollies are provided to install the System Cabinets. Dollies remain the property of GE to be returned after cabinets are in place at customer site.
4	1	M7000ZP	MR450w Dock and 32-Channel Switch Collector MR450w Dock and 32-Channel Switch Collector The MR450w Dock and 32-Channel Switch collector provides the interface between the magnet and GEM Express Patient Table with IntelliTouch. Also included is the RF signal switching hardware that routes the input signals to the respective OpTix

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description
			receivers.
5	1	S4500WH	Optima MR450w Cable Configuration - A Optima MR450w Cable Configuration - A To accommodate various electronic and scan room configurations and sizes, the MR450w has preset lengths of cables and connector kits to speed system installation. This cable collection is compatible with fixed and relocatable building configurations.
6	1	M1060MA	Vibroacoustic Damping Kit Vibroacoustic Damping Kit Material in the Vibroacoustic Damping Kit can significantly attenuate the transmission of gradient-generated acoustic noise through the building structure to nearby areas, including adjacent rooms and floors above or below the MR suite. If this kit is applied during the installation of a new magnet, no additional service charges are necessary. However, installation of the Vibroacoustic Damping kit under an existing magnet requires special steps. The steps to prepare the site and steps to install, such as modifications to the RF screen room, and other magnet rigging, modifications to the RF screen room, and other finishing work, are not covered in the pricing.
7	1	M7000WL	MR450/MR750 Main Disconnect Panel MR450/MR750 Main Disconnect Panel The Main Disconnect Panel safeguards the MR system's critical electrical components, by providing complete power distribution and emergency-off control.
8	1	M1000LH	MR Safety Warning Kit - English MR Safety Warning Kit - English Maintaining awareness around both patient and personnel safety is of paramount concern. This versatile kit contains signage in the English language that can be posted around the MR suite to heighten awareness of a high field MR system and the special precautions that ensure the safety of patients, technologists, and other people who come into close proximity with the MR system.
9	1	M3335JZ	English Keyboard English Keyboard Required for our operator console. This keyboard is ergonomically designed to keep your staff comfortable even through the longest shifts. The scan control keyboard assembly has an intercom speaker, microphone, volume controls and emergency

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description
			stop switch.
10	1	M7000ZT	Cable Concealment Kit - MR450w GEM, MR750w, MR750w GEM Cable Concealment Kit - MR450w GEM, MR750w, MR750w GEM The Cable Concealment Kit option accommodates a wide-range of scan room ceiling heights and is designed to provide a clean-look installation by concealing the overhead cabling from view.
11	1	M1000MW	Operator's Console Table Operator's Console Table Wide table designed specifically for the color LCD monitor and keyboard.
12	1	M3335CB	1.5T Calibration Phantom Kit 1.5T Calibration Phantom Kit This 1.5T calibration kit contains a large volume shim phantom, a daily quality assurance phantom, an echo-planar calibration phantom, and the associated loader shells.
13	1	M3335CA	Calibration Kit Phantom Holder Cart Calibration Kit Phantom Holder Cart
14	1	M7000CT	Diffusion Tensor Imaging Diffusion Tensor Imaging Diffusion Tensor imaging (DTI) creates contrast based on the degree of diffusion anisotropy in cerebral tissues such as white matter. The DTI method expands Echo planar imaging capability to include diffusion imaging sequence using motion sensing gradient pulses along 6 to 155 orientations in order to generate tensor component images. With the Signa MR750 Express Workflow, fractional anisotropy (FA) and Volume Ratio Anisotropy (VRA) maps may be automatically created after image acquisition without any user intervention. With the DTI data, the separate FiberTrak post processing utility generates eigen-vector information from the diffusion tensor acquisition and processed datasets. Using a robust and efficient seeding process, three dimensional renderings of the diffusion along white matter tracts are generated.
15	1	M7000CW	FiberTrak FiberTrak

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description
			White matter tracts and tissues with high fractional anisotropy are easily displayed and visualized in the 3D Volume Viewer with FiberTrak. This host computer post processing tool expands the capability of Diffusion Tensor imaging by generation of 2D color orientation maps, 2D eigenvector maps, and 3D tractography maps from the diffusion tensor image data. The resulting datasets may be easily saved and archived for later use.
16	1	M7000EJ	CartiGram T2 Cartilage Mapping CartiGram T2 Cartilage Mapping Cartigram is a non-invasive imaging method for early detection of osteoarthritis. It quantifies the T2 relaxation of knee cartilage and can overlay the quantified parametric maps over high resolution images for clear visualization of the anatomy. The imaging results are color mapped to indicate whether or not the cartilage structure is breaking down and, if so, to what extent. This information can be used to determine the best course of treatment for the individual patient. In addition, it can be used to monitor the cartilage post-treatment, obviating the need for follow-up arthroscopic surgeries or biopsies.
17	1	M7000LK	MR450w GEM Suite - Core Components MR450w GEM Suite - Core Components The Geometry Embracing Method (GEM) Suite of surface coils and accessories improves image quality and patient comfort while simplifying workflow for the operator. The GEM design ensures that the geometry of the surface coil matches the geometry of the patient. By matching size and shape of the coil with the size and shape of the patient, the GEM Suite embraces the natural shape of the anatomy thus improving image quality and patient comfort. In addition, the GEM Suite is fully integrated into the Express Patient Table and provides a simple method for the operator to prepare each patient with minimal effort and maximum productivity. The core components of the GEM Suite include the fully integrated Posterior Array, the Head and Neck Unit, and the Large Anterior Array. Each component of the GEM Suite may be used individually or combined together to increase anatomical coverage. The GEM Suite of surface coils is used with the fully detachable GEM Express Patient Table. This combination of technologies can dramatically simplify technologist and radiographer workflow and enables the patient to be positioned head-first or feet-first for all exams. GEM Posterior Array: The GEM Posterior Array (PA) is designed to provide optimum element geometry for each targeted anatomy. Unlike matrix arrays that use the exact same coil element size and shape for all anatomy, the GEM PA uses different element

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description

geometries for the cervical-to-thoracic spine transition, thoracic and lumbar spine, and body and cardiac anatomy. This approach maximizes signal-to-noise by matching the size and shape of the coil elements to the size and shape of the targeted anatomy. Four different sizes and shapes of elements are used throughout the design, and parallel imaging is supported in all three planes.

The GEM PA is symmetrically positioned within the patient cradle and is fixed in location. This design enables all components of the GEM Suite to support either head-first or feet-first patient orientation to support either patient preference.

The GEM PA is invisible to additional surface coils when they are placed directly on top of the surface. Unique electronic decoupling circuits ensures there is no electrical interference between surface coils. This feature is critically important for patient and operator workflow and enables the PA to be stationary for all exams, including breast and musculoskeletal exams where dedicated coils are typically used for these anatomies.

PA Coil Specifications:

- S/I Coverage: 100cm.
- Head or Feet-first imaging.
- Elements: 40.

The GEM PA Array is designed to be used in conjunction with the GEM Head and Neck Unit, the Large Anterior Array, the Small Anterior Array (purchased separately) and the GEM Peripheral Vascular Array (purchased separately). In addition, the PA may co-reside with a suite of flexible coils or dedicated anatomy-specific coils (each purchased separately). Additional GE PA coils may be purchased for use in additional patient tables.

GEM Head and Neck Unit and Comfort Tilt: The GEM Head and Neck Unit (HNU) is a standard component of the GEM Suite. The HNU consists of four imaging components, a HNU Base Plate and three anatomy-optimized anterior components. The inclusion of separate anterior components ensure that the geometry of the surface coil matches the geometry of the patient to improve both image quality and patient comfort. The three anterior components are the Neuro Vascular Array, a dedicated Cervical Array, and the Open Face Adapter.

The HNU Base Plate supports the patient's head and includes three rows of elements separated in both the superior/inferior and right/left dimensions. Any of the three separate anterior arrays may be connected to the Base Plate.

The Comfort Tilt is a variable-degree ramp that may be positioned under the HNU. The Comfort Tilt can elevate the superior end of the coil to match the curvature of the patient's head and thoracic spine angulations. The operator may easily adjust the

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description

angle of tilt with a single motion.

The HNU Base Plate, Comfort Tilt, and any of the anterior components may be positioned at either end of the GEM Express Patient Table to support head-first or feet-first imaging. The HNU Base plate may remain in place for all body, vascular, spine, and the majority of musculoskeletal exams for either patient orientation.

GEM Head and Neck Unit Coil Specifications:

- Length: 49.5 cm (19.5 in).
- Width: 38.8 cm (15.3 in).
- Height: 36.8 cm (14.5 in).
- Height: 33.6cm (13.2in) with Cervical Array.
- Height: 25.7cm (10.1in) with Open Face Adapter.
- Weight: 8.8kg (19.4 lb).
- S/I Coverage: 42 cm.
- R/L Coverage: 50 cm.
- Head or feet-first imaging.
- Elements: up to 28 elements in the Field of View.

GEM Anterior Array: The GEM Anterior Array (AA) is a standard component of the GEM Suite that facilitates chest, abdomen, pelvis, and cardiac imaging. The GEM AA is lightweight, flexible, thin, and pre formed to conform to the patient's size and shape. With 54 cm of S/I coverage, the coil permits upper abdominal and pelvic imaging without repositioning the patient.

GEM Anterior Array Specifications:

- Length: 56.2 cm (22.1 in).
- Width: 69.8 cm (27.5 in).
- Height: 4.4 cm (1.7 in).
- Weight: 2.4 kg (5.3 lb) resting on patient.
- Weight: 3.6 kg (7.9 lb) with cable.
- S/I Coverage: 54 cm.
- Head or feet-first imaging.
- Elements: up to 36 elements in the field of view when used with the GEM Posterior Array.

18	1	M7000FY	MR450w GEM Small Anterior Array

MR450w 1.5T GEM Small Anterior Array

The GEM Small Anterior Array is a receive-only, high-density RF coil designed to

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description
			produce images with optimal signal to noise ratio and uniform coverage for cardiovascular, pulmonary, renal, and abdominal imaging. The light-weight coil design contains 16 channels, with parallel imaging capability in all three dimensions to speed up high-resolution, breath-held, and free breathing cardiovascular exams. The Small dimension of the coil and coil elements provide optimal specifications: • Length: 45 cm (17.7 in). • Width: 40.5 cm (15.9 in). • Height: 4.5 cm (1.8 in). • Weight: 2.94 kg (6.5 lbs). • S/I Coverage: 27 cm (10.6 in). • R/L Coverage: 35 cm (13.8 in). • Head-first or feet-first imaging. • Up to 33 elements in the FOV, when combined with the GEM PA.
19	1	M7000FW	MR450w GEM Wrist Array MR450w GEM Wrist Array The 8-Channel Wrist Array generates high definition images of the hand and wrist. The one-piece, ovoid, hinged design is optimal for small-FOV imaging and provides 12-cm S/I coverage. The coil can be positioned overhead or at the patient's side in either a vertical or horizontal orientation. The array is compatible with PURE processing for uniform signal intensity, and ASSET and ARC parallel imaging methods for accelerated acquisition speed. This coil is designed for GE and is only compatible with the Optima MR450w with GEM system and GEM Express Patient Table.
20	1	M7000AT	1.5T 3-Channel Shoulder Array - GE Coils 1.5T 3-Channel Shoulder Array - GE Coils The 1.5T 3-channel Shoulder Array offers the increased signal-to-noise characteristic of phased-array technology, along with a unique sleeve design that delivers exceptional joint-imaging capabilities. The coil provides clear definition of the shoulder joint, specifically the head of the humerus, clavicle, acromion, supraspinatus muscle and ligaments. Patient comfort pads and restraining straps are included.
21	1	M7000FS	MR450w GEM T/R Knee Array MR450w GEM T/R Knee Array The 1.5T Transmit and Receive Knee Array is designed for high definition imaging of

Item No.	Qty	Catalog No.	Description
			the knee. This array uses unique hybrid technology where separate birdcage coils are used for RF transmission and excitation, and independent receive elements. Designed uniquely for GE. The array is compatible with PURE for uniform signal intensity, and ASSET and ARC parallel imaging method for accelerated acquisition speed. This coil is only compatible with the Optima MR450w with GEM system and GEM Express Patient Table.
22	1	M7000FT	MR450w GEM Lower Extremity Coil MR450w GEM Lower Extremity Coil The combined transmit and receive design of the Extremity Coil helps ensure optimal results in studies of the knee, ankle and foot. Its unique anterior extension increases the imaging volume for thorough evaluations in dorsi-flexed foot and ankle studies, covering fields of view up to 30 cm for the foot and ankle, and up to 20 cm for the knee. This coil is designed for GE and is only compatible with the Optima MR450w with GEM system and GEM Express Patient Table.
23	1	M3340CD	1.5T 8-Channel Foot / Ankle Coil - Invivo 1.5T 8-Channel Foot / Ankle Coil - Invivo The 1.5T compatible foot / ankle coil produces high-resolution images of the foot and ankle by incorporating an 8-channel phased array design in a unique "ski" boot design. The unique coil design has excellent distal coverage and supports multiple foot positions for optimizing studies. Parallel imaging is supported to reduce acquisition times.
24	1	M1085GF	1.5T General Purpose Flex Coil 1.5T General Purpose Flex Coil This coil can be used to optimize imaging of irregular anatomy such as the neck, shoulder, elbow, brachial plexus, hip, thigh, knee, ankle, and foot, and to facilitate dynamic joint imaging. Its generous sensitive volume helps ensure uniform signal intensity, and therefore superior soft-tissue imaging throughout the area of interest.
25	1	M7000EP	1.5T GP Flex Coil Adaptor for MR450/MR450w 1.5T GP Flex Coil Adaptor for MR450/MR450w This adaptor provides the necessary interface between the general-purpose flex coil and the MR450 and MR450w system.

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description
26	1	E8823M	Magnacoustics Genesis Ultra Music System for MR Magnacoustics Genesis ULTRA Communication & Music System The Magnacoustics Genesis ULTRA is the only MRI Communication & Music System to interface directly with GE's MRI hardware and software. This allows software driven Auto Voice Commands from GE's computer to be delivered directly into the patient's ears for breath-hold sequences. This same interface allows the Technologist to talk directly to the patient through the console Mic even while the scan is in progress. The Genesis ULTRA also features an exclusive Patient Ready Signal. By simply depressing a small button on the handheld control an audible and visual signal is transmitted to the Technologist indicating the patient's readiness for the scan to begin. This simple step streamlines the breath-hold exam which amounts to approximately 30% of all exams. Patient Handheld Volume and Media Selection Controls with Voice Feedback interface with an FM/AM stereo, CD player, and iPod interface. This distracts even the most apprehensive of your patients by allowing them to be in control of their own environment. Additionally, the Auto Gain feature automatically raises and lowers the volume level for the patient based on the Sound Pressure Level of the MRI. Magnacoustics also provides the only patented 8-driver transducer that provides the highest sound directly to the patients ears with the MagnaLink Headset System. This patented system includes a stethoscope-style headset with the MagnaPlug (replaceable earplug) that provides 29dB of attenuation and complies with GE Healthcare MR Safety Guide Operator Manual. The Genesis ULTRA's See-In-the-Dark GUI Electroluminescent Backlit Technologist Control Unit enhances operation in the normally low-lit MRI environment allowing the Technologist to operate the entire system with the touch of a button. The Genesis ULTRA includes an integral interface for fMRI with built-in input for audio stimulation and output for responses...E
27	1	E8823ML	MagnaLink Headset - Stethoscope-Style MagnaLink Headset - Stethoscope-Style MagnaLink Headset, Stethoscope-style headset to be used with the MagnaPlug, which fits any Magnacoustics Communications/Music System. Complies with the GE Healthcare MR Safety Guide Operator Manual, Rev 7.
28	1	E8823MP	MagnaPlug Earplugs for MagnaLink Headset MagnaPlug Earplug for MagnaLink Headset Standard Size Earplug (E8823ML) MagnaPlug - Earplug to be used with the MagnaLink Headset, which provides the patient with 29dB (NRR) or better attenuation tested per ANSI standard. Complies with

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Quotation Number: P7-C146605 V 2

Item No.	Qty	Catalog No.	Description
			the GE Healthcare MR Safety Guide Operator Manual, Rev 7. 500 Pairs per bag
29	1	E8803BE	Physician's Chair with Padded Arms Physician's Chair with Padded Arms Physician's chair has padded arms for comfort and comes in a charcoal gray color that blends with any environment. Chair adjusts from 16.75 in. to 21 in. (42.5 cm x 53.3cm) and is only for use in the MR Control Room. Weighs 45 lbs.
30	1	W0106MR	TiP Discovery and Optima Family Training 10 Days Onsite Plus 10 Hrs TVA TiP Discovery and Optima Family Training 10 Days Onsite Plus 10 Hrs TVA The TiP Training Choices program is designed for CURRENT GE customers WITHOUT HDx experience who purchase a Discovery or Optima system. Training is delivered onsite at the customer's facility and instructs students in start-up operation of the system and introduces participants to the system design, workflow, new options and clinical applications included. Extended TVA support ensures learners maintain performance over the long term. This training program must be scheduled and completed within 36 months after the date of product delivery.
31	1	W1119HC	TiP Tuition Only Optima MR450w Session One TiP Tuition Only Optima MR450w Session One The Optima MR450w 1.5T Session One-introduces the Optima MR450w 1.5T system and instructs participants in user interface functionality, new scanning workflow, protocol building, linking with post processing applications and basic scanning applications. Headquarters classes are delivered in the Milwaukee, WI area and do not include travel or living expenses. This training program must be scheduled and completed within 24 months afte the date of product delivery.
32	1	W1120HC	TiP Tuition Only Optima MR450w Session Two TiP Tuition Only Optima MR450w Session Two The Optima MR450w 1.5T - Session Two- introduces participants to intermediate and advanced applications and new features/options available on the Optima MR450w 1.5T system. Primary focus of session two is the building of strong clinical scanning skills. Students will be asked to participate in a wide variety of hands-on scanning exercises to support desired skill development. Headquarters classes are delivered in the Milwaukee, WI area and do not include

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Item No.	Qty	Catalog No.	Description
			travel or living expenses. This training program must be scheduled and completed within 24 months after the date of product delivery.

Quote Summary:

Total Quote Net Selling Price **$1,800,000.00**

(Quoted prices do not reflect state and local taxes if applicable)

Budgetary Quote

If you would like to place an order for this equipment, a formal contract document will be prepared for your consideration. This quote is for budgetary use only; only a GE contract can become a binding order.

PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

Hospital for Special Surgery
Connecticut Certificate of Need Application
Acquisition and Installation of an MRI at 1 Blachley Rd., Stamford
Attachment IX – Description of Proposed Building Work

HSS will be renovating approximately 18,000 square feet being leased at the above location in accordance with the attached drawing at a total cost of approximately $9 million. Approximately 2,100 square feet of the total will be renovated to accommodate the proposed MRI unit at a cost of approximately $1.5 million. The remaining space will be renovated to accommodate MD office and exam space, diagnostic x-ray facilities, a fluoroscopic guidance imaging facility and conference and waiting space. Also included in the total cost of renovation/construction is site work to improve access to the space in order to meet ADA requirements. Design and renovation work will be performed by licensed professionals under the supervision of a construction management company. When completed, the space will meet all applicable local, state and federal regulations and codes. Renovations will commence approximately 30 days after approval of this CON application and take approximately 6 months to complete. Operations at the site will commence approximately 30 to 60 days after substantial completion of renovations and issuance of all required approvals.

Perkins Eastman
422 SUMMER STREET
STAMFORD, CT 06901
T. 203.251.7400
F. 203.251.7474

1 OF 11
SCALE: 1/16" = 1'-0"

OPTION B2 FLOOR PLAN

HSS: Stamford Site
Stamford, CT
06/27/2012

HOSPITAL FOR SPECIAL SURGERY

12. C (i). Please provide one year of actual results and three years of projections of **Total Facility** revenue, expense and volume statistics without, incremental to and with the CON proposal in the following reporting format:

($ in 000's):	**FY 2011**	**FY 2014**			**FY 2015**			**FY 2016**		
Description	**Actual Results**	**Projected W/out CON**	**Projected CON**	**Projected With CON**	**Projected W/out CON**	**Projected CON**	**Projected With CON**	**Projected W/out CON**	**Projected CON**	**Projected With CON**
NET PATIENT REVENUE										
Non-Government	$421,700	$463,449	$1,934	$465,383	$488,294	$2,329	$490,623	$514,834	$2,398	$517,232
Medicare	$127,402	$193,378	$176	$193,554	$207,045	$207	$207,252	$221,710	$209	$221,919
Medicaid and Other Medical Assistance	$10,092	$10,659	$15	$10,674	$11,287	$18	$11,305	$11,955	$18	$11,973
Other Government	$17,096	$41,933	$51	$41,984	$44,405	$60	$44,465	$47,032	$61	$47,093
Total Net Patient Revenue	$576,290	$709,419	$2,176	$711,595	$751,031	$2,614	$753,645	$795,531	$2,686	$798,217
Other Operating Revenue (1)	$118,081	$145,805		$145,805	$154,755		$154,755	$164,254		$164,254
Revenue from Operations	$694,371	$855,224	$2,176	$857,400	$905,786	$2,614	$908,400	$959,785	$2,686	$962,471
OPERATING EXPENSES										
Salaries and Fringe Benefits	$356,065	$434,569	$263	$434,832	$457,809	$272	$458,081	$482,292	$281	$482,573
Professional / Contracted Services	$42,114	$57,908	$4	$57,912	$62,100	$5	$62,105	$66,596	$6	$66,602
Supplies and Drugs	$114,115	$156,890	$33	$156,923	$168,245	$40	$168,285	$180,428	$42	$180,470
Bad Debts	$2,654	$3,250	$27	$3,277	$3,439	$32	$3,471	$3,643	$33	$3,676
Other Operating Expense	$62,067	$85,287	$63	$85,350	$91,369	$161	$91,530	$97,987	$170	$98,157
Subtotal	$577,015	$737,904	$390	$738,294	$782,962	$510	$783,472	$830,946	$532	$831,478
Depreciation/Amortization	$38,458	$49,763	$405	$50,168	$53,009	$405	$53,414	$56,465	$405	$56,870
Interest Expense	$10,051	$10,685	$0	$10,685	$10,193	$0	$10,193	$9,724	$0	$9,724
Lease Expense	$26,245	$33,558	$40	$33,598	$35,734	$40	$35,774	$38,050	$41	$38,091
Total Operating Expense	$651,769	$831,910	$835	$832,745	$881,898	$955	$882,853	$935,185	$978	$936,163
Gain/(Loss) from Operations	$42,602	$23,314	$1,341	$24,655	$23,888	$1,659	$25,547	$24,600	$1,708	$26,308
Plus: Non-Operating Revenue										
Revenue Over/(Under) Expense	$42,602	$23,314	$1,341	$24,655	$23,888	$1,659	$25,547	$24,600	$1,708	$26,308
FTEs	3,467	3,975	3	3,978	4,125	3	4,128	4,275	3	4,278

(1) Includes income from investments and net assets released from restrictions for operations and research opertations.

*Volume Statistics:
Provide projected inpatient and/or outpatient statistics for any new services and provide actual and projected inpatient and/or outpatient statistics for any existing services which will change due to the proposal.

12.C(ii). Please provide **three** years of projections of incremental revenue, expense and volume statistics **attributable to the proposal** in the following reporting format:

Type of Service Description	**MRI**
Type of Unit Description:	**MRI Scan**
# of Months in Operation	12

FY 2014	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FY Projected Incremental		Rate	Units	Gross	Allowances/	Charity	Bad	Net	Operating	Gain/(Loss)
Total Incremental Expenses:	**$808,418**			Revenue	Deductions	Care	Debt	Revenue	Expenses	from Operations
				Col. 2 * Col. 3				Col.4 - Col.5	Col. 1 Total *	Col. 8 - Col. 9
Total Facility by Payer Category:								-Col.6 - Col.7	Col. 4 / Col. 4 Total	
Medicare		$3,129	394	$1,232,826	$1,052,942	$3,459	$3,459	$172,966	$146,444	$26,522
Medicaid		$3,129	46	$143,934	$127,938	$592	$592	$14,812	$17,098	($2,286)
CHAMPUS/TriCare		$3,129	80	$250,320	$198,486	$997	$997	$49,840	$29,735	$20,105
Total Governmental		$3,129	520	$1,627,080	$1,379,366	$5,048	$5,048	$237,618	$193,277	$44,341
Commericial Insurers		$3,129	1,625	$5,084,625	$3,196,732	$18,509	$18,509	$1,850,875	$603,990	$1,246,885
Uninsured		$3,129	30	$93,870	$26,120	$3,080	$3,080	$61,590	$11,151	$50,439
Total NonGovernment		$3,129	1,655	$5,178,495	$3,222,852	$21,589	$21,589	$1,912,465	$615,141	$1,297,324
Total All Payers		$3,129	2,175	$6,805,575	$4,602,218	$26,637	$26,637	$2,150,083	$808,418	$1,341,665

# of Months in Operation	12

FY 2015	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FY Projected Incremental		Rate	Units	Gross	Allowances/	Charity	Bad	Net	Operating	Gain/(Loss)
Total Incremental Expenses:	**$924,138**			Revenue	Deductions	Care	Debt	Revenue	Expenses	from Operations
				Col. 2 * Col. 3				Col.4 - Col.5	Col. 1 Total *	Col. 8 - Col. 9
Total Facility by Payer Category:								-Col.6 - Col.7	Col. 4 / Col. 4 Total	
Medicare		$3,254	459	$1,493,586	$1,282,115	$4,067	$4,067	$203,337	$167,000	$36,337
Medicaid		$3,254	53	$172,462	$153,859	$689	$689	$17,225	$19,283	($2,058)
CHAMPUS/TriCare		$3,254	94	$305,876	$244,384	$1,183	$1,183	$59,126	$34,200	$24,926
Total Governmental		$3,254	606	$1,971,924	$1,680,358	$5,939	$5,939	$279,688	$220,483	$59,205
Commericial Insurers		$3,254	1,898	$6,176,092	$3,905,210	$22,264	$22,264	$2,226,354	$690,557	$1,535,797
Uninsured		$3,254	36	$117,144	$33,390	$3,807	$3,807	$76,140	$13,098	$63,042
Total NonGovernment		$3,254	1,934	$6,293,236	$3,938,600	$26,071	$26,071	$2,302,494	$703,655	$1,598,839
Total All Payers		$3,254	2,540	$8,265,160	$5,618,958	$32,010	$32,010	$2,582,182	$924,138	$1,658,044

FY 2016	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FY Projected Incremental		Rate	Units	Gross	Allowances/	Charity	Bad	Net	Operating	Gain/(Loss)
Total Incremental Expenses:	**$945,197**			Revenue	Deductions	Care	Debt	Revenue	Expenses	from Operations
				Col. 2 * Col. 3				Col.4 - Col.5	Col. 1 Total *	Col. 8 - Col. 9
Total Facility by Payer Category:								-Col.6 - Col.7	Col. 4 / Col. 4 Total	
Medicare		$3,384	459	$1,553,256	$1,339,877	$4,103	$4,103	$205,173	$170,805	$34,368
Medicaid		$3,384	53	$179,352	$160,578	$695	$695	$17,384	$19,723	($2,339)
CHAMPUS/TriCare		$3,384	94	$318,096	$256,018	$1,194	$1,194	$59,690	$34,980	$24,710
Total Governmental		$3,384	606	$2,050,704	$1,756,473	$5,992	$5,992	$282,247	$225,508	$56,739
Commericial Insurers		$3,384	1,898	$6,422,832	$4,084,192	$22,928	$22,928	$2,292,784	$706,293	$1,586,491
Uninsured		$3,384	36	$121,824	$35,576	$3,920	$3,920	$78,408	$13,396	$65,012
Total NonGovernment		$3,384	1,934	$6,544,656	$4,119,768	$26,848	$26,848	$2,371,192	$719,689	$1,651,503
Total All Payers		$3,384	2,540	$8,595,360	$5,876,241	$32,840	$32,840	$2,653,439	$945,197	$1,708,242

Hospital for Special Surgery
Stamford MRI Acquisition
Financial Attachments I & II – Assumptions

I. Total Facility Projections – The Total Facility Projections reflected on Financial Attachment I are based on HSS's five year financial forecast prepared in September 2011. The forecasts considered volume, payer mix and payment rate trends as well as the impacts of proposed regulatory reforms, capacity constraints, and anticipated capital initiatives.

a. Net Patient Revenue

i. Volume – Overall volume growth is projected at approximately 4% per year. Growth projections consider historical HSS trends as well as market trends, market saturation and healthcare reform impacts.
ii. Payer Mix – Payer mix is forecasted to remain relatively consistent throughout the forecast period with slight shifts to Medicare due to the aging population.
iii. Rates – Average annual reimbursement rate increases are forecasted at 2-3%.

b. Operating Expenses – In addition to inflationary increases, forecasted operating expenses consider cost of expansion required to meet anticipated growth and costs associated with initiatives to continue to meet regulatory requirements and improve organizational efficiency and effectiveness.

i. Salaries & Fringe Benefits – Salary forecasts reflect annual cost of living increases of 3%, provisions for market and other salary adjustments, anticipated physician recruitment, and additional FTEs to support growth and other strategic initiatives. Fringe benefit forecasts reflect increased salary expenses, as well as anticipated benefit premium increases and actuarially determined pension expense estimates.
ii. Other Non-Salary Expenses – Non-salary expense forecasts reflect anticipated inflationary increases for different categories of expenses, as well as the additional expenses to support growth and other strategic initiatives.

II. Projected CON

a. Net Patient Revenue

i. Volume –The Financial Attachments reflect the projected volume as detailed in Section 3.
ii. Payer Mix – Payer mix is assumed to be consistent with HSS's current payer mix for MRI services as detailed in section 6.

iii. Rates – Payment rates are projected based on HSS's current rates adjusted to reflect anticipated changes in managed care rates for MRI services provided outside of HSS's main campus.

b. Operating Expenses – Operating expenses include rent, depreciation, facility, supply and staffing costs needed to operate the MRI unit and support the forecasted volumes. Details are as follows:

	2014	**2015**	**2016**
Salaries & Benefits	$262,600	$271,791	$281,303
Supplies & Other Expenses	36,975	45,339	47,606
Housekeeping	27,300	28,665	30,098
Laundry	3,000	3,150	3,308
Utilities	33,000	34,650	36,383
Maintenance Contract	-	95,000	99,750
Rent	40,194	40,194	41,400
Depreciation	405,349	405,349	405,349
Total	$808,418	$924,138	$945,197

RECEIVED
AUG 16 2012
OFFICE OF HEALTH CARE ACCESS

Jeffrey R. Immelt
Chairman & CEO

3135 Easton Turnpike
Fairfield, CT 06828
USA

T +1 203 373 3367
F +1 203 373 2225
jri.immelt@ge.com

August 14, 2012

Ms. Lisa A. Davis
Deputy Commissioner
Connecticut Dept. of Public Health
Office of Health Care Access
410 Capitol Avenue
Hartford, CT 06134

Dear Commissioner Davis:

I am writing in support of Hospital for Special Surgery's application to expand the services it currently provides to the residents of Connecticut. HSS has a site in Greenwich with physician offices and X-ray, and is looking to transition this site to the new Chelsea Piers complex in Stamford.

Each year, I understand HSS performs over 3,300 MRIs at its main campus facility in New York City for Connecticut patients and residents living within 15 miles of Stamford. Having an MRI at the Chelsea Piers site is an essential service for HSS physicians who seek to provide the most convenient, efficient, and innovative care to their patients. Some of these patients will undoubtedly be GE employees who will benefit greatly from expanded local access afforded by the approval of an MRI in Stamford.

I strongly urge the Office of Health Care Access to approve HSS's proposal to install an MRI in Stamford and enable patients to receive the best possible care closer to home.

Thank you very much for your consideration.

Sincerely,

[signature]

cc: Louis A. Shapiro
President & CEO
Hospital for Special Surgery

RECEIVED
AUG 16 2012
Department of Public Health
Office of the Commissioner

Konrad R. Kruger
2 Seagate Road
Riverside, CT 06878

August 16, 2012

RECEIVED
AUG 20 2012
OFFICE OF
HEALTH CARE ACCESS

Lisa A. Davis
Deputy Commissioner
Connecticut Dept. of Public Health
Office of Health Care Access
410 Capitol Avenue
Hartford, CT 06134

Dear Commissioner Davis,

I am writing in support of Hospital of Special Surgery's application to expand the services it currently provides to the residents of Connecticut. HSS has a site in Greenwich with physician offices and X-ray and is looking to transition this site to the new Chelsea Piers complex in Stamford. At this time patients in need of magnetic resonance imagining services (MRIs) must travel to Manhattan.

Each year, HSS performs over 3,300 MRIs at its main campus facility in New York City for Connecticut patients and residents living within 15 miles of Stamford. Having an MRI at the Chelsea Piers site is an essential service for HSS physicians who seek to provide the most convenient, efficient, and innovative care to their patients.

I strongly urge the Office of Health Care Access to approve HSS's proposal to install an MRI in Stamford and enable patients to receive the best possible care closer to home.

Thank you very much for your consideration.

Sincerely,

Konrad R. Kruger

cc: Louis A. Shapiro
President & CEO, Hospital for Special Surgery

RECEIVED
AUG 20 2012
Department of Public Health
Office of the Commissioner

Arthur Levitt
43 Owenoke Park
Westport, Connecticut 06880

August 16, 2012

Lisa A. Davis
Deputy Commissioner
Connecticut Dept. of Public Health
Office of Health Care Access
410 Capitol Avenue
Hartford, CT 06134

Re: Hospital for Special Surgery MRI CON Application

Dear Commissioner Davis,

I am writing in support of Hospital for Special Surgery's application to expand the services it currently provides to the residents of Connecticut. HSS has a site in Greenwich with physician offices and X-ray and is looking to transition this site to the new Chelsea Piers complex in Stamford. At this time patients in need of magnetic resonance imaging services (MRIs) must travel into Manhattan.

Each year, HSS performs >3,300 MRIs at its main campus facility in New York City for Connecticut patients and residents living within 15 miles of Stamford. Having an MRI at the Chelsea Piers site is an essential service for HSS physicians who seek to provide the most convenient, efficient, and innovative care to their patients.

I strongly urge the Office of Health Care Access to approve HSS's proposal to install an MRI in Stamford and enable patients to receive the best possible care closer to home. Thank you very much for your consideration.

Sincerely,

Arthur Levitt
HSS Supporter

F. D. Rich Company
222 Summer Street
Stamford, Connecticut 06901
(203) 359-2900
(203) 328-7980 (fax)
www.fdrich.com

August 23, 2012

Lisa A. Davis, Deputy Commissioner
Connecticut Department of Public Health
Office of Health Care Access
410 Capitol Avenue
Hartford, CT 06134

Dear Commissioner Davis:

I am writing this letter in support of Hospital for Special Surgery's application to expand the services it currently provides to the residents of Connecticut. HSS has a site in Greenwich with physician offices and X-ray and is looking to transition this site to the new Chelsea Piers complex in Stamford.

Each year, HSS performs over 3,300 MRIs at its main campus facility in New York City for Connecticut patients and residents living within 15 miles of Stamford. Having an MRI at the Chelsea Piers site is an essential service for HSS physicians who seek to provide the most convenient, efficient, and innovative care for their patients.

I strongly urge the Office of Health Care Access to provide HSS's proposal to install an MRI in Stamford and enable patients to receive the best possible care closer to home. Thank you very much for your consideration.

Sincerely,

Robert N. Rich
Chairman, Board of Directors

RNR:cf

cc: File

steven & alexandra cohen foundation

August 20, 2012

RECEIVED
AUG 28 2012
OFFICE OF HEALTH CARE ACCESS

Lisa A. Davis
Deputy Commissioner
Connecticut Dept. of Public Health
Office of Health Care Access
410 Capitol Avenue
Hartford, CT 06134

Dear Commissioner Davis,

On behalf of the Steven & Alexandra Cohen Foundation, I am writing in support of Hospital for Special Surgery's application to expand its services to the new Chelsea Piers complex in Stamford.

The installation of the MRI in Stamford would enable the local residents to receive treatment closer to home. Thank you in advance for your thoughtful consideration of Hospital for Special Surgery's application.

Sincerely,

Jeanne Melino

Jeanne Melino
Director of Philanthropy & Community Relations

cc: Louis A. Shapiro
President & CEO,
Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

RECEIVED
AUG 23 2012
Department of Public Health
Office of the Commissioner

P.O. Box 142 | Greenwich, CT 06836-0142 | t: 203-422-0185 | f: 203-595-6612 | cohenfoundation@sac.com

Anthony E. Malkin
107 Doubling Road
Greenwich, CT 06830

August 27, 2012

Lisa A. Davis
Deputy Commissioner
Connecticut Department of Public Health
Office of Health Care Access
410 Capitol Avenue
Hartford, CT 06134

Dear Commissioner Davis,

I am writing in support of Hospital for Special Surgery's application to expand the services it currently provides to the residents of Connecticut. HSS has a site in Greenwich with physician offices and X-ray and is looking to transition this site to the new Chelsea Piers complex in Stamford. At this time patients in need of magnetic resonance imaging services (MRIs) must travel into Manhattan.

Each year, HSS performs over 3,300 MRIs at its main campus facility in New York City for Connecticut patients and residents living within 15 miles of Stamford. Having an MRI at the Chelsea Piers site is an essential service for HSS physicians who seek to provide the most convenient, efficient, and innovative care to their patients.

I strongly urge the Office of Health Care Access to approve HSS's proposal to install an MRI in Stamford and enable patients to receive the best possible care closer to home. Thank you very much for your consideration.

Onward and upward.

Best regards,

cc: Louis A. Shapiro
President & CEO, Hospital for Special Surgery

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.
Commissioner

Dannel P. Malloy
Governor
Nancy Wyman
Lt. Governor

August 30, 2012

The Honorable Dan Fox
State Representative
State of Connecticut
General Assembly
State Capitol
Hartford, CT 06106-1591

Re: Certificate of Need
Hospital for Special Surgery, Docket Number: 12-31780-CON
Proposal for the Acquisition and Installation of an MRI in Stamford

Dear Representative Fox:

On August 29, 2012, the Department of Public Health ("DPH") received your letter concerning the Certificate of Need ("CON") for the proposal by the Hospital for Special Surgery for the acquisition and installation of an MRI in Stamford.

I welcome and appreciate your comments regarding this matter. I have forwarded your letter to DPH's Office of Health Care Access ("OHCA"). Your letter will be made part of OHCA's formal record of the CON application docket. Please be advised, once a decision has been rendered it will be posted and available on OHCA's website at http:// www.ct.gov/dph/ohca. Meanwhile, OHCA's website maintains status reports that you may review at your convenience.

If you have any further concerns or questions, please feel free to contact Kimberly Martone at (860) 418-7029.

Sincerely,

Lisa A. Davis

Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner

LAD:KRM:bko

Connecticut Department of Public Health

Phone: (860) 509-8000 • Fax: (860) 509-7184 • VP: (860) 899-1611
410 Capitol Avenue, P.O. Box 340308
Hartford, Connecticut 06134-0308
www.ct.gov/dph
Affirmative Action/Equal Opportunity Employer

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.
Commissioner

Dannel P. Malloy
Governor
Nancy Wyman
Lt. Governor

August 30, 2012

The Honorable Gerald Fox, III
State Representative
State of Connecticut
General Assembly
State Capitol
Hartford, CT 06106-1591

Re: Certificate of Need
Hospital for Special Surgery, Docket Number: 12-31780-CON
Proposal for the Acquisition and Installation of an MRI in Stamford

Dear Representative Fox:

On August 29, 2012, the Department of Public Health ("DPH") received your letter concerning the Certificate of Need ("CON") for the proposal by the Hospital for Special Surgery for the acquisition and installation of an MRI in Stamford.

I welcome and appreciate your comments regarding this matter. I have forwarded your letter to DPH's Office of Health Care Access ("OHCA"). Your letter will be made part of OHCA's formal record of the CON application docket. Please be advised, once a decision has been rendered it will be posted and available on OHCA's website at http:// www.ct.gov/dph/ohca. Meanwhile, OHCA's website maintains status reports that you may review at your convenience.

If you have any further concerns or questions, please feel free to contact Kimberly Martone at (860) 418-7029.

Sincerely,

Lisa A. Davis

Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner

LAD:KRM:bko

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.
Commissioner

Dannel P. Malloy
Governor
Nancy Wyman
Lt. Governor

August 30, 2012

The Honorable Carlo Leone
State Senator
State of Connecticut
General Assembly
State Capitol
Hartford, CT 06106-1591

Re: Certificate of Need
Hospital for Special Surgery, Docket Number: 12-31780-CON
Proposal for the Acquisition and Installation of an MRI in Stamford

Dear Senator Leone:

On August 29, 2012, the Department of Public Health ("DPH") received your letter concerning the Certificate of Need ("CON") for the proposal by the Hospital for Special Surgery for the acquisition and installation of an MRI in Stamford.

I welcome and appreciate your comments regarding this matter. I have forwarded your letter to DPH's Office of Health Care Access ("OHCA"). Your letter will be made part of OHCA's formal record of the CON application docket. Please be advised, once a decision has been rendered it will be posted and available on OHCA's website at http:// www.ct.gov/dph/ohca. Meanwhile, OHCA's website maintains status reports that you may review at your convenience.

If you have any further concerns or questions, please feel free to contact Kimberly Martone at (860) 418-7029.

Sincerely,

Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner

LAD:KRM:bko

State of Connecticut
GENERAL ASSEMBLY
STATE CAPITOL
HARTFORD, CONNECTICUT 06106-1591

August 27, 2012

Honorable Jewel Mullen, Commissioner
410 Capitol Avenue
Hartford, CT 06134

Dear Commissioner Mullen:

I am writing in support of the Hospital for Special Surgery (HSS) application, Docket No. 12-31780-CON.

As you may know, The Hospital for Special Surgery in New York City has a presence in Connecticut in Old Greenwich and they are looking to expand that operation to Stamford to better accommodate their patient population residing in our state and northern New York. An MRI machine is absolutely essential to this project.

The proposal is beneficial to Stamford and our community on many levels. It would significantly improve the efficiency and delivery of patient care, providing a higher quality health care, as well as greater access to health care. It would also create many construction jobs and in the long-term more employment opportunities in the medical field.

This is a wonderful opportunity for our community and I thank you in advance for your consideration of this important matter.

Sincerely,

Gerald Fox, III
State Representative, 146th District

Dan Fox
State Representative, 148th District

Carlo Leone
State Senator, 27th District

RECEIVED
AUG 29 2012

MICHAEL A. PAVIA
MAYOR
CITY OF STAMFORD, CONNECTICUT

TEL: 203 977 4150
FAX: 203 977 5845
E-MAIL: MPAVIA@CI.STAMFORD.CT.US

August 28, 2012

Lisa Davis, Deputy Commissioner
Connecticut Department of Public Health
Office of Health Care Access
410 Capitol Avenue
Hartford, CT 06134

Re: Hospital for Special Surgery MRI CON Application, DN 12-31780-CON

Dear Commissioner Davis:

As Mayor of the City of Stamford, I am writing in support of the application of the Hospital for Special Surgery ("HSS") to provide magnetic resonance imaging services at a proposed new location at Chelsea Piers in Stamford.

We are very excited that HSS, with its reputation as the leading Orthopedic Hospital in the country, wishes to locate here in Stamford.

A Stamford based HSS MRI will provide a measurable convenience to HSS patients from Connecticut who otherwise would have to go to New York for an HSS MRI. It will make Fairfield County an even more desirable place to live., a goal which is central to my administration.

Therefore, I support HSS's proposal to locate an MRI in Stamford, and urge approval of its application for a certificate of need.

Very truly yours,

Michael Pavia
Mayor

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.
Commissioner

Dannel P. Malloy
Governor
Nancy Wyman
Lt. Governor

September 5, 2012

The Honorable Michael Pavia
Mayor
City of Stamford
888 Washington Boulevard
P.O. Box 10152
Stamford, CT 06904-2152

Re: Certificate of Need
Hospital for Special Surgery, Docket Number: 12-31780-CON
Proposal for the Acquisition and Installation of an MRI in Stamford

Dear Mayor Pavia:

On August 31, 2012, the Department of Public Health ("DPH") received your letter concerning the Certificate of Need ("CON") for the proposal by the Hospital for Special Surgery for the acquisition and installation of an MRI in Stamford.

I welcome and appreciate your comments regarding this matter. I have forwarded your letter to DPH's Office of Health Care Access ("OHCA"). Your letter will be made part of OHCA's formal record of the CON application docket. Please be advised, once a decision has been rendered it will be posted and available on OHCA's website at http:// www.ct.gov/dph/ohca. Meanwhile, OHCA's website maintains status reports that you may review at your convenience.

If you have any further concerns or questions, please feel free to contact Kimberly Martone at (860) 418-7029.

Sincerely,

Lisa A Davis

Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner

LAD:KRM:bko

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

September 12, 2012

VIA FAX ONLY

Ms. Stacey L. Malakoff
Executive Vice President/CFO
Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

RE: Certificate of Need Application, Docket Number 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and installation of an MRI in Stamford

Dear Ms. Malakoff:

On August 13, 2012, the Office of Health Care Access ("OHCA") received your Certificate of Need application filed on behalf of the New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("HSS" or "Applicant"), for the acquisition and installation of an MRI in Stamford. OHCA has reviewed the CON application and requests the following additional information pursuant to General Statutes §19a-639a(c):

1. On page 7 of the CON application it states that HSS "developed proprietary new applications for MRI for musculoskeletal conditions, and is one of the world's leading institutions in musculoskeletal MRI innovations." In reference to above, identify or provide the following:
    a. Do these protocols require specialized equipment, software or patient positioning techniques to achieve the desired imaging results? If yes, please identify and describe.
    b. Do you have a patent, trademark or copyright for your proprietary MRI application? If so, please provide a copy.
    c. Can existing imaging facilities in Connecticut replicate your MRI protocols? If not, explain why.

2. Please provide evidence that the use of HSS proprietary MRI protocols result in better surgical outcomes.

3. Please provide a draft lease agreement for the proposed site of MRI installation. What is the length of time that the lease will be in effect?

4. On page 12 of the CON Application it states that "a key component to HSS's strategic plan is developing offsite locations to enable HSS patients in the applicable communities near the site to see their doctors and receive services closer to home." Does the Applicant have a Board-approved written strategic plan? If so, please provide OHCA all pages relevant to imaging services.

5. It appears that the majority of the letters of support submitted in the CON application are from non-medical providers. Please describe HSS's existing relationship with other providers in Connecticut who provide similar services.

6. Please expand Table 2a on page 27 to include all MRI scanners operated by the Applicant. Be sure to include historical, current year and projected scan volumes.

7. On page 20, the applicant states that "HSS is able to perform MRI scans on persons with pre-existing joint deformity as well as persons with orthopedic hardware. Some MRI sites decline such patients." Please describe why an MRI provider would decline to screen a patient with these conditions and provide a list of any known Connecticut MRI providers who follow this practice.

8. Please revise the "All of Connecticut & Westchester within 15 miles of Stamford" section of the table submitted on page 11 of the application. Include utilization volumes for Admissions, Ambulatory Surgery, and MRI Scans for 2007, 2008, 2009, 2010 and 2011 and 2012 to date. Provide the data in the following categories: Connecticut patients in the proposed service area (Stamford, Greenwich, New Canaan and Darien), Other Connecticut patients, and patients from Westchester within 15 miles of Stamford. Identify if the data submitted represent calendar or fiscal year.

9. On page 25, the applicant states that a small portion of MRI scans are performed at Connecticut MRI locations as a result of HSS-affiliated physician orders. For 2009, 2010 and 2011, provide the name of the Connecticut imaging facility and the number of scans completed as a result of MRI scans ordered by HSS-affiliated physicians.

10. Given that local referrals for MRI scans are currently being made, has consideration been given to contract services with these same Connecticut providers in lieu of purchasing a new MRI scanner? Describe if any alternative proposals to purchasing new equipment were evaluated.

11. On page 28, the applicant states that the physicians currently seeing patients at the Greenwich location will be relocating to the proposed Stamford location containing the MRI unit and that 16 of the 17 physicians work on a part-time basis. Will physician staffing patterns be similar at the new location?

12. On page 26, the applicant states that "the proposed service will not duplicate any MRI services currently provided in Connecticut." Please elaborate on how the purchase and installation of a new MRI machine in the proposed service area would avoid duplicating services, given the existing MRI providers in the proposed service area and throughout Connecticut.

13. Please provide the percentage of MRI scans that were ordered on the same day as the physician visit at the hospital's main campus for Connecticut patients in 2011 and 2012.

14. On page 337 of the CON application Charity Care and Bad Debt amounts appear to be the same. Please explain the reasoning for these projections. Provide a copy of the bad debt and charity care policy currently in place at HSS.

In responding to the questions contained in this letter, please repeat each question before providing your response. Paginate and date your response, i.e., each page in its entirety. Information filed after the initial CON application submission (i.e. completeness letter, late file submissions, and the like) must be numbered sequentially from the Applicant document preceding it. As the current submission for the application concludes with page 339, please begin with the completeness response with page 340. Reference Docket Number: 12-31780-CON and submit one (1) original and six (6) hard copies of your response in its entirety, including any supporting documentation. Submit a scanned copy of your response in Adobe format, an electronic copy in MS Word format and any worksheets in MS Excel, including all attachments, on CD.

Sincerely,

Brian A. Carney
Associate Research Analyst

Alla Veyberman
Health Care Analyst

Copy (faxed): Stacey L. Malakoff, Executive Vice President/CFO, Hospital for Special Surgery

```
*********************
***   TX REPORT   ***
*********************
```

TRANSMISSION OK

TX/RX NO	3051
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	09/12 09:18
TIME USE	00'46
PAGES SENT	4
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: **STACEY MALAKOFF**

FAX: **212.774.2620**

AGENCY: **HOSPITAL FOR SPECIAL SURGERY**

FROM: **OHCA**

DATE: **09/12/2012** **Time:**

NUMBER OF PAGES: **4**
(including transmittal sheet

Comments:

Completeness Letter
Docket Number: 12-31780-CON

PLEASE PHONE ***IF THERE ARE ANY***
TRANSMISSION PROBLEMS

WESTERN CONNECTICUT HEALTH NETWORK

DANBURY HOSPITAL

24 Hospital Ave
Danbury, CT 06810
203.739.4903
DanburyHosptial.org

From:	Sally Herlihy		
	Vice President, Planning		
To:	Kimberly Martone		
Fax:	860-418-7053	No. of Pages:	25
Phone:	860-418-7001	Date:	October 10, 2012
RE:	FBC CON Docket 12-31781-CON	CC:	

☐ Urgent ☒ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

Fax

The original document plus 4 additional copies will be mailed today.

Thank you.

10/10/2012

NMH FBC CON -90

WESTERN CONNECTICUT HEALTH NETWORK

DANBURY HOSPITAL · NEW MILFORD HOSPITAL

24 Hospital Ave.
Danbury, CT 06810
203.739.7000

WesternConnecticutHeatlhNetwork.org
DanburyHospital.org
NewMilfordHospital.org

October 10, 2012

Kimberly R. Martone
Director of Operations
Department of Public Health
Office of Health Care Access
410 Capitol Avenue, MS#13HCA
P.O. Box 340308
Hartford, CT 06134-0308

Re: Docket Number: 12-31781-CON
Termination of Inpatient Obstetrical Delivery Service at New Milford Hospital

Dear Ms. Martone,

Based on September 10, 2012 correspondence from your office requesting additional information on Docket Number: 12-31781-CON, please find enclosed WCHN responses to your questions.

If you have any questions that the attached submission does not answer, please contact me so that we may provide whatever additional information you need in your deliberations. I can be reached directly at 203-739-4903, or sally.herlihy@wchn.org.

Sincerely,

Sally F. Herlihy

Sally F. Herlihy, FACHE
Vice President, Planning
Western Connecticut Health Network

cc: Enclosure

1) The Applicants state on page 6 of the initial application that with the declining number of babies being born at NMH that the inpatient obstetrical delivery service should be terminated before reaching a level of questionable sustainability. What alternate solutions were considered by the Applicants to address the decreasing utilization of the inpatient obstetrical delivery service at NMH? Provide a discussion with supporting documentation.

Response:

Over the years, marketing outreach efforts, inclusive of advertising, promotion, open houses, education programs and website content have been routinely utilized to support awareness of the general public to the Family Birthing Center (FBC) program at NMH. In the last 12-15 months the following promotional activities about the program capabilities and its physicians included:

- Direct Mail/New Movers Campaign - sent monthly (*see* Attachment XIII)
- NMH Web Site Content listing FBC services and prenatal education classes/events calendar (*also included in* Attachment XIII)

  Website Pageviews for the last two years:

Year	FBC-Birthing	FBC-Newborn	FBC-Education
2010-2011	1,381	377	607
2011-2012	1,562	423	611

- Physician Referral Service - obstetrics/gynecology listings in medical staff directory and online profiles

  Beryl Call Center Activity for the last two years:

Year	MD Referral	# FBC Service Calls	# Class Registrations
2010-2011	19	29	190
2011-2012	7	17	79

- Spirit of Women Quarterly Magazine (Spring 2011, pg. 5 - FBC and back cover physician referral ad)
- Spirit of Women Quarterly Magazine (Fall 2011, pg. 13 - Dr. Carol Papov, OB/GYN)
- Spirit of Women Quarterly Magazine (Summer 2012, pg. 12 - Dr. Brooke Davidson, OB/GYN)

With a declining number of births in the region, and a market capture rate in FY11 of approximately 51% for NMH, and 45% for DH of selected towns in the region (Bridgewater, Kent, New Milford, Roxbury, Sherman, Warren, Washington; see Appendix III, page 25 of the CON), recapture of the outmigration to other providers would not result in a significant impact on the FBC program volumes:

- 96% of 320 deliveries is the market captured and utilizing either NMH or DH; the remaining 4% equates to approximately 10 newborns, or <1 delivery per month not delivered at NMH.

This potential volume would not assuage the continual operating loss and negative viability of the program, therefore recruitment of additional physicians was not considered an option as the number of obstetricians already on staff at NMH was felt to be addressing the needs of the community. Additional physicians would not equate to additional utilization since 96% of newborns in the service area are presently being born at NMH or DH.

2) The Applicants state that the time to travel from NMH to DH is 17 minutes. Explain how this time was determined. Report the variability in the time to travel from NMH to DH under varying road and traffic conditions. Also report the maximum times and distances to DH for a number of locations in the towns of New Milford, Kent, Washington, Roxbury, Bridgewater and Sherman.

Response:

An estimate of the driving times for the towns of New Milford, Kent, Washington, Roxbury, Bridgewater and Sherman to the hospitals located in New Milford, Danbury, Torrington and Sharon CT is included in Appendix VI, page 28 of the CON application and provided below. The figures on this chart were developed utilizing MapQuest, and the # miles and # minutes is captured from the zip code for each town to the specific zip code for New Milford, Danbury, Charlotte Hungerford and Sharon hospitals. Individual addresses across each town would yield slightly different figures.

The "average" for the towns represented in the chart indicate an additional 21 minutes to DH vs. NMH (ie. 39 minutes – 18 minutes = + 21 minutes):

Zip Code	CT Town	New Milford, 06776		Danbury, 06810		Torrington, 06794		Sharon, 06069	
		# Miles	# Min	# Miles	# Min	# Miles	# Min	# Miles	# Min
06752	Bridgewater	4	8	14	29	32	55	31	51
06757, 06785	Kent	12	29	27	48	25	45	17	28
06755, 06776	New Milford	4	9	19	32	28	50	24	40
06783	Roxbury	7	14	25	36	29	48	29	50
06784	Sherman	6	15	15	34	35	62	31	48
06754	Warren	13	29	29	54	20	36	11	20
06777, 06793 06794	Washington	8	20	24	44	20	37	21	34
	AVERAGE	**8**	**18**	**21**	**39**	**27**	**47**	**24**	**39**

The statement of 17 minutes in the Introduction on page 6 of the CON application was inadvertently mistyped and should have read only 17 *miles* away. Per MapQuest, the travel time specifically from NMH (21 Elm Street, New Milford, CT) to DH (20 Hospital Avenue, Danbury, CT) is 15.66 miles, 24 minutes. Variability in time associated with road and traffic conditions (and reasons) cannot be predicted and can impact travel anywhere across the service area, and the state.

Contact was made with the New Milford Police Department to better understand the degree and frequency of Route 7 closures which might impact a laboring patient en route to DH from the New Milford community. Beginning with 9/1/11 to present, there were 11 partial or full Route 7 closures. All were accident related, and alternate routes were available to travel through the affected areas. Additionally, Danbury Ambulance Service, Inc. indicated "on the few occasions accidents closed Route 7 over the past year patient transport was not disrupted due to multiple alternate routes available."

3) Please report the average daily census for the birthing services at NMH by month for the last 12 months. Report the average length of stay for the last 12 months.

Response:

The FBC average daily census (reported as # of patients) by month at NMH for birthing services between 9/1/11 to 8/31/12 is:

	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
Maternity	2.1	1.6	2.0	2.2	1.9	1.6	1.1	2.5	2.4	1.9	1.8	1.4	1.9
Newborn	1.9	1.7	1.7	2.0	1.7	1.4	1.3	2.6	2.2	1.7	1.6	1.2	1.7
Total	4.0	3.3	3.7	4.2	3.6	3.0	2.3	5.0	4.6	3.6	3.4	2.6	3.6

The average length of stay (reported as # of days) for the same time period is:

	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
Maternity	2.6	2.7	2.9	2.7	2.9	2.4	2.8	3.7	3.0	2.9	2.7	2.3	2.8
Newborn	2.3	2.7	2.6	2.7	2.7	2.1	2.6	3.5	2.8	2.4	2.5	2.2	2.6
Total	2.5	2.7	2.7	2.7	2.8	2.2	2.7	3.6	2.9	2.7	2.6	2.3	2.7

4) Please complete the following table concerning the utilization of the inpatient obstetrical delivery service at NMH:

Fiscal Year	2009	2010	2011	2012 year to date
Number of patients that required transfer from NMH to another acute care hospital for delivery	0	5	7	8
Number of newborns that required transfer to another acute care hospital for neonatal intensive care services	0	5	12	7
Number of patients that arrived at NMH's Emergency Department in labor	2	0	0	0
Number of patients that arrived at NMH's Emergency Department in labor requiring transfer to another acute care hospital for delivery	0	0	0	0
List the names of the facilities currently used for transfer of patients for delivery	Danbury Hospital, UCONN Medical Center			
List the names of the facilities currently used for transfer of newborns from NMH for neonatal intensive care services	Danbury Hospital, UCONN Medical Center, CCMC, Yale			

5) On page 8 it states that five obstetricians routinely admitted patients to NMH. There are two group practices and two solo practitioners. Please list of the locations of the offices where these physicians meet their patients for pre- and post-natal care.

Response:

The statement on page 8 of the CON application indicates one group practice with 3 physicians (which reduced to 2 physicians just prior to the submission of the CON). This office is as follows:

Women's Healthcare of New Milford (WHCNM)
Claudia Johnson-Baxter, MD and Carol Papov, MD
120 Park Lane Road
New Milford, CT 06776

The remaining two solo physician practices are as follows:

New Milford OB/Gyn
John Sussman, MD
2 Old Park Lane Road
New Milford, CT 06776

Orlito Trias, MD
9 Aspetuck Avenue
New Milford, CT 06776

The projected deliveries as of 9/11/12 for the next 6 months are estimated as follows:

Physician	Sept '12	Oct '12	Nov '12	Dec '12	Jan '13	Feb '13
WHCNM	6	12*	16*	4*	6*	3*
Sussman	3	2	5	4	3	3
Trias	5	3	9	7	3	1
TOTAL	14	17	30	15	12	7

Since the submission of the CON, there has been an additional change in the mix of physicians at NMH. Specifically, Drs. Baxter and Papov (WHCNM) have indicated that effective October 1, 2012 they will relocate all of their deliveries to Charlotte Hungerford Hospital.

Included as Appendix XIV please find correspondence between Deborah Weymouth, Executive Director and SVP at New Milford Hospital and Carol Papov, MD related to this change.

6) On page 9 the Applicants state that the birthing facility at NMH requires refurbishing. Please describe the current facility and explain what improvements are needed.

Response:

The FBC is comprised of 9,621 square feet of space in the 1988 building, on the second floor, east side of the NMH facility. According to the 2010 Guidelines for Design and Construction of Health Care Facilities from the Facility Guideline Institute, Section A2.202.11.1a, this FBC is designed as a Traditional Model obstetrical unit, meaning that labor, delivery, recovery, and post-partum occur in separate spaces. Additionally, this section tells us that guidelines for new construction of traditional delivery rooms have been eliminated from the guideline document, as this model is no longer built or used for obstetrical units.

Therefore, to renovate the FBC in any way we would need to develop plans to build one of the two other models in the guidelines: LDRs (Labor-Delivery-Recovery model) or LDRPs (Labor-Delivery-Recovery-Postpartum model). This would require a major construction project, basically an almost deck to deck gut renovation. This would be at a significant cost, approximated at a total estimated cost of between $3,533,300 and $4,976,450 as follows:

- Minimum cost for renovation with utilizing existing walls where applicable - $300/sq. ft. X 9,621 sq. ft. = $2,886,300
- Major gut and renovate to install all new systems and room capacities – $450/sq. ft. X 9,621 sq. ft. = $4,329,450

In addition, the air handling units and mechanical equipment servicing this area are nearing 25 years old. Although they appear to be in relatively good condition for their age, there are systems that are failing related to the chilled water system, specifically distribution and the respective pumping systems for both chilled and hot water to get to the respective coils in the air handling units. This work could add significantly more cost to a major renovation project for this area.

Concerning fixtures, furniture and equipment, the birthing and patient beds currently in use on the FBC range from 10 years old to 22 years old, respectively. Currently there are 2 birthing beds and 11 patient beds. For comparative purposes only, to replace those beds in kind would cost the following:

- 2 birthing beds @ approximately $30,000 each = $60,000
- 11 patient beds @ approximately $12,000 each = $132,000
- A specialty bed used in LDR or LDRP rooms, would be 13 needed @ approximately $35,000 each = $455,000

7) On page 7 it states that the 14 registered nurses staffing the delivery service each maintain neonatal resuscitation certification. On page nine it states that retraining of personnel would require a significant investment of money. What retraining is required?

Response:

Updates to all policies and procedures as well as new additional policies are necessary to standardize practice within the health network, and training would be necessary for the nurses on these policies. Nurses need continuing education on OB emergencies and current evidence based labor and delivery practices. To maintain standard of practices, all 14 RNs are due for Neonatal Resuscitation recertification this fall. This recertification training is currently being planned. Also, all nurses should be Electronic Fetal Monitoring (EFM) certified. At the time of the initial CON submission, only 5 of the regular staff had this credential, leaving 9 RNs to be EFM certified. Due to our continued commitment to the community, we have validated the competency of all 14 RNs on EFM, and have provided certification preparation training to 3 additional staff, with 2 more scheduled for this certification preparation training within the next month. We have also contracted with an additional travelling RN who is EFM certified. Advanced Cardiac Life Support (ACLS) certification/recertification of all nurses would also be required to bring staff up to standard due to anesthesia not being on site 24/7 at NMH.

8) On page 10 it states that with the proposal the labor room located within NMH's Emergency Department will require refurbishing and that ED physician staff will require training for obstetrical and neonatal support. Please describe the refurbishments required and the training that needs to be provided prior to implementation of the proposal by the Applicants.

Response:

The proposed labor room in the ED is currently designated as the "Consult" room. It is equipped with an OB/Gyn stretcher, medical gasses, and gynecologic exam equipment. Additional obstetrical equipment will be placed in a room across the hall and include an isolette, infant warmer and ultrasound machine to support management of the obstetrical and newborn patient.

Education for MDs, RNs, PAs and EMS personnel is planned. The MDs are all Residency trained and board certified in Emergency Medicine which includes training and testing for proficiency in managing OB emergencies. The MDs and PAs will be provided a PowerPoint educational tool on OB emergencies as a refresher. A series of presentations to local EMS services is being arranged with the assistance of Dr. Matt Kim, Danbury Maternal Fetal Medicine (see Appendix XI, page 74 for CV in the CON application).

The following educational components have been implemented in regards to OB/GYN education:

- Specialty Care Transport course – ALS providers specially trained to provide inter-facility transportation of high-risk OB patient population. There are two installments of this course to capture a greater populace, October 3rd and November 6th.
- Continuing Medical Education – Training for all service level providers. There was one presentation held for Danbury Area services, September 29th. There are two upcoming scheduled presentations, October 9th for greater Danbury/ New Milford Area services and October 25th for the greater New Milford area services.

Education services are being coordinated with Eastern Connecticut Health Network as well. ED RNs will be trained in the normal physiological changes in pregnancy, nursing management of OB emergencies, and assisting in precipitous births. The RNs will be certified in Pediatric Advanced Life Support (PALS) and Neonatal Resuscitation Program (NRP). They will also participate in a shadowing experience in the Labor & Delivery unit and the Newborn nursery at Danbury Hospital.

9) Please provide any available documentation that supports the continuance of pre-natal, post-natal, pediatric and gynecological care at a facility that does not provide delivery services.

Response:

Current and future obstetric patients residing in the local communities will continue to have a choice of which obstetrician they will utilize. The NMH OB/Gyn physicians located in the community is explained in question 5 above. The only difference in the birthing process would be the location of the birth itself.

Access to prenatal and postnatal care is critical to a successful outcome of the pregnancy. NonStress testing and labor checks that have been conducted on the FBC unit will continue to be available in partnership with the OB/Gyn offices. Diagnostic or therapeutic services required outside of the OB/Gyn office would still be accessible at NMH for any necessary care for patients during the course of their pregnancy.

Additionally, the following Family Birthing Center educational resources will continue to be accessible for residents of the community: Prepared Childbirth Education; Infant Care Class; Breastfeeding Group for Pregnant Women; and a Breastfeeding Support Group. The classes will be centrally coordinated for the Network and offered in New Milford based on demand. If and when necessary, due to low utilization of these programs, patients would be offered a smooth transition to programs offered at DH. Programs that would be discontinued include Massage for New Mothers and a Celebration Dinner for New Parents as both these programs were part of the inpatient experience following delivery at NMH.

NMH has an Obstetrical Program that all four obstetricians are currently active participants in the program along with several radiologists and anesthesiologists. The program is administered through NMH social workers who connect directly with patients from the community. The program has been in existence since 1988 and current participation for individuals who meet social and financial eligibility is as follows:

- FY 2009 – 7 patients
- FY 2010 – 8 patients
- FY 2011 – 12 patients
- FY 2012 – 5 patients

Objectives of the program include: providing a program of observation, guidance, education and management with the intent of making pregnancy and delivery a healthy, satisfying experience resulting in a health baby. Proper instruction and information in good nutrition, general activity, personal hygiene, and personal guidance by providing a team approach. This program also considers the entire family structure during prenatal, intrapartum, and postpartum care.

10)Other than the possibility that a delivery will take place in the ED at NMH what are other possible scenarios have been envisioned by the Applicants that will need to be addressed in order to move forward with the proposal?

Response:

The following scenario planning and course of action (which involve protocols for the determination and ability to stabilize and transport the patient to DH as needed) was provided on page 15 of the CON application for the following situations:

- Ectopic Pregnancy– Emergency Physician evaluates patient and discusses with patient's OB
- Ectopic Pregnancy (ruptured) – stabilize and transfer to DH
- Pre-eclampsia – Emergency Physician evaluates patient and discusses with patient's OB
- Eclampsia – stabilize patient and discuss with patient's OB
- Fetal Demise – Emergency Physician evaluates patient and discusses with patient's OB
- Threatened Abortion – Emergency Physician evaluates patient and discusses with patient's OB
- Incomplete Abortion – stabilize patient and discuss with patient's OB
- Completed Abortion – Emergency Physician evaluates patient and discusses with patient's OB
- Uterine Contractions (pre-term, term and Braxton-Hicks) – Emergency Physician evaluates patient and discusses with patient's OB
- Maternal Trauma (minor) – Emergency Physician evaluates patient and discusses with patient's OB
- Maternal Trauma (major) – stabilize and transfer to DH
- Rupture of membranes – Emergency Physician evaluates patient and discusses with patient's OB
- Pregnancy with active bleeding (abruption, placenta previa, uterine rupture) – stabilize and transfer to DH
- Active Labor – Emergency Physician evaluates patient and discusses with patient's OB
- Delivery – stabilize mother & baby and transfer to DH
- Postpartum hemorrhage – stabilize mother & baby and transfer to DH
- Maternal Death – stat C-section performed by Emergency Physician

11) Discuss the availability of public transportation within New Milford and NMH's other service area towns. If there is no public transportation, how do patients without personal transportation travel to NMH?

Response:

The only public transportation available in New Milford is operated by the Housatonic Area Regional Transit (HART) which offers a fixed route schedule (HART 7) at various points through New Milford south on Route 7 to Brookfield and Danbury. This schedule runs 6 days per week: 6 AM - 6 PM Monday-Friday and 8 AM - 5 PM on Saturdays. There is no public transportation service to other service area towns adjacent to New Milford, resulting in the use of private transportation by patients.

In any emergency situation involving an imminent birth or a pre-birth emergency, an ambulance would be discharged to the mother's location in response to receipt of a 911 call.

Appendix XIII

Marketing and Promotion Examples

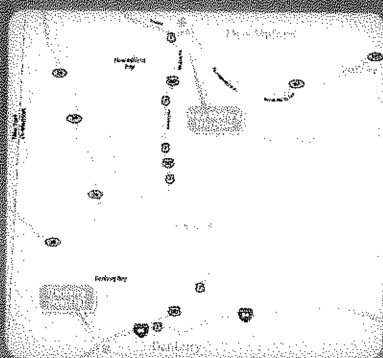
Western Connecticut Health Network

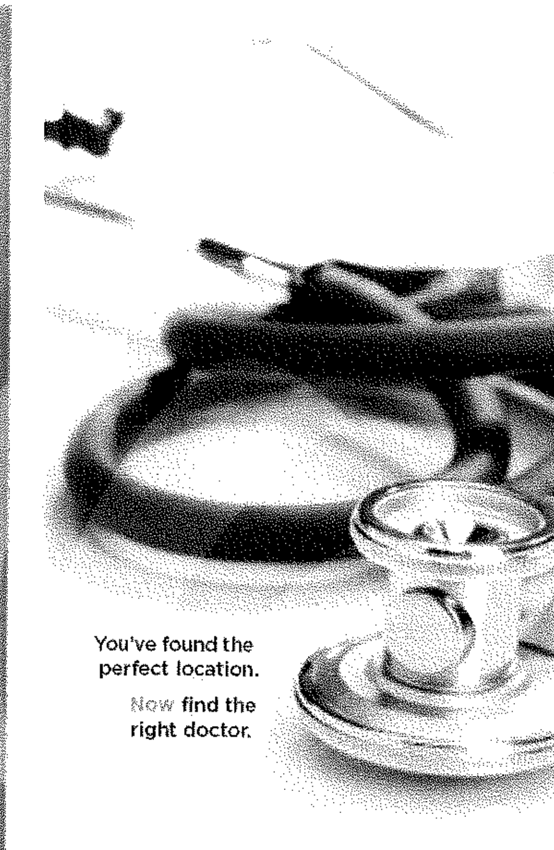
DANBURY HOSPITAL • NEW MILFORD HOSPITAL

Find the physician right for you.
Call 800-584-9762
Or visit WCTHN.org

Access to outstanding hospitals

As part of Western Connecticut Health Network you will have easy access to Danbury Hospital and New Milford hospital. Highly trained physicians, nurses, and extensive outpatient services are closer than ever before.





You've found the perfect location.

Now find the right doctor.

Peace of mind can be found right in your own backyard.

Welcome home! Now that you're unpacked and settled in, you can choose a health network with outstanding hospitals, highly trained physicians and extensive outpatient services all within reach.

The right care, at the right time, in the right place — close to home.

As the 3rd largest health network in Connecticut, we offer complete, patient-centered care unlike any other. From orthopedic specialists who perform the highest number of joint replacement and spine surgeries in the area, to comprehensive cancer and cardiac care programs, Western Connecticut Health Network has the expertise when and where you need it.

Outstanding services for the entire family:

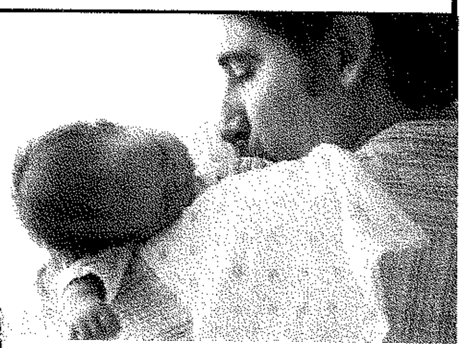
Emergency Care
Our Emergency departments are located in two convenient locations and accredited with stroke, trauma and chest pain designations.

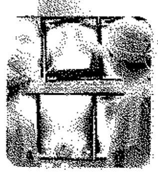
Family Birth Center
Expecting? Expect comfort. Families can find a birthing experience customized to their preferences along with hotel-like amenities and a level IIIb NICU for reassured support.

Children's Health & Wellness Center
Offers an innovative, family-friendly environment with a wide range of pediatric specialists.

Radiology and Lab
Available throughout the community, our imaging facilities and labs offer state-of-the-art technology with a focus on patient comfort.

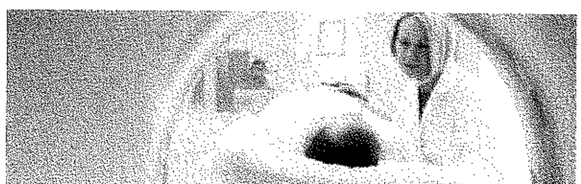
Wellness and Prevention
A full calendar of educational and empowering events include FREE Spirit of Women programs - focused on helping women take care of themselves and their families. Become a member and learn more at www.DanburyHospital.org/SpiritofWomen.





Western Connecticut Health Network

DANBURY HOSPITAL · NEW MILFORD HOSPITAL



Find the physician right for you.
Call 800-584-9762
Or visit WCTHN.org

Learn & share with us.

WESTERN CONNECTICUT HEALTH NETWORK

NEW MILFORD HOSPITAL

AFFILIATED WITH **DANBURY HOSPITAL**

51 Elm Street
[illegible]
[illegible]
[illegible]

› Board Login
› Physician Login
› Employee Login

ABOUT US | GUIDE TO OUR HOSPITAL | SERVICES | EVENTS & WELLNESS | CONTACT US

:: Hospital News

- New Milford Hospital Receives $15,000 Grant from the Ellen Knowles Harcourt Foundation
- New Milford Hospital Offers Quit Now Smoking Cessation Program
- Strong Women™ Strong Bones Fitness Program Helps Prevent and Reverse Osteoporosis/Osteopenia

› More news articles

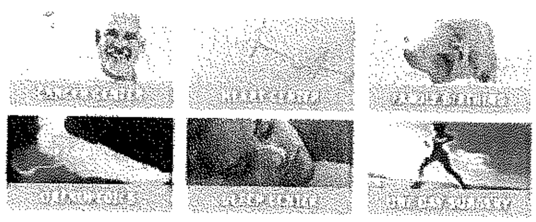
:: Quick Links

- Affiliations
- Directions
- Emergency Medicine
- Employment
- Facts & Statistics
- Find a Doctor
- Foundation
- Media Information
- News
- Patient Satisfaction
- Publications/Ads
- Quality Rankings
- Visiting Hours
- How to Volunteer
- WebNursery

Plow to Plate »

Online Giving »

Planetree »



Use our online Find a Doctor tool, or call 1-800-585-7196 if you need a doctor referral

WESTERN CONNECTICUT HEALTH NETWORK

NEW MILFORD HOSPITAL

AFFILIATED WITH DANBURY HOSPITAL

Family Birthing Center

The team of the Family Birthing Center at New Milford Hospital is committed to helping you welcome your new baby with confidence and medical expertise to help ensure a beautiful beginning for you and your family. Our board-certified obstetrician/gynecologists, together with our maternity registered nurses, will be by your side to guide you through labor and delivery, monitoring your progress and providing support and encouragement. Our nurses are trained in lactation support to assist new mothers in getting to know their newborn, and establishing critical early feeding habits that will help foster successful breastfeeding. Based on your expectations for your birth experience and standards for high-quality care, our board-certified anesthesiologists provide a variety of pain control methods to ensure your comfort and safety during your delivery.

Our facility offers a private, restful environment that includes including a rocking chairs and recliner in each room, a private bath and shower, and personalized touches to create a serene, home-like surroundings.

Because personalized care is our hallmark, nurturing comes naturally at New Milford Hospital. We look forward to serving you and to making the birth of your baby an extraordinary experience that you will cherish for years to come.

Family Birthing Center Resources

Prepared Childbirth Education	Sibling Preparation
Infant Care Class	Massage for New Mothers
Breastfeeding Group for Pregnant Women	Celebration Meal for New Parents
Breastfeeding Support Group	

For more information on New Milford Hospital's Family Birthing Center classes or referral to an obstetrician/gynecologist visit our web-based physician referral and events, or call 1-800-585-7198.

Use our online Find a Doctor tool, or call 1-800-585-7198 if you need a doctor referral.

Classes

Breastfeeding Support Group, 2012 Schedule

11:00 a.m. - 1:00 p.m.

A one-session postpartum breastfeeding class, held monthly on Tuesdays.

Need some mommy time? Breastfeeding your baby is a big job. After the baby arrives, you may need to go out with your baby and get the added benefit of breastfeeding support. Mothers and their babies are encouraged to attend one of our sessions with a certified lactation consultant. These groups encourage sharing experiences and questions which naturally come up as the baby grows.

You may also have a private session with one of our credentialed nurse lactation specialists.

Dress comfortably!

Schedule for 2012:
January 3
February 7
March 6
April 3
May 1
June 5
July 17
August 7
September 18
October 16
November 6
December 4

Location: Family Birthing Center, New Milford Hospital.

Registration is required; no fee. Please call toll-free 1-800-350-1595 to register. For mothers who have delivered at New Milford Hospital.

Infant Care Class, 2012 Schedule

6:30 - 9:00 pm

A 2-1/2-hour, one-session class, offered monthly on Tuesdays.

This class covers a variety of topics relevant to caring for your new baby, including bathing, cord care, circumcision care, feeding, swaddling, temperature taking, and when to call the pediatrician. The class also focuses on safety. You will learn about preparing your home for your new baby. Car seat safety is also covered.

It is recommended that you attend this class about 4 to 8 weeks before your due date.

This class is open to patients delivering at New Milford Hospital
Schedule for 2012:
January 3
February 7

Fee: $150 for series. Registration limited to women scheduled to deliver at New Milford Hospital

Schedule for 2012
January 10, 17, 24
February 14, 21, 28
March 13, 20, 27
April 10, 17, 24
May 8, 15, 22
June 12, 19, 26
July 10, 17, 24
August 14, 21, 28
September 11, 18, 25
October 9, 16, 23
November 13, 20, 27
December 11, 18, TBD

Location: 2nd Floor Conference Room (next to Family Birthing Center), New Milford Hospital

Fee: $150 for series. Please call toll-free 1-800-350-1595 to register. Registration limited to women scheduled to deliver at New Milford Hospital.

Use our online Find a Doctor tool, or call 1-800-585-7198 if you need a doctor referral.

Appendix XIV

Weymouth-Papov Correspondence

Carol Papov, M.D.
Women's Health Care of New Milford
120 Park Lane Road
Unit B202
New Milford, CT 06776

HAND DELIVERED

September 10, 2012

Dear Dr. Papov:

Given our meeting that took place on Tuesday, September 4th that included Dr. Koobatian, this letter serves to clarify and document the decision you shared during that meeting to relocate all deliveries under the care of Women's Healthcare New Milford to Charlotte Hungerford Hospital by October 1, 2012.

We further understood your offices would continue to be located in New Milford but you desire to have all on-call obligations for OB services at New Milford end on October 1, 2012. Finally, you are currently considering potential alternatives to the location of the GYN procedures and surgeries provided by your group, but you would prefer to keep those services in New Milford Hospital assuming we can mutually resolve on-call responsibilities in a fair and equitable manner.

Given this short notification period, we do understandably require time to adequately plan and prepare appropriately for the care and safety of our patients. I also learned from our OB/FBC nursing team that you have shared your plan of 10/1/12 relocation directly with them and that your office has started contacting patients in our community to share this news. Both of these facts further support our need to respond quickly.

Although we are not certain of the impact it will have on the processing of our CON (12-31781-C) application to relocate OB services to Danbury Hospital, we do intend to share this communication with the State of Connecticut Office of Health Care Access so they are aware of your intentions.

If your plans have changed please let me know within the next 24 hours. If we do not hear from you we will move forward based on the above information.

Together over the years we have collectively cared for thousands of patients successfully. Thank you for your dedication to providing OB services to our community and we wish you continued success in the future.

Sincerely,

Deborah K Weymouth, FACHE
Executive Director and SVP
New Milford Hospital

WOMEN'S HEALTHCARE OF NEW MILFORD
OBSTETRICS, GYNECOLOGY, & INFERTILITY
CAROL S. PAPOV, M.D., F.A.C.O.G.
CLAUDIA M. BAXTER, M.D., F.A.C.O.G.
KAREN M. WUNDERLICH, R.N.C., M.S.

120 Park Lane Road • Unit B202
New Milford, CT 06776

Tel: (860) 210-0082
Fax: (860) 210-1633

September 12, 2012

Deborah Weymouth, FACHE

Executive Director and Senior Vice President

New Milford Hospital

21 Elm Street

New Milford, CT 06776

Dear Deborah,

Dr. Claudia Baxter and I would like to request a change in our Medical Staff Category from Active Staff to Courtesy Staff effective October 1st.

We have reviewed the qualifications and guidelines for this category and believe it meets our needs. We would like to further discuss this change at the OB/Gyn department meeting on 9/20/2012.

Sincerely,

Carol S. Papov, M.D.

WOMEN'S HEALTHCARE OF NEW MILFORD
OBSTETRICS, GYNECOLOGY, & INFERTILITY
CAROL S. PAPOV, M.D., F.A.C.O.G.
CLAUDIA M. BAXTER, M.D., F.A.C.O.G.
KAREN M. WUNDERLICH, R.N.C., M.S.

120 Park Lane Road • Unit B202
New Milford, CT 06776

Tel: (860)210-0082
Fax: (860) 210-1633

September 21, 2012

Deborah Weymouth, FACHE

Executive Director and Senior Vice President

New Milford Hospital

21 Elm Street

New Milford, CT 06776

Dear Deborah,

I would like to request a change in my Medical Staff Category from Active Staff to Active Staff with waived ER call effective October 1st, 2012.

I have am aware of the qualifications and guidelines for this category and believe it meets my needs.

Sincerely,

Carol S. Papov, M.D.

WOMEN'S HEALTHCARE OF NEW MILFORD
OBSTETRICS, GYNECOLOGY, & INFERTILITY
CAROL S. PAPOV, M.D., F.A.C.O.G.
CLAUDIA M. BAXTER, M.D., F.A.C.O.G.
KAREN M. WUNDERLICH, R.N.C., M.S.

120 Park Lane Road • Unit B202
New Milford, CT 06776

Tel: (860)210-0082
Fax: (860) 210-1633

September 21, 2012

Deborah Weymouth, FACHE

Executive Director and Senior Vice President

New Milford Hospital

21 Elm Street

New Milford, CT 06776

Dear Deborah,

I would like to request a change in my Medical Staff Category from Active Staff to Active Staff with waived ER call effective October 1st, 2012.

I have am aware of the qualifications and guidelines for this category and believe it meets my needs.

Sincerely,

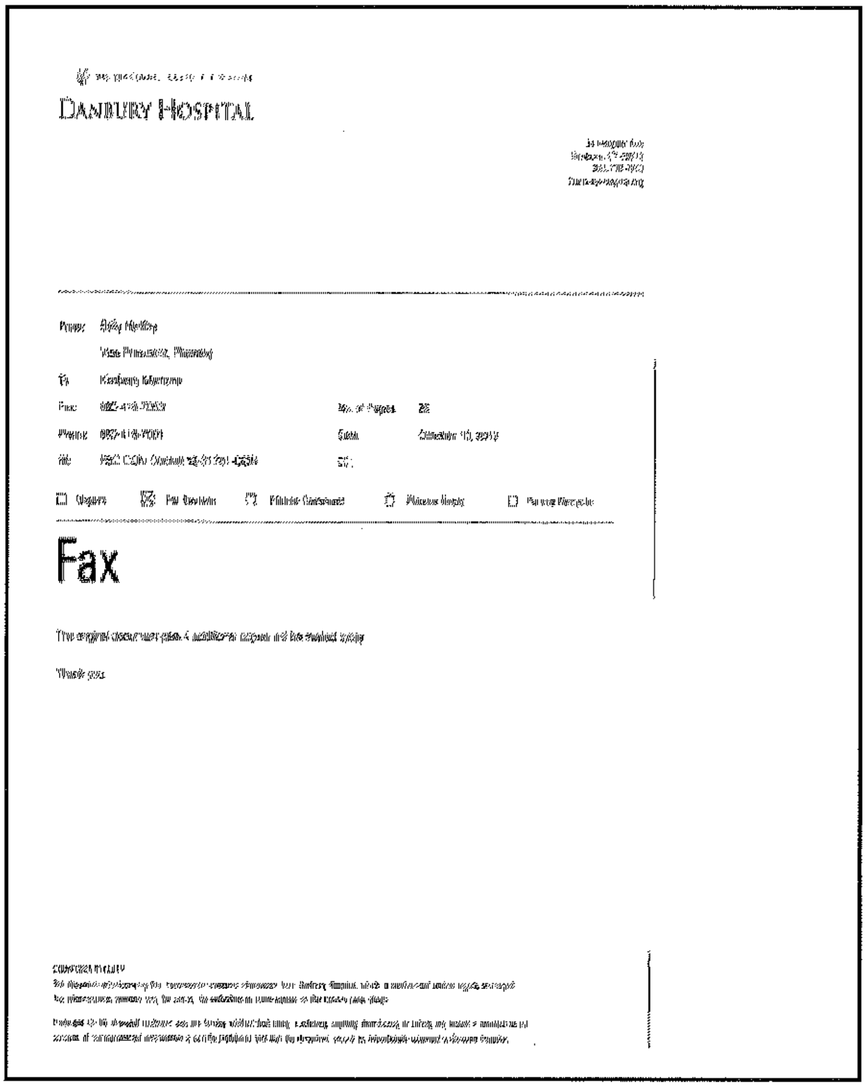
CMBaxter, MD

Claudia M. Baxter, M.D.

Result Summary			
Job Number	433952	**Submitted**	10/10/2012 3:17:11 PM
Subject		**Recipients**	1
Total Pages	26	**Status**	1 of 1 successful
Billing Info	prn131		

Recipient Results

Name	Number/ Address	Result	Elapsed Time
	918604187053	Success	12:47


DANBURY HOSPITAL

Fax

State of Connecticut
HOUSE OF REPRESENTATIVES
STATE CAPITOL
HARTFORD, CONNECTICUT 06106-1591

REPRESENTATIVE WILLIAM TONG
147TH ASSEMBLY DISTRICT

LEGISLATIVE OFFICE BUILDING
ROOM 2405
HARTFORD, CT 06106-1591
CAPITOL: 860-240-0413
TOLL FREE: 1-800-842-8267
FAX: 860-240-0206
E-MAIL: William.Tong@cga.ct.gov

CHAIRMAN
BANKS COMMITTEE

MEMBER
ENERGY AND TECHNOLOGY COMMITTEE
JUDICIARY COMMITTEE

October 1, 2012

Honorable Jewel Mullen, Commissioner
410 Capitol Avenue
Hartford, CT 06134

Re: Hospital for Special Surgery (HSS)

Dear Commissioner Mullen:

I am writing in support of the Hospital for Special Surgery (HSS) application, Docket No. 12-31780-CON.

As you may know, The Hospital for Special Surgery in New York City has a presence in Connecticut - Old Greenwich and they are looking to expand that operation to Stamford to better accommodate their patient population residing in our state and northern New York. An MRI machine is absolutely essential to this project.

The proposal is beneficial to Stamford and our community on many levels. It would significantly improve the efficiency and delivery of patient care, providing a higher quality of health care, as well as greater access to health care. It would also create many construction jobs and in the long-term more employment opportunities in the medical field.

This is a wonderful opportunity for our community and I thank you in advance for your consideration of this important matter.

Very truly yours,

William Tong

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.
Commissioner

Dannel P. Malloy
Governor
Nancy Wyman
Lt. Governor

October 11, 2012

The Honorable William Tong
Representative
State of Connecticut
Legislative Office Building, Room 2405
Hartford, CT 06106-1591

Re: Certificate of Need
Hospital for Special Surgery, Docket Number: 12-31780-CON
Proposal for the Acquisition and Installation of an MRI in Stamford

Dear Representative Tong:

On October 2, 2012, the Department of Public Health ("DPH") received your letter concerning the Certificate of Need ("CON") for the proposal by the Hospital for Special Surgery for the acquisition and installation of an MRI in Stamford.

I welcome and appreciate your comments regarding this matter. I have forwarded your letter to DPH's Office of Health Care Access ("OHCA"). Your letter will be made part of OHCA's formal record of the CON application docket. Please be advised, once a decision has been rendered it will be posted and available on OHCA's website at http:// www.ct.gov/dph/ohca. Meanwhile, OHCA's website maintains status reports that you may review at your convenience.

If you have any further concerns or questions, please feel free to contact Kimberly Martone at (860) 418-7029.

Sincerely,

Lisa A. Davis

Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner

LAD:KRM:bko

HOSPITAL
FOR
**SPECIAL
SURGERY**

**Specialists
in Mobility**

October 12, 2012

Brian A. Carney
Associate Research Analyst
Connecticut Department of Public Health
Office of Health Care Access
410 Capitol Avenue
MS #13HCA
Hartford, CT 06134

Hospital for Special Surgery Completeness Letter
Docket 12-31780-CON

Dear Mr. Carney,

Enclosed please find Hospital for Special Surgery's response to your Completeness Letter dated September 12, 2012. The following items are included:

1. Original and six (6) copies of HSS's response in its entirety, and
2. CD containing a PDF of the full response including attachments and the response narrative in MS Word.

Please feel free to contact me at (646)797-8228 or via e-mail at buscemip@hss.edu if there are any questions or problems.

Best regards,

Peter Buscemi
Senior Director of Financial Planning

535 East 70th Street
New York, NY 10021
tel 212.606.1000

Hospital for Special Surgery
Docket 12-31780-CON
September 12, 2012 Completeness Letter Responses

1. On Page 7 of the CON application it states that HSS "developed proprietary new applications for MRI for musculoskeletal conditions, and is one of the world's leading institutions in musculoskeletal MRI innovations." In reference to above, identify or provide the following:

   a. Do these protocols require specialized equipment, software or patient positioning techniques to achieve the desired imaging results? If yes, please identify and describe.

These protocols do not require specialized equipment, however they do require specialized software for prototype pulse sequences. For example, standardized cartilage sensitive imaging performed in three planes greatly increases diagnostic accuracy and the presence of a pre-existing deformity does not impair HSS's ability to perform high quality diagnostic imaging. The protocols themselves do not require specialized positioning techniques. However, HSS has patients with a wide variety of body habitus and complex musculoskeletal conditions, and is extraordinarily vigilant in positioning all of its patients in accordance with its standards.

HSS and its radiologists have specialized in musculoskeletal MRI for over 20 years and perform over 30,000 musculoskeletal MRI exams annually. HSS focuses *solely* on orthopedics and rheumatology and requires that its radiologists have completed a musculoskeletal imaging fellowship, typically the fellowship offered at HSS. We are not aware of any other MRI centers that specialize in musculoskeletal MRI and perform anywhere near the number of musculoskeletal MRI's performed at HSS. It would be very difficult for an MRI center that treats all types of patients and does not do the level of musculoskeletal MRI volume that HSS does to fully replicate the protocols and services provided to HSS physicians and their patients.

b. Do you have a patent, trademark or copyright for your proprietary MRI application? If so, please provide a copy.

HSS has no patents, copyrights or trademarks on its MRI protocols and applications. The prototype pulse sequences are the property of General Electric. HSS and its patients have benefited from the comprehensive and collaborative research agreement that HSS has with General Electric, allowing them access to many newer sequences and MRI techniques which are not currently available in the tri-state area. One example is the MAVRIC sequence from GE Healthcare, a prototype developed in collaboration with HSS that markedly improves image quality around orthopedic hardware (such as that used for fractures) or implants like joint replacements. This type of imaging is now essential to the standard diagnostic workup of HSS arthroplasty surgeons when evaluating a patient with a painful joint.

c. Can existing imaging facilities in Connecticut replicate your MRI protocols? If not, explain why.

No. HSS utilizes the highest performing gradients on the market today. Its MRI units contain the most updated and state of the art technology. HSS's protocols are customized to meet the specific needs of its physicians and patients. One example is quantitative T2 mapping, a sequence developed in collaboration with GE Healthcare. This quantitative technique correlates to the structural building blocks of joint cartilage and provides noninvasive insight into structural integrity. Other examples include a series of proprietary and prototype means for early detection and treatment of osteoarthritis, assessing surgical cartilage repair and protocols for MRI assessment of arthroplasty, and assessing bone loss and regional adverse tissue reactions around joint replacements.

Scans are normally checked prior to the patient leaving the facility to ensure diagnostic quality. A musculoskeletal MRI radiologist is available at all

times when scanning is being conducted to review or assist with the scan. After such review, additional sequences may be performed in order to achieve the required imaging results without the necessity of the patient returning for another visit. This allows each HSS physician to maximize the usefulness of the MRI as a tool for diagnosis and development of a treatment plan.

HSS and its radiologists have specialized in musculoskeletal MRI for over 20 years and perform over 30,000 musculoskeletal MRI exams annually. HSS focuses *solely* on orthopedics and rheumatology and requires that its radiologists have completed a musculoskeletal imaging fellowship, typically the fellowship offered at HSS. We are not aware of any other MRI centers that specialize in musculoskeletal MRI and perform anywhere near the number of musculoskeletal MRI's performed at HSS. It would be very difficult for an MRI center that treats all types of patients and does not do the level of musculoskeletal MRI volume that HSS does to fully replicate the protocols and services provided to HSS physicians and their patients. The fact that over 3,000 patients from the State of Connecticut and nearby Westchester currently travel to HSS in Manhattan for their MRI's is further evidence that HSS's MRI imaging capabilities are not available from providers in Connecticut.

2. Please provide evidence that the use of HSS proprietary MRI protocols result in better surgical outcomes.

HSS is ranked as the #1 Orthopedic Hospital in the nation by U.S. News and World Report and has had this ranking for the last 5 out of 6 years. We have been top ranked for 22 consecutive years. MRI has been a critical component in the diagnosis and treatment of its patients. The accuracy and quality of HSS's MRI protocols have been validated for accuracy against surgical standards and published in peer review literature (a number of these articles were included with our application submission – see "Noncontrast

Magnetic Resonance Imaging of Superior Labral Lesions" beginning at page 60 of the CON application and "Magnetic Resonance Imaging of the Hip: Detection of Labral and Chondral Abnormalities Using Noncontrast Imaging" at page 80). The preoperative MRI often obviates the need for diagnostic arthroscopy (an invasive surgical procedure) and enables the surgeon to move straight to therapeutic intervention, thus shortening surgical time, length of anesthesia and quickening of the recovery period.

3. Please provide a draft lease agreement for the proposed site of MRI installation. What is the length of time that the lease will be in effect?

HSS is in active negotiations with the landlord for the site and the landlord has required that terms of the lease be kept confidential. As a result, we are unable to provide a copy of the draft lease. However, the landlord has provided the attached letter (Attachment XI) confirming the location of the site, the term of the lease and the anticipated time to finalize the lease. As stated in this letter, the proposed location is 1 Blachely Rd, Stamford CT, the lease has an initial term of ten (10) years with two (2) five (5) year renewal options and it is expected that the lease will be finalized and executed shortly.

It should be noted that the lessee under lease will be HSS Properties Corporation ("Properties"), an affiliate of HSS organized under the Not-For-Profit Corporation Law of the State of New York. Properties owns, leases and operates real estate for Hospital purposes. It is a tax-exempt organization under Section 501(c)(3) of the Internal Revenue Code. Concurrently with the execution of the lease between Properties and the landlord, a sublease between HSS and Properties will also be executed granting all rights and responsibilities under the lease between Properties and landlord to HSS.

4. On page 12 of the CON Application it states that "a key component to HSS's strategic plan is developing offsite locations to enable HSS patients in the applicable communities near the site to see their doctors and receive services closer to home." Does the Applicant have a Board-approved written strategic plan? If so, please provide OHCA all pages relevant to imaging services.

HSS does have a Board approved strategic plan that is in the process of being updated. The development of the HSS Strategic Plan for 2013-2015 began in late 2011 with an organizational assessment of our strengths, weaknesses, opportunities, and threats, incorporating feedback from both medical staff leadership and senior management, as well as internal performance metrics and key external trends. The collective insights from this assessment were then discussed at a leadership retreat in January 2012, from which a preliminary set of seven strategic priorities emerged. Over the course of the next nine months, planning teams comprised of medical staff leadership and senior managers developed detailed initiatives for each of these strategic priorities. In September 2012, a retreat with Board members, senior leadership, and medical staff was held to discuss, refine, and align on the emerging Strategic Plan for 2013-2015. The recommendations from the retreat will be incorporated in the further refinement of the 2013-2015 Strategic Plan by members of the applicable planning teams, which will result in a final plan by year end. The Strategic Plan will then be rolled out to the organization at large across early 2013.

One of the initiatives in the Strategic Plan will be a focus on developing new offsite locations as well as broadening the scope of services provided at these sites. HSS currently operates sites in Greenwich, CT, Uniondale, NY, Queens, NY, and Madison Avenue in Manhattan. Patients seek the internationally recognized and specialized care of HSS from a broad geographic service area. Percentage of volume by region is summarized in the table below.

	Inpatients		Ambulatory Surgery	
	2011	2010	2011	2010
Manhattan	15%	15%	28%	30%
Other NYC Boroughs	18%	19%	17%	17%
Long Island	18%	18%	14%	13%
Fairfield CT/Lower Hudson Valley	15%	16%	16%	15%
Northern NJ	19%	18%	16%	15%
All other (domestic and international)	15%	14%	9%	10%

This strategy enables more of HSS's current patients to see their doctors and receive services closer to home. Furthermore, it will alleviate significant capacity constraints at HSS's main campus.

5. It appears that the majority of the letters of support submitted in the CON application are from non-medical providers. Please describe HSS's existing relationship with other providers in Connecticut who provide similar services.

HSS, as a global specialized resource in the area of musculoskeletal healthcare, readily shares its knowledge with other providers as part of its role as a knowledge based leader. HSS was recently approached by Yale New Haven Health System (YNHHS) with a request to allow a team of their leaders to come to HSS to learn from our best practices. HSS accommodated this request and enabled YNHHS leaders to spend a half day touring and talking to HSS leaders.

HSS and Stamford Hospital are exploring a relationship in the area of Physical Therapy so that HSS knowledge as it relates to advanced therapy protocols for orthopedic related conditions can be transferred to Stamford Hospital staff and therefore enable HSS to have a strategic relationship in this area.

HSS's President & CEO, Louis A. Shapiro has been in contact with Frank Corvino, President & CEO of Greenwich Hospital and Brian Grissler, President & CEO of Stamford Hospital. Mr. Corvino has indicated that

YNHHS (of which Greenwich Hospital is a member) will not oppose HSS's application and Mr. Grissler has been supportive of HSS's application and in fact has facilitated a meeting with the Mayor of Stamford, Michael Pavia, where this was specifically discussed.

Finally, in addition to the letters of support already received by OHCA, which include letters from various business leaders, Stamford Mayor Michael A. Pavia, State Representatives Gerald Fox III and Dan Fox and State Senator Carlo Leone, HSS has also received letters of support from State Senator L. Scott Frantz, State Representatives Livvy Floren, Michael Molgano, William Tong, Patricia Billie Miller, and Terrie Wood and Ray Dalio, Founder & President of Bridgewater Associates. Copies of these letters are included in Attachment XII.

6. Please expand Table 2a on page 27 to include all MRI scanners operated by the Applicant. Be sure to include historical, current year and projected scan volumes.

	Actual Volume (Last 3 Completed FYs)			CFY Vol. (d)	Projected Volume (First 3 Full Operational FYs)		
	2009	2010	2011	2012	2014	2015	2016
HSS Main Campus (a)(b):							
- Unit A	4,555	4,054	3,825	3,267	3,359	3,464	3,568
- Unit B	3,700	3,232	3,244	3,008	3,094	3,191	3,287
- Unit C	3,892	3,963	3,996	3,810	3,919	4,042	4,162
- Unit D	4,194	4,031	3,863	3,567	3,667	3,781	3,895
- Unit E	3,787	3,420	3,382	3,215	3,306	3,409	3,512
- Unit F	2,974	3,648	3,835	3,470	3,568	3,679	3,790
- Unit G (11/3/09)	754	3,754	3,654	3,489	3,587	3,699	3,811
- Unit H (c)	1,708	1,303	2,327	3,397	3,491	3,600	3,709
- Unit I (3/26/12)	-	-	-	1,934	2,591	2,672	2,753
75th St (11/28/11)	-	-	190	2,443	2,512	2,590	2,668
Uniondale, NY (1/1/13)	-	-	-	-	2,400	2,400	2,400
Stamford, CT (1/1/14)	-	-	-	-	2,175	2,540	2,540
Total	25,564	27,405	28,316	31,600	37,669	39,067	40,095

(a) HSS Main Campus MRIs operate 13.5 hours/day (Unit A – 16 hours/day) and on weekends (limited hours), whereas the units at the offsite locations operate 10 hours/day and no weekends. 75th St, which is in close proximity to the Main Campus, operates 11.5 hours/day.

(b) Nine of the above listed units are 1.5 Tesla units and three are 3.0 Tesla units. Tesla measures the strength of the magnet. HSS employs mostly 1.5T units since these are most effective for orthopedic imaging in most cases.

(c) Unit H was converted from an Open to a 1.5T MRI in May 2011 due to obsolescence. New MRI models with larger bores have eliminated the need for an Open MRI.

(d) Represents projected 2012 totals based on actual volumes through August 2012.

Note: All above years represent calendar years. Above totals are for outpatients only.

7. On page 20, the applicant states that "HSS is able to perform MRI scans on persons with pre-existing joint deformity as well as persons with orthopedic hardware. Some MRI sites decline such patients." Please describe why an MRI provider would decline to screen a patient with these conditions and provide a list of any known Connecticut MRI providers who follow this practice.

It has been our experience that many MRI providers decline patients with orthopedic hardware due to the fact that metal in a targeted area can obscure imaging results. A provider may also decline a patient with a pre-

existing joint deformity due to the challenges in positioning such patients (HSS has alternative positioning protocols for such patients). It is not the practice of HSS to maintain a list of other MRI providers who decline care to certain patients.

8. Please revise the "All of Connecticut & Westchester within 15 miles of Stamford" section of the table submitted on page 11 of the application. Include utilization volumes for Admissions, Ambulatory Surgery, and MRI Scans for 2007, 2008, 2009, 2010 and 2011 and 2012 to date. Provide the data in the following categories: Connecticut patients in the proposed service area (Stamford, Greenwich, New Canaan and Darien), Other Connecticut patients, and patients from Westchester within 15 miles of Stamford. Identify if the data submitted represent calendar or fiscal year.

	2007	2008	2009	2010	2011	Aug. 2012 YTD
Proposed Service Area (Stamford, Greenwich, New Canaan and Darien)						
Admissions	**164**	**222**	**234**	**258**	**258**	**151**
Ambulatory Surgery	**448**	**476**	**490**	**611**	**614**	**405**
MRI Scans	**526**	**644**	**738**	**949**	**881**	**581**
Other Connecticut						
Admissions	**350**	**401**	**398**	**429**	**489**	**339**
Ambulatory Surgery	**522**	**484**	**579**	**543**	**584**	**456**
MRI Scans	**469**	**614**	**705**	**739**	**725**	**622**
Westchester within 15 miles of Stamford						
Admissions	**384**	**416**	**458**	**474**	**488**	**338**
Ambulatory Surgery	**761**	**708**	**721**	**842**	**891**	**591**
MRI Scans	**752**	**1,026**	**1,119**	**1,298**	**1,281**	**943**
Totals						
Admissions	**898**	**1,039**	**1,090**	**1,161**	**1,235**	**828**
Ambulatory Surgery	**1,731**	**1,668**	**1,790**	**1,996**	**2,089**	**1,452**
MRI Scans	**1,747**	**2,284**	**2,562**	**2,986**	**2,887**	**2,146**

Note: Above years represent calendar years.

9. On page 25, the applicant states that a small portion of MRI scans are performed at Connecticut MRI locations as a result of HSS-affiliated physician orders. For 2009, 2010 and 2011, provide the name of the Connecticut imaging facility and the number of scans completed as a result of MRI scans ordered by HSS-affiliated physicians.

HSS does not track referrals by its Medical Staff to non-HSS MRI providers so this data is not available. However, based upon discussions with HSS Medical Staff currently practicing at HSS's Old Greenwich site, it is HSS's understanding that a small percentage of HSS's patients are referred to Connecticut providers (predominantly Greenwich Hospital).

10. Given that local referrals for MRI scans are currently being made, has consideration been given to contract services with these same Connecticut providers in lieu of purchasing a new MRI scanner? Describe if any alternative proposals to purchasing new equipment were evaluated.

Consideration was not given to contracting services with Connecticut providers as none of these providers sufficiently replicate HSS protocols to meet the needs of HSS patients and physicians. HSS utilizes the highest performing gradients on the market today. Its MRI units contain the most updated and state of the art technology. HSS's protocols are customized to meet the specific needs of its physicians and patients.

Scans are normally checked prior to the patient leaving the facility to ensure diagnostic quality. A musculoskeletal MRI radiologist is available at all times when scanning is being conducted to review or assist with the scan. After such review, additional sequences may be performed in order to achieve the required imaging results without the necessity of the patient returning for another visit. This allows each HSS physician to maximize the usefulness of the MRI as a tool for diagnosis and development of a treatment plan.

HSS and its radiologists have specialized in musculoskeletal MRI for over 20 years and perform over 30,000 musculoskeletal MRI exams annually. HSS focuses *solely* on orthopedics and rheumatology and requires that its radiologists have completed a musculoskeletal imaging fellowship, typically the fellowship offered at HSS. We are not aware of any other MRI centers that specialize in musculoskeletal MRI and perform anywhere near the number of musculoskeletal MRI's performed at HSS. It would be very difficult for an MRI center that treats all types of patients and does not do the level of musculoskeletal MRI volume that HSS does to fully replicate the protocols and services provided to HSS physicians and their patients.
The fact that over 3,000 patients from the State of Connecticut and nearby Westchester currently travel to HSS in Manhattan for their MRI's is further evidence that HSS's MRI imaging capabilities are not available from providers in Connecticut. These scans will continue to be referred to the HSS MRI department regardless of whether the MRI is located in NYC, Stamford or another location.

11. On page 28, the applicant states that the physicians currently seeing patients at the Greenwich location will be relocating to the proposed Stamford location containing the MRI unit and that 16 of the 17 physicians work on a part-time basis. Will physician staffing patterns be similar at the new location?

Physician staffing patterns will be similar at the new location, with a mix of part-time and full-time physicians providing services to HSS's patients in the region. Several of the MDs relocating from Old Greenwich to the Stamford site will expand the amount of time they currently spend in Connecticut to better accommodate their Connecticut and Westchester patients and other existing HSS MDs who see patients from the service area will spend time at this location on a part time basis. When fully operational, it is anticipated that a total of 24 physicians, the majority part-time, will be practicing at the site.

12. On page 26, the application states that "the proposed service will not duplicate any MRI services currently provided in Connecticut." Please elaborate on how the purchase and installation of a new MRI machine in the proposed service area would avoid duplicating services, given the existing MRI providers in the proposed service area and throughout Connecticut.

Since HSS's protocols and applications are unique to HSS, the addition of an HSS MRI in the region does not duplicate any MRI services currently provide in Connecticut. HSS utilizes the highest performing gradients on the market today. Its MRI units contain the most updated and state of the art technology. HSS's protocols are customized to meet the specific needs of its physicians and patients.

Scans are normally checked prior to the patient leaving the facility to ensure diagnostic quality. A musculoskeletal MRI radiologist is available at all times when scanning is being conducted to review or assist with the scan. After such review, additional sequences may be performed in order to achieve the required imaging results without the necessity of the patient returning for another visit. This allows each HSS physician to maximize the usefulness of the MRI as a tool for diagnosis and development of a treatment plan.

HSS and its radiologists have specialized in musculoskeletal MRI for over 20 years and perform over 30,000 musculoskeletal MRI exams annually. HSS focuses *solely* on orthopedics and rheumatology and requires that its radiologists have completed a musculoskeletal imaging fellowship, typically the fellowship offered at HSS. We are not aware of any other MRI centers that specialize in musculoskeletal MRI and perform anywhere near the number of musculoskeletal MRI's performed at HSS. It would be very difficult for an MRI center that treats all types of patients and does not do the level of musculoskeletal MRI volume that HSS does to fully replicate the protocols and services provided to HSS physicians and their patients.

The fact that over 3,000 patients from the State of Connecticut and nearby Westchester currently travel to HSS in Manhattan for their MRI's is further evidence that HSS's MRI imaging capabilities are not available from providers in Connecticut. These scans will continue to be referred to the HSS MRI department regardless of whether the MRI is located in NYC, Stamford or another location.

13. Please provide the percentage of MRI scans that were ordered on the same day as the physician visit at the hospital's main campus for Connecticut patients in 2011 and 2012.

Approximately 18% of all MRI scans at HSS's main campus are performed on the same day as the patient's MD office visit. However, HSS does not track unscheduled walk-in patients by patient origin so we are unable to provide this percentage for Connecticut patients only.

14. On page 337 of the CON application Charity Care and Bad Debt amounts appear to be the same. Please explain the reasoning for these projections. Provide a copy of the bad debt and charity care policy currently in place at HSS.

Charity care and bad debt amounts have been estimated based on HSS historical experience as a percentage of net revenue. See Attachment XIII for copies of HSS's Bad Debt and Charity Care Policies.

The mission of the Hospital is to provide the highest quality patient care, improve mobility and enhance the quality of life for all and to advance the science of orthopedic surgery, rheumatology and their related fields through research and education. The Hospital does this regardless of race, color creed, sexual orientation or ethnic origin.

Consistent with its mission, the Hospital invests significant amounts for the benefit of its local, national and international communities through patient care, education, research and other community benefit activities. The

calculation of community benefits is consistent with the guidelines prescribed by the Internal Revenue Service.

As a matter of policy, the Hospital provides significant amounts of partially or totally uncompensated care. Such uncompensated care is treated either as charity care under the Hospital's Financial Assistance Policy or as bad debt expense. The Hospital's Financial Assistance Policy provides full or partial uncompensated care to eligible patients and ensures the provision of quality healthcare to the community served while carefully considering and taking into account the ability of the patient to pay. The Hospital's Financial Assistance Program's eligibility threshold is 500% of the federal poverty guidelines, which is in excess of the New York State minimum requirement of 300% and the Connecticut requirement of 250%. In addition, the Hospital operates its clinics at a loss to help meet the needs of low income and uninsured individuals and also operates numerous outreach and educational programs which benefits the communities it serves.

Attachment XI

STAMFORD EXIT 9, LLC
46 Westchester Avenue
Pound Ridge, NY 10576
(914) 764-1000

October 1, 2012

Stacey Malakoff
Executive Vice President/CFO
Hospital for Special Surgery
535 East 70th Street
New York, New York, 10021

Re: 1 Blachley Road
Stamford, CT

Dear Stacey:

You have asked me, on behalf of the ownership of the above-referenced property, for a letter for Hospital for Special Surgery (HSS) to submit to the Office of Health Care Access of the State of Connecticut in connection with your application for a certificate of need.

This will confirm that we are negotiating a lease for space at 1 Blachley Road, Stamford, with an affiliate of HSS, HSS Properties Corporation. The term of this lease will be ten years, with rights to renew for two, five year periods.

We are expecting that the lease will be signed shortly, however, at this time no contractual relationship exists and the lease discussions are subject to the mutual execution and delivery of all appropriate lease documentation.

For our business reasons, we are requiring that the lease itself be kept confidential by HSS. However, if the Office of Health Care Access requests additional information, please let us know so that we can endeavor to provide such information, without negating the confidential status of the lease in other respects.

Sincerely,

Steven Wise

Attachment XII

State of Connecticut
GENERAL ASSEMBLY
STATE CAPITOL
HARTFORD, CONNECTICUT 06106-1591

September 14, 2012

Honorable Jewel Mullen, Commissioner
Office of the Health Care Advocate
410 Capitol Avenue
Hartford, CT 06106

Dear Commissioner Mullen:

I am writing in support of the Hospital for Special Surgery (HSS) application, Docket No. 12-31780-CON.

It has come to our attention that The Hospital for Special Surgery in New York City, which currently serves patients in Greenwich Connecticut is looking to expand their operation to the city of Stamford. HSS is a top orthopedic hospital in the country and the leading center in orthopedic research, which leads many Connecticut residents to receive surgery there. If the application is approved, Connecticut HSS patients would no longer need to travel to New York City to have MRI saving time and money, and it would promote greater access to healthcare.

Many Thanks,

Livvy R. Floren

Livvy Floren
State Representative, 149th District

L. Scott Frantz
State Senator, 36th District

Michael L. Molgano

Michael Molgano
State Representative, 144th District

State of Connecticut
HOUSE OF REPRESENTATIVES
STATE CAPITOL
HARTFORD, CONNECTICUT 06106-1591

REPRESENTATIVE WILLIAM TONG
147TH ASSEMBLY DISTRICT

LEGISLATIVE OFFICE BUILDING
ROOM 2405
HARTFORD, CT 06106-1591
CAPITOL: 860-240-0413
TOLL FREE: 1-800-842-8267
FAX: 860-240-0206
E-MAIL: William.Tong@cga.ct.gov

CHAIRMAN
BANKS COMMITTEE

MEMBER
ENERGY AND TECHNOLOGY COMMITTEE
JUDICIARY COMMITTEE

October 1, 2012

Honorable Jewel Mullen, Commissioner
410 Capitol Avenue
Hartford, CT 06134

Re: Hospital for Special Surgery (HSS)

Dear Commissioner Mullen:

I am writing in support of the Hospital for Special Surgery (HSS) application, Docket No. 12-31780-CON.

As you may know, The Hospital for Special Surgery in New York City has a presence in Connecticut - Old Greenwich and they are looking to expand that operation to Stamford to better accommodate their patient population residing in our state and northern New York. An MRI machine is absolutely essential to this project.

The proposal is beneficial to Stamford and our community on many levels. It would significantly improve the efficiency and delivery of patient care, providing a higher quality of health care, as well as greater access to health care. It would also create many construction jobs and in the long-term more employment opportunities in the medical field.

This is a wonderful opportunity for our community and I thank you in advance for your consideration of this important matter.

Very truly yours,

William Tong

State of Connecticut
HOUSE OF REPRESENTATIVES
STATE CAPITOL
HARTFORD, CONNECTICUT 06106-1591

REPRESENTATIVE PATRICIA BILLIE MILLER
145TH ASSEMBLY DISTRICT

LEGISLATIVE OFFICE BUILDING
ROOM 4016
HARTFORD, CT 06106-1591

HOME: (203) 325-3315
CAPITOL: (860) 240-8585
TOLL FREE: (800) 842-8267
FAX: (860) 240-0206
E-MAIL: Patricia.Miller@cga.ct.gov

VICE CHAIRMAN
APPROPRIATIONS COMMITTEE

MEMBER
EDUCATION COMMITTEE
HOUSING COMMITTEE

October 1, 2012

Dr. Jewel Mullen, Commissioner
Department of Public Health
410 Capitol Avenue
Hartford, CT 06131

Reg. Docket No. 12-31780- CON; Hospital for Special Surgery (HSS)

I am writing in support of the hospital for special surgery in Stamford, CT. This project will bring a world class health care facility to Connecticut and create many construction jobs and in the long term more employment opportunities in the medical field.

It would be beneficial to the Stamford community on many levels. It would improve access to care increase efficiency and delivery of services and provide higher quality care.

This is a wonderful opportunity for our community and I thank you in advance for your consideration of this important matter.

Sincerely,

Patricia Billie Miller
State Representative
145th District

LIO/pbm

State of Connecticut

HOUSE OF REPRESENTATIVES
STATE CAPITOL

REPRESENTATIVE TERRIE WOOD
ONE HUNDRED AND FORTY-FIRST DISTRICT

50 ST. NICHOLAS ROAD
DARIEN, CT 06820
CAPITOL: (860) 240-8700
TOLL FREE: 1-800-842-1423
EMAIL: Terrie.Wood@housegop.ct.gov

RANKING MEMBER
SELECT COMMITTEE ON CHILDREN

MEMBER
APPROPRIATIONS COMMITTEE
ENVIRONMENT COMMITTEE

October 10, 2012

Dr. Jewel Mullen
Commissioner
Department of Public Health
410 Capitol Avenue
Hartford, CT 06106

Dear Dr. Mullen:

I am writing in support of the Hospital for Special Surgery (HSS) application, Docket No. 12-31780-CON.

I understand that The Hospital for Special Surgery in New York City, which serves many patients in the Stamford, Connecticut metro area is looking to expand their operation to the city of Stamford. HSS is the top orthopedic hospital in the country and the leading center in orthopedic research. This leads many Stamford area residents choosing to have their surgery there. If the application is approved, Connecticut HSS patients would no longer need to travel to New York City to have an MRI, saving time and money, and providing greater access to healthcare.

The proposal is enormously beneficial to Stamford and our community at large. It would significantly improve the efficiency and delivery of patient care, providing a higher quality health care. It would also create many construction jobs and in the long-term more employment opportunities in the medical field.

This is a wonderful opportunity for our community and I sincerely hope that Department of Public Health will give HSS the necessary approvals.

Best regards,

Terrie Wood

Terrie Wood
State Representative

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.
Commissioner

Dannel P. Malloy
Governor
Nancy Wyman
Lt. Governor

October 18, 2012

The Honorable Terrie Wood
Representative
State of Connecticut
50 St. Nicholas Rd.
Darien, CT 06820

Re: Certificate of Need
Hospital for Special Surgery, Docket Number: 12-31780-CON
Proposal for the Acquisition and Installation of an MRI in Stamford

Dear Representative Wood:

On October 11, 2012, the Department of Public Health ("DPH") received your letter concerning the Certificate of Need ("CON") for the proposal by the Hospital for Special Surgery for the acquisition and installation of an MRI in Stamford.

I welcome and appreciate your comments regarding this matter. I have forwarded your letter to DPH's Office of Health Care Access ("OHCA"). Your letter will be made part of OHCA's formal record of the CON application docket. Please be advised, once a decision has been rendered it will be posted and available on OHCA's website at http:// www.ct.gov/dph/ohca. Meanwhile, OHCA's website maintains status reports that you may review at your convenience.

If you have any further concerns or questions, please feel free to contact Kimberly Martone at (860) 418-7029.

Sincerely,

Lisa A Davis

Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner

LAD:KRM:bko

Keeping Connecticut Healthy
DPH
Connecticut Department of Public Health

Phone: (860) 509-8000 • Fax: (860) 509-7184 • VP: (860) 899-1611
410 Capitol Avenue, P.O. Box 34038
Hartford, Connecticut 06134-0308
www.ct.gov/dph

Raymond T. Dalio

BRIDGEWATER

August 9, 2012

Ms. Lisa A. Davis
Deputy Commissioner
Connecticut Dept. of Public Health
Office of Health Care Access
410 Capitol Avenue
Hartford, CT 06134

Dear Commissioner Davis,

I am writing in support of the Hospital for Special Surgery's application to expand the services it currently provides to the residents of Connecticut. HSS has a site in Greenwich, CT with physician offices and X-ray capabilities and is looking to transition this site to the new Chelsea Piers complex in Stamford, CT. At this time patients in need of magnetic resonance imaging services (MRIs) must travel into Manhattan.

Each year, HSS performs over 3,300 MRIs at its main campus facility in New York City for Connecticut patients and residents living within 15 miles of Stamford. Having an MRI at the Chelsea Piers site is an essential service for HSS physicians who seek to provide the most convenient, efficient, and innovative care to their patients.

I strongly urge the Office of Health Care Access to approve HSS's proposal to install an MRI in Stamford and enable patients to receive the best possible care closer to home. Thank you very much for your consideration.

Sincerely,

Ray Dalio

cc: Louis A. Shapiro
President & CEO, Hospital for Special Surgery

Attachment XIII

HOSPITAL FOR SPECIAL SURGERY
PATIENT ACCOUNTING POLICIES AND PROCEDURES

Subject: **Self Pay Billing & Collections / Bad Debt**

Revised: 02/04, 02/05, 2/06, 2/07, 4/08, 3/09, 11/09, 12/09, 12/10, 10/11

Policy: to follow appropriate guidelines for the billing and collection of patient balances.

Procedures:

1. **Self Pay Collections – Balances due from patients without insurance, insured patients whose insurance rejected their claim, and balances due after payment from an insurance carrier:**

   a. All patients will be billed according to standard dunning cycles, issued a detail bill, a minimum of at least 2 additional collection letters and/or telephone calls, and then transferred to a "pre-collection status." Balances over $500.00 will enter a separate ("internal pre collection") Financial Class (056) and dunning flow. All collection efforts will be documented in the patient's file, on the computer system, regardless of balance.
   b. During pre collection phase, additional telephone calls and/or letters are made to attempt to collect payment in full. Accounts are typically sent to an "inhouse" pre-collection company which issues a 2 letter series prior to referral to "external pre-collection" status (FC 05A thru 05D).
   c. If unsuccessful, accounts will then transfer to a professional collection agency (bad debt) financial class (053 or 055) no less than 120 days after original self pay billing date.
   d. These reasonable collection efforts include all patient accounts, for both Medicare and non-Medicare patients. Medicare and non-Medicare accounts are recorded separately.
   e. Payments received by the collection agency reduce amount recorded as bad debt.

2. **Guidelines**
   a. Payment Arrangements
      1. If patients are unable to pay entire balance in full, payment arrangements of monthly payments may be offered. These arrangements should be complete within six months, whenever possible.
      2. A confirmation letter will be sent within 5 days, explaining the terms of the agreement
      3. If a monthly payment is missed, the account will progress to the next dunning cycle

   b. Financial assistance
      1. The Finance Department (Financial Assistance Unit) is responsible for evaluating and processing all requests for Financial Assistance.
      2. Discounts are applied based on HSS Charity Guidelines, as described in administrative policy 2.04 Financial Assistance (Charity Care) Policy and Procedure.
      3. When patient contacts the FA Unit expressing interest in applying for financial assistance consideration, patient balance billing will be held pending adjudication.
      4. Upon adjudication, patient will be billed for any balance deemed to be owed.

3. **Collection Actions**
   a. It is the hospital's practice not to file suit, attach assets, or pursue liens. In certain instances, and in coordination with the hospital's legal counsel, the hospital may take such measures if deemed warranted.

4. **Reference Material**
    a. Chapter III of Medicare Hospital Manual "Bad Debts, Charity, and Courtesy Allowances"
    b. NY State Fair Debt Collection Act (see attached)

New York Fair Debt Collection Practices Act § 600.

Definitions. As used in this article, unless the context or subject matter otherwise requires:

1. "Consumer claim" means any obligation of a natural person for the payment of money or its equivalent which is or is alleged to be in default and which arises out of a transaction wherein credit has been offered or extended to a natural person, and the money, property or service which was the subject of the transaction was primarily for personal, family or household purposes. The term includes an obligation of a natural person who is a co-maker, endorser, guarantor or surety as well as the natural person to whom such credit was originally extended.

2. "Debtor" means any natural person who owes or who is asserted to owe a consumer claim.

3. "Principal creditor" means any person, firm, corporation or organization to whom a consumer claim is owed, due or asserted to be due or owed, or any assignee for value of said person, firm, corporation or organization.

New York Fair Debt Collection Practices Act § 601. Prohibited practices. No principal creditor, as defined by this article, or his agent shall:

1. Simulate in any manner a law enforcement officer, or a representative of any governmental agency of the state of New York or any of its political subdivisions; or

2. Knowingly collect, attempt to collect, or assert a right to any collection fee, attorney's fee, court cost or expense unless such changes are justly due and legally chargeable against the debtor; or

3. Disclose or threaten to disclose information affecting the debtor's reputation for credit worthiness with knowledge or reason to know that the information is false; or

4. Communicate or threaten to communicate the nature of a consumer claim to the debtor's employer prior to obtaining final judgment against the debtor. The provisions of this subdivision shall not prohibit a principal creditor from communicating with the debtor's employer to execute a wage assignment agreement if the debtor has consented to such an agreement; or

5. Disclose or threaten to disclose information concerning the existence of a debt known to be disputed by the debtor without disclosing that fact; or

6. Communicate with the debtor or any member of his family or household with such frequency or at such unusual hours or in such a manner as can reasonably be expected to abuse or harass the debtor; or

7. Threaten any action which the principal creditor in the usual course of his business does not in fact take; or

8. Claim, or attempt or threaten to enforce a right with knowledge or reason to know that the right does not exist; or

9. Use a communication which simulates in any manner legal or judicial process or which gives the appearance of being authorized, issued or approved by a government, governmental agency, or attorney at law when it is not.

New York Fair Debt Collection Practices Act § 602. Violations and penalties.

1. Except as otherwise provided by law, any person who shall violate the terms of this article shall be guilty of a misdemeanor, and each such violation shall be deemed a separate offense.

2. The attorney general or the district attorney of any county may bring an action in the name of the people of the state to restrain or prevent any violation of this article or any continuance of any such violation.

New York Fair Debt Collection Practices Act § 603. Severability.

If any provision of this article or the application thereof to any person or circumstances is held invalid the invalidity thereof shall not affect other provisions or applications of the article which can be given effect without the invalid provision or application, and to this and the provisions of this article are severable.

HOSPITAL FOR SPECIAL SURGERY
ADMINISTRATIVE POLICIES AND PROCEDURES

MANUAL CODE:	2.04
SUBJECT:	***FINANCIAL ASSISTANCE (CHARITY CARE) POLICY***
EFFECTIVE DATE:	6/85
REVIEWED/REVISED DATE:	1/05, 12/06, 8/08, 7/09, 3/10
DISTRIBUTION:	All Manual Holders

POLICY

The Mission of Hospital for Special Surgery is to provide the highest quality patient care, improve mobility and enhance the quality of life for all and to advance the science of orthopedic surgery, rheumatology and their related fields through research and education. We do this regardless of race, color, creed, sexual orientation or ethnic origin.

In keeping with its Mission, HSS will provide Financial Assistance to persons that meet the qualifications described in this policy. HSS's Financial Assistance policy and procedures will be maintained and operated in compliance with the applicable State of New York Hospital Financial Assistance laws.

The Finance Department is responsible for evaluating and processing all requests for Financial Assistance. Uninsured patients whose income level is at or below the U.S. Health and Human Services Poverty Guidelines will be charged no more than a nominal fee for any hospital service. For other uninsured patients whose income level is at or below 500% of the Poverty Guidelines, there will be a sliding scale discount off of HSS' bills, which discount for inpatient and outpatient services will be a percentage reduction off of what Medicaid would pay for the same service. The extent of the sliding scale discount for an uninsured patient will depend upon the patient's income level, and for those whose income is above 150% of the Poverty Guidelines, may also depend upon available net assets. Patients will be considered "uninsured" if they have no health insurance or have exhausted their insurance benefits.

All determinations shall be handled on a case by case basis, but shall be processed consistently in accordance with the guidelines outlined in this Policy and Procedures.

Individuals who have insurance coverage for services provided at HSS will also be considered for a discount off of copayments, deductibles or other fees due to the Hospital, which may result in a write-off of some or all of their responsibility based on their insurance coverage (whether available at HSS or elsewhere), gross annual income when compared to the Poverty Guidelines, and their reasonably available net assets.

PURPOSE

The purpose of this Policy is to ensure that all requests for Financial Assistance are evaluated and processed consistently and with dignity, compassion and in a respectful manner. HSS is committed to providing financial assistance when financially warranted regardless of age, gender, religion, race or sexual orientation.

PROCEDURE

A. What is Financial Assistance?

Financial Assistance is a term used to describe services provided at a reduced cost to needy individuals. It is not intended to be a substitute for available insurance coverage, or entitlement or other assistance programs.

B. When Will the Financial Assistance Summary be Distributed?

Patients will receive copies of the Financial Assistance Summary during registration as a patient at HSS, as well as any other time such patient makes a request for Financial Assistance.

C. Who is Eligible for Financial Assistance?

1. Residents of the United States whose gross annual income does not exceed five times the most current U.S. Health and Human Services (HHS) Poverty Guidelines for their family size (total exemptions claimed on their Federal tax return) are eligible to be considered for a percentage discount of their hospital bill as outlined in this policy, including, where applicable, a discount off of their co-payments or deductibles.
2. In addition, patients with higher income levels who face extraordinary medical bills may be considered for Financial Assistance.
3. If a patient has medical insurance and that insurance would cover the types of services the patient is seeking, but does not cover those services when provided at HSS, such patient will be eligible for Financial Assistance at HSS, unless the patient would have insurance coverage if those same medical services were to be provided at a medical facility within 50 miles of the patient's residence.
4. This Policy applies to hospital services only, and does not apply to services rendered by physicians.

D. What Constitutes a Request?

HSS will consider any indication of inability to pay as a possible request for Financial Assistance. A request for Financial Assistance may be made at any time. This means that an individual may make a request before, during or after services are received, including after commencement of a collection agency action against the individual. Initial requests may be made by telephone but the Financial Assistance Application needs to be filed before a final determination can be made. Once an individual makes a request, the individual is to be advised of this Policy, and sent a copy of the relevant application forms, as well as the Financial Assistance Summary.

E. **Determination of Eligibility for Financial Assistance**

A determination of eligibility for Financial Assistance will be made only upon submission of a completed Financial Assistance Application form accompanied by required documentation. The form must be submitted to the Financial Assistance Program in the Finance Department which can be reached at 212-606-1505. HSS staff must document certain information on the application form, in accordance with Section F below.

1. A determination of eligibility for Financial Assistance must be made within 30 days after the receipt of a complete application. An application will be deemed complete when all requested information and materials have been received by the Finance Department.
2. HSS staff must obtain from the patient the information pertaining to the patient's insurance coverage, family size, family income, and net assets for the 12 months preceding the determination of eligibility (see Section F below regarding process to verify household income and available assets).
    a. Available Assets are defined as liquid assets and will exclude patient's primary residence, assets held in a tax-deferred or comparable retirement savings account, college savings account or cars used regularly by a patient or immediate family members.
    b. Available Assets will not be considered for any uninsured patient (or patients whose insurance benefits have been exhausted), whose income level is at 150% or less of the Poverty Guidelines.
3. If there are no or few available net assets, HSS staff must multiply the latest 3 months income times four (4) and compare the result with the 12- month's figures. **The lesser amount will be used to determine eligibility for Financial Assistance.**
4. If the Finance Department determines that a patient may be eligible for government benefits that could defray the cost of the patient's medical bills, it may choose to require the patient to submit an application for such benefits.
5. HSS staff must compare the patient's household income and family size to the HHS Poverty Guidelines in effect. If the patient's income for family size is at or below 100% of the Poverty Guidelines, HSS will charge such patient no more than a nominal fee. If an uninsured patient's income is between 100% and 150% of the Poverty Guidelines, HSS shall apply the HSS sliding scale discount attached to this Policy. For uninsured patients whose income is between 151% and 500% of the Poverty Guidelines, HSS staff shall then review the patient's available net assets.
6. If a determination has been made that a patient is not eligible for government benefits, and/or an uninsured patient whose income is between 151% and 500% of the Poverty Guidelines does not have sufficient available net assets, then HSS staff shall determine the proposed payment discount for the service if the patient's household gross yearly income meets or does not exceed five times the most recent HHS Poverty Guidelines for their family size, according to the HSS sliding discount chart based on income level and family size.
7. For uninsured patients whose income is between 151% and 500% of the Poverty Guidelines who do have sufficient available net assets to pay some or all of their hospital bills, HSS shall evaluate the extent of such assets before applying appropriate adjustments to the HSS sliding scale discount chart.

8. Write-offs may then be granted by the Finance Department. Finance Department shall then document the determination on the Financial Assistance Determination of Eligibility Form (see Section H below).
9. Insured individuals whose income is close to or below the Poverty Guidelines and who do not have sufficient net assets will be considered for discounts off of co-payment and deductibles.
10. Individuals whose income exceeds five times the Poverty Guidelines for their family size but who do not have available net assets might be eligible for a discount off fees due to HSS which are not covered by insurance, based upon HSS's processes for those whose medical expenses are extraordinary. Applications for such cases will be considered on a case by case basis and need the approval of the AVP or VP of Finance.
11. Before granting any write-off in excess of $20,000, HSS staff must submit the proposed write-off to the AVP or VP of Finance. The AVP or VP of Finance, after application of this Policy and Procedure, shall then document either the denial or approval of the write-off. HSS staff shall then document the AVP or VP of Finance's determination on the Financial Assistance Determination of Eligibility Form (see Section H below).
12. Use of payment plans is permitted for the payment of outstanding balances. The monthly payment under such plan shall not exceed 10% of the gross monthly income for uninsured patients and shall be limited to a maximum duration of 5 years.

F. **Verification of Household Income and Assets**

HSS shall use the following methods to verify the patient's household gross yearly income:

a. Most current three months pay stubs
b. W-2 tax withholding form
c. Income tax returns
d. Form approving or denying unemployment compensation
e. Oral or written income verification from public assistance agencies
f. Bank account or investment statements
g. Flexible Spending Account or Health Care Savings Account election information and balance
h. SSI Benefit Statement or Benefit Determination

G. **Completion of Financial Assistance Application**

Patient or his/her legal guardian must complete the following information on the Request for Financial Assistance Application form:

a. Date of formal request
b. Requested by (Parent or guardian if patient is a minor)
c. Patient's name
d. Patient's date of birth
e. Patient's address
f. Telephone number
g. Number of persons in family (as defined by number of exemptions claimed on their Federal tax return)
h. Family income for the last twelve (12) months and the last (3) months.
i. Available assets for those individuals with income above 150% of the Poverty Guidelines

j. Type of hospital service requested
k. Signed and dated application

H. Financial Assistance Determination of Eligibility

The HSS Finance Department shall complete the following information on the Financial Assistance Determination of Eligibility Form after reviewing the Request for Financial Assistance Application and making a determination:

a. Date of determination
b. Patient's name
c. Hospital Account Number
d. Initial Service Date
e. Eligibility Determination (Approved / Denied) by appropriate designee
f. Amount approved for write-off

I. Patient Notification and Appeals

1. The HSS Finance Department shall proceed as follows once the determination for Financial Assistance is made:
   a. If the request is approved, give or mail the patient or legal guardian a letter of the Financial Assistance determination indicating the approved discount.
   b. If the request is denied, document the reason for denying the request on the Financial Assistance Determination form and give or mail a letter of denial to the patient or legal guardian. The notice of denial will include information regarding the patient's right and process to appeal the denial decision.
   c. File copies of the notices (denial or approval) with the completed Request for Financial Assistance Application in Finance Department.

2. If the patient files an appeal, the AVP or VP of Finance will re-review the patient's documentation, including any newly submitted material and will again document its approval or denial and notify the patient in accordance with Section I.1. above.

J. Responsibility for Dissemination of Financial Assistance Policy and Training

1. Hospital registration staff is responsible for ensuring the Summary is distributed at registration in accordance with Section B above. The Finance Department will be responsible for advising patients of such policy when uninsured patients, or other individuals without sufficient insurance coverage, inquire about the costs of HSS's services and for posting signs regarding the HSS Financial Assistance Policy at hospital registration locations.
2. The Finance Department will be responsible to train, educate and monitor appropriate hospital staff (those who interact with patients or staff who have billing or collection responsibility) on HSS's Financial Assistance policy.

K. Collection Activities

1. The HSS Finance Department will monitor the standards and scope of practices to be used to collect outstanding patient debt, including the establishment of written policies regarding when patient debt is referred for collection or legal action.
2. The HSS Finance Department will obtain written agreement from collection agencies acting on the Hospital's behalf to follow this Policy and Procedure, including an

agreement to provide patients with information on how to apply for Financial Assistance where appropriate.

3. HSS will refrain from sending an account to collection if the patient has submitted a completed Financial Assistance Application, including any required supporting documentation, while the Hospital determines the patient's eligibility for such aid.
4. The patient's bill will contain a notification, not less than thirty days prior to the referral of patient's debt for collection, that the debt will be referred for collection.
5. A patient will be notified of the availability of Financial Assistance, if applicable, prior to the commencement of a collection action.
6. Collections will not be made from any patient determined to be eligible for medical assistance pursuant to Medicaid at the time services were rendered and for which services Medicaid payment is available.
7. Any collection agency used by HSS must obtain the written consent of HSS prior to commencing a legal action to collect sums owed to HSS by a patient.
8. HSS may not force the sale or foreclosure of patient's primary residence to collect on an outstanding bill.

L. **Reporting and Compliance**

1. The Finance Department will be responsible for the submission of required reports to the State of New York with regards to the Financial Assistance Program.
2. The Finance Department will be responsible to certify HSS's compliance with the requirements of the State of New York in regards to the provision of Financial Assistance through the certification of its outside auditor or through an attestation by a senior hospital official.

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

November 7, 2012

VIA FAX ONLY

Ms. Stacey L. Malakoff
Executive Vice President/CFO
Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

RE: Certificate of Need Application, Docket Number 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and installation of an MRI in Stamford

Dear Ms. Malakoff:

This letter is to inform you that, pursuant to Section 19a-639a(d) of the Connecticut General Statutes, the Office of Health Care Access has determined that the above-referenced application has been deemed complete as of November 2, 2012.

If you have any questions regarding this matter, please feel free to contact me at (860) 418-7014.

Sincerely,

Brian A. Carney

Brian A. Carney
Associate Research Analyst, DPH OHCA

Copy:

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3129
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	11/07 12:11
TIME USE	00'22
PAGES SENT	2
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: STACEY L. MALAKOFF / HOSPITAL FOR SPECIAL SURGERY

FAX: (212) 774-2620

AGENCY:

FROM: BRIAN CARNEY

DATE: 11/7/12 TIME:

NUMBER OF PAGES: 2
(including transmittal sheet)

Comments: APPLICATION HAS BEEN DETERMINED COMPLETE - SEE LETTER

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

November 15, 2012

Stacey L. Malakoff
Executive Vice President/CFO
Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

RE: Certificate of Need Application, Docket Number 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery

Proposal for the Acquisition and Installation of an MRI in Stamford

Dear Ms. Malakoff,

With the receipt of the completed Certificate of Need ("CON") application information submitted by Hospital for Special Surgery ("Applicant") on November 2, 2012, the Office of Health Care Access ("OHCA") has initiated its review of the CON application identified above.

Pursuant to General Statutes § 19a-639a (f), OHCA may hold a hearing with respect to any Certificate of Need application.

This hearing notice is being issued pursuant to General Statutes § 19a-639a (f)

Applicant:	New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Docket Number:	12-31780-CON
Proposal:	Proposal for the Acquisition and Installation of an MRI in Stamford with a total capital expenditure of $3,245,583

Notice is hereby given of a public hearing to be held in this matter to commence on:

Date: December 18, 2012

Time: 1:00 p.m.

Place: Department of Public Health, Office of Health Care Access
Third Floor Hearing Room
410 Capitol Avenue
Hartford, CT 06134

The Applicants are designated as party in this proceeding. Enclosed for your information is a copy of the hearing notice for the public hearing that will be published in *The Advocate* pursuant to General Statutes § 19a-639a (f).

Sincerely,

Kimberly R. Martone
Director of Operations

Enclosure

cc: Henry Salton, Esq., Office of the Attorney General
Marianne Horn, Department of Public Health
Kevin Hansted, Department of Public Health
Wendy Furniss, Department of Public Health
Marielle Daniels, Connecticut Hospital Association

KRM:BC:AV:lmg

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

November 15, 2012 Requisition # 40337

The Advocate
258 Atlantic Street
Stamford, CT 06903

Gentlemen/Ladies:

Please make an insertion of the attached copy, in a single column space, set solid under legal notices, in the issue of your newspaper by no later than **Monday, November 19, 2012.** Please provide the following **within 30 days** of publication:

- Proof of publication (copy of legal ad. acceptable) showing published date along with the invoice.

If there are any questions regarding this legal notice, please contact Kaila Riggott at (860) 418-7001.

KINDLY RENDER BILL IN DUPLICATE ATTACHED TO THE TEAR SHEET.

Sincerely,

Kimberly R. Martone
Director of Operations

Attachment

cc: Danielle Pare, DPH
Marielle Daniels, Connecticut Hospital Association

KRM:KR:lmg

The Advocate **November 15, 2012**
Notice of Public Hearing, Docket Number 12-31780-CON

PLEASE INSERT THE FOLLOWING:

Office of Health Care Access Public Hearing

Statute Reference:	19a-639
Applicant:	New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Town:	Stamford
Docket Number:	12-31780-CON
Proposal:	Proposal for the Acquisition and Installation of an MRI with a total capital expenditure of $3,245,583
Date:	December 18, 2012
Time:	1:00 p.m.
Place:	Department of Public Health, Office of Health Care Access 410 Capitol Avenue, 3rd Floor Hearing Room Hartford, CT

Any person who wishes to request status in the above listed public hearing may file a written petition no later than December 13, 2012 (5 calendar days before the date of the hearing) pursuant to the Regulations of Connecticut State Agencies §§ 19a-9-26 and 19a-9-27. If the request for status is granted, such person shall be designated as a Party, an Intervenor or an Informal Participant in the above proceeding. Please check OHCA's website at **www.ct.gov/ohca** for more information or call OHCA directly at (860) 418-7001.

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3147
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	11/16 12:11
TIME USE	00'54
PAGES SENT	5
RESULT	OK

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: STACEY L. MALAKOFF

FAX: (212) 774-2620

AGENCY: HOSPITAL FOR SPECIAL SURGERY

FROM: BRIAN CARNEY/ALLA VEYBERMAN

DATE: 11/16/12 **TIME:**

NUMBER OF PAGES: 5
(including transmittal sheet

Comments: DN: 12-31780-CON Notice of Public Hearing

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

Greer, Leslie

From:	ADS <ADS@graystoneadv.com>
Sent:	Friday, November 16, 2012 10:49 AM
To:	Greer, Leslie
Subject:	Re: Hearing Notices

Good day!

Thanks so much for your ad submission.
We will be in touch shortly and look forward to serving you.

If you have any questions or concerns, please don't hesitate to contact us at the number below.

We sincerely appreciate your business.

PLEASE NOTE: New Department of Labor guidelines allow web base advertising when hiring foreign nationals. To provide required documentation Graystone will retrieve & archive verification for the 1st and 30th days of posting for $115.00/web site. If required, notify Graystone when ad placement is approved.

Thank you,
Graystone Group Advertising

2710 North Avenue
Bridgeport, CT 06604
Phone: 800-544-0005
Fax: 203-549-0061

E-mail new ad requests to: ads@graystoneadv.com
http://www.graystoneadv.com/

From: <Greer>, Leslie <Leslie.Greer@ct.gov>
Date: Friday, November 16, 2012 10:45 AM
To: ads <ads@graystoneadv.com>
Subject: Hearing Notices

Please post the three attached hearing notices by 11/19/12.

DN: 12-31775-CON	Record Journal	Requisition # 40333
DN: 12-31780-CON	The Advocate	Requisition # 40337
DN: 12-31781-CON	The News Times	Requisition # 40337

If you have any questions, please feel free to call me.

Thank you,

Leslie M. Greer
CT Department of Public Health
Office of Health Care Access
410 Capitol Avenue, MS#13HCA
Hartford, CT 06134
Phone: (860) 418-7013
Fax: (860) 418-7053
Website: www.ct.gov/ohca
Please consider the environment before printing this message

Greer, Leslie

From:	Laurie <Laurie@graystoneadv.com>
Sent:	Friday, November 16, 2012 3:30 PM
To:	Greer, Leslie
Subject:	FW: Hearing Notices
Attachments:	12-31780 Advocate.doc; 12-31781News-Times.doc; 12-31775np Record Journal resaved[1].doc

Your legal notice is all set to run as follows:

DN: 12-31775-CON	Record Journal, 11/19 issue - $140.29
DN: 12-31780-CON	The Advocate, 11/19 issue - $196.64
DN: 12-31781-CON	The News Times, 11/19 issue - $438.93

Thanks,
Laurie Miller

Graystone Group Advertising
2710 North Ave., Ste 200, Bridgeport, CT 06604
Ph: 203-549-0060, ext 319, Fax: 203-549-0061,Toll free: 800-544-0005
email: laurie@graystoneadv.com
www.graystoneadv.com

From: <Greer>, Leslie <Leslie.Greer@ct.gov>
Date: Friday, November 16, 2012 10:45 AM
To: ads <ads@graystoneadv.com>
Subject: Hearing Notices

Please post the three attached hearing notices by 11/19/12.

DN: 12-31775-CON	Record Journal	Requisition # 40333
DN: 12-31780-CON	The Advocate	Requisition # 40337
DN: 12-31781-CON	The News Times	Requisition # 40337

If you have any questions, please feel free to call me.

Thank you,

Leslie M. Greer
CT Department of Public Health
Office of Health Care Access
410 Capitol Avenue, MS#13HCA
Hartford, CT 06134

Phone: (860) 418-7013
Fax: (860) 418-7053
Website: www.ct.gov/ohca

Frank A. Corvino
President &
Chief Executive Officer

GREENWICH HOSPITAL
YALE NEW HAVEN HEALTH

November 9, 2012

Lisa Davis, MBA, BSN, RN
Deputy Commissioner
Office of Health Care Access
Department of Public Health
410 Capitol Avenue, MS#13HCA
P. O. Box 340308
Hartford, CT 06134

Re: Certificate of Need Application ("CON") Docket Number: 12-31780-CON
Hospital for Special Surgery, Proposal for the Acquisition and Installation of an MRI in Stamford

Dear Deputy Commissioner Davis:

I am writing this letter to express Greenwich Hospital's position on the above referenced CON application. It is understood that some Connecticut residents who reside in Greenwich Hospital's service area choose to seek services, including MRI scans, from the Hospital for Special Surgery ("HSS"). To date, MRI scans provided by HSS, have required travel by Connecticut residents into Manhattan. Greenwich Hospital recognizes the inconvenience such travel may bring to area residents.

Greenwich Hospital respectively requests that should the Office of Health Care Access ("OHCA") approve the above referenced CON application that the proposed MRI scanner is limited to providing MRI scans <u>only for HSS musculoskeletal patients</u>. HSS has indicated in its CON application that its desire to establish a Stamford, CT location with an MRI is being pursued in order to "...provide better access to its proprietary and customized MRI scans for its many patient in Connecticut...who currently travel to HSS's location in Manhattan to receive MRIs" (Applicant page 7). Such a limitation is consistent with previous CON applications, specifically Docket No.: 06-30674 subsequently modified by Docket No.: 09-31347-CON which restricts Neurology Associates, LLC to offering MRI services only to patients of the practice and Docket No.: 08-31120-CON which restricts Orthopaedic & Neurosurgery Specialists, P.C. to providing MRI services only to its own orthopedic and neurosurgical patients.

Greenwich Hospital is a long-standing provider of MRI services offering two scanners, a 1.5 Tesla and 3.0 Tesla, which provide high quality MRI imaging for a variety of conditions. These scanners have capacity to continue to offer most MRI scanning to the service area.

Please do not hesitate to contact me at (203) 863-3901 if you have any questions or if I can provide additional information.

Sincerely,

Frank A. Corvino
President & CEO

5 Perryridge Road
Greenwich, CT 06830-4697
(203) 863-3000
Fax (203) 863-3921

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.
Commissioner

Dannel P. Malloy
Governor
Nancy Wyman
Lt. Governor

TO: Kevin Hansted, Hearing Officer

FROM: Jewel Mullen, M.D., M.P.H., M.P.A., Commissioner

DATE: November 20, 2012

RE: Certificate of Need Application; Docket Number: 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and Installation of an MRI in Stamford

---

I hereby designate you to sit as a hearing officer in the above-captioned matter to rule on all motions and recommend findings of fact and conclusions of law upon completion of the hearing.

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

December 6, 2012

VIA FAX ONLY

Ms. Stacey L. Malakoff
Executive Vice President/CFO
Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

RE: Certificate of Need Application, Docket Number 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and installation of an MRI in Stamford

Dear Ms. Malakoff:

The Office of Health Care Access ("OHCA") will hold a public hearing on Tuesday, December 18, 2012, at 1:00 p.m. at the Department of Public Health, Office of Health Care Access, Third Floor Hearing Room, 410 Capitol Avenue, Hartford, regarding the Certificate of Need ("CON") application identified above. Pursuant to the Regulations of Connecticut State Agencies § 19a-9-29 (e), any party or other participant is required to prefile in written form all substantive, technical, or expert testimony that it proposes to offer at the hearing. The Applicant's prefiled testimony must be submitted to OHCA no later than **12:00 pm, on Thursday, December 13, 2012.**

All persons providing prefiled testimony must be present at the public hearing to adopt their written testimony under oath and must be available for cross-examination for the entire duration of the hearing. If you are unable to meet the specified time for filing the prefiled testimony you must request a time extension in writing, detailing the reasons for not being able to meet the specified deadline.

Additionally, please find OHCA's attachment outlining the suggested discussion points to prepare for the hearing.

Please contact Brian Carney at (860) 418-7014, if you have any questions concerning this request.

Sincerely,

Kevin T. Hansted, Esq.
Hearing Officer

Issues for Public Hearing:

Certificate of Need Application, Docket Number 12-31780-CON

New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and installation of an MRI in Stamford

Please be fully prepared to discuss the issues described below:

1) Clear public need for the proposal

2) Hospital for Special Surgery's proprietary MRI protocols

3) Target patient population

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3194
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	12/06 09:41
TIME USE	00'38
PAGES SENT	4
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: MS. STACEY L. MALAKOFF

FAX: (212) 774-2620

AGENCY: HOSPITAL FOR SPECIAL SURGERY

FROM: BRIAN A. CARNEY / OHCA

DATE: 12/6/12 TIME: 8:35

NUMBER OF PAGES: 4
(including transmittal sheet

Comments: PLEASE SEE DEADLINE FOR THE SUBMISSION OF YOUR PREFILE TESTIMONY & DISCUSSION POINTS FOR THE HEARING.

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

MURTHA CULLINA

PAUL E. KNAG
203.653.5407 DIRECT TELEPHONE
860.240.5711 DIRECT FACSIMILE
PKNAG@MURTHALAW.COM

December 12, 2012

RECEIVED
DEC 12 2012
OFFICE OF
HEALTH CARE ACCESS

Mr. Kevin T. Hansted, Esq.
Hearing Officer
State of Connecticut
Department of Public Health
Office of Health Care Access
410 Capital Ave., MS#13HCA
P.O. Box 340308
Hartford, CT 06134-0308

Dear Kevin:

Enclosed is the prefiled testimony of Hospital for Special Surgery in connection with Docket Number12-31780-CON and for the hearing scheduled for December 18 at 1p.m.

Very truly yours,

Paul

Paul E. Knag

Hospital for Special Surgery
Acquisition and Installation of an MRI in Stamford
Docket 12-31780-CON

Pre-filed Testimony of Louis A. Shapiro (President and Chief Executive Officer) and Stacey L. Malakoff (Executive Vice President and Chief Financial Officer)

I am Louis A. Shapiro, President and Chief Executive Officer of Hospital for Special Surgery ("HSS"). I want to thank you for the opportunity to speak to you about HSS and the Certificate of Need application that is before you.

HSS is located on the Upper East Side on Manhattan, NY, with several offsite medical office locations, including a site in Greenwich. Founded in 1863, HSS is an internationally renowned academic medical center specializing in the treatment of musculoskeletal diseases. Our mission is to provide the highest quality patient care, improve mobility, and enhance the quality of life for all and to advance the science of orthopedic surgery, rheumatology, and their related disciplines through research and education.

We currently have over 3,200 employees and approximately 300 active medical staff (including 95 orthopedic surgeons). In 2012, HSS will perform over 27,000 surgeries and have over 300,000 outpatient visits for non-surgical services such as radiology and rehabilitation. HSS was ranked #1 in the country for orthopedics and #3 for rheumatology by *U.S. News and World Report* in its 2012 "Best Hospitals" issue, marking the 22nd consecutive year that HSS has been among the top ranked hospitals in those fields.

Patients travel to New York City for HSS's internationally recognized and specialized care from all over the tri-state region, as well as nationally and internationally (only 15% of inpatient volume is from patients who reside in Manhattan). For the three year period 2009-2011, nearly 17,000 residents from the State of Connecticut and nearby Westchester County, NY (within 15 miles of our proposed Stamford site) traveled to New York City to receive care at HSS (representing approximately 54,000 visits). There were an additional 7,000 visits to HSS's current medical office site in Greenwich.

HSS has experienced significant volume growth throughout its broad geographic service area in both surgical and non-surgical services (including MRI). This growth has been driven by the continued increasing awareness regionally, nationally, and internationally of HSS's unique services, as well as many demographic trends increasing the demand for services in orthopedics and rheumatology. To address the capacity constraints created by this demand, HSS has increased the number of beds, operating rooms, MRI's, and other patient care services on its main New York City campus. Since the end of 2007, the number of operating rooms has increased from 27 to 35, the number of inpatient beds has increased from 162 to 205, and the number of MRI's has increased from 7 to 10. Demand for HSS's services is expected to continue to increase over the remainder of the decade, further exacerbating patient care capacity constraints at the New York City campus. A key component of HSS's strategic plan is developing offsite locations to enable HSS patients in the applicable communities to see their doctors and receive services closer to home, while at the same time alleviating the capacity constraints on our New York City campus.

HSS's current site in Greenwich is approximately 6,700 square feet and provides physician services, diagnostic x-ray, and fluoroscopic guidance imaging services. HSS plans to relocate and expand these services to an approximate 20,000 square foot site in Stamford (adjacent to the Chelsea Piers Complex). In addition, subject to OHCA approval, a 1.5 Tesla Magnetic Resonance Imaging ("MRI") unit will be purchased and installed at the site. This new and expanded site will enable more of our current Connecticut and Westchester patients to see their doctors and receive services closer to home.

HSS is one of the world's leading institutions in musculoskeletal MRI innovations. HSS and its radiologists have specialized in musculoskeletal MRI for over 20 years and perform over 30,000 musculoskeletal MRI exams annually. HSS focuses *solely* on orthopedics and rheumatology. It would be very difficult for an MRI center that treats all types of patients and does not do the level of musculoskeletal MRI volume and research that HSS does to fully replicate the protocols and services provided to HSS physicians and their patients. MRI is an essential diagnostic tool for HSS's physicians. A key ingredient to the quality of care that HSS patients receive is the unique and specialized magnetic resonance imaging performed at HSS. The protocols developed for MRI scans are customized to meet the needs and specifications of each HSS physician. These protocols have been developed and refined over the past 20 years through the close and ongoing collaboration between HSS's radiologists, surgeons, and other physicians. The majority of HSS physicians prefer that their patients have an HSS MRI and rely upon the HSS MRI protocols and quality as a tool for accurate diagnosis, development of efficient treatment plans, and ultimately superior patient outcomes. It is for all these reasons that approximately 3,250 residents of Connecticut and nearby Westchester County, NY (within 15 miles of the Stamford site) will travel to New York City in 2012 to receive MRI scans at HSS, rather than at local MRI facilities closer to their homes. The primary objective of the Stamford MRI is to provide better and more convenient access for many of these patients. The planned hours of the operation for the new unit are Monday to Friday, 10 hours per day. Based on these hours of operation and HSS's average MRI scan time, the maximum annual capacity is approximately 2,500 scans. HSS patients currently traveling to New York City for their MRI scans are expected to immediately fill this capacity. A similar proposal with similar objectives for an MRI at a satellite facility in Long Island has been approved by New York State.

HSS's proposed Stamford MRI will not impact the volumes of current Connecticut MRI providers since it will not be marketed to non-HSS physicians or their patients nor would there even be capacity to accommodate such patients in view of the number of HSS patients currently receiving MRI scans in New York who are expected to use the Stamford based MRI if approved. Furthermore, services at HSS's site will be limited exclusively to musculoskeletal MRI.

This proposal has generated a great deal of excitement and support. In particular, we have received and submitted letters of support from all of the Stamford area legislators, as well as key leaders of the business community. The Department of Economic and Community Development is also excited about what this proposed activity will mean for the state and its economy and is recommending state financial support for our project.

In summary, we have developed a plan that will greatly benefit our existing Connecticut area patients and bring world class orthopedic care to Connecticut. We therefore urge your approval of this application.

Hospital for Special Surgery
Acquisition and Installation of an MRI in Stamford
Docket 12-31780-CON

Pre-filed Testimony of Hollis G. Potter, M.D.

I am Dr. Hollis G. Potter, Chief, Division of Magnetic Resonance Imaging for Hospital for Special Surgery ("HSS"). I have specialized in Musculoskeletal MR Imaging since 1990. I have published 157 scientific articles and 54 book chapters and have lectured extensively at scientific orthopedic and radiology meetings throughout the world. I am funded by the National Institute of Health for MR research in both clinical and basic science projects and I am internationally recognized for my expertise in developing MR applications for orthopedic conditions. I want to thank you for the opportunity to speak to you about HSS and the Certificate of Need application that is before you.

MRI is an essential diagnostic tool for HSS's physicians. A key ingredient to the quality of care that HSS patients receive is the unique and specialized magnetic resonance imaging performed at HSS. The protocols developed for MRI scans are customized to meet the needs and specifications of each HSS physician. These protocols have been developed and refined over the past 20 years through the close and ongoing collaboration between HSS's radiologists, surgeons, and other physicians. The majority of HSS physicians prefer that their patients have an HSS MRI and rely upon the HSS MRI protocols and quality as a tool for accurate diagnosis, development of efficient treatment plans, and ultimately superior patient outcomes. The preoperative MRI often obviates the need for diagnostic arthroscopy (an invasive surgical procedure) and enables the surgeon to move straight to therapeutic intervention, thus shortening surgical time, length of anesthesia and quickening of the recovery period. It is for these reasons that approximately 3,250 residents of Connecticut and nearby Westchester County, NY (within 15 miles of the Stamford site) will travel to New York City in 2012 to receive MRI scans at HSS, rather than at local MRI facilities closer to their homes. The primary objective of the Stamford MRI is to provide better and more convenient access for many of these patients. The planned hours of the operation for the new unit are Monday to Friday, 10 hours per day. Based on these hours of operation and HSS's average MRI scan time, the maximum annual capacity is approximately 2,500 scans. HSS patients currently traveling to New York City for their MRI scans are expected to immediately fill this capacity.

HSS is one of the world's leading institutions in musculoskeletal MRI innovations. The Radiology department at HSS includes 15 Board-certified radiologists specializing in musculoskeletal imaging, including 5 radiologists dedicated to musculoskeletal MRI. HSS and its radiologists have specialized in musculoskeletal MRI for over 20 years and perform over 30,000 musculoskeletal MRI exams annually. HSS focuses *solely* on orthopedics and rheumatology and requires that its radiologists have completed a musculoskeletal imaging fellowship, typically the fellowship offered at HSS. HSS's musculoskeletal radiology fellows will have already done substantial research and achieved top ratings in their residency programs before being accepted into the HSS fellowship program. HSS has received several NIH awards for advanced imaging development. HSS and its patients also benefit from the comprehensive and collaborative research agreement that HSS has with GE Healthcare, allowing access to many newer, prototype sequences and techniques not commercially or currently available in the tri-state area. We are not aware of any other MRI centers that specialize in musculoskeletal MRI and perform anywhere near the number of musculoskeletal MRI's performed at HSS. It would be very difficult for an MRI center that does not specialize in musculoskeletal MRI, does not have HSS's level of musculoskeletal MRI volume, does not routinely perform imaging of complex cases, does not have access to the advanced technology that HSS has, and does not have radiologists who are fellowship trained in musculoskeletal imaging to fully replicate the protocols and services provided to HSS physicians and their patients. Even to partially replicate HSS's MRI protocols and quality would have adverse economic implications to a local provider, including investment in specialized staff and equipment, as well as reduced throughput (HSS's average time per scan is approximately 40 minutes vs. approximately 25 minutes for a typical MRI provider).

Processes and protocols developed for MRI scans performed at HSS include the following:

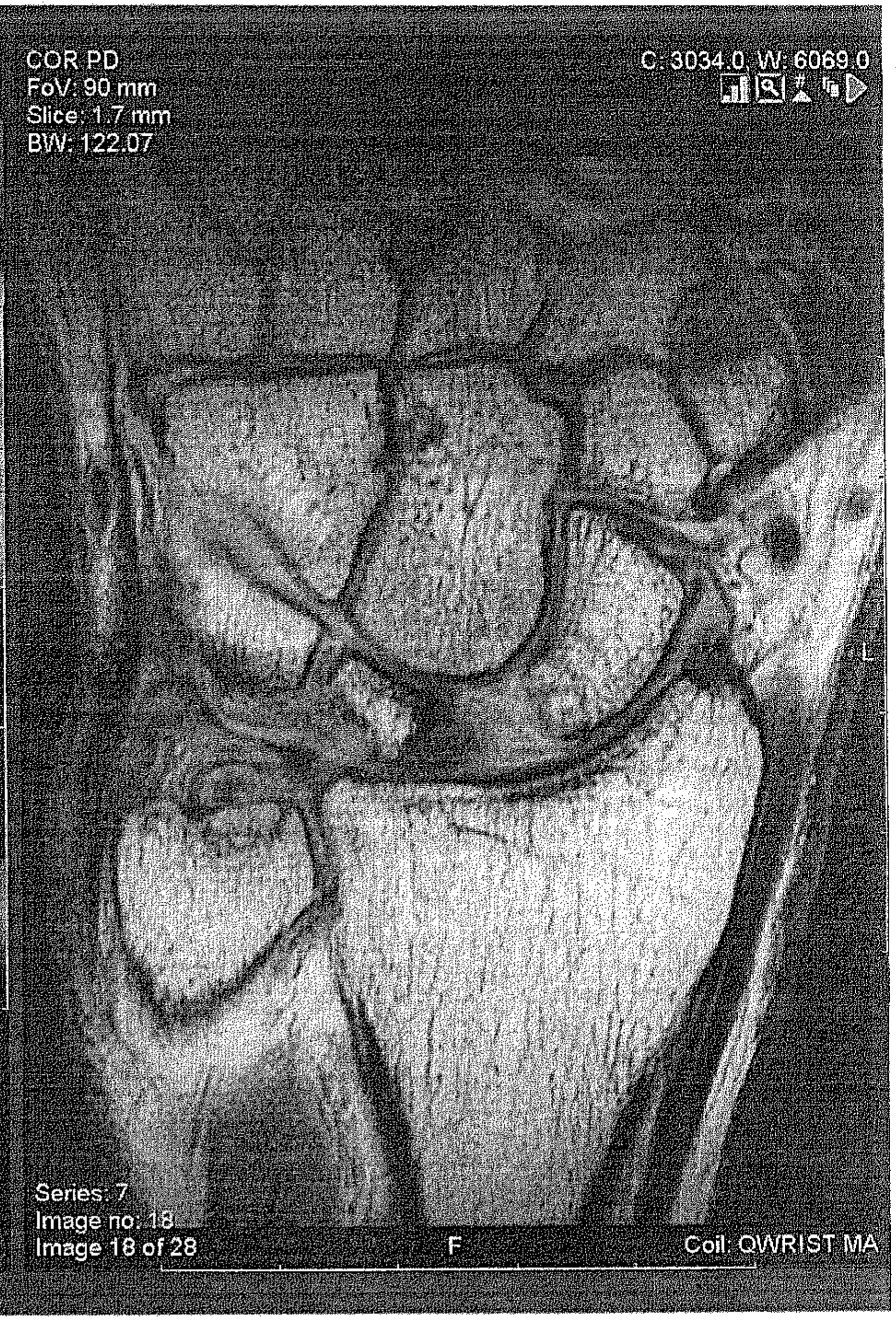
- Standardized cartilage-sensitive imaging performed in three planes which greatly increases diagnostic accuracy
- Dedicated coils used for specific body parts
- Utilization of high matrix imaging/thin slice imaging
- Checking of scans prior to the patient leaving the facility to ensure diagnostic quality; a musculoskeletal MRI radiologist is available at all times when scanning is being conducted. Enables additional sequences to be performed (if needed) to achieve the required imaging results and avoids the patient having to return for another visit
- High resolution non-contrast techniques which eliminate the need for intra-articular injections and limit the use of contrast injections. This reduces pain and risk of infection for the patient. These protocols have been independently validated for accuracy based on a surgical standard and these studies have been previously published in the peer review literature.
- Extraordinarily vigilant patient positioning techniques; HSS's patients have a wide variety of complex musculoskeletal conditions and the presence of a pre-existing deformity does not impair HSS's ability to perform high quality diagnostic imaging
- A series of proprietary and prototype means for early detection and treatment of osteoarthritis, post operative assessment of cartilage repair using MRI rather than follow up surgery, and assessment of bone loss and regional adverse tissue reactions around joint replacements
- The MAVRIC sequence, developed in collaboration with GE Healthcare, which markedly improves image quality around orthopedic hardware or implants (metal in a targeted area can often obscure imaging results)

- Following completion of the exam, the interpretation of the results is also of paramount importance. Due to our highly specialized area of expertise, we have had the opportunity to diagnose both rare conditions and unusual presentations of more common conditions that are often not recognized by less specialized radiologists. This results in more confidence in the diagnosis gleaned from a single imaging test, obviating the need for additional imaging and reducing the cost to the patient and healthcare system.

Attached for your reference is a sample of an HSS MRI image compared to a non-HSS MRI image.

We have developed a plan that will provide our existing Connecticut patients more convenient access to HSS's unique and specialized MRI services. We urge your approval of this application.


COR PD NO FAT
FoV: 80 mm
Slice: 3 mm
BW: 267
C: 334.4, W: 581.6
RF
Series: 601
Image no: 6
Image 6 of 14
FL
Coil: SENSE-Wrist-4


COR PD
FoV: 90 mm
Slice: 1.7 mm
BW: 122.07
C: 3034.0, W: 6069.0
L
Series: 7
Image no: 18
Image 18 of 28
F
Coil: QWRIST MA

Hospital for Special Surgery
Acquisition and Installation of an MRI in Stamford
Docket 12-31780-CON

Pre-filed Testimony of Jo A. Hannafin, M.D., PhD

I am Dr. Jo A. Hannafin, Attending Orthopedic Surgeon at Hospital for Special Surgery ("HSS") where I have been on the medical staff since 1992. I am a Professor of Orthopaedic Surgery at Weil Cornell Medical College and the President-Elect of the American Orthopaedic Society for Sports Medicine. I have published 85 papers in peer reviewed journals, 20 book chapters and am the author of "Say Goodbye to Knee Pain". I am the Director of Orthopaedic Research at HSS and have received research funding from the NIH and other foundations. I want to thank you for the opportunity to speak to you about HSS and the Certificate of Need application that is before you.

HSS is an internationally renowned academic medical center specializing in the treatment of musculoskeletal diseases. Patients travel from the tri-state region, national and international locations to New York City and the hospital satellite offices for specialized care. HSS was ranked #1 in the country for orthopedics and #3 for rheumatology by *U.S. News and World Report* in its 2012 "Best Hospitals" issue, marking the 22nd consecutive year that HSS has been among the top ranked hospitals in those fields. As the top-ranked orthopedic specialty hospital, a large proportion of our patients have highly complex musculoskeletal conditions and disorders, including patients with prior surgeries. A critical contributor to the hospital's top ranking and a key ingredient in the hospital continuum of care is the unique and specialized diagnostic capabilities of Hospital for Special Surgery MRI facilities.

The Radiology department at HSS includes 15 Board-certified radiologists specializing in musculoskeletal imaging, including 5 radiologists dedicated to musculoskeletal MRI. Over 30,000 musculoskeletal MRI exams are performed at HSS annually. Radiologists check scans prior to the patient leaving the facility to ensure diagnostic quality and allow for additional sequences to be performed (if needed) to achieve the required imaging results. The interpretation of the imaging studies is also of paramount importance. HSS radiologists regularly diagnose both rare conditions and unusual presentations of more common conditions that may not be recognized by less specialized radiologists. HSS and its patients also benefit from the comprehensive and collaborative research agreement with GE Healthcare, allowing access to new prototype sequences and techniques in advance of commercially availability in the tri-state area.

The protocols developed for MRI scans are customized to meet the specific needs of the surgeons and the patients they treat. These protocols have been developed and refined over the past 20 years through the close and ongoing collaboration between HSS's radiologists and surgeons. As noted above, a large proportion of our patient population has complex musculoskeletal conditions and disorders, which can present significant challenges in obtaining quality MRI images. In addition, certain body areas (e.g. hand, foot, spine) present inherent challenges because of the complexity of the anatomic structures. Standardized cartilage-sensitive imaging performed in three planes greatly increases diagnostic accuracy as do dedicated coils used to optimize imaging of specific body parts. HSS surgeons utilize the HSS MRI protocols, quality, experience, and expertise as a tool for accurate diagnosis and development of efficient treatment plans. Because of the detailed, meticulous, and customized HSS imaging, surgeons have a detailed "roadmap" to plan and implement surgical and non-surgical treatment and achieve the best outcomes. The accuracy of the HSS MRI imaging enables precise and optimal surgical intervention and optimal patient education concerning treatment options.

Over 3,000 residents of Connecticut and nearby Westchester County, NY (within 15 miles of the Stamford site) will travel to New York City in 2012 to receive MRI scans at HSS. HSS's Stamford-based MRI will enable these patients to receive their HSS MRI's closer to home. There are currently no local facilities that meet the diagnostic MRI needs, demands, and expectations of HSS surgeons for patients with complex injury, revision surgery where metallic hardware is present or imaging of joint replacements. It would be very difficult for an MRI center that does not specialize in musculoskeletal MRI, does not have HSS's level of musculoskeletal MRI volume, does not routinely perform imaging of complex cases, does not have access to the advanced technology that HSS has, and does not have radiologists who are fellowship trained in musculoskeletal imaging to fully replicate the protocols and services provided to HSS physicians and their patients.

We have developed a plan that will provide our existing Connecticut and Westchester patients more convenient access to HSS's unique and specialized MRI services. We urge your approval of this application.

WWW.ONSMD.COM
ORTHOPAEDIC & NEUROSURGERY SPECIALISTS

ORTHOPAEDIC SURGEONS

Michael R. Clain, MD
Foot and Ankle Surgery
Sports Medicine

John F. Crowe, MD
Hand and Wrist

James G. Cunningham, MD
Sports Medicine
Shoulder and Knee Surgery

Francis A. Ennis, Jr., MD
Hip and Knee Joint Replacement and Revision
Hip Arthroscopy

Tim Greene, MD
Hip Arthroscopy
Sports Medicine

Steven E. Hindman, MD
General Orthopaedics
Sports Medicine

Brian F. Kavanagh, MD
Hip and Knee Joint Replacement and Revision

Seth R. Miller, MD
Shoulder Surgery
Sports Medicine

David P. Nocek, MD
General Orthopaedics
Sports Medicine

Paul M. Sethi, MD
Sports Medicine
Shoulder and Knee Surgery

Katie B. Vadasdi, MD
Shoulder and Elbow
Sports Medicine

Mark A. Vitale, MD
Hand and Wrist

NEUROLOGICAL SURGEONS

Paul J. Apostolides, MD
Spine Surgery

Mark H. Camel, MD
Brain and Spinal Surgery

Amory J. Fiore, MD
Spine Surgery

Scott L. Simon, MD
Spine and Scoliosis Surgery

PHYSICAL MEDICINE

Jeffrey M. Heftler, MD
Interventional Physiatry

Tamar Kessel, MD
Interventional Spine and Sports Medicine

NON-OPERATIVE SPORTS MEDICINE

Gloria C. Cohen, MD

December 12, 2012

Via FedEx

The Honorable Jewel Mullen, MD, MPH, MPA
Commissioner
Department of Public Health, Division of Office of Health Care Access
410 Capital Avenue, MS#13HCA
Hartford, Connecticut 06134

RE: Certificate of Need Application, Docket Number 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and Installation of an MRI in Stamford

Dear Commissioner Mullen,

Orthopedic & Neurosurgery Specialists ("ONS"), is an orthopedic and sports medicine group located in Greenwich, Connecticut, specializing in non-operative and operative treatments for injuries and conditions of the musculoskeletal system and providing MRI services to patients. We have reviewed the Certificate of Need ("CON") application filed on behalf of the Hospital for Special Surgery located in New York City ("HSS" or the "Applicant"), for the acquisition and installation of an MRI in Stamford, CT ("Proposed HSS MRI"). We are submitting this letter to respectfully request that OHCA deny the CON application because HSS has not satisfied the statutory requirements enumerated in Conn. Gen. Stat. §19a-639. More specifically, the Applicant has (1) failed to demonstrate the proposed project is related to the Statewide Health Care Facilities and Services Plan; (2) failed to demonstrate a clear public need; (3) failed to prove the project will positively impact the financial strength of Connecticut's health care system; (4) failed to adequately identify the patient population; (5) failed to identify the utilization in the service area; and (6) failed to prove that the proposed project will

GREENWICH
6 Greenwich Office Park
40 Valley Drive
Greenwich, CT 06831
tel 203 869.1145
fax 203 869.2170

STAMFORD
Tully Health Center
32 Strawberry Hill Court
4th Floor
Stamford, CT 06902
tel 203 487.0363
fax 203 487.0308

not result in any unnecessary duplication of existing CON approved MRI facilities.

Applicant Has Failed to Demonstrate the Proposed Project is Related to the Statewide Health Care Facilities and Services Plan

The Statewide Health Care Facilities and Services Plan (the "Statewide Plan") recognizes the importance of maintaining appropriate levels of imaging services to avoid underutilization and ensure there is a clear public need for the acquisition of each imaging machine.[1] The Statewide Plan states "CON approval is required for these acquisitions and purchases must demonstrate clear public need for the equipment."[2] As outlined below, the Applicant has failed to demonstrate that a clear public need exists for the Proposed HSS MRI.

Applicant Has Failed to Demonstrate A Clear Public Need

Entities seeking OHCA authorization to acquire an MRI must demonstrate they meet a clear public need to add additional MRI capacity to the state. The Applicant has written about the level of care it provides, but it has not satisfactorily demonstrated the need for the Proposed HSS MRI in the primary and secondary service areas. The Applicants estimated utilization figures are not adequately supported and the Applicant has not properly analyzed the needs of its Connecticut patient draw.

The Applicant has proposed a primary service area of four Connecticut towns (Stamford, Greenwich, Darien and New Canaan) and three New York towns.[3] The Applicant lacks clear public need for the Proposed HSS MRI because 1) there exists excess capacity for MRI services in the proposed service area; 2) the need in the primary Connecticut service area is very small at only 896 scans[4]; and 3) the existing MRI providers can easily accommodate 896 scans with current capability in the service area. The Applicant states that certain patients in the proposed service area would still be obtaining MRI scans at the Manhattan location; however, the Applicant has not given any projection on what that patient percentage will be.[5] Applicant also represents it does not track patient origin data

---

[1] *The Statewide Health Care Facilities and Services Plan* (hereinafter, the "*Statewide Plan*"), 60 (October 2012).
[2] *Id.*
[3] *Certificate of Need Application, Docket Number 12-31780-CON* (hereinafter "CON Application"), 15.
[4] *CON Application*, 15. Also, as will be argued below, New York patient needs should not influence OHCA.
[5] *Id.* at 16

by MRI immediate walk-in need versus scheduled need.[6] This estimated 896 scans is actually lower as it is not adjusted to reflect patients who would prefer to have their scans at the Manhattan locations or who would obtain walk-in MRI services at the Manhattan MRI locations rather than at the Proposed HSS MRI. Without accurate figures, the proposed data on MRI utilization for Connecticut residents is not representative of how many patients need the Proposed HSS MRI opposed to those patients would actually utilize or be directed to the Applicant's Manhattan MRI locations.

OHCA, through the Statewide Plan, estimates that each scanner should perform approximately 4,000 scans annually.[7] The Applicant's estimated public need of 896 scans does not come close to this number and does not satisfy OHCA's clear public need requirement. Further, the Applicant has failed to identify any backlog or delay in timely treatment or diagnosis for patients in the proposed service area.

New York – Not Relevant for Connecticut Residents

Additionally, the Applicant states the Proposed HSS MRI will address patient needs in New York, but New York residents needs are not relevant to OHCA. OHCA and the CON process address the health care access needs of Connecticut residents and Connecticut providers, not those of other states. Further, the Applicant does not explain how the patients of Westchester County will benefit from an MRI machine in Connecticut rather than Westchester County, which has a strong patient draw for HSS.

The Applicant has included the entire state in the secondary service area. This is unreasonable estimation of a secondary service area as OHCA addresses need through analysis of service areas rather than the needs of the entire state. Even with a statewide service area, Connecticut patients have numerous options for patients to obtain MRI services statewide. There are approximately 114 MRI machines in Connecticut that Connecticut residents have access to for MRI services. Specifically, MRIs are maintained at 38 main hospital campus, 27 hospital satellite and 60 non-hospital provider MRI sites located throughout this state.[8] The Applicant has failed to address the secondary service area public need in relation to the existing 114 CON-approved MRIs.

---

[6] *CON Application*, 352.
[7] *Statewide Plan*, 61.
[8] *Statewide Plan*, 233.

The Applicant has extensively emphasized the level of care it provides its patients but does not associate such level of care with the need for an additional MRI in the proposed service areas. The Applicant also spends considerable time describing its protocol and software; however, such factors are not compelling nor do they substantiate need. Any proposed need for software or protocol cannot replace need for additional MRI and the Applicant's arguments are misplaced.

Applicant Has Failed to Prove the Project Will Positively Impact the Financial Strength of the State's Health Care System

The Applicant has failed to prove that the Proposed HHS MRI will improve the financial strength of the state's health care system. The state's health care system financial strength will not be improved by adding the HSS MRI to a service area that can accommodate the Applicant's minimal public need. The Applicant has not represented it will interface with other providers or hospitals in the area regarding the Proposed HSS MRI and placing the Proposed HSS MRI in Stamford to perform scans at a Connecticut physician location for hospital-based care in New York City does not encourage state-wide or county-wide provider integration.

Applicant Has Failed to Adequately Identify the Patient Population

The Applicant has failed to adequately identify the patient population. The application addresses the general draw of patients from New York and Connecticut but does not address the percentage of such patients who can or will utilize the HSS MRI opposed to the Applicant's New York MRIs. As stated above, New York patient utilization should not influence OHCA. The Applicant also fails to track patient origin data by immediate walk-in need versus scheduled need.[9] The Application further fails to describe the continuum of services available at the Stamford location and the patient populations who will benefit from such services. Without the figures and facts, the analysis on the Proposed HSS MRI patient population is an inadequate representation of the expected patient population to utilize the Proposed HSS MRI.

Applicant Has Failed to Identify the Utilization in the Service Area

The Applicant has not identified the utilization of MRI machines in the service area. The Applicant failed to describe its existing relationship with other

[9] *CON Application*, 352.

providers in Connecticut who provide similar services as requested by OHCA possibly indicating a lack of knowledge of the service area.[10] The Applicant's lack of MRI utilization knowledge in the service area results in a failure to analyze MRI options that are most beneficial to its patients. The proposed addition of another MRI in Stamford will risk financial stability that local long time established Connecticut providers have made in the decline of healthcare services by altering utilization rates. Further, no clear plan has been detailed regarding staffing of the MRI machine which could result in staffing challenges in the service area.

Applicant Has Failed to Prove the Proposed Project Will Not Result in Any Unnecessary Duplication of Existing or Approved MRI Facilities

Additional MRI capacity in the area will result in additional duplication of current CON-approved imaging equipment. The Applicant does not represent that the Proposed HSS MRI is different from existing CON-approved MRIs and HSS physicians currently refer patients to other MRI providers in the area.

Applicant represents that it needs the Proposed HSS MRI to provide specialized services to patients. However, nearly all of the procedures and services provided by physicians employed by the Applicant are the same procedures and services provided by Connecticut providers. This follows that the Proposed HSS MRI itself and potential capabilities are not different from other MRIs in the proposed service areas, and Applicant's specialized technique and protocol are not required to administer scans to HSS patients as the Applicant represents.

The Applicant also states that HSS physicians currently refer HSS patients to other MRI providers in the service area, including Greenwich Hospital.[11] Under this representation, the Applicant's patients have access to scans on any of the existing CON-approved MRIs in the proposed service area. Additionally, the capabilities of the scanner itself are not more advanced than that of other scanners in the service area. The Applicant has stated that a 1.5 Tesla strength MRI will be acquired; according to the Statewide Plan, there are numerous 1.5 Tesla strength MRIs in the proposed service area.[12] The capabilities of the Proposed HSS MRI are the same as the existing 1.5 Tesla scanners in the primary service area. Since the Applicant represents that HSS patient scans are currently being performed in Connecticut at the request of HSS physician orders, the Applicant's argument that

---

[10] *CON Application*, 345.
[11] *CON Application*, 25 and 349.
[12] *Statewide Plan*, 223 to 233.

the Proposed HSS MRI's specialized software and technique is necessary is not persuasive; the addition of the Proposed HSS MRI will simply add additional capacity to the proposed service area.

Further, the Applicant has not addressed whether the primary service area can accommodate more capacity, and thus the Applicant has failed to prove that the proposed additional MRI is needed and will not duplicate services. The Applicant has not looked to partner with current MRI providers in the area to accommodate its patients or otherwise to eliminate duplication of services. Most important, if there truly is a need for the software and technique in this service area that Applicants suggests, orthopedic groups and hospitals would have acquired it already.

Lastly, the Applicant does not state it will limit use of its MRI machine to HSS providers, it only states it will not market to non-HSS providers. The applicant fails to define "market" and has not provided any parameters of such marketing. Therefore, the Applicant may not accurately be representing the utilization of its machine and the service area if non-affiliated providers will be shifting additional capacity from appropriately utilized MRIs to a new MRI.

Conclusion

The Applicant's CON application fails to establish a clear public need. The application is not data-driven and does not support the addition of another 1.5 Tesla MRI scanner to the primary and secondary service area. The need and access for Connecticut residents has not been established and acquisition of the Proposed HSS MRI machine will result in excess capacity. We urge OHCA to deny HSS's CON application.

Thank you,

ONS Directors & Officers

ONS
WWW.ONSMD.COM
ORTHOPAEDIC & NEUROSURGERY SPECIALISTS

ORTHOPAEDIC SURGEONS

Michael R. Clain, MD
Foot and Ankle Surgery
Sports Medicine

John F. Crowe, MD
Hand and Wrist

James G. Cunningham, MD
Sports Medicine
Shoulder and Knee Surgery

Francis A. Ennis, Jr., MD
Hip and Knee Joint Replacement and Revision
Hip Arthroscopy

Tim Greene, MD
Hip Arthroscopy
Sports Medicine

Steven E. Hindman, MD
General Orthopaedics
Sports Medicine

Brian F. Kavanagh, MD
Hip and Knee Joint Replacement and Revision

Seth R. Miller, MD
Shoulder Surgery
Sports Medicine

David P. Nocek, MD
General Orthopaedics
Sports Medicine

Paul M. Sethi, MD
Sports Medicine
Shoulder and Knee Surgery

Katie B. Vadasdi, MD
Shoulder and Elbow
Sports Medicine

Mark A. Vitale, MD
Hand and Wrist

NEUROLOGICAL SURGEONS

Paul J. Apostolides, MD
Spine Surgery

Mark H. Camel, MD
Brain and Spinal Surgery

Amory J. Fiore, MD
Spine Surgery

Scott L. Simon, MD
Spine and Scoliosis Surgery

PHYSICAL MEDICINE

Jeffrey M. Heftler, MD
Interventional Physiatry

Tamar Kessel, MD
Interventional Spine and Sports Medicine

NON-OPERATIVE SPORTS MEDICINE

Gloria C. Cohen, MD

RECEIVED
DEC 13 2012
OFFICE OF HEALTH CARE ACCESS

December 12, 2012

Via FedEx

The Honorable Jewel Mullen, MD, MPH, MPA
Commissioner
Department of Public Health, Division of Office of Health Care Access
410 Capital Avenue, MS#13HCA
Hartford, Connecticut 06134

RE: Certificate of Need Application, Docket Number 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and Installation of an MRI in Stamford

Dear Commissioner Mullen,

Orthopedic & Neurosurgery Specialists ("ONS"), is an orthopedic and sports medicine group located in Greenwich, Connecticut, specializing in non-operative and operative treatments for injuries and conditions of the musculoskeletal system and providing MRI services to patients. We have reviewed the Certificate of Need ("CON") application filed on behalf of the Hospital for Special Surgery located in New York City ("HSS" or the "Applicant"), for the acquisition and installation of an MRI in Stamford, CT ("Proposed HSS MRI"). We are submitting this letter to respectfully request that OHCA deny the CON application because HSS has not satisfied the statutory requirements enumerated in Conn. Gen. Stat. §19a-639. More specifically, the Applicant has (1) failed to demonstrate the proposed project is related to the Statewide Health Care Facilities and Services Plan; (2) failed to demonstrate a clear public need; (3) failed to prove the project will positively impact the financial strength of <u>Connecticut's</u> health care system; (4) failed to adequately identify the patient population; (5) failed to identify the utilization in the service area; and (6) failed to prove that the proposed project will

GREENWICH
6 Greenwich Office Park
40 Valley Drive
Greenwich, CT 06831
tel 203 869.1145
fax 203 869.2170

STAMFORD
Tully Health Center
32 Strawberry Hill Court
4th Floor
Stamford, CT 06902
tel 203 487.0363
fax 203 487.0308

not result in any unnecessary duplication of existing CON approved MRI facilities.

Applicant Has Failed to Demonstrate the Proposed Project is Related to the Statewide Health Care Facilities and Services Plan

The Statewide Health Care Facilities and Services Plan (the "Statewide Plan") recognizes the importance of maintaining appropriate levels of imaging services to avoid underutilization and ensure there is a clear public need for the acquisition of each imaging machine.[1] The Statewide Plan states "CON approval is required for these acquisitions and purchases must demonstrate clear public need for the equipment."[2] As outlined below, the Applicant has failed to demonstrate that a clear public need exists for the Proposed HSS MRI.

Applicant Has Failed to Demonstrate A Clear Public Need

Entities seeking OHCA authorization to acquire an MRI must demonstrate they meet a clear public need to add additional MRI capacity to the state. The Applicant has written about the level of care it provides, but it has not satisfactorily demonstrated the need for the Proposed HSS MRI in the primary and secondary service areas. The Applicants estimated utilization figures are not adequately supported and the Applicant has not properly analyzed the needs of its Connecticut patient draw.

The Applicant has proposed a primary service area of four Connecticut towns (Stamford, Greenwich, Darien and New Canaan) and three New York towns.[3] The Applicant lacks clear public need for the Proposed HSS MRI because 1) there exists excess capacity for MRI services in the proposed service area; 2) the need in the primary Connecticut service area is very small at only 896 scans[4]; and 3) the existing MRI providers can easily accommodate 896 scans with current capability in the service area. The Applicant states that certain patients in the proposed service area would still be obtaining MRI scans at the Manhattan location; however, the Applicant has not given any projection on what that patient percentage will be.[5] Applicant also represents it does not track patient origin data

---

[1] *The Statewide Health Care Facilities and Services Plan* (hereinafter, the "*Statewide Plan*"), 60 (October 2012).
[2] *Id.*
[3] *Certificate of Need Application, Docket Number 12-31780-CON* (hereinafter "CON Application"), 15.
[4] *CON Application*, 15. Also, as will be argued below, New York patient needs should not influence OHCA.
[5] *Id.* at 16

by MRI immediate walk-in need versus scheduled need.[6] This estimated 896 scans is actually lower as it is not adjusted to reflect patients who would prefer to have their scans at the Manhattan locations or who would obtain walk-in MRI services at the Manhattan MRI locations rather than at the Proposed HSS MRI. Without accurate figures, the proposed data on MRI utilization for Connecticut residents is not representative of how many patients need the Proposed HSS MRI opposed to those patients would actually utilize or be directed to the Applicant's Manhattan MRI locations.

OHCA, through the Statewide Plan, estimates that each scanner should perform approximately 4,000 scans annually.[7] The Applicant's estimated public need of 896 scans does not come close to this number and does not satisfy OHCA's clear public need requirement. Further, the Applicant has failed to identify any backlog or delay in timely treatment or diagnosis for patients in the proposed service area.

New York – Not Relevant for Connecticut Residents

Additionally, the Applicant states the Proposed HSS MRI will address patient needs in New York, but New York residents needs are not relevant to OHCA. OHCA and the CON process address the health care access needs of Connecticut residents and Connecticut providers, not those of other states. Further, the Applicant does not explain how the patients of Westchester County will benefit from an MRI machine in Connecticut rather than Westchester County, which has a strong patient draw for HSS.

The Applicant has included the entire state in the secondary service area. This is unreasonable estimation of a secondary service area as OHCA addresses need through analysis of service areas rather than the needs of the entire state. Even with a statewide service area, Connecticut patients have numerous options for patients to obtain MRI services statewide. There are approximately 114 MRI machines in Connecticut that Connecticut residents have access to for MRI services. Specifically, MRIs are maintained at 38 main hospital campus, 27 hospital satellite and 60 non-hospital provider MRI sites located throughout this state.[8] The Applicant has failed to address the secondary service area public need in relation to the existing 114 CON-approved MRIs.

---

[6] *CON Application*, 352.
[7] *Statewide Plan*, 61.
[8] *Statewide Plan*, 233.

The Applicant has extensively emphasized the level of care it provides its patients but does not associate such level of care with the need for an additional MRI in the proposed service areas. The Applicant also spends considerable time describing its protocol and software; however, such factors are not compelling nor do they substantiate need. Any proposed need for software or protocol cannot replace need for additional MRI and the Applicant's arguments are misplaced.

Applicant Has Failed to Prove the Project Will Positively Impact the Financial Strength of the State's Health Care System

The Applicant has failed to prove that the Proposed HHS MRI will improve the financial strength of the state's health care system. The state's health care system financial strength will not be improved by adding the HSS MRI to a service area that can accommodate the Applicant's minimal public need. The Applicant has not represented it will interface with other providers or hospitals in the area regarding the Proposed HSS MRI and placing the Proposed HSS MRI in Stamford to perform scans at a Connecticut physician location for hospital-based care in New York City does not encourage state-wide or county-wide provider integration.

Applicant Has Failed to Adequately Identify the Patient Population

The Applicant has failed to adequately identify the patient population. The application addresses the general draw of patients from New York and Connecticut but does not address the percentage of such patients who can or will utilize the HSS MRI opposed to the Applicant's New York MRIs. As stated above, New York patient utilization should not influence OHCA. The Applicant also fails to track patient origin data by immediate walk-in need versus scheduled need.[9] The Application further fails to describe the continuum of services available at the Stamford location and the patient populations who will benefit from such services. Without the figures and facts, the analysis on the Proposed HSS MRI patient population is an inadequate representation of the expected patient population to utilize the Proposed HSS MRI.

Applicant Has Failed to Identify the Utilization in the Service Area

The Applicant has not identified the utilization of MRI machines in the service area. The Applicant failed to describe its existing relationship with other

---

[9] *CON Application*, 352.

providers in Connecticut who provide similar services as requested by OHCA possibly indicating a lack of knowledge of the service area.[10] The Applicant's lack of MRI utilization knowledge in the service area results in a failure to analyze MRI options that are most beneficial to its patients. The proposed addition of another MRI in Stamford will risk financial stability that local long time established Connecticut providers have made in the decline of healthcare services by altering utilization rates. Further, no clear plan has been detailed regarding staffing of the MRI machine which could result in staffing challenges in the service area.

Applicant Has Failed to Prove the Proposed Project Will Not Result in Any Unnecessary Duplication of Existing or Approved MRI Facilities

Additional MRI capacity in the area will result in additional duplication of current CON-approved imaging equipment. The Applicant does not represent that the Proposed HSS MRI is different from existing CON-approved MRIs and HSS physicians currently refer patients to other MRI providers in the area.

Applicant represents that it needs the Proposed HSS MRI to provide specialized services to patients. However, nearly all of the procedures and services provided by physicians employed by the Applicant are the same procedures and services provided by Connecticut providers. This follows that the Proposed HSS MRI itself and potential capabilities are not different from other MRIs in the proposed service areas, and Applicant's specialized technique and protocol are not required to administer scans to HSS patients as the Applicant represents.

The Applicant also states that HSS physicians currently refer HSS patients to other MRI providers in the service area, including Greenwich Hospital.[11] Under this representation, the Applicant's patients have access to scans on any of the existing CON-approved MRIs in the proposed service area. Additionally, the capabilities of the scanner itself are not more advanced than that of other scanners in the service area. The Applicant has stated that a 1.5 Tesla strength MRI will be acquired; according to the Statewide Plan, there are numerous 1.5 Tesla strength MRIs in the proposed service area.[12] The capabilities of the Proposed HSS MRI are the same as the existing 1.5 Tesla scanners in the primary service area. Since the Applicant represents that HSS patient scans are currently being performed in Connecticut at the request of HSS physician orders, the Applicant's argument that

[10] *CON Application*, 345.
[11] *CON Application*, 25 and 349.
[12] *Statewide Plan*, 223 to 233.

the Proposed HSS MRI's specialized software and technique is necessary is not persuasive; the addition of the Proposed HSS MRI will simply add additional capacity to the proposed service area.

Further, the Applicant has not addressed whether the primary service area can accommodate more capacity, and thus the Applicant has failed to prove that the proposed additional MRI is needed and will not duplicate services. The Applicant has not looked to partner with current MRI providers in the area to accommodate its patients or otherwise to eliminate duplication of services. Most important, if there truly is a need for the software and technique in this service area that Applicants suggests, orthopedic groups and hospitals would have acquired it already.

Lastly, the Applicant does not state it will limit use of its MRI machine to HSS providers, it only states it will not market to non-HSS providers. The applicant fails to define "market" and has not provided any parameters of such marketing. Therefore, the Applicant may not accurately be representing the utilization of its machine and the service area if non-affiliated providers will be shifting additional capacity from appropriately utilized MRIs to a new MRI.

Conclusion

The Applicant's CON application fails to establish a clear public need. The application is not data-driven and does not support the addition of another 1.5 Tesla MRI scanner to the primary and secondary service area. The need and access for Connecticut residents has not been established and acquisition of the Proposed HSS MRI machine will result in excess capacity. We urge OHCA to deny HSS's CON application.

Thank you,

ONS Directors & Officers

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3206
RECIPIENT ADDRESS	912127747841
DESTINATION ID	
ST. TIME	12/14 09:53
TIME USE	01'49
PAGES SENT	7
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: PAUL KNAG / MURTHA CULLINA LLP

FAX: (212) 774-7841

REF: ~~AGENCY:~~ 12-31780-CON HOSP. FOR SPECIAL SURGERY

FROM: BRIAN A. CARNEY

DATE: 12/14/12 TIME:

NUMBER OF PAGES: 7
(including transmittal sheet

Comments: PLEASE SEE ATTACHED LETTER OF OPPOSITION.

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3205
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	12/14 09:51
TIME USE	01'32
PAGES SENT	7
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: STACEY L. MALAKOFF

FAX: (212) 774 - 2620

AGENCY: HOSPITAL FOR SPECIAL SURGERY

FROM: BRIAN A CARNEY

DATE: 12/14/12 TIME:

NUMBER OF PAGES: 7
(including transmittal sheet

Comments: 12 - 31780 - CON
PLEASE SEE THE ATTACHED LETTER
OF OPPOSITION.

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

HOSPITAL
FOR
SPECIAL
SURGERY

December 17, 2012

The Honorable Jewel Mullen, MD, MPH, MPA
Commissioner
Department of Public Health, Division of Office of Health Care Access
410 Capital Avenue, MS#13HCA
Hartford, Connecticut 06134

Specialists in Mobility

Re: Certificate of Need Application, Docket Number 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled,
Maintaining the Hospital for Special Surgery ("HSS")
Proposal for the Acquisition and Installation of an MRI in Stamford

Dear Commissioner Mullen,

We have reviewed the letter of opposition dated December 12, 2012 from Orthopaedic and Neurosurgery Specialists ("ONS") to our above noted Certificate of Need ("CON") application (copy of letter attached). This letter is being submitted in response to the assertions contained in the ONS letter.

We have documented in great detail in our CON application and pre-filed testimonies the clear public need for our project, as well as the unique and specialized nature of HSS's MRI services. The primary objective of our Stamford-based MRI is to enable a large portion of the approximately 3,200 residents of Connecticut and nearby Westchester who currently travel to New York City ("NYC") for an HSS MRI, to get their MRI closer to home. This patient population, alone, will essentially utilize the full capacity of the new unit (full capacity is approximately 2,500 scans annually). HSS's MRI services will not be marketed to non-HSS physicians or their patients.

As the top-ranked orthopedic specialty hospital in the nation, a large proportion of HSS's patients have highly complex musculoskeletal conditions and disorders, including patients with prior surgeries. A critical contributor to HSS's outstanding patient outcomes and a key ingredient in the continuum of care is the unique and specialized diagnostic capabilities of HSS's MRI services. HSS has specialized in musculoskeletal MRI for over 20 years and performs over 30,000 musculoskeletal MRI's annually, including highly complex and challenging cases. The sole focus of HSS's MRI services is orthopedics and rheumatology and we have 15 Board certified radiologists specializing in musculoskeletal imaging, including 5 dedicated exclusively to orthopaedic MRI, including Dr. Potter. Our collaborative research agreement with GE allows access to newer technologies well in advance of commercial availability. Customized protocols have been developed for each HSS referring physician based on over 20 years of close

Stacey L. Malakoff
Executive Vice President of Finance/
Chief Financial Officer

535 East 70th Street
New York, NY 10021
tel 212.606.1239
fax 212.774.2620
E-mail: malakoffs@hss.edu

collaboration with HSS's radiologists. These protocols enable quality images for all types of patients and musculoskeletal conditions and are an essential part of our patient's comprehensive evaluation. HSS's physicians rely on the quality and accuracy of the HSS MRI to develop and optimize precise and optimal surgical and non-surgical treatment plans for their patients. Because of its meticulous and detailed protocols, the capacity and throughput of HSS's MRI is lower than a typical MRI provider (average time per scan is approximately 60% longer). All of these characteristics are what makes HSS's MRI services very different from other providers and it would be very difficult for another MRI provider to replicate the protocols and services provided to HSS physicians and their patients. It is primarily for this reason why 3,200 residents of Connecticut and nearby Westchester travel to HSS's MRI facility in NYC for their MRI's, rather than to more conveniently located facilities in their communities.

The following are our responses to specific assertions in the ONS letter:

1. **HSS Has Failed to Demonstrate a Clear Public Need**
    a. ONS asserts that estimated utilization figures are not adequately supported and that HSS has not properly analyzed the needs of its Connecticut patient draw – HSS's utilization estimates are based on the actual number of patients from the region who currently travel to HSS's MRI facility in NYC
    b. ONS asserts that HSS lacks clear public need for the proposed MRI because the need in the Connecticut primary service area is only 896 scans and that there exists excess capacity for MRI services in the service area – As a world-renowned musculoskeletal specialty hospital, HSS draws its patients from a broad geographic area throughout the region and nationally. The 896 scans is only the HSS MRI volume from the four closest towns to the Stamford site. As noted above, there are 3,200 residents of Connecticut and nearby Westchester who receive MRI's at HSS's facility in New York City. As to whether or not there exists excess capacity for MRI services in the service area is not relevant, as these 3,200 residents require HSS's unique and specialized MRI services which is the reason why they are traveling to NYC, rather than to a local provider.
    c. ONS asserts that HSS has not given any projection on what the percentage of patients in the proposed service area would continue to obtain their MRI scans at HSS's NYC MRI facility – Projections were provided on page 30 of the CON application

2. **New York – Not Relevant for Connecticut Residents**
    a. ONS notes that the proposed MRI addresses the needs of HSS's Westchester patients and that the needs of New York residents are not relevant to OCHA – Approximately 700 of the 3,200 HSS patients referred to above are from Westchester (within 15 miles of the Stamford site). These 700 patients are relevant to our CON as they represent a portion of the current HSS patient population that will utilize the Stamford

MRI. Again, the point being that the primary objective of our Stamford-based MRI is to enable our current patients in the region who currently travel to NYC for an HSS MRI, to get their MRI closer to home. Furthermore, this assertion by ONS is inconsistent with their own position on their CON application, Docket Number 08-31120-CON, to acquire a new MRI unit. The findings of fact in the final decision states "According to ONS, since it is located near the Connecticut-New York State border, its physicians serve residents of communities in each state. For the purpose of this application, ONS has developed an overall service area and a Connecticut portion of the service area".

b. ONS notes that HSS does not explain how the patients of Westchester will benefit from an MRI machine in Connecticut rather than Westchester – Our patients in Westchester benefit from an HSS MRI anywhere locally (either Stamford or Westchester) since they will be able to travel 15 miles or less to receive their MRI vs. traveling in to NYC.

3. **Secondary Service Area**
   a. ONS asserts that the inclusion of the entire state of Connecticut is an unreasonable estimation of the secondary service area and that even with a statewide service area, patients have numerous MRI service options in the state – The 3,200 residents of the entire state of Connecticut and nearby Westchester are the <u>actual</u> number of patients from the region who currently travel to HSS's MRI facility in NYC and represent the targeted market for the Stamford MRI, so it is a very reasonable estimation. The extent of other MRI service options in the state is not relevant, as these 3,200 residents require HSS's unique and specialized MRI services which is the reason why they are traveling to NYC, rather than to a local provider.

4. **HSS Has Failed to Prove the Project Will Positively Impact the Financial Strength of the State's Health Care System**
   a. ONS asserts that HSS has failed to prove that the proposed MRI will improve the financial strength of the state's healthcare system – With the opening of the Stamford site, fewer of HSS's Connecticut patients will have to travel out of state to receive our world class musculoskeletal care and additional jobs will be created. Furthermore, local MRI providers will not be adversely impacted as capacity of the Stamford MRI will essentially be fully utilized by patients currently traveling to HSS's MRI facility in NYC and HSS's MRI services will not be marketed to non-HSS physicians or their patients. The Department of Economic and Community Development is recommending $2 million in financial support given the anticipated positive economic impact to the state.
   b. ONS asserts that HSS has not represented that it will interface with other providers or hospitals in the area – HSS, as a global specialized resource in the area of musculoskeletal healthcare, readily shares its knowledge with other providers as part of its role as a knowledge based leader. Leadership from Yale New Haven Health System recently spent a half day

touring HSS's facilities and talking to HSS leaders about HSS's best practices. HSS and Stamford Hospital are exploring a relationship in the area of physical therapy so that HSS knowledge as it relates to advanced therapy protocols for orthopedic related conditions can be transferred to Stamford Hospital staff.

5. **HSS Has Failed to Adequately Identify the Patient Population**
    a. ONS asserts that HSS's application addresses the general draw of patients from New York and Connecticut, but does not address the percentage of such patients who will utilize the Stamford MRI – HSS's patient population is very specific and targeted. Projections were provided on page 30 of the CON application
    b. ONS asserts that HSS's application fails to describe the continuum of services available at the Stamford location – As noted on page 6 of the CON application, HSS's Stamford office will provide physician services, x-ray, and fluoroscopic guided imaging services, in addition to MRI.

6. **HSS Has Failed to Identify the Utilization in the Service Area**
    a. ONS asserts that HSS has not identified the utilization of MRI machines in the service area- Page 24 of the CON application has this data
    b. ONS asserts that HSS failed to describe its existing relationship with other providers in Connecticut who provide similar services – There are no providers in Connecticut who provide similar MRI services, which is the reason why 3,200 residents of Connecticut and Westchester travel to HSS's facility in NYC for MRI's rather than to providers in their communities.
    c. ONS asserts that no clear plan has been detailed regarding staffing – Financial projections, including staffing, are on page 336 of the application.

7. **HSS Has Failed to Prove the Proposed Project Will Not Result in Any Unnecessary Duplication of Existing or Approved MRI Facilities**
    a. ONS asserts that HSS does not represent that its proposed MRI is different from existing MRI's and HSS physicians currently refer patients to other MRI providers in the area – HSS's MRI services are very unique and different from other MRI service providers and we have documented this in great detail in our CON application and pre-filed testimonies, as well as in this letter in the above third paragraph. Referrals by HSS physicians to other MRI providers in the area are very minimal.
    b. ONS asserts that nearly all of the procedures and services provided by HSS physicians are the same provided by Connecticut physicians; and this follows that HSS's proposed MRI is no different from other MRI's in the service area and HSS's specialized MRI protocols are not required – The procedures and services provided by HSS physicians are <u>not</u> the same as those provided by Connecticut physicians. HSS is the top-ranked orthopedic specialty hospital in the nation attracting patients from all over

the world and a large proportion of HSS's patients have highly complex musculoskeletal conditions and disorders.

c. ONS asserts that HSS has not addressed whether the primary service area can accommodate more capacity – As noted, the capacity from the Stamford MRI will be filled by HSS patients currently traveling to NYC to receive an HSS MRI.

d. ONS asserts that the capabilities of the scanner itself are not more advanced than that of other scanners in the service area and if there is truly a need for the software and technique in this service area that HSS suggests, orthopedic groups and hospitals would have acquired it already – Our collaborative research agreement with GE allows access to newer technologies well in advance of commercial availability. Indeed, many of the MRI prototype sequences have been developed by Dr. Potter and the scientists in her MRI laboratory in collaboration with physicists from GE. The MRI intended to be placed at the Stamford site is not a conventional 1.5T unit but rather a state of the art system with high gradient performance sufficient to support the advanced imaging protocols required by our MRI radiologists. Furthermore, there are many characteristics other than the software (characteristics that cannot just be "acquired") that differentiate HSS's MRI services as articulated in the above third paragraph. Our fellowship-trained radiologists interpret over 120 orthopaedic MRIs per day, which is more than many practices interpret in an entire week.

e. ONS asserts that HSS does not state it will limit use of its MRI to HSS providers, it only states it will not market to non-HSS providers – As noted, the primary objective of our Stamford MRI is to accommodate current HSS patients traveling to NYC and we expect this patient population to essentially fill the capacity of the unit. We only do musculoskeletal MRI's and have no intention of seeking referrals from non-HSS physicians.

We believe that the assertions in the ONS letter of opposition are without merit. HSS has developed a plan that will greatly benefit our existing Connecticut area patients and bring world-class orthopedic care to the State.

Sincerely,

Stacey L. Malakoff
Executive Vice President/CFO

ONS
WWW.ONSMD.COM
ORTHOPAEDIC & NEUROSURGERY SPECIALISTS

ORTHOPAEDIC SURGEONS
Michael R. Clain, MD
Foot and Ankle Surgery
Sports Medicine
John F. Crowe, MD
Hand and Wrist
James G. Cunningham, MD
Sports Medicine
Shoulder and Knee Surgery
Francis A. Ennis, Jr., MD
Hip and Knee Joint Replacement and Revision
Hip Arthroscopy
Tim Greene, MD
Hip Arthroscopy
Sports Medicine
Steven E. Hindman, MD
General Orthopaedics
Sports Medicine
Brian F. Kavanagh, MD
Hip and Knee Joint Replacement and Revision
Seth R. Miller, MD
Shoulder Surgery
Sports Medicine
David P. Nocek, MD
General Orthopaedics
Sports Medicine
Paul M. Sethi, MD
Sports Medicine
Shoulder and Knee Surgery
Katie B. Vadasdi, MD
Shoulder and Elbow
Sports Medicine
Mark A. Vitale, MD
Hand and Wrist

NEUROLOGICAL SURGEONS
Paul J. Apostolides, MD
Spine Surgery
Mark H. Camel, MD
Brain and Spinal Surgery
Amory J. Fiore, MD
Spine Surgery
Scott L. Simon, MD
Spine and Scoliosis Surgery

PHYSICAL MEDICINE
Jeffrey M. Heftler, MD
Interventional Physiatry
Tamar Kessel, MD
Interventional Spine and Sports Medicine

NON-OPERATIVE SPORTS MEDICINE
Gloria C. Cohen, MD

RECEIVED
DEC 13 2012
OFFICE OF HEALTH CARE ACCESS

December 12, 2012

Via FedEx

The Honorable Jewel Mullen, MD, MPH, MPA
Commissioner
Department of Public Health, Division of Office of Health Care Access
410 Capital Avenue, MS#13HCA
Hartford, Connecticut 06134

RE: Certificate of Need Application, Docket Number 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and Installation of an MRI in Stamford

Dear Commissioner Mullen,

Orthopedic & Neurosurgery Specialists ("ONS"), is an orthopedic and sports medicine group located in Greenwich, Connecticut, specializing in non-operative and operative treatments for injuries and conditions of the musculoskeletal system and providing MRI services to patients. We have reviewed the Certificate of Need ("CON") application filed on behalf of the Hospital for Special Surgery located in New York City ("HSS" or the "Applicant"), for the acquisition and installation of an MRI in Stamford, CT ("Proposed HSS MRI"). We are submitting this letter to respectfully request that OHCA deny the CON application because HSS has not satisfied the statutory requirements enumerated in Conn. Gen. Stat. §19a-639. More specifically, the Applicant has (1) failed to demonstrate the proposed project is related to the Statewide Health Care Facilities and Services Plan; (2) failed to demonstrate a clear public need; (3) failed to prove the project will positively impact the financial strength of <u>Connecticut's</u> health care system; (4) failed to adequately identify the patient population; (5) failed to identify the utilization in the service area; and (6) failed to prove that the proposed project will

GREENWICH
6 Greenwich Office Park
40 Valley Drive
Greenwich, CT 06831
tel 203 869.1145
fax 203 869.2170

STAMFORD
Tully Health Center
32 Strawberry Hill Court
4th Floor
Stamford, CT 06902
tel 203 487.0363
fax 203 487.0308

not result in any unnecessary duplication of existing CON approved MRI facilities.

Applicant Has Failed to Demonstrate the Proposed Project is Related to the Statewide Health Care Facilities and Services Plan

The Statewide Health Care Facilities and Services Plan (the "Statewide Plan") recognizes the importance of maintaining appropriate levels of imaging services to avoid underutilization and ensure there is a clear public need for the acquisition of each imaging machine.[1] The Statewide Plan states "CON approval is required for these acquisitions and purchases must demonstrate clear public need for the equipment."[2] As outlined below, the Applicant has failed to demonstrate that a clear public need exists for the Proposed HSS MRI.

Applicant Has Failed to Demonstrate A Clear Public Need

Entities seeking OHCA authorization to acquire an MRI must demonstrate they meet a clear public need to add additional MRI capacity to the state. The Applicant has written about the level of care it provides, but it has not satisfactorily demonstrated the need for the Proposed HSS MRI in the primary and secondary service areas. The Applicants estimated utilization figures are not adequately supported and the Applicant has not properly analyzed the needs of its Connecticut patient draw.

The Applicant has proposed a primary service area of four Connecticut towns (Stamford, Greenwich, Darien and New Canaan) and three New York towns.[3] The Applicant lacks clear public need for the Proposed HSS MRI because 1) there exists excess capacity for MRI services in the proposed service area; 2) the need in the primary Connecticut service area is very small at only 896 scans[4]; and 3) the existing MRI providers can easily accommodate 896 scans with current capability in the service area. The Applicant states that certain patients in the proposed service area would still be obtaining MRI scans at the Manhattan location; however, the Applicant has not given any projection on what that patient percentage will be.[5] Applicant also represents it does not track patient origin data

[1] *The Statewide Health Care Facilities and Services Plan* (hereinafter, the "*Statewide Plan*"), 60 (October 2012).
[2] *Id.*
[3] *Certificate of Need Application, Docket Number 12-31780-CON* (hereinafter "CON Application"), 15.
[4] *CON Application*, 15. Also, as will be argued below, New York patient needs should not influence OHCA.
[5] *Id.* at 16

by MRI immediate walk-in need versus scheduled need.[6] This estimated 896 scans is actually lower as it is not adjusted to reflect patients who would prefer to have their scans at the Manhattan locations or who would obtain walk-in MRI services at the Manhattan MRI locations rather than at the Proposed HSS MRI. Without accurate figures, the proposed data on MRI utilization for Connecticut residents is not representative of how many patients need the Proposed HSS MRI opposed to those patients would actually utilize or be directed to the Applicant's Manhattan MRI locations.

OHCA, through the Statewide Plan, estimates that each scanner should perform approximately 4,000 scans annually.[7] The Applicant's estimated public need of 896 scans does not come close to this number and does not satisfy OHCA's clear public need requirement. Further, the Applicant has failed to identify any backlog or delay in timely treatment or diagnosis for patients in the proposed service area.

New York – Not Relevant for Connecticut Residents

Additionally, the Applicant states the Proposed HSS MRI will address patient needs in New York, but New York residents needs are not relevant to OHCA. OHCA and the CON process address the health care access needs of Connecticut residents and Connecticut providers, not those of other states. Further, the Applicant does not explain how the patients of Westchester County will benefit from an MRI machine in Connecticut rather than Westchester County, which has a strong patient draw for HSS.

The Applicant has included the entire state in the secondary service area. This is unreasonable estimation of a secondary service area as OHCA addresses need through analysis of service areas rather than the needs of the entire state. Even with a statewide service area, Connecticut patients have numerous options for patients to obtain MRI services statewide. There are approximately 114 MRI machines in Connecticut that Connecticut residents have access to for MRI services. Specifically, MRIs are maintained at 38 main hospital campus, 27 hospital satellite and 60 non-hospital provider MRI sites located throughout this state.[8] The Applicant has failed to address the secondary service area public need in relation to the existing 114 CON-approved MRIs.

---

[6] *CON Application*, 352.
[7] *Statewide Plan*, 61.
[8] *Statewide Plan*, 233.

The Applicant has extensively emphasized the level of care it provides its patients but does not associate such level of care with the need for an additional MRI in the proposed service areas. The Applicant also spends considerable time describing its protocol and software; however, such factors are not compelling nor do they substantiate need. Any proposed need for software or protocol cannot replace need for additional MRI and the Applicant's arguments are misplaced.

Applicant Has Failed to Prove the Project Will Positively Impact the Financial Strength of the State's Health Care System

The Applicant has failed to prove that the Proposed HHS MRI will improve the financial strength of the state's health care system. The state's health care system financial strength will not be improved by adding the HSS MRI to a service area that can accommodate the Applicant's minimal public need. The Applicant has not represented it will interface with other providers or hospitals in the area regarding the Proposed HSS MRI and placing the Proposed HSS MRI in Stamford to perform scans at a Connecticut physician location for hospital-based care in New York City does not encourage state-wide or county-wide provider integration.

Applicant Has Failed to Adequately Identify the Patient Population

The Applicant has failed to adequately identify the patient population. The application addresses the general draw of patients from New York and Connecticut but does not address the percentage of such patients who can or will utilize the HSS MRI opposed to the Applicant's New York MRIs. As stated above, New York patient utilization should not influence OHCA. The Applicant also fails to track patient origin data by immediate walk-in need versus scheduled need.[9] The Application further fails to describe the continuum of services available at the Stamford location and the patient populations who will benefit from such services. Without the figures and facts, the analysis on the Proposed HSS MRI patient population is an inadequate representation of the expected patient population to utilize the Proposed HSS MRI.

Applicant Has Failed to Identify the Utilization in the Service Area

The Applicant has not identified the utilization of MRI machines in the service area. The Applicant failed to describe its existing relationship with other

---

[9] *CON Application*, 352.

providers in Connecticut who provide similar services as requested by OHCA possibly indicating a lack of knowledge of the service area.[10] The Applicant's lack of MRI utilization knowledge in the service area results in a failure to analyze MRI options that are most beneficial to its patients. The proposed addition of another MRI in Stamford will risk financial stability that local long time established Connecticut providers have made in the decline of healthcare services by altering utilization rates. Further, no clear plan has been detailed regarding staffing of the MRI machine which could result in staffing challenges in the service area.

Applicant Has Failed to Prove the Proposed Project Will Not Result in Any Unnecessary Duplication of Existing or Approved MRI Facilities

Additional MRI capacity in the area will result in additional duplication of current CON-approved imaging equipment. The Applicant does not represent that the Proposed HSS MRI is different from existing CON-approved MRIs and HSS physicians currently refer patients to other MRI providers in the area.

Applicant represents that it needs the Proposed HSS MRI to provide specialized services to patients. However, nearly all of the procedures and services provided by physicians employed by the Applicant are the same procedures and services provided by Connecticut providers. This follows that the Proposed HSS MRI itself and potential capabilities are not different from other MRIs in the proposed service areas, and Applicant's specialized technique and protocol are not required to administer scans to HSS patients as the Applicant represents.

The Applicant also states that HSS physicians currently refer HSS patients to other MRI providers in the service area, including Greenwich Hospital.[11] Under this representation, the Applicant's patients have access to scans on any of the existing CON-approved MRIs in the proposed service area. Additionally, the capabilities of the scanner itself are not more advanced than that of other scanners in the service area. The Applicant has stated that a 1.5 Tesla strength MRI will be acquired; according to the Statewide Plan, there are numerous 1.5 Tesla strength MRIs in the proposed service area.[12] The capabilities of the Proposed HSS MRI are the same as the existing 1.5 Tesla scanners in the primary service area. Since the Applicant represents that HSS patient scans are currently being performed in Connecticut at the request of HSS physician orders, the Applicant's argument that

[10] *CON Application*, 345.
[11] *CON Application*, 25 and 349.
[12] *Statewide Plan*, 223 to 233.

the Proposed HSS MRI's specialized software and technique is necessary is not persuasive; the addition of the Proposed HSS MRI will simply add additional capacity to the proposed service area.

Further, the Applicant has not addressed whether the primary service area can accommodate more capacity, and thus the Applicant has failed to prove that the proposed additional MRI is needed and will not duplicate services. The Applicant has not looked to partner with current MRI providers in the area to accommodate its patients or otherwise to eliminate duplication of services. Most important, if there truly is a need for the software and technique in this service area that Applicants suggests, orthopedic groups and hospitals would have acquired it already.

Lastly, the Applicant does not state it will limit use of its MRI machine to HSS providers, it only states it will not market to non-HSS providers. The applicant fails to define "market" and has not provided any parameters of such marketing. Therefore, the Applicant may not accurately be representing the utilization of its machine and the service area if non-affiliated providers will be shifting additional capacity from appropriately utilized MRIs to a new MRI.

Conclusion

The Applicant's CON application fails to establish a clear public need. The application is not data-driven and does not support the addition of another 1.5 Tesla MRI scanner to the primary and secondary service area. The need and access for Connecticut residents has not been established and acquisition of the Proposed HSS MRI machine will result in excess capacity. We urge OHCA to deny HSS's CON application.

Thank you,

ONS Directors & Officers

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

TENTATIVE AGENDA

PUBLIC HEARING

Docket Number: 12-31780-CON

New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery

Acquisition and Installation of an MRI in Stamford

December 18, 2012, at 1:00 p.m.

I. Convening of the Public Hearing

II. Applicant's Direct Testimony (10 minutes)

III. OHCA's Questions

IV. Closing Remarks

VI. Public Hearing Adjourned

An Equal Opportunity Employer
410 Capitol Ave., MS#13HCA, P.O.Box 340308, Hartford, CT 06134-0308
Telephone: (860) 418-7001 Toll-Free: 1-800-797-9688
Fax: (860) 418-7053

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

Office of Health Care Access

TABLE OF THE RECORD

APPLICANT: New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery

DOCKET NUMBER: 12-31780-CON

PUBLIC HEARING: December 18, 2012 at 1:00 p.m.

**PLACE: 410 Capitol Avenue, Third Floor Hearing Room
Hartford, Connecticut**

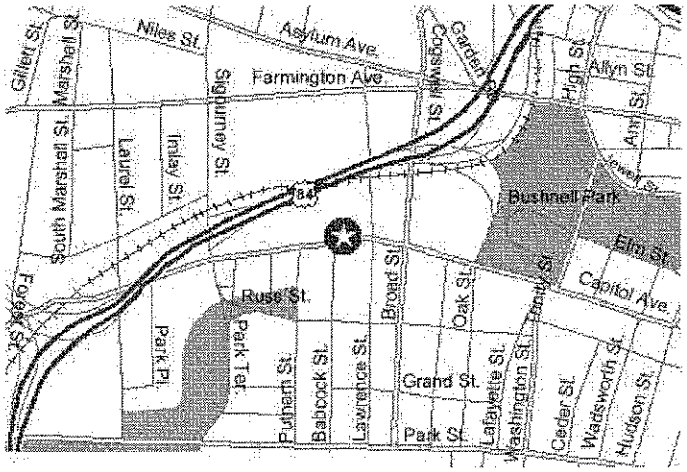
EXHIBIT	DESCRIPTION
A	A Certificate of Need ("CON") application from the **New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("Applicant"),** for the acquisition and installation of an MRI in Stamford, was received by the Office of Health Care Access ("OHCA") on August 13, 2012. (339 pages)
B	Letters to OHCA with various dates in support of the CON application under Docket Number 12-31780, received by OHCA on various dates. (7 pages)
C	Letter of support received from Representative Gerald Fox, III, Representative Dan Fox and Senator Carlo Leone dated August 27, 2012 and OHCA's response dated August 30, 2012 in the matter of the CON application under Docket Number 12-31780. (4 pages)
D	Letter to OHCA dated August 27, 2012 in the matter of the CON application under Docket Number 12-31780, received on August 29, 2012. (1 page)
E	OHCA's letter to the Applicant dated September 12, 2012 requesting additional information and/or clarification in the matter of the CON application under Docket Number 12-31780. (3 pages)
F	Applicant's responses to OHCA's letter of September 12, 2012, dated October 12, 2012, in the matter of the CON application under Docket Number 12-31780, received by OHCA on October 15, 2012.(35 pages)
G	Letter from Mayor Michael Pavia dated August 28, 2012 and the Department of Public Health's response dated September 5, 2012 in the matter of the CON application under Docket Number 12-31780. (2 pages)

An Equal Opportunity Employer
410 Capitol Ave., MS#13HCA, P.O.Box 340308, Hartford, CT 06134-0308
Telephone: (860) 418-7001 Fax: (860) 418-7053

H	Letter from Representative Terrie Wood dated October 10, 2012 and the Department of Public Health's response dated October 18, 2012 in the matter of the CON application under Docket Number 12-31780. (2 pages)
I	Designation letter, dated November 20, 2012, designating Attorney Kevin Hansted as hearing officer in the matter of the CON application under Docket Number 12-31780. (1 page)
J	OHCA's letter to the Applicant dated November 7, 2012 deeming the application complete in the matter of the CON application under Docket Number 12-31780. (1 page)
K	Letter to OHCA from Greenwich Hospital dated November 9, 2012 regarding the CON application under Docket Number 12-31780, received by OHCA on November 16, 2012. (1 page)
L	OHCA's request for legal notification in *The Advocate* and OHCA's Notice to the Applicant of the public hearing scheduled for December 18, 2012, in the matter of the CON application under Docket Number 12-31780, dated November 15, 2012. (4 pages)
M	OHCA's letter to the Applicant dated December 6, 2012 requesting prefile testimony and issues for public hearing in the matter of the CON application under Docket Number 12-31780. (3 pages)
N	Applicant's letter to OHCA dated December 12, 2012 enclosing prefile testimony in the matter of the CON application under Docket Number 12-31780, received by OHCA on December 12, 2012. (10 pages)
O	Letter from Orthopaedic & Neurosurgery Specialist to OHCA dated December 12, 2012 in opposition of the CON application under Docket Number 12-31780, received by OHCA on December 13, 2012.(6 pages)
P	OHCA's facsimile letter dated December 14, 2012 enclosing a copy of the letter OHCA received from Orthopaedic & Neurosurgery Specialist in the matter of the CON application under Docket Number 12-31780. (6 pages)
Q	Letter from applicant dated December 17, 2012 that responds to the Orthopaedic & Neurosurgery Specialists letter of opposition (see Exhibit O) in the matter of the CON application under Docket Number 12-31780, received by OHCA on December 17, 2012. (11 pages)

Directions

410 CAPITOL AVE
* 3RD FLOOR
HEARING ROOM



DIRECTIONS TO 410-474 CAPITOL AVENUE

The 410-474 Capitol Avenue complex is a series of renovated, brick, turn-of-the-century, factory buildings located on Capitol Avenue in Hartford, approximately one-half mile west of the State Capitol.

Entrance driveways are located between Hartford Office Supply and building 410, and buildings 450 and 460. After entering, proceed to the security station located in the center of the lot. Visitors to a particular agency should park in the assigned visitors parking spaces, and sign in with a security guard or receptionist to obtain a guest pass. If the visitors' spaces are full, please see a security guard for assistance.

From 1-91 (north or south) and from east of the river

In Hartford, take I-84 west, in less than a mile from the I-91 interchange, get off at Asylum Street, Exit 48. At the signal at the bottom of the ramp, make a gradual right, staying to the left of the fork on to Farmington Avenue. Take an immediate left at the signal on to Broad Street.

Take the first right at the signal on to Capitol Avenue. The Capitol Avenue complex is two blocks on the right just past the signal at the base of Putnam St.

From the West

Take 1-84 east to Capitol Avenue, Exit 48B, bearing right toward the Capitol area and staying to the right of the ramp. At the bottom of the ramp, turn right on to Capitol Avenue. The Capitol Avenue complex is on the right just past the signal at the base of Putnam Street.

Address: 410 Capitol Avenue,
P.O. Box 340308,
Hartford, Connecticut 06134-0308
Phone: (860) 509-8000; TDD: (860) 509-7191
Office Hours: 8:30AM - 4:30PM (M - F)

*** TX REPORT ***

TRANSMISSION OK

TX/RX NO	3209
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	12/17 16:39
TIME USE	01'03
PAGES SENT	5
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: STACEY L. MALAKOFF / EXEC VP / CFO

FAX: (212) 774-2620

AGENCY: HOSPITAL FOR SPECIAL SURGERY

FROM: BRIAN A. CARNEY

DATE: 12/17/12 TIME: 3:30

NUMBER OF PAGES: 5
(including transmittal sheet)

Comments: REF. DOCKET #12-31780-CON
PLEASE SEE ATTACHED TENTATIVE AGENDA, TABLE OF THE RECORD & DIRECTIONS FOR TOMORROW'S HEARING @ 1PM.

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

STAMFORD HOSPITAL | The Regional Center for Health

Affiliate Columbia University College of Physicians & Surgeons
Member NewYork-Presbyterian Healthcare System
A Planetree Hospital

30 Shelburne Road
P.O. Box 9317
Stamford, CT 06904-9317
203.276.1000
www.stamhealth.org

RECEIVED
DEC 17 2012
OFFICE OF HEALTH CARE ACCESS

Fax Transmittal Cover Page

STAMFORD HEALTH SYSTEM
Administration Department

30 Shelburne Road
FAX: 203-276-5529

DATE: December 17, 2012

TO: Kimberly Martone FAX#: 860-418-7053

RE: OCHA Docket No 12-31780-CON

FROM Brian Geissler TEL # 203-276-7510

Number of pages to follow: 1

Special Instructions:

"The information contained in this facsimile transmittal is protected by law and is intended only for the use of the designated recipient(s) named above. If the reader of this transmission is not the intended recipient(s), you are notified that any disclosure, dissemination, distribution or duplication of its contents is strictly prohibited. If you have received this transmittal in error, please notify the sender by telephone and destroy the transmittal immediately. Thank you."

If you have any problems with this transmittal message, please call Administration Department on 203-276-5555.

STAMFORD HOSPITAL
The Regional Center for Health | Discover More

30 Shelburne Road
P.O. Box 9317
Stamford, CT 06904-9317
203.276.1000
stamfordhospital.org

December 17, 2012

VIA FACSIMILE AND OVERNIGHT MAIL

The Honorable Jewel Mullen, MD, MPH, MPA
Commissioner
Connecticut Department of Public Health
Office of Health Care Access Division
410 Capitol Avenue, MS#13HCA
Hartford, Connecticut 06134

RECEIVED
DEC 17 2012
OFFICE OF
HEALTH CARE ACCESS

Re: OHCA Docket Number 12-31780-CON

Dear Commissioner Mullen:

This letter is being sent on behalf of The Stamford Hospital ("TSH") in connection with the Hospital for Special Surgery's ("HSS") application to acquire and install an MRI in the Chelsea Piers complex in Stamford. As an existing provider of imaging services in HSS's proposed service area, we recommend that the Office of Health Care Access consider the notion that if HSS is granted certificate of need approval to operate the 1.5 Tesla MRI then the unit should be made available to service non-HSS patients to the extent scheduling and capacity allows.

For example, TSH has affiliated orthopedic practices that will have medical office space in the Chelsea Piers complex. There may be instances where it is appropriate for this group's physicians to refer patients to the proposed MRI. TSH also operates its own MRI units within the proposed service area and, at any given time, these units may require maintenance or otherwise be out of operation. Also, temporary backlogs on these units can exist simply due to patient volume. Again, to the extent that the proposed MRI has capacity, it would help fill a need created by constraints on our MRI units if patients could be served on the unit HSS is proposing to install. Overall, such flexibility could improve accessibility to MRI for patients throughout the service area.

Thank you for your time and consideration regarding this matter.

Sincerely,

Brian G. Grissler
President and CEO

cc: Kimberly Martone, Director of Operations

STAMFORD HOSPITAL | The Regional Center for Health

Affiliate Columbia University College of Physicians & Surgeons
Member NewYork-Presbyterian Healthcare System
A Planetree Hospital

30 Shelburne Road
P.O. Box 9317
Stamford, CT 06904-9317
203.276.1000
www.stamhealth.org

Fax Transmittal Cover Page

STAMFORD HEALTH SYSTEM
Administration Department

30 Shelburne Road
FAX: 203-276-5529

DATE: December 17, 2012

TO: Kimberly Martone FAX#: 860-418-7053

RE: OCHA Docket No 12-31780-CON

FROM Brian Geissler TEL # 203-276-7510

Number of pages to follow: 1

Special Instructions:

"The information contained in this facsimile transmittal is protected by law and is intended only for the use of the designated recipient(s) named above. If the reader of this transmission is not the intended recipient(s), you are notified that any disclosure, dissemination, distribution or duplication of its contents is strictly prohibited. If you have received this transmittal in error, please notify the sender by telephone and destroy the transmittal immediately. Thank you."

If you have any problems with this transmittal message, please call Administration Department on 203-276-5555.

STAMFORD HOSPITAL
The Regional Center for Health | Discover More

30 Shelburne Road
P.O. Box 9317
Stamford, CT 06904-9317
203.276.1000

stamfordhospital.org

December 17, 2012

VIA FACSIMILE AND OVERNIGHT MAIL

The Honorable Jewel Mullen, MD, MPH, MPA
Commissioner
Connecticut Department of Public Health
Office of Health Care Access Division
410 Capitol Avenue, MS#13HCA
Hartford, Connecticut 06134

Re: OHCA Docket Number 12-31780-CON

Dear Commissioner Mullen:

This letter is being sent on behalf of The Stamford Hospital ("TSH") in connection with the Hospital for Special Surgery's ("HSS") application to acquire and install an MRI in the Chelsea Piers complex in Stamford. As an existing provider of imaging services in HSS's proposed service area, we recommend that the Office of Health Care Access consider the notion that if HSS is granted certificate of need approval to operate the 1.5 Tesla MRI then the unit should be made available to service non-HSS patients to the extent scheduling and capacity allows.

For example, TSH has affiliated orthopedic practices that will have medical office space in the Chelsea Piers complex. There may be instances where it is appropriate for this group's physicians to refer patients to the proposed MRI. TSH also operates its own MRI units within the proposed service area and, at any given time, these units may require maintenance or otherwise be out of operation. Also, temporary backlogs on these units can exist simply due to patient volume. Again, to the extent that the proposed MRI has capacity, it would help fill a need created by constraints on our MRI units if patients could be served on the unit HSS is proposing to install. Overall, such flexibility could improve accessibility to MRI for patients throughout the service area.

Thank you for your time and consideration regarding this matter.

Sincerely,

Brian G. Grissler
President and CEO

cc: Kimberly Martone, Director of Operations

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3210
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	12/18 09:27
TIME USE	00'40
PAGES SENT	3
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: STACEY L. MALAKOFF 12-31780-CON

FAX: (212) 774-2620

AGENCY: HOSPITAL FOR SPECIAL SURGERY

FROM: BRIAN A. CARNEY

DATE: 12/18/12 TIME: 8:20

NUMBER OF PAGES: 3
(including transmittal sheet)

Comments: PLEASE SEE ATTACHED LETTER OF SUPPORT FROM STAMFORD HOSPITAL

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

Greer, Leslie

From: Carney, Brian
Sent: Tuesday, December 18, 2012 9:45 AM
To: 'Paul E. Knag'
Cc: Riggott, Kaila; Veyberman, Alla; Hansted, Kevin; Martone, Kim; Greer, Leslie
Subject: RE: Letters of support.

Paul, we have adjusted the table of record slightly and will have an updated version available prior to the hearing. All of the letters of support have been accounted for. Certain letters that came in as part of the application or completeness response are not cited separately.

~Brian~

From: Paul E. Knag [mailto:PKNAG@murthalaw.com]
Sent: Tuesday, December 18, 2012 8:17 AM
To: Carney, Brian
Subject: RE: Letters of support.

Thanks much Brian.

Paul E. Knag
Partner
PKNAG@murthalaw.com

Murtha Cullina LLP | Attorneys at Law | www.murthalaw.com
177 Broad Street | Stamford | CT | 06901
Direct: 203-653-5407
Fax: 860-240-5711
Mobile: 203-561-6438

From: Carney, Brian [mailto:Brian.Carney@ct.gov]
Sent: Tuesday, December 18, 2012 8:16 AM
To: Paul E. Knag

Cc: Riggott, Kaila
Subject: RE: Letters of support.

I will have someone check on this and get back to you.

From: Paul E. Knag [mailto:PKNAG@murthalaw.com]
Sent: Monday, December 17, 2012 11:48 PM
To: Carney, Brian
Subject: Letters of support.

Brian,

Thanks for sending us the index to the record.

The index references the letter from Representatives Dan Fox andGerald Fox III and Sen. Carlo Leone, and also letters from Mayor Pavia and Representative Wood. Does the record also include letters of support from each the following:

Senator L. Scott Franz Representative Livvy Floren Representative Michael Molgano Representative William Tong Representative Patricia Billie Miller	Ray Dalio, Bridgewater Jeffrey R. Immelt, GE Paul R. Tregurtha, Moran Towing Peter L. Malkin, Malkin Properties Paul Tudor Jones II, Tudor Investment Corp. Robert N. Rich, F.D. Rich Co. Jeanne Melino, Steven & Alexandra Cohen Found. Arthur Levitt, HSS Supporter Konrad R. Kruger, HSS Supporter Anthony E. Malkin, HSS Supporter

Thanks for your help on this matter. We look forward to the hearing at 1.

Paul E. Knag
Partner
PKNAG@murthalaw.com

Murtha Cullina LLP | Attorneys at Law | www.murthalaw.com
177 Broad Street | Stamford | CT | 06901
Direct: 203-653-5407
Fax: 860-240-5711
Mobile: 203-561-6438

Please consider the environment before printing this email.

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

Office of Health Care Access

TABLE OF THE RECORD

APPLICANT: **New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery**

DOCKET NUMBER: **12-31780-CON**

PUBLIC HEARING: **December 18, 2012 at 1:00 p.m.**

PLACE: **410 Capitol Avenue, Third Floor Hearing Room Hartford, Connecticut**

EXHIBIT	DESCRIPTION
A	A Certificate of Need ("CON") application from the New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("Applicant"), for the acquisition and installation of an MRI in Stamford, was received by the Office of Health Care Access ("OHCA") on August 13, 2012. (339 pages)
B	Letters to OHCA with various dates in support of the CON application under Docket Number 12-31780, received by OHCA on various dates. (7 pages)
C	Letter of support received from Representative Gerald Fox, III, Representative Dan Fox and Senator Carlo Leone dated August 27, 2012 and OHCA's response dated August 30, 2012 in the matter of the CON application under Docket Number 12-31780. (4 pages)
D	Letter to OHCA dated August 27, 2012 in the matter of the CON application under Docket Number 12-31780, received on August 29, 2012. (1 page)
E	OHCA's letter to the Applicant dated September 12, 2012 requesting additional information and/or clarification in the matter of the CON application under Docket Number 12-31780. (3 pages)
F	Applicant's responses to OHCA's letter of September 12, 2012, dated October 12, 2012, in the matter of the CON application under Docket Number 12-31780, received by OHCA on October 15, 2012.(35 pages)
G	Letter from Mayor Michael Pavia dated August 28, 2012 and the Department of Public Health's response dated September 5, 2012 in the matter of the CON application under Docket Number 12-31780. (2 pages)

H	Letter from Representative Terrie Wood dated October 10, 2012 and the Department of Public Health's response dated October 18, 2012 in the matter of the CON application under Docket Number 12-31780. (2 pages)
I	Letter from Representative William Tong dated October 1, 2012 and the Department of Public Health's response dated October 11, 2012 in the matter of the CON application under Docket Number 12-31780. (2 pages)
J	Designation letter, dated November 20, 2012, designating Attorney Kevin Hansted as hearing officer in the matter of the CON application under Docket Number 12-31780. (1 page)
K	OHCA's letter to the Applicant dated November 7, 2012 deeming the application complete in the matter of the CON application under Docket Number 12-31780. (1 page)
L	Letter to OHCA from Greenwich Hospital dated November 9, 2012 regarding the CON application under Docket Number 12-31780, received by OHCA on November 16, 2012. (1 page)
M	OHCA's request for legal notification in *The Advocate* and OHCA's Notice to the Applicant of the public hearing scheduled for December 18, 2012, in the matter of the CON application under Docket Number 12-31780, dated November 15, 2012. (4 pages)
N	OHCA's letter to the Applicant dated December 6, 2012 requesting prefile testimony and issues for public hearing in the matter of the CON application under Docket Number 12-31780. (3 pages)
O	Applicant's letter to OHCA dated December 12, 2012 enclosing prefile testimony in the matter of the CON application under Docket Number 12-31780, received by OHCA on December 12, 2012. (10 pages)
P	Letter from Orthopaedic & Neurosurgery Specialist to OHCA dated December 12, 2012 in opposition of the CON application under Docket Number 12-31780, received by OHCA on December 13, 2012.(6 pages)
Q	OHCA's facsimile letter to the Applicant dated December 14, 2012 enclosing a copy of the letter OHCA received from Orthopaedic & Neurosurgery Specialist in the matter of the CON application under Docket Number 12-31780. (6 pages)
R	Letter from applicant dated December 17, 2012 that responds to the Orthopaedic & Neurosurgery Specialists letter of opposition (see Exhibit O) in the matter of the CON application under Docket Number 12-31780, received by OHCA on December 17, 2012. (11 pages)
S	Letter from Stamford Hospital dated December 17, 2012 regarding availability of use of MRI to service non–HSS patients to the extent scheduling and capacity allow in the matter of the CON application under Docket Number 12-31780, received by OHCA on December 17, 2012. (1 page)

OHCA HEARINGS - EXHIBIT AND LATE FILE FORM

Applicants: Hospital for Special Surgery

DN: 12-31780-CON

Hearing Date: December 18, 2012

Time: 1:00 p.m.

Proposal: Acquisition and installation of an MRI in Stamford

OHCA Exhibit #	Description
1	
2	
3	
4	
5	

Applicant Late File #	Description	Due Date	Rec'd
1	MRI Charges FY 2012	12/26th	
2			
3			
4			
5			
6			

PUBLIC HEARING
INFORMAL PARTICIPAN
SIGN UP SHEET

December 18, 2012
1:00 p.m.

Docket Number: 12-31780-CON
Hospital for Special Surgery
Acquisition and installation of an MRI in Stamford

PRINT NAME	Phone	Fax	Representing Organization
[illegible]	203 594 0222		[illegible]

PUBLIC HEARING
APPLICANT
SIGN UP SHEET

December 18, 2012
1:00 p.m.

Docket Number: 12-31780-CON
Hospital for Special Surgery
Acquisition and installation of an MRI in Stamford

PRINT NAME	Phone	Fax	Representing Organization
Stacey Malakoff	212-606-1239		HSS
Jo Hannafin MD	212 606-1469		HSS
Louis Potter MD	212 606 1023		HSS
Lou Shapiro	212 606 1625		HSS
PAUL KNAG	203 561 6438		Murtha Cullina, attorneys for HSS

STAMFORD HOSPITAL
The Regional Center for Health | Discover More

30 Shelburne Road
P.O. Box 9317
Stamford, CT 06904-9317
203.276.1000

stamfordhospital.org

December 17, 2012

VIA FACSIMILE AND OVERNIGHT MAIL

The Honorable Jewel Mullen, MD, MPH, MPA
Commissioner
Connecticut Department of Public Health
Office of Health Care Access Division
410 Capitol Avenue, MS#13HCA
Hartford, Connecticut 06134

Re: OHCA Docket Number 12-31780-CON

Dear Commissioner Mullen:

This letter is being sent on behalf of The Stamford Hospital ("TSH") in connection with the Hospital for Special Surgery's ("HSS") application to acquire and install an MRI in the Chelsea Piers complex in Stamford. As an existing provider of imaging services in HSS's proposed service area, we recommend that the Office of Health Care Access consider the notion that if HSS is granted certificate of need approval to operate the 1.5 Tesla MRI then the unit should be made available to service non-HSS patients to the extent scheduling and capacity allows.

For example, TSH has affiliated orthopedic practices that will have medical office space in the Chelsea Piers complex. There may be instances where it is appropriate for this group's physicians to refer patients to the proposed MRI. TSH also operates its own MRI units within the proposed service area and, at any given time, these units may require maintenance or otherwise be out of operation. Also, temporary backlogs on these units can exist simply due to patient volume. Again, to the extent that the proposed MRI has capacity, it would help fill a need created by constraints on our MRI units if patients could be served on the unit HSS is proposing to install. Overall, such flexibility could improve accessibility to MRI for patients throughout the service area.

Thank you for your time and consideration regarding this matter.

Sincerely,

Brian G. Grissler
President and CEO

cc: Kimberly Martone, Director of Operations

STAMFORD HOSPITAL | Discover More
The Regional Center for Health

30 Shelburne Road
P.O. Box 9317
Stamford, CT 06904-9317
203.276.1000

stamfordhospital.org

December 17, 2012

VIA FACSIMILE AND OVERNIGHT MAIL

The Honorable Jewel Mullen, MD, MPH, MPA
Commissioner
Connecticut Department of Public Health
Office of Health Care Access Division
410 Capitol Avenue, MS#13HCA
Hartford, Connecticut 06134

Re: OHCA Docket Number 12-31780-CON

Dear Commissioner Mullen:

This letter is being sent on behalf of The Stamford Hospital ("TSH") in connection with the Hospital for Special Surgery's ("HSS") application to acquire and install an MRI in the Chelsea Piers complex in Stamford. As an existing provider of imaging services in HSS's proposed service area, we recommend that the Office of Health Care Access consider the notion that if HSS is granted certificate of need approval to operate the 1.5 Tesla MRI then the unit should be made available to service non-HSS patients to the extent scheduling and capacity allows.

For example, TSH has affiliated orthopedic practices that will have medical office space in the Chelsea Piers complex. There may be instances where it is appropriate for this group's physicians to refer patients to the proposed MRI. TSH also operates its own MRI units within the proposed service area and, at any given time, these units may require maintenance or otherwise be out of operation. Also, temporary backlogs on these units can exist simply due to patient volume. Again, to the extent that the proposed MRI has capacity, it would help fill a need created by constraints on our MRI units if patients could be served on the unit HSS is proposing to install. Overall, such flexibility could improve accessibility to MRI for patients throughout the service area.

Thank you for your time and consideration regarding this matter.

Sincerely,

Brian G. Grissler
President and CEO

cc: Kimberly Martone, Director of Operations

HOSPITAL
FOR
**SPECIAL
SURGERY**

**Specialists
in Mobility**

December 21, 2012

The Honorable Jewel Mullen, MD, MPH, MPA
Commissioner
Department of Public Health, Division of Office of Health Care Access
410 Capital Avenue, MS#13HCA
Hartford, Connecticut 06134

Re: Certificate of Need Application, Docket Number 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled,
Maintaining the Hospital for Special Surgery ("HSS")
Proposal for the Acquisition and Installation of an MRI in Stamford

Dear Commissioner Mullen,

This letter is being submitted in response to the questions raised on our MRI charge master at our December 18th hearing.

HSS's MRI charge master contains approximately 290 items. 35 of these items account for over 95 % of the MRI's performed at HSS. Facility component charges for these 35 items range from $1,266 to $3,351, with an average of approximately $2,900 in 2012. Differences in charges are due to variations in resource utilization (i.e. staff time, sequences to be performed, supply costs, etc.). Charges are consistent with charges at other academic medical centers in HSS's service area.

All government payor volume and approximately 60% of commercial payor volume are based on fee schedules. Such fee schedule payments are not driven by or related to HSS's charges. As reported on Financial Attachment II in HSS's CON application (CON Page 337), the projected average charge per unit at the Stamford site is expected to be $3,129 in the first year of operation (2014) and the expected average net revenue per unit is expected to be $989. Many of our uninsured and partially insured patients receive discounted rates under HSS's financial assistance policy. Individuals whose income level is at or below 500% of the U.S. Health and Human Services Poverty Guidelines are eligible for discounts under the policy. Discounts range from 50% to 98% of amounts due. A copy of HSS's Financial Assistance Policy was previously submitted to OHCA on October 12, 2012 as part of our response to Completeness Question #14 (HSS CON Pages 366 – 371).

535 East 70th Street
New York, NY 10021
tel 212.606.1000

Please contact Stacey Malakoff at (212) 606-1239 or via e-mail at MalakoffS@hss.edu if you have any further questions or need additional information.

Thank you.

Sincerely,

Louis A. Shapiro
President/CEO

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3226
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	12/24 14:56
TIME USE	00'26
PAGES SENT	2
RESULT	OK

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: STACY L. MALAKOFF

FAX: (212) 774-2620

AGENCY: HOSPITAL FOR SPECIAL SURGERY

FROM: KEVIN T. HANSTED

DATE: 12/24/12 **Time:**

NUMBER OF PAGES: 2
(including transmittal sheet

Comments:
Closing of the hearing for Docket Number 12-31780-CON

PLEASE PHONE Barbara K. Olejarz IF THERE ARE ANY TRANSMISSION PROBLEMS.

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO:	**STACY L. MALAKOFF**
FAX:	**(212) 774-2620**
AGENCY:	**HOSPITAL FOR SPECIAL SURGERY**
FROM:	**KEVIN T. HANSTED**
DATE:	12/24/12 **Time:**

NUMBER OF PAGES: 2
(including transmittal sheet

Comments:
Closing of the hearing for Docket Number 12-31780-CON

PLEASE PHONE Barbara K. Olejarz IF THERE ARE ANY TRANSMISSION PROBLEMS.

Phone: (860) 418-7001 ***Fax: (860) 418-7053***

410 Capitol Ave., MS#13HCA
P.O.Box 340308
Hartford, CT 06134

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

December 24, 2012 VIA FACSIMILE ONLY

Stacey L. Malakoff
Executive Vice President/CFO
Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

RE: Certificate of Need Application; Docket Number: 12-31780-CON
New York Society for the Reliefof the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and Installation of an MRI in Stamford
Closure of the Public Hearing

Dear Ms. Malakoff:

On December 21, 2012, the Office of Health Care Access ("OHCA") received the information requested by OHCA as a late file submission from the public hearing held in this matter on December 18, 2012. With the receipt of the late file submission, the hearing on the above application is hereby closed.

If you have any questions regarding this matter, please feel free to contact Brain Carney at (860) 418-7014.

Sincerely,

Kevin T. Hansted, Esq.
Hearing Officer

ORIGINAL

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

OFFICE OF HEALTH CARE ACCESS

NEW YORK SOCIETY FOR THE RELIEF OF THE
RUPTURED AND CRIPPLED
MAINTAINING THE HOSPITAL FOR SPECIAL SURGERY

ACQUISITION AND INSTALLATION OF AN MRI IN STAMFORD

DOCKET NO. 12-31780-CON

DECEMBER 18, 2012

1:00 P.M.

410 CAPITOL AVENUE
HARTFORD, CONNECTICUT

POST REPORTING SERVICE
HAMDEN, CT (800) 262-4102

. . .Verbatim proceedings of a hearing before the State of Connecticut, Department of Public Health, Office of Health Care Access, in the matter of New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery, Acquisition and Installation of an MRI in Stamford, held at 410 Capitol Avenue, Hartford, Connecticut, on December 18, 2012 at 1:00 p.m. . . .

HEARING OFFICER KEVIN HANSTED: Good afternoon, everyone. Before we start, would you please just turn off your cell phones? If you're a doctor, please feel free to keep them on for emergency purposes.

This public hearing before the Office of Health Care Access is identified by Docket No. 12-31780-CON, is being held on December 18, 2012 to consider New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery's application for the acquisition and installation of an MRI in Stamford, Connecticut.

This public hearing is being held pursuant to Connecticut General Statutes, Section 19a-639a, and will be conducted as a contested case, in accordance with the provisions of Chapter 54 of the Connecticut General Statutes, the Uniform Administrative Procedures Act.

My name is Kevin Hansted, and I've been designated by Commissioner Jewel Mullen of the Department of Public Health to serve as the Hearing Officer for this matter.

The staff members assisting me today are Kaila Riggott, Brian Carney and Alla Veyberman. The hearing is being recorded by Post Reporting Services.

Following the hearing, I will issue a proposed final decision, in accordance with the Connecticut General Statutes 4-179.

In making its decision, OHCA will consider and make written findings concerning the principles and guidelines set forth in Section 19a-639 of the Connecticut General Statutes.

The Applicant, New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery, has been designated as a party in this proceeding.

At this time, I will ask staff to read into the record those documents already appearing in OHCA's Table of the Record in this case. All documents have been identified in the Table of the Record for reference purposes. Ms. Veyberman?

MS. ALLA VEYBERMAN: I would like to enter into the record Exhibits from A through G, please, and, also, Exhibits from H to S.

HEARING OFFICER HANSTED: Okay.

MR. PAUL KNAG: We have no objection.

HEARING OFFICER HANSTED: No objection? Thank you.

MR. KNAG: Mr. Carney, may I ask? May I inquire? I just had communicated with Mr. Carney that I was anxious to be sure that all of the letters of support were included in the record, and I take it that they are?

MR. BRIAN CARNEY: Yes, they are.

MR. KNAG: Thank you, sir.

MR. CARNEY: They're all accounted for.

HEARING OFFICER HANSTED: At this time, I would ask all the individuals, who are going to testify on behalf of the Applicant, to please stand, raise your right hand, and be sworn in.

(Whereupon, the parties were sworn.)

HEARING OFFICER HANSTED: And to all those individuals, who just took the oath, the first time you start speaking, would you please just state your name and adopt your written testimony, your pre-filed testimony here today?

At this time, Attorney Knag, you may proceed.

MR. KNAG: Thank you.

HEARING OFFICER HANSTED: You're welcome.

MR. KNAG: It's my high honor to be here with the -- we're also a leading center for orthopedic surgery, the Hospital for Special Surgery, and our first person, who will testify, is the President of the Hospital, Mr. Lou Shapiro.

MR. LOU SHAPIRO: My name is Lou Shapiro, and I adopt the pre-filed testimony.

HEARING OFFICER HANSTED: Thank you.

MR. SHAPIRO: Okay, so, Hospital for Special Surgery, we're located in New York City. As you know, we are an internationally-renowned academic medical center, specializing in orthopedics and rheumatology.

We have approximately 95 orthopedic surgeons on our staff and perform over 27,000 surgeries per year.

We see quite a large number of patients from Connecticut and nearby Westchester from the period of time 2009 through 2011, over 54,000 patient visits from residents of Connecticut and nearby Westchester and New York City, and over 3,000 MRI scans annually.

Our goal for the Stamford-based MRI is to enable HSS patients, who live in Connecticut and nearby Westchester, to receive their scans closer to home, rather than traveling all the way into the City to receive their scan. A secondary objective will be alleviating our capacity constraints in New York.

Our proposed scanner in Stamford will be limited exclusively to patients -- to musculoskeletal MRI. Our patients that currently travel to New York City for their scan will fill the capacity of the scanner, and we will not market our services to any non-HSS physician or their patients.

We've received many letters of support from local legislators, as well as key business community leaders, and the Department of Economic and Community Development is recommending state support in the amount of two million dollars for our scanner, for our project.

I'd like to introduce Dr. Hollis Potter, who is the Chief of the MRI Department at HSS.

DR. HOLLIS POTTER: Good afternoon.

HEARING OFFICER HANSTED: Good afternoon.

DR. POTTER: I'd like to adopt the pre-filed testimony.

HEARING OFFICER HANSTED: Thank you.

DR. POTTER: And thank you for the opportunity to speak today. I'm an orthopedic MR radiologist, and I've been doing just that for 22 years. I'm the Professor of Radiology at Cornell Med. School, and I hold the Coleman Chair in MR research.

MRI is an integral part of patient care at Special Surgery. We see a lot of patients as a tertiary referral center that come in with very complex orthopedic conditions.

When a patient comes for an MRI, that specific MRI exam is tailored for the needs of that patient, the diagnostic needs of that patient, so all the technical details, the tissue contrast, the in-plane resolution, through-plane resolution, the angle of acquisition of the images for the joint, are tailored for that specific need of that patient.

About 50 percent of patients that I scan I will speak to an HSS clinician prior to actually even seeing the patient in the MRI Department, and I will have a long, lengthy history.

Unfortunately, a lot of our folks come in with many previous operations, then they have nerve entrapment, often have hardware. All these pose specific challenges for imaging, so that specific exam is tailored for that patient.

All of our exams are then acquired with the specialty type of pulse sequence, and then interpreted by a Board-certified MSK fellowship-trained MR radiologist.

Indeed, before the patient leaves the scanner, we check all of our MRIs, so I won't let you leave Special Surgery. I'll hold you prisoner, until I figure out exactly what's causing your pain. That's my role and care.

And then that information goes to the clinician, and they determine exactly what mode of therapy to use, so, often, the MRI is the means by which we determine either conservative versus non-conservative care, or even if we know it's going to be surgical care, and maybe one, or two, or even three different operations, but it's based on all the details that I can provide on that tailored MR examination.

I have over 10 years, about a 12-year history of research collaboration with GE Health Care, and what that means is that I come up with new MR protocols and new pulse sequence parameters. That's actually not just the way you use the MR, but something completely new, in terms of reduction of artifact.

For example, our group has shown that MR is the means by which we assess any kind of adverse reaction around orthopedic implants. You may have seen this on the news, that there's a lot of concern about tissue reactions. Most of those data are from our lab and our publications.

In collaboration with physicists at GE Health Care, we have come up with a prototype pulse sequence that is not yet product, but is available on all of our scanners, so our patients can benefit from those prototypes that most facilities will not see for at least another three years.

The basis of our research drives, then, the clinical management, so it's not just the prototypes, but, also, the ability to define much more beyond just they have a cartilage tear, or you have a biceps tear.

A typical MR facility will say a biceps tendon is torn in the elbow. What I will get is I will have a patient with a fixed flexion contracture, so they can't extend their elbow as most elbow MRs are done, and, oh, by the way, they have stainless steel hardware in part of their bones. I have to scan around that.

So, again, it's a very specialized, specific protocol that's applied for that particular patient. We want to incorporate this into the care that we provide in a Connecticut facility.

HEARING OFFICER HANSTED: Thank you, Doctor.

DR. POTTER: I'd like to introduce Dr. Jo Hannafin, who is an orthopedic surgeon on staff and co-Director of the Women's Sports Medicine.

DR. JO HANNAFIN: As Hollis said, my name is Jo Hannafin. I'm an orthopedic surgeon, and I would like to adopt my pre-filed testimony, as well.

HEARING OFFICER HANSTED: Thank you.

DR. HANNAFIN: I'm here really to represent the clinicians that use the magnets at HSS. Because we're a tertiary care hospital, we often have patients referred from local orthopedic surgeons, as well as orthopedic surgeons around New England, for complex problems.

Those complex problems post-surgery could include extensive scar, malformation of joints, and the biggest issue is orthopedic hardware, screws, and plates, and wires, and things like that.

The majority of MRI facilities have a very difficult time imaging around hardware and will often turn the patients away, so you have to have the ability to image these patients, because it's all roadmap as surgeons for what we're going to need to do, if we can do something to solve their problem.

I think one of the things that's -- the interaction between the surgeons and MRI has a tradition of over 20 years since Hollis came on staff, where technology was developed, working hand-in-hand with the surgeon, so we would have something we couldn't see on an MRI, and we'd bring it up at a conference, and she would, then, design the pulse sequence parameters to let us look at those things, so that is an ongoing interaction between all of the surgical staff and the MRI staff at the hospital, which I think ultimately improves patient care.

The volume of patients that we see in the Connecticut office and most of the physicians that see patients in the Connecticut office are from Connecticut, from Fairfield County, has grown steadily, and the complexity of the problems has grown steadily, and it is important, often, to convince the patient to go into New York City.

You have a teenager, whose mother has to take him out of school and drive him into New York, it's a difficult thing to do, but you convince them, based on quality, and for a lot of things that we see the quality is so different between what we get in the City and what we may get at a local scanner, that you spend time convincing the patients to do that.

For me, as a clinician, who sees patients weekly in the Connecticut office, it would be an incredible service to the patients to be able to see them, image them, be able to go over their imaging with them on the same day, and it ultimately improves the quality of care that you can provide and the timeliness of the quality that you can provide.

I think the other piece is for physicians, who are perhaps younger and practice as surgeons with less experience interpreting their own MRI. Having a very skilled reader be able to literally teach you through the imaging that they do and show you things that you may miss on a clinical exam that can show up on a well-done MRI is a way that continues to teach our faculty, so we learn, as surgeons, from the MR radiologists on a weekly basis, and that ultimately improves the patient care, as well.

I thank you for your time.

HEARING OFFICER HANSTED: Thank you.

MR. KNAG: That concludes our presentation, and, if you could give us a second, we'll move our chairs, so we're all next to a microphone, and be ready for your questions.

HEARING OFFICER HANSTED: Absolutely. All set? We do have a few questions. Do you want to start?

MS. VEYBERMAN: On page seven of your application, you stated that Hospital for Special Surgery developed proprietary application for MRI for musculoskeletal conditions. Can you elaborate more regarding your new proprietary application and just give us more detail and understanding?

DR. POTTER: I'd be happy to. So the proprietary means are based on the prototype pulse sequences that are not yet commercially available that we helped to develop in collaboration with GE Health Care.

For example, we were able to look at the building blocks of articular cartilage non-invasively. Traditionally, what a lot of what surgeons would have to do is to actually biopsy the cartilage and look at it under a microscope.

The building blocks, the ability of cartilage to withstand load, is a function of what's called extracellular matrix. We have a prototype pulse sequence that's called T1rho that actually looks at prodia glycan. T2, which we helped to develop, looks at collagen.

The MAVRIC pulse sequence, which is an acronym for the sequence that allows us to image around metal, is a culmination about 10 years' worth of research, and what this does is, if you normally put a patient that has any kind of stainless steel hardware or cobalt, chromium, any kind of implant, you're going to just see what looks like a big void of -- a black blob.

You won't be able to see anything around it and answer any of the clinically-relevant questions about the tissue or bone around it.

What the MAVRIC sequence does is eradicates the artifact, based on kind of the physical principles of magnetism, and will allow us to figure out exactly what's causing the pain in that particular patient.

We can see the soft tissue. We can see the bone. We can see the joint fluid around it and determine appropriate care.

COURT REPORTER: Your name is Hollis Potter?

DR. POTTER: I'm sorry. My name is Hollis Potter, yes. Sorry.

MS. VEYBERMAN: And, Dr. Potter, one more question for you.

DR. POTTER: Sure.

MS. VEYBERMAN: In your pre-filed testimony, you stated that in order for local provider to replicate your protocol and services, they need to invest in specialized staff and equipment.

DR. POTTER: Um-hum.

MS. VEYBERMAN: And can you provide more details about the specialized staff and equipment? That would require any additional training, or education?

DR. POTTER: Sure. Happy to. Let's start with the equipment. So it requires high-performance gradience. A lot of folks have reasonable hardware, so to speak, but it's like having a Porsche. You never take it out at first gear.

The protocols that we use really drive the gradience, so we need high-performance gradience. We have access to prototype coils through RF Engineers, so, for example, children with spinal deformity, we have ability to look at their whole spinal axis, despite the fact that, unfortunately, their spine start to look a little bit like a pretzel, but then it's also the interpretation of the images.

A lot of folks will say -- let's say someone has a shoulder dislocation, the shoulder dislocates. The average radiologist that is not trained at Special Surgery will say, well, gosh, you have a cartilage tear.

The difference at Special Surgery is that I would provide, my colleagues, like Dr. Hannafin, insight into the suitability of tissue for repair, so that she can determine preoperatively if she needs additional tissue, and what we're trying to avoid is having the Special Surgery physician in the recovery room with mom and dad or the patient, saying, oh, gosh, I didn't expect to do that, because the MRI was wrong. We want to know everything preoperatively.

My technologist, in addition, regardless of how, when they come for a job in the MRI department, I don't care how long they've been working on the outside, they have to be trained for six months with another HSS technologist before we'll allow them to scan a patient on their own, so what we do is very, very different from the standard orthopedic facility.

MS. VEYBERMAN: So it takes approximately six months to train somebody, who has experience in the field, to be able to perform, according to your protocols and procedures?

DR. POTTER: Yes, absolutely. Our protocols are so different than the standardized MR. The standardized MR uses what's called T1 and T2. Those are parameters by which we derive tissue contrast.

About 15 years ago, I threw those out, because we weren't seeing articular cartilage, because colleagues, like Dr. Hannafin, were saying, Hollis, you're missing stuff, and I can see it in the OR, so we went back to the drawing board and said we have to come up with a new means by which to generate tissue contrast.

I would argue that the ability to reliably and accurately assess articular cartilage drives patient management more than almost any other variable out there.

So when you come for a scan at Special Surgery, I don't care if I'm scanning just your pinky, this tiny joint, I'm scanning your shoulder, your hip, your ankle, whatever. You will get cartilage-sensitive pulse sequencing in three planes, and I will determine the integrity of your cartilage preoperatively, so as to obviate the need for something like diagnostic arthroscopy, where they have to take a look first, because they're not sure.

The other point is that many outside facilities resort to having to do what's called MR arthrography. MR arthrography is where you take contrast, and you get a three-inch spinal needle put into your joint, and they will put gallilinium, which is an MR contrast agent, and this provides a very black and white image.

A lot of folks, who haven't read a lot of orthopedic MR, like it, because they can see literally contrast going into a tear in the cartilage.

The beauty of MR, why it's really an amazing diagnostic tool, lies in the shades of gray, not the black and the white, the ability to see that dynamic tissue, where we can talk about tissue deformation, capsular stretched in a young Little League pitcher.

I can tell a colleague, like Dr. Hannafin, the shoulder capsule is not going to hold suture. You need to be prepared to have either allograft tissue or some sort of augmentation in the OR, because it won't hold it on its own, so we go that step further, and we do so, because without having to put contrast in the patient, so no MR arthrography at all, which is unusual.

MS. VEYBERMAN: And you just described all this special software you have, in addition to the regular MRI.

DR. POTTER: Right.

MS. VEYBERMAN: And my question is how does this specialized software or any other addition effect the cost and the charge for your regular average MRI scan and how it's comparable with other average MRI scan?

DR. POTTER: We don't charge at all for any additional. I answer the clinical question, so if I have to keep you in my scanner for over an hour, I will do so, and you will get the same charge as a person that is in the scanner for 40 minutes.

The T1rho, the T2, the MAVRIC, there's no additional charge for that, because that is relevant to your diagnostic problem.

That is tailored to suit your need. I'm not going to charge extra for that, and we don't.

MS. VEYBERMAN: But does it build into the cost of the procedure for MRI?

DR. POTTER: We have a standardized charge for MR, and there's no additional charge for receiving any kind of specialized protocol or prototype. There's no additional charge for prototype.

MS. VEYBERMAN: So are you saying that's probably the same as any other MRI in the industry?

MS. STACEY MALAKOFF: Right. What I'd say is our charges in New York are based off of the hospital-based charges and are equal to other charges within the New York Metropolitan area. The charges will be set in Connecticut to negotiate with the managed care companies.

COURT REPORTER: Your name, please?

MS. MALAKOFF: Oh, I'm sorry. Stacey Malakoff, and I adopt the pre-filed statement. And our charges will be set in accordance with hospital-based reasonable charges.

MS. VEYBERMAN: And is it possible for us to have a copy of your chargemaster regarding only MRI charges? We just wanted to see like what's your average charge for MRI scan.

MR. KNAG: Call it Late File 1?

MS. VEYBERMAN: Yes.

HEARING OFFICER HANSTED: Late File 1.

MR. KNAG: You just want the MRI charges?

MS. VEYBERMAN: Just MRI charges, not the whole chargemaster. Just that piece.

MS. MALAKOFF: The charges, also, are not what -- we do realize charges are also not what the patient pays, because it's negotiated, based on what the managed care rates are.

MS. VEYBERMAN: Absolutely. Yes.

MR. CARNEY: My name is Brian Carney. I'm an OHCA staff member. I have several questions for you this afternoon. The first question, given that there are seven existing MRI scanners in the primary service area, which we're talking stated were Stamford, Greenwich, New Canaan and Darien, and four additional MRI scanners in Norwalk, a total of 11, within close proximity to Stamford, how is this proposal not a duplication of service?

MR. SHAPIRO: I'll start. So just taking --

HEARING OFFICER HANSTED: Can you just state your name again for the record?

MR. SHAPIRO: I'm sorry. Lou Shapiro.

HEARING OFFICER HANSTED: Thank you.

MR. SHAPIRO: So, just taking a step back, HSS is the largest orthopedic hospital probably in the world. We do more of what we do than anyone else, and, as a consequence of that, we have a system of care that is unique to us that allows us to produce what we believe and what the data demonstrate to be leading outcomes, return to function, lowest infection rate, lower complication rates, high levels of patient satisfaction.

It's not any one thing that causes that. It's the integration of everything that's specialized, including MRI, and, as a consequence of that, people come to us from all over the world, all over the world.

There's probably not a country on the globe that people don't come to us from, including a large number of people from Connecticut and nearby Westchester.

They're already coming to us, in excess of 3,000 patients per year just for MRI, so we are meeting the community need by enabling those patients to receive care in the manner that Dr. Potter and Dr. Hannafin described closer to home, so, in our view, it's absolutely meeting community need.

Those patients are not going to go to those other scanners for the reasons that Dr. Potter indicated, and they will continue to come to us. We just want to deliver it here, so they don't have to drive them to the City.

DR. HANNAFIN: If I could make a comment, as well? This is Jo Hannafin. I think having a number of MRIs the quality issue becomes important, and I think that's one of the things that we focus on and why patients are sent into New York to be imaged.

It's often frustrating, when a patient, let's say, will come in as a referral with an MRI of poor quality that you, then, have to repeat, in order to find the information that you need, and simply having an MRI does not necessarily mean that the quality of all those MRIs is the same, and I think that's the rationale for wanting to have HSS quality close to home for our patients, so that you can provide them with the best possible study that doesn't need to be repeated, because you can give them the quality that you expect, and that, as surgeon, is my roadmap.

And you can have a roadmap that only has five roads on it. You can have a roadmap that has 150 roads on it, and, clearly, if you're lost, having a roadmap with 150 roads is far more beneficial to you. The detail is important, and I think that's a major distinction that makes this important for us.

MR. CARNEY: Okay, so, as a follow-up, so it seems like you're saying, then, basically looking at the clear public need in our state, you're saying that your MRI protocols are superior in quality to other non-HSS providers, and that's sort of your leading basis for saying there's a clear public need for your service, that the quality is better. Is that accurate?

MR. SHAPIRO: I would just broaden that. It's the entire system of care around MRI services that make that a true statement.

It is the skill and experience and training of the radiology staff, the radiologist, the physicians, the staff, the equipment, the software, the protocols, the interaction, the multi-disciplinary interaction that exists on each and every patient between these two and their colleagues.

All those things together make what you said an absolutely true statement.

MR. CARNEY: Okay, so, system of care and quality of care, superior system. Okay.

MR. KNAG: Bear in mind, of course, that these patients are already getting this quality of care. They just have to go into New York for it, so the main change would be they're getting the same quality in Connecticut as they have been getting in New York, but closer to home.

MR. CARNEY: Another question. Does the American College of Radiology accredit you in a unique way compared to other accredited providers?

DR. POTTER: So our facilities are accredited from JCAHO. They're hospital-based.

MR. CARNEY: Okay.

DR. POTTER: But we adopt the safety guidelines and all the appropriateness of the ACR.

MR. CARNEY: Okay. Is that JCAHO accreditation, then, different than another provider, a non-HSS provider? Is there something special in your accreditation, based on your protocols?

MR. SHAPIRO: For us, Joint Commission, they set sort of like the lowest minimum bar of expectations for us. What we deliver, in terms of quality of outcomes, goes far, far above that.

DR. POTTER: Hollis Potter, again. If I might just add, though, in terms of accreditation, this is not a formalized accreditation, but it's a very rare facility, that has all of their parameters, all of their protocols validated in peer-reviewed literature, based on the surgical standard, so included in the application were several papers, where if you come to me and you have, say, a cartilage tear in the knee, how do you know how accurate I am?

People don't think twice about imaging facilities. They just go to an MR. You would think twice about a cardiologist, or an orthopedic surgeon, or a neurologist, but people don't think twice about radiologists.

I've had patients and, indeed, insurance companies ask us for a validation, based on our accuracy, and provided peer-reviewed literature to support it.

MR. CARNEY: Why is it that your protocols are, you know, solely in your hands and they're not sort of broader based at this point? Just because you have this special relationship with GE and you work with them hand-in-hand and develop these things, and eventually this will trickle out to other providers?

DR. POTTER: Well the prototypes will eventually become product, and then they will become more ubiquitous, but the point is MR is extraordinarily dynamic, so once we finish with one thing, we're on to the next question, clinically unmet need, so the concept is really coming up with imaging solutions to meet the clinical questions driven by my colleagues, such as Dr. Hannafin.

So, quite frankly, we're finished with one thing and we're on to the next, so there will always be another prototype.

DR. HANNAFIN: Could I make a comment, as well? This is Jo Hannafin, again. I think one of the things that the radiologists at HSS have done is they share their protocol, so we train a large number of musculoskeletal fellows in surgery, who then go out to institutions across the country, and one of the first things they'll do is they'll have their local MR radiologist get in touch with Dr. Potter to have copies of her pulse sequences and how they do things.

Some of those are adopted, and some are not adopted, because the pulse sequences that she uses tend to take more time, so, in terms of efficiency of a magnet, a local provider may say, hey, if I can do a reasonable scan in 30 minutes, that's what I'm going to do.

They have access to the protocols, but it might take 45 minutes to scan the patient, and people may choose to use those protocols or not, but once they're published, they are free and open to anyone to adopt and use in their own facilities, and the standardization and the surgical backup that shows accuracy, those things are all published in the literature and available to anyone that wants to use them.

It generally is two or three years from the time it's been designed, but it ultimately comes out to everyone.

DR. POTTER: Hollis Potter, again. Another point is that, as I mentioned, MR is dynamic, not just for prototypes, but for the non-prototype.

I'm constantly updating our protocols. I mean, several times a year, I will change the pulse sequence parameters, because I need to tweak something and recall that I may have an MR protocol of the elbow, but I will change that four times out of five, because a patient is coming in with a specific problem.

MR. CARNEY: It's a dynamic process.

DR. POTTER: It's dynamic, and it's really tailored and individualized for specific patient care.

MR. CARNEY: Do you have any comparative scientific studies or empirical evidence to support that your MRI protocols are better than MRI protocols used by Connecticut providers?

DR. POTTER: We have anecdotal cases, and I provided you with images in the application, just showing you the difference, and I can certainly discuss those images, if you'd like.

Our peer-reviewed literature is not based on a specific Connecticut facility, but I would tell you that our accuracy, sensitivity, specificity, accuracy, reproducibility, in terms of a weighted kappa, is as high as anything that's been reported at other facilities.

MR. CARNEY: Do you have any evidence to validate that surgical outcomes are better for patients receiving an HSS protocol MRI scan compared to a patient receiving an MRI scan from, say, a Connecticut-based imaging provider?

DR. POTTER: We have not specifically addressed surgical outcomes as a result of our MR protocols, but, anecdotally, I see it every single day, clinicians calling me literally from right after the operating room and the recovery room, saying I'm so happy that we got that MR, because it looked exactly like that. I was able to plan appropriately.

It's the concept of streamlining care, as Mr. Shapiro indicated. It's the concept that I don't want Dr. Hannafin talking to some family member in the recovery room, saying I'm sorry, but the MR wasn't accurate. What I want Dr. Hannafin saying, great, we were able to do this.

And consider the scenario, where you have a cartilage tear in your knee. You think you have a meniscal tear.

If you just have a meniscal tear, she

could do a little shaving of a meniscus, and you could be up, playing tennis, being happy as a clam very soon.

If, however, you have an articular cartilage shear and she does a microfracture, that's going to take six to eight weeks non-weight bearing. Don't you want to know that beforehand?

If you think about a young mom with kids, she has to take care of -- you had to get child care. She has to figure out how she's going to get her kids to school. We know that ahead of time, so you can plan, you know, you're not going to be playing tennis for six to eight weeks, or the mom can get child care to kind of streamline things through.

MR. SHAPIRO: If I can just stress, again -- Lou Shapiro, again. It's a little redundant, but it's integrated care, so our outcomes, not comparing them against Connecticut, but comparing them nationally, our outcomes, ranging from mortality, to infection rate, to post-surgical complications, are lower, and it is a consequence of the integrated care of every part of our system that works together, including MRI.

There's other measures of that. People, who -- probably the best validator of our quality of outcomes are people making the decision to come to us for care when they can stay local, so we have elite athletes from all over the world that seek these two out, because they have the best likelihood to get back to their game, whether they're Olympic athletes, who are, you know, football players, or whatever the case may be.

And, then, you know, U.S. News, again, this is in the aggregate, not just MRI, but MRI is a critical piece of the puzzle, U.S. News analyzes many different variables to determine who has what ranking, and they consistently put us at the top of the list.

MR. CARNEY: Now I'd like to change direction just a little bit. On page 25 of the application, referencing the use of the MRI at the proposed location, you state that you will not market the service to non-HSS physicians.

My question is, if you have open time slots available for a machine, would you accept MRI scan referrals from non-HSS physicians?

You're saying you're not going to market it, but, if you've got time and you get a referral, are you going to fill that slot?

MR. SHAPIRO: We will not market it, but we do receive referrals from other orthopedic surgeons. In New York, we receive referrals from other orthopedic surgeons, who are at other institutions, who have their own MRI, because they want the specialized expertise.

MR. CARNEY: Right. That would include Connecticut, as well.

MR. SHAPIRO: Well I'm just talking about what we do today, anyone, who wants to come to us, but we will now market it Stamford Hospital, as I think you know, because they submitted a letter, they would like to have the capability to send, and we're essentially right next to them, they would like to have the capability to send MRIs to our facility if they need to, because they are -- if they are capacity-constrained, or if a machine is down, but we will not market to any other physician or their patients.

MR. CARNEY: The last question I have is will any of your physicians be seeking privileges at any of the local hospitals?

MR. SHAPIRO: We will have Stamford Hospital open. If our physicians would like to obtain privileges there, that will be up to them.

MR. CARNEY: And one follow-up. All your patients at the proposed Stamford location, basically, who are identified as needing surgery and agree to it, will they all receive their surgery at the Hospital for

Special Care in New York?

MR. SHAPIRO: Hospital for Special Surgery. Yes.

MR. CARNEY: Okay, so, no plans to --

DR. HANNAFIN: Could I just make a comment? I think it's very different for a patient to travel into New York for a single day for an operation.

I think patients are willing to do that, because of the multiple layers of care that are integrated, and we routinely will get notes from patients, from the person who registered me to the nurse who scrubbed my leg.

It's a unique experience for them, and I think the physicians respect and understand the importance of the institution and the care of our patients, but I think we all also have office hours here and function in our communities, taking care of our neighbors and our friends and other local folks.

And it is very nice to have the best of both worlds, and I think the best of both worlds is to be able to see patients, many of whom are non-operative, be able to do our imaging, local physical therapy referrals in Fairfield County, and, then, if someone does need surgery, to bring them into a specialized center that is specialized for lots of reasons and a long history.

And, so, I think they get the best of both worlds, in terms of very good care close to home, and, if you need to be operated on, then you have your brief period of time in New York, but the rest of your care takes place in Connecticut.

MR. CARNEY: Okay. That's all I have. Thank you very much.

MS. RIGGOTT: I just have one very general question. On page 13 of your application, I know we've addressed, or you've addressed the quality of your MRI services, on page 13, you state in your application this is largely a shift in volume or location, from New York to Connecticut.

Can you elaborate a bit on how this equates to improving access, as opposed to improving convenience for the patient?

DR. HANNAFIN: I can make a comment. Jo Hannafin, again. I think it's improving access, in terms of timeliness of access, so if we have our imaging facility and we're seeing a patient and we can literally walk the patient and get them into MRI, have their scan done, and have the information for them, that ultimately improves the time frame of their recovery, because you can have a good plan, you map out the plan, whether it's surgical or non-surgical, and you move that patient along.

For patients to travel into New York, let's say you have a high school student, or a younger child, the time that it takes to organize to get into Manhattan and the family things, the dynamics of going into Manhattan, is actually a much bigger deal than you would think for many patients, and, so, the ability to be seen at 3:00 in the afternoon after school, see a physician, have your MRI done, and have an answer, it is convenient, but it also expedites their care, and, for me, that would be enormous, because I have that ability to do that in New York. I don't have that ability to do that when I see patients here.

HEARING OFFICER HANSTED: Does anybody have anything additional? I don't have any questions. Attorney Knag, did you want to give a closing statement?

MR. KNAG: No. I think we've basically said what we had to say, but I'll make a couple of points.

Number one, it should be clearly understood that there's not going to be any change in cost to the system or the patients. These patients are already being treated by New York Hospital for Special Surgery, and they're paying the hospital's charges, as negotiated with their HMOs, or is payable by Medicare, and they're still going to be paying those charges, whether it's in New York, or in Stamford, so it's not going to change the cost in any way to the HMOs, or Medicare, or anybody else. That's point one.

Point two, I think it's a really simple equation here, and that is would there be any reason not to improve access and convenience to this group of patients, who are now required to go into New York, and who we could accommodate, and at the same time deal with our capacity constraints in New York in Stamford, and I didn't see anything in the opposition letter, or anything else that would indicate that that was the case.

Number three, of course, we do feel there's a huge distinction between what we offer and the alternatives in the community centers.

It's not a criticism of the community centers, but there's a reason why we're number one in New York News and World Report, and I think Dr. Potter has done a great job in explaining it.

So, based on all that, we hope that you'll approve our application.

HEARING OFFICER HANSTED: Okay, thank you, Attorney Knag. Are there any members of the public, who would like to comment on this application today? Let the record reflect there are none.

I want to thank everyone for coming today. I understand you traveled from New York today. I appreciate that.

A FEMALE: Actually, Connecticut.

HEARING OFFICER HANSTED: Yes, and Connecticut. Southern Connecticut, so that still counts, I guess. With that, I'll adjourn this hearing.

(Whereupon, the hearing adjourned at 1:44 p.m.)

HEARING RE: OFFICE OF HEALTH CARE ACCESS
DECEMBER 18, 2012

AGENDA

CERTIFICATE

I, Paul Landman, a Notary Public in and for the State of Connecticut, and President of Post Reporting Service, Inc., do hereby certify that, to the best of my knowledge, the foregoing record is a correct and verbatim transcription of the audio recording made of the proceeding hereinbefore set forth.

I further certify that neither the audio operator nor I are attorney or counsel for, nor directly related to or employed by any of the parties to the action and/or proceeding in which this action is taken; and further, that neither the audio operator nor I are a relative or employee of any attorney or counsel employed by the parties, thereto, or financially interested in any way in the outcome of this action or proceeding.

In witness whereof I have hereunto set my hand and do so attest to the above, this 28th day of December, 2012.

Paul Landman
President

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3226
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	12/24 14:56
TIME USE	00'26
PAGES SENT	2
RESULT	OK

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: STACY L. MALAKOFF

FAX: (212) 774-2620

AGENCY: HOSPITAL FOR SPECIAL SURGERY

FROM: KEVIN T. HANSTED

DATE: 12/24/12 **Time:**

NUMBER OF PAGES: 2
(including transmittal sheet

Comments:
Closing of the hearing for Docket Number 12-31780-CON

PLEASE PHONE Barbara K. Olejarz IF THERE ARE ANY TRANSMISSION PROBLEMS.

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: STACY L. MALAKOFF

FAX: (212) 774-2620

AGENCY: HOSPITAL FOR SPECIAL SURGERY

FROM: KEVIN T. HANSTED

DATE: 12/24/12 **Time:**

NUMBER OF PAGES: 2
(including transmittal sheet

Comments:
Closing of the hearing for Docket Number 12-31780-CON

PLEASE PHONE Barbara K. Olejarz IF THERE ARE ANY TRANSMISSION PROBLEMS.

Phone: (860) 418-7001 *Fax: (860) 418-7053*

410 Capitol Ave., MS#13HCA
P.O.Box 340308
Hartford, CT 06134

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

December 24, 2012 VIA FACSIMILE ONLY

Stacey L. Malakoff
Executive Vice President/CFO
Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

RE: Certificate of Need Application; Docket Number: 12-31780-CON
New York Society for the Reliefof the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and Installation of an MRI in Stamford
Closure of the Public Hearing

Dear Ms. Malakoff:

On December 21, 2012, the Office of Health Care Access ("OHCA") received the information requested by OHCA as a late file submission from the public hearing held in this matter on December 18, 2012. With the receipt of the late file submission, the hearing on the above application is hereby closed.

If you have any questions regarding this matter, please feel free to contact Brain Carney at (860) 418-7014.

Sincerely,

Kevin T. Hansted, Esq.
Hearing Officer

An Equal Opportunity Employer
410 Capitol Ave., MS#13HCA, P.O.Box 340308, Hartford, CT 06134-0308
Telephone: (860) 418-7001 Toll-Free: 1-800-797-9688
Fax: (860) 418-7053

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

April 8, 2013

Stacey L. Malakoff
Executive Vice President/CFO
The Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

RE: Certificate of Need Application; Docket Number: 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery

Acquisition of a Magnetic Resonance Imaging Scanner to be Located in Stamford, Connecticut

Dear Ms. Malakoff:

Enclosed please find a copy of the Proposed Final Decision rendered by Hearing Officer Kevin T. Hansted, Esq. in the above-referenced case.

Pursuant to Connecticut General Statutes § 4-179, New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery, the party in this matter, may request the opportunity to file exceptions or a brief or a request to present an oral argument, in writing, with the Deputy Commissioner, OHCA of the Department within twenty-one (21) days from the mailing of the decision, or by April 29, 2013. If no such request is received by this date, the Deputy Commissioner will take those rights to be waived and will render a Final Decision in this matter.

If you wish to expedite the process and avoid the necessity that the Deputy Commissioner await the expiration of the aforementioned twenty-one days, you may submit a written statement to the Deputy Commissioner affirmatively waiving those rights.

Sincerely,

Kimberly R. Martone
Director of Operations

Copy: Stephen M. Cowherd, Jeffers and Cowherd, PC.

An Equal Opportunity Employer
410 Capitol Ave., MS#13HCA, P.O.Box 340308, Hartford, CT 06134-0308
Telephone: (860) 418-7001 Toll-Free: 1-800-797-9688
Fax: (860) 418-7053

Department of Public Health
Office of Health Care Access
Certificate of Need Application

Proposed Final Decision

Applicants: **New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery**
535 East 70th Street, New York, New York 10021

Docket Number: **12-31780-CON**

Project Title: **Acquisition of a Magnetic Resonance Imaging Scanner to be Located in Stamford, Connecticut**

Project Description: New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("HSS" or "Applicant") seeks to acquire a Magnetic Resonance Imaging ("MRI") scanner to be located in Stamford, Connecticut, with an associated capital expenditure of $3,245,583.

Procedural History: The Applicant published notice of its intent to file a CON application in The Advocate (Stamford) on June 26, 27 and 28, 2012. On August 13, 2012, the Office of Health Care Access ("OHCA") received the Certificate of Need ("CON") application from the Applicant for the above-referenced project. On November 2, 2012, OHCA deemed the application complete.

On November 16, 2012, the Applicant was notified of the date, time, and place of the public hearing. On November 19, 2012, a notice to the public announcing the hearing was published in the *Record Journal*, *The Advocate* and *The News Times*. Thereafter, pursuant to Conn. Gen. Stat. § 19a-639a, a public hearing regarding the CON application was held on December 18, 2012.

Commissioner Jewel Mullen designated Attorney Kevin T. Hansted as the hearing officer in this matter. The hearing was conducted as a contested case in accordance with the provisions of the Uniform Administrative Procedure Act (Chapter 54 of the General Statutes) and Conn. Gen. Stat. § 19a-639a. The public hearing record was closed on December 24, 2012.

Findings of Fact

1. HSS is a not-for-profit, acute care, academic medical center located at 535 East 70th Street, New York, NY 10021. HSS is a health care facility or institution as defined by Conn. Gen. Stat. § 19a-630. Ex. A, p. 8.

2. HSS currently provides physician services, diagnostic x-ray and fluoroscopic guidance imaging services at 143 South Beach Avenue, in Old Greenwich, Connecticut. Ex. A, p. 6.

3. HSS is a top ranked hospital in the orthopedic and rheumatology fields; its MRI centers specialize in musculoskeletal exams. Ex. A, p. 6; Ex. F, p. 340.

4. HSS is planning to expand and relocate its services from 143 South Beach Avenue, Old Greenwich, Connecticut to 1 Blachley Road, Stamford, Connecticut. Ex. A, p. 6.

5. HSS is seeking approval for the acquisition of a 1.5 Tesla Magnetic Resonance Imaging (MRI) unit at this new location. Ex. A, p. 6.

6. HSS currently operates ten MRI units at or in close proximity to its main hospital campus in Manhattan, and has received approval from the state of New York to operate a new unit at a satellite location in Uniondale, NY. Ex. A, p. 7; Ex. B, p. 347.

7. Table 1 shows historical, current and projected utilization for all MRI scanners operated by HSS.

Table 1: HSS Existing MRI Units and Volumes by Location:

	Actual Volume (Last 3 Completed CYs)			CY Vol. (d)	Projected Volume (First 3 Full Operational CYs)		
	2009	2010	2011	2012	2014	2015	2016
HSS Main Campus (a)(b):							
- Unit A	4,555	4,054	3,825	3,267	3,359	3,464	3,568
- Unit B	3,700	3,232	3,244	3,008	3,094	3,191	3,287
- Unit C	3,892	3,963	3,996	3,810	3,919	4,042	4,162
- Unit D	4,194	4,031	3,863	3,567	3,667	3,781	3,895
- Unit E	3,787	3,420	3,382	3,215	3,306	3,409	3,512
- Unit F	2,974	3,648	3,835	3,470	3,568	3,679	3,790
- Unit G (11/3/09)	754	3,754	3,654	3,489	3,587	3,699	3,811
- Unit H (c)	1,708	1,303	2,327	3,397	3,491	3,600	3,709
- Unit I (3/26/12)	-	-	-	1,934	2,591	2,672	2,753
75th St (11/28/11)	-	-	190	2,443	2,512	2,590	2,668
Uniondale, NY (1/1/13)	-	-	-	-	2,400	2,400	2,400
Stamford, CT (1/1/14)	-	-	-	-	2,175	2,540	2,540
Total	25,564	27,405	28,316	31,600	37,669	39,067	40,095

Ex. F, p. 347.

(a) HSS Main Campus MRIs operate 13.5 hours/day (Unit A – 16 hours/day) and on weekends (limited hours), whereas the units at the offsite locations operate 10 hours/day and no weekends. 75Th St, which is in close proximity to the Main Campus, operates 11.5 hours/day.

(b) Nine of the above listed units are 1.5 Tesla units and three are 3.0 Tesla units. Tesla measures the strength of the magnet. HSS operates mostly 1.5T units since these are most effective for orthopedic imaging in most cases.

(c) Unit H was converted from an Open to a 1.5T MRI in May 2011 due to obsolescence.

(d) Represents projected 2012 totals based on actual volumes through August 2012.

Note: All above years represent calendar years (CYs). Above totals are for outpatients only.

8. The Applicant states that the proposed service area would include the following towns: Stamford, Greenwich, Darien and New Canaan, Connecticut, and Scarsdale, Rye, and Mamaroneck, New York. Ex. A, p. 15.

9. Based on CY 2012 volumes, HSS projects that it will perform approximately 3,250 MRI scans for its patients residing in Connecticut and Westchester County. Of the total projected volume, 896 scans (28%) would originate from the Connecticut portion of the proposed service area. Ex. A, p. 7.

Table 2: HSS Historical/Projected MRI Volumes for the Proposed Service Area:

Town	2011	Actual through June 2012	Projected through end of 2012
Stamford	144	67	134
Greenwich	454	243	486
Darien	174	68	136
New Canaan	109	70	140
CT Portion of Proposed Service Area	**881**	**448**	**896**
Scarsdale	229	114	228
Rye	217	110	220
Mamaroneck	219	144	288
NY Portion of Proposed Service Area	**665**	**368**	**736**
Total Proposed Service Area	**1,546**	**816**	**1,632**
Other CT Residents	725	465	930
Other NY Residents	616	344	688
Total HSS MRI Volume	**2,887**	**1,625**	**3,250**

Ex. A, p. 15.

10. HSS claims that the maximum capacity of the MRI requested in this proposal will be 2,540 scans; based on a five day-per-week, 10-hour-per-day schedule. As the projected volume of 3,250 scans exceeds the claimed maximum capacity of 2,540 scans, a portion of patients would thus need to receive their MRI scan in Manhattan. Ex. A, pp. 16-17.

11. HSS is projecting the following utilization for its proposed MRI scanner:

Projected MRI Volume

	Projected Volume		
	FY 2014	FY 2015	FY 2016
MRI Total	**2,175**	**2,540**	**2,540**

Ex. A, p. 27.

12. HSS states that its MRI scans use proprietary protocols that are customized to meet the needs and specifications of individual patients and their physicians. HSS claims the protocols/customization allows each physician to maximize the usefulness of the MRI as a tool for diagnosis and to help develop effective treatment plans. The protocols used by HSS do not require specialized equipment; however, they do require specialized software for prototype pulse sequences, which is the property of General Electric (GE). Ex. A, pp. 6-7; Ex. F, p. 340.

13. HSS has a comprehensive and collaborative research agreement with GE, allowing it to use these newer sequence and MRI techniques that are not currently available to other providers in the tri-state area. Ex. F, p. 341.

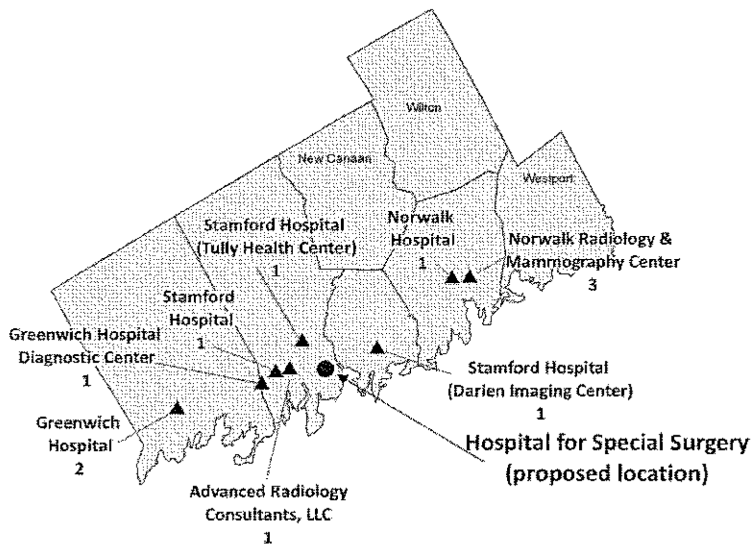
14. HSS sends the majority of its patients (approximately 3,250) to its Manhattan campus to receive MRI scans. Only a small percentage of patients are referred to Connecticut providers. HSS will continue to refer patients to the HSS MRI department, regardless of whether the MRI is located in Manhattan, Stamford or another location. Ex. A, p. 7; Ex. F, pp. 349, 352.

15. HSS stated that patients are sent to New York to be imaged due to the focus on MRI quality. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Dr. Jo A. Hannafin, Attending Orthopedic Surgeon at the Hospital for Special Surgery.

16. HSS stated that it had only anecdotal cases to support its claim that HSS MRI protocols are better than those used by Connecticut providers. HSS' peer-reviewed literature is not based on any specific Connecticut facility. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Dr. Hollis Potter, Chief of the MRI department at the Hospital for Special Surgery.

17. HSS stated that it had not specifically addressed improvement in surgical outcomes as a result of using its MRI protocols. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Dr. Hollis Potter, Chief of the MRI department at the Hospital for Special Surgery.

18. At present, there are seven existing MRI scanners located within the proposed service area towns of Greenwich (2 units), Stamford (4 units), Darien (1 unit) and four additional MRI scanners in close proximity to the service area (Norwalk – 4 units). Source: Statewide Health Care Facilities and Services Plan (October 2012).



19. MRI scan volumes for machines located within the proposed service area or within close proximity to Stamford are listed below. Scan volume totals for calendar year 2010 range from a low of 1,914 to a high of 7,356.

Table 3: MRI Scanners/Volumes within Proposed Service Area or in Close Proximity:

Imaging Facilities in Proposed Service Area	Type	Location	MRI Scans (CY 2010)
Stamford Hospital	Hospital	Stamford	7,356
Tully Health Center	Satellite-Stamford Hosp.	Stamford	3,553
Greenwich Hospital Diagnostic Center	Satellite-Greenwich Hosp.	Stamford	1,914
Advanced Radiology Consultants, LLC	Imaging Center	Stamford	5,744
Greenwich Hospital (2 Units)	Hospital	Greenwich	6,395[A]
Darien Imaging Center	Satellite-Stamford Hosp.	Darien	2,230
Imaging Facilities in Close Proximity	**Type**	**Location**	**MRI Scans (CY 2010)**
Norwalk Hospital	Hospital	Norwalk	2,530
Norwalk Radiology & Mammography Center (3 Units)	Satellite-Norwalk Hosp.	Norwalk	8,829[B]

Source: 2010 OHCA Imaging providers' survey.

[A]Volume represents the total number of scans for two MRI units – average volume per unit is 3,197.5 scans.

[B]Volume represents the total number of scans for three MRI units – average volume per unit is 2,943.0 scans.

20. The Applicant asserts that clear public need for this proposal is demonstrated by the following:
    - An MRI site in Stamford provides a more convenient location for Connecticut and Westchester County, NY patients than the HSS main campus in Manhattan. Ex. A, pp. 7, 13.
    - The ability to free up needed capacity and alleviate current issues with MRI backlog at HSS's Manhattan location. Ex. A, pp. 7, 13.

21. The Applicant asserts that this proposal will not impact the volumes of existing Connecticut MRI providers, due to the following:
    - MRI volume will shift from Manhattan to Stamford;
    - HSS can fill the capacity of the proposed MRI with its own patients;
    - The proposed MRI scanner will not be marketed to non-HSS physicians or patients.

    Ex. A, p. 7.

22. Although HSS does not directly market it services to non-HSS physicians, testimony received stated that HSS does currently accept referrals from non-HSS orthopedic surgeons in New York. HSS also stated that it would like to market its MRI services to an orthopedic practice affiliated with The Stamford Hospital and located within the same building (Chelsea Piers complex) where the proposed MRI would be operated. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Lou Shapiro, President and Chief Executive Officer for the Hospital for Special Surgery.

23. The projected patient population mix presented below is based on HSS's current MRI payer mix and assumes that the mix of patients treated in Stamford will be similar:

Table 4: HSS Projected Payer Mix:

Coverage Type	Year 1 FY 2014	Year 2 FY 2015	Year 3 FY 2016
Medicare*	18.1%	18.1%	18.1%
Medicaid*	2.1%	2.1%	2.1%
CHAMPUS & TriCare	0.0%	0.0%	0.0%
Total Government	**20.2%**	**20.2%**	**20.2%**
Commercial Insurers*	74.7%	74.7%	74.7%
Uninsured	1.4%	1.4%	1.4%
Workers Compensation	3.7%	3.7%	3.7%
Total Non-Government	**79.8%**	**79.8%**	**79.8%**
Total Payer Mix	**100.0%**	**100.0%**	**100.0%**

Ex. A, p. 36.
*Includes managed care activity.

24. The total capital expenditure is $3,245,583 and will be funded from HSS operations. The capital costs include: $1,800,000 for imaging equipment and $1,445,583 for construction and renovation.

25. The Applicant projects incremental gains from operations of $1,341,000 in FY 2014, $1,659,000 in FY 2015, and $1,708,000 in FY 2016.

Table 5: Financial Projections Incremental to the Project:

Description	FY 2014	FY 2015	FY 2016
Incremental Revenue from Operations[1]	$2,176	$2,614	$2,686
Incremental Total Operating Expenses[2]	$835	$955	$978
Incremental Gain from Operations	**$1,341**	**$1,659**	**$1,708**

Ex. A, pp. 336-339.

Note: figures are in thousands.

[1] Forecasts consider volume, payer mix and payment rate trends as well as the impacts of proposed regulatory reforms, capacity constraint, and anticipated capital initiatives.

[2] Operating expenses include rent, depreciation, facility, supply and staffing costs needed to operate the MRI unit and support the forecasted volumes.

26. OHCA is currently in the process of establishing its policies and standards as regulations. Therefore, OHCA has not made any findings as to this proposal's relationship to any policies and standards not yet adopted as regulations by OHCA. (Conn. Gen. Stat. § 19a-639(a)(1))

27. This CON application was deemed complete by OHCA prior to the state wide health care facilities and services plan being published. Therefore, OHCA has not made any findings as to the relationship between this CON application and the state wide health care facilities and services plan. (Conn. Gen. Stat. § 19a-639(a)(2))

28. The Applicant has failed to establish that there is a clear public need for its proposal. (Conn. Gen. Stat. § 19a-639(a)(3))

29. The Applicant has satisfactorily demonstrated that the proposal is financially feasible. (Conn. Gen. Stat. § 19a-639(a)(4))

30. The Applicant has failed to satisfactorily demonstrate that the proposal would improve quality, accessibility and cost effectiveness of health care delivery in the region. (Conn. Gen. Stat. § 19a-639(a)(5))

31. The Applicant has shown that there would be no change to the provision of health care services to the relevant populations and payer mix. (Conn. Gen. Stat. § 19a-639(a)(6))

32. The Applicant has satisfactorily identified the population to be served by its proposal, but has failed to satisfactorily demonstrate that this population has a need as proposed. (Conn. Gen. Stat. § 19a-639(a)(7))

33. The overall historical utilization of MRIs in the service area does not support this proposal. (Conn. Gen. Stat. § 19a-639(a)(8))

34. The Applicant has failed to satisfactorily demonstrate that its proposal would not result in an unnecessary duplication of existing MRI services in the area. (Conn. Gen. Stat. § 19a-639(a)(9))

Discussion

CON applications are decided on a case by case basis and do not lend themselves to general applicability due to the uniqueness of the facts in each case. In rendering its decision, OHCA considers the factors set forth in General Statutes § 19a-639(a). The Applicant bears the burden of proof in this matter by a preponderance of the evidence. *Goldstar Medical Services, Inc., et al. v. Department of Social Services, 288 Conn. 790 (2008).*

The New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("Applicant" or "HSS"), a not-for-profit hospital located in New York City, proposes to acquire a 1.5 Tesla MRI scanner to be located in Stamford, Connecticut. *FF1&5.*

The proposal is based upon the assertion that a new MRI unit in Stamford would provide a more convenient location for HSS patients residing in Connecticut and Westchester County to receive HSS' MRI services. The relevant portion of HSS' patient volume would shift from Manhattan to a new location in Stamford. HSS has stated that the approval of this proposal would help alleviate capacity constraints and backlog at the hospital's main campus in Manhattan. *FF20-21.*

HSS claims that its use of proprietary and customized MRI protocols result in higher quality images and improved diagnostic accuracy. *FF12-13&15.* Thus, the application is not based on whether the service area needs additional capacity, but rather upon the claimed unique benefits of HSS' MRI protocols.

Although HSS has provided credible testimony as to its experience and expertise generating musculoskeletal MRI scans, it has failed to provide conclusive evidence (i.e., comparative scientific studies or empirical evidence) to validate that HSS' MRI protocols provide significantly better imaging results or lead to better surgical outcomes than MRI protocols used by existing Connecticut providers. *FF3; FF16-17.* Given this lack of evidence to substantiate the Applicant's claim of a unique benefit, approval of this proposal would result in the duplication of services in the region. *FF18-19.*

At present, there are seven existing MRI scanners located within the proposed service area towns: Greenwich (2 units), Stamford (4 units), and Darien (1 unit). Four additional MRI scanners are located in close proximity to the service area (Norwalk – 4 units). Based on the number of existing MRI scanners within or in close proximity to the service area, there is adequate MRI capacity to serve HSS patients residing in the primary service area. *FF18-19.* In addition, the projected 930 HSS patients residing in Connecticut, but outside of the proposed service area, could access one of the other 103 MRI scanners located throughout Connecticut. *FF9.*

Although HSS would not directly market its services to non-HSS physicians, HSS' current practice is to accept referrals from non-HSS physicians, if presented. In addition, HSS stated that it would like to provide MRI services to a local orthopedic practice located within the same building as the proposed MRI. *FF22*. Both of these factors support the conclusion that approval of this proposal would lead to decreased patient volumes and revenues for existing MRI providers in the service area and result in an unnecessary duplication of MRI services in the region. *FF18-19*.

OHCA's determination on the acquisition of an MRI is based, in part on the demonstrated need for the acquisition, not whether an MRI may provide a more convenient location for the patient or help to address capacity issues outside of Connecticut. *FF20*. Although HSS provided numerous anecdotal examples and testimony about the quality of its MRI services and overall system of care, both the application and testimony lack evidence to substantiate that access or health care outcomes for Connecticut patients would be improved as a result of this proposal. After considering all of the factors listed above, OHCA concludes that the Applicant did not demonstrate clear public need for its proposal.

Order

Based upon the foregoing Findings of Fact and Discussion, I respectfully recommend that the Certificate of Need application of the New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery for the acquisition and operation of an MRI scanner in Stamford, Connecticut with an associated capital expenditure of $3,245,583 be **DENIED**.

Respectfully submitted,

4/8/13
Date

Kevin T. Hansted
Hearing Officer

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3406
RECIPIENT ADDRESS	98602405711
DESTINATION ID	
ST. TIME	04/08 15:01
TIME USE	07'10
PAGES SENT	14
RESULT	OK

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: **PAUL KNAG**

FAX: **(860) 240-5711**

AGENCY: **MURTHA CULLINA LLP**

FROM: **OHCA**

DATE: **4/8/13** **TIME:**

NUMBER OF PAGES: **14**
(including transmittal sheet

Comments: DN: 12-31780-CON Proposed Final Decision

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

Phone: (860) 418-7001 *Fax: (860) 418-7053*

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3405
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	04/08 14:50
TIME USE	02'28
PAGES SENT	14
RESULT	OK

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: **STACEY L. MALAKOFF**

FAX: **(212) 774-2620**

AGENCY: **THE HOSPITAL FOR SPECIAL SURGERY**

FROM: **OHCA**

DATE: **4/8/13** **TIME:**

NUMBER OF PAGES: **14**
(including transmittal sheet

Comments: DN: 12-31780-CON Proposed Final Decision

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

Phone: (860) 418-7001 *Fax: (860) 418-7053*

```
*********************
***   TX REPORT   ***
*********************
```

TRANSMISSION OK

TX/RX NO	3415
RECIPIENT ADDRESS	912032591070
DESTINATION ID	
ST. TIME	04/08 15:55
TIME USE	02'21
PAGES SENT	14
RESULT	OK

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: **STEPHEN M. COWHERD**

FAX: **(203) 259-1070**

AGENCY: **JEFFERS COWHERD P.C.**

FROM: **OHCA**

DATE: **4/8/13** **TIME:**

NUMBER OF PAGES: **14**
(including transmittal sheet

Comments: Docket 12-31780-CON Proposed Final Decision

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

HOSPITAL
FOR
SPECIAL
SURGERY

Specialists in Mobility

Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner
State of Connecticut Department of Public Health
Office of Health Care Access Division
410 Capitol Avenue
MS#13HCA
P.O. Box 340308
Hartford, Connecticut 06134-0308

RECEIVED
APR 19 2013
OFFICE OF
HEALTH CARE ACCESS

Re: Docket No. 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery; Acquisition of a MRI to be Located in Stamford, Connecticut

Dear Deputy Commissioner Davis:

Pursuant to Section 4-179(a) of the Connecticut General Statutes, the New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("HSS") requests the opportunity to file exceptions and briefs and to present oral argument to the Department of Public Health regarding the Proposed Final Decision in the above-referenced matter dated April 8, 2013. HSS is adversely affected by the Proposed Final Decision, which denies HSS the ability to acquire a MRI to be located in Stamford, Connecticut. We understand that, upon receipt of this letter, the Office of Health Care Access will assign a date by which HSS's exceptions and briefs must be filed and will schedule a date for oral argument.

Our lease for the space in Stamford includes a right of termination should OHCA approval for the MRI not be granted. Since this right expires on June 17, 2013, we respectfully request that oral argument be scheduled for an early date to facilitate a decision by the end of May.

Thank you for your consideration of this request.

Sincerely,

Louis A. Shapiro

RECEIVED
APR 19 2013
Department of Public Health
Office of the Commissioner

Louis A. Shapiro
President and
Chief Executive Officer

535 East 70th Street
New York, NY 10021
tel 212.606.1625
fax 212.606.1628
e-mail: shapirol@hss.edu

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.
Commissioner

Dannel P. Malloy
Governor
Nancy Wyman
Lt. Governor

April 26, 2013

Mr. Louis A. Shapiro
President and Chief Executive Officer
Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

Certified Mail: 7005 0390 0001 3506 9945

In RE: Certificate of Need Application, Docket Number 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and installation of an MRI in Stamford

NOTICE OF ORAL ARGUMENT

New York Society for the Relief of Ruptured and Crippled, maintaining the Hospital for Special Surgery has requested oral argument regarding the recommendation of Hearing Officer Kevin Hansted, Esq. Pursuant to Section 4-179 C.G.S., Oral Argument for the above cited case has been scheduled as follows:

May 23, 2013 at 2:00 p.m.
Department of Public Health
3rd Floor, DPH Conference Room 3C
410 Capitol Avenue, Hartford, Connecticut

On May 23, 2013, you will have fifteen minutes to make your argument. If you wish to file briefs, you must do so by May 17, 2013. Please call Barbara Olejarz at (860) 418-7005 if you have any questions.

Lisa Davis, MBA, BSN, RN
Deputy Commissioner

Date 4/26/13

C: Jewel Mullen, M.D., M.P.H., M.P.A., Commissioner
Stacey L. Malakoff, Executive Vice President/CFO
Attorney Paul Knag, Murtha Cullina, LLP

Greer, Leslie

From: Carney, Brian
Sent: Friday, April 26, 2013 3:43 PM
To: Paul E. Knag (PKNAG@murthalaw.com)
Cc: Riggott, Kaila; Greer, Leslie; Olejarz, Barbara
Subject: 12-31780-CON Hospital for Special Surgery Oral Argument Request
Attachments: 31780 Oral Argument Date.pdf

Attorney Knag,

Please see attached Notice of Oral Argument for the above referenced matter.

It has been scheduled for May 23, 2013 at 2pm, here at OHCA.

Sincerely,
Brian A. Carney

Brian A. Carney, MBA
Department of Public Health
Office of Health Care Access
410 Capitol Ave.
Hartford, CT 06134-0308
Phone: 860-418-7014
Fax: 860-418-7053

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
OFFICE OF HEALTH CARE ACCESS

NEW YORK SOCIETY FOR THE RELIEF OF THE RUPTURED AND CRIPPLED, MAINTAINING THE HOSPITAL FOR SPECIAL SURGERY - ACQUISITION AND INSTALLATION OF A MAGNETIC RESONANCE IMAGING SCANNER TO BE LOCATED IN STAMFORD, CONNECTICUT	DOCKET NO. 12-31780-CON May 10, 2013

EXCEPTIONS TO PROPOSED FINAL DECISION

Applicant Hospital for Special Surgery ("HSS") respectfully submits the following Exceptions to the Proposed Final Decision rendered by the Department of Public Health's Office of Health Care Access Division ("OHCA") through Hearing Officer Kevin T. Hansted on April 8, 2013 (the "Proposed Decision"). Applicant intends to appear before Deputy Commissioner Lisa Davis on May 23, 2013 and present oral argument on these Exceptions.

I. Introduction & Summary of Argument

HSS was ranked #1 in the nation for Orthopedics and #3 in Rheumatology by U.S. News and World Report in its 2012-2013 "Best Hospitals" issue, marking the 22nd consecutive year that HSS has been among the top rated Hospitals in these fields. (Ex. A., p. 6.) The Proposed Decision acknowledges that HSS "is a top ranked hospital in the orthopedic and rheumatology fields." (Proposed Decision Finding of Fact ("FF") 3.) Largely because of its reputation and world class care, HSS attracted 17,000 patients from Connecticut and nearby Westchester County ("Nearby Westchester County" is defined as those zip codes in Westchester County within 15 miles of Stamford) in New York over the three year period from 2009 - 2011. (Ex. A, p. 14.)

HSS is an academically oriented integrated delivery system focused on the care of patients with Musculoskeletal (MSK) diseases and conditions. The highly coordinated and comprehensive integrated nature of the HSS system of care is what has created the leading patient outcomes and world class status that it enjoys. Unlike a general hospital or healthcare system, each component of the HSS delivery system is highly specialized, including both its people and its technology and the application of this technology to the patients it treats. A key to HSS' outstanding patient outcomes includes its approach to MRI imaging. HSS has developed proprietary protocols for MRI scans which are further customized to meet the needs and specifications of each patient and their physician. HSS has a comprehensive research agreement with GE Healthcare wherein it has sole access to GE proprietary MRI protocols in the Northeast, years in advance of commercial availability. HSS radiologists must complete a special fellowship in musculoskeletal imaging following their normal radiology training, and as members of the HSS radiology staff, do solely musculoskeletal imaging. (Ex. A, p. 18.) HSS' Chief of Radiology, Dr. Hollis Potter, is a world renowned leader in advancements in musculoskeletal MRI, with hundreds of peer reviewed articles and books, and a litany of awards and presentations around the globe. A copy of Dr. Potter's CV has been previously submitted (Ex. A, pp. 137 - 197). HSS radiologists work closely with the other HSS physicians in creating and executing the protocol for each physician and his/her patients. This collaborative process has been developed over the past 20 years and continues to be developed today.

It is because of these factors that most HSS MDs prefer that their patients receive an HSS MRI. In 2012, approximately 3,300 patients from Connecticut and nearby Westchester County traveled to HSS in Manhattan to have their MRIs performed on one of ten MRI scanners located there (Ex. A, p. 15.)

HSS is now proposing to establish a new office in Stamford to serve Connecticut and nearby Westchester County HSS patients. This office would replace the current HSS Old Greenwich office which has no MRI. No CON is required for this pursuant to a prior OHCA ruling, except for the MRI which HSS wishes to locate in Stamford. (OHCA Docket No. 11-31733-DTR.) This MRI would be able to accommodate 2,540 of the 3,300 patients currently going to HSS in Manhattan, thus providing much improved access for a patient population that often has limited mobility due to orthopedic injury. Because HSS would not be able to fully accommodate its own area patients at this new location, the proposed MRI would not have any impact on volumes at existing facilities.

Excited about having this world class hospital extend its footprint in Connecticut, the Mayor of Stamford, all of the Stamford area legislators and a number of its key business leaders have written letters of support for this new facility. Also, the Connecticut Department of Economic Development has recommended a state grant of $2,000,000 to induce HSS to proceed with its proposal, which will result in the creation of nearly 50 jobs and contribute to economic development in the Stamford area. No current providers sought intervener status to oppose HSS' application. Greenwich Hospital sent a letter which did not oppose the application but asked that the MRI's use be restricted to HSS patients. (Ex. L.) Stamford Hospital then sent a letter asking that its patients be allowed access to the proposed HSS MRI. (Ex. S.) This was not addressed in the Proposed Decision.

Since HSS' current utilization will fully occupy the proposed scanner, HSS respectfully submits that need is clearly established. 3,300 patients from this area have concluded that they want HSS MRI technology, and they are electing to go to HSS in New York rather than a Stamford area MRI provider.

The Proposed Decision indicates that OHCA is not concerned with the fact that a "MRI may provide a more convenient location for the patient" nor with capacity issues outside of Connecticut. However, Conn. Gen. Stat. § 19a-639 (a)(5) specifically requires OHCA to consider accessibility in all of its decisions, and this is particularly so when the population involved has severe mobility issues.

Instead of relying on the fact that HSS' current utilization will fully occupy the proposed MRI, and without giving HSS advance notice as required by Connecticut General Statutes § 4-178, OHCA relied on 2010 data from a survey it conducted in connection with the OHCA Statewide Facilities and Services Plan (the "Statewide Plan") published in October, 2012, to conclude, without elaboration, that the primary service area has "adequate MRI capacity" if HSS patients wanted to forgo the benefits of HSS MRIs and use existing community facilities.

However, without considering the area patients currently being served by HSS in Manhattan, the data in the Proposed Decision shows there is not adequate capacity in the primary service area under the Statewide Plan formulas or any other standard. In the Statewide Plan, there is a section entitled "Standards and Guidelines Specific to MRI" which under Section 3(a) requires a showing, subject to a right of Applicant to introduce other factors, "that Percent Utilization of Current Capacity in the Primary Service Area" exceeds 85%. Using this formula, 85% of current capacity, as defined, is 23,800 MRI scans per year (7 MRI units times 4,000 scans per unit at 85% utilization). Using the 2010 data set out in the Proposed Decision (2011 data cited by HSS is higher), there were in fact 27,192 MRIs performed in 2010. So, notwithstanding HSS' intention to serve only those patients currently traveling to HSS in NYC to receive an MRI scan, OHCA's conclusion that there is no need for another MRI in its proposed primary service area is unfounded.

The Proposed Decision further cites an absence of "conclusive evidence (i.e. comparative scientific studies or empirical evidence) to validate that HSS' MRI protocols provide significantly better imaging results or lead to better outcomes than by existing Connecticut providers." HSS has produced overwhelming evidence of the reliability, reproducibility and surgical correlation of the MRI results and has demonstrated that the quality of its MRIs are better than community alternatives for its patients (set out in further detail in Sections II.A. and II.B. below). HSS presented evidence from two world renowned physicians, who have produced hundreds of peer reviewed articles and book chapters, as to the preeminence of HSS as the top orthopedic hospital in the country, its leadership in the development of musculoskeletal MRI protocols which are not available elsewhere and its specially trained musculoskeletal MRI radiologists and its coordinated approach wherein its surgeons work closely with its musculoskeletal radiologists to design and customize a radiology plan for each patient. This diagnostic approach is vital to ensure prompt diagnosis and planning for treatment, whether it be surgical or conservative.

Notwithstanding HSS' demonstration of its high quality MRI scanning techniques and their impact on the quality of HSS' outcomes, the key point is that over 3,300 patients make the decision to go to HSS for their MRIs each year, clearly demonstrating need in the region. The real issue is whether these patients should continue to be required to travel to New York for their MRIs when HSS is willing to provide this service in Stamford.

Moreover, the Proposed Decision notes that HSS indicated a willingness to make its MRI available, where possible, to non-HSS patients. HSS does not insist on this if OHCA feels that it would be better to limit HSS to serving its own patients. HSS was merely trying to respond to the request from Stamford Hospital.

In summary, there is no basis for concern that adding the proposed MRI would adversely impact existing volumes at existing MRIs, no reason to conclude that need has not been shown even if HSS were not bringing its own patients to the new MRI, no reason to deny Stamford the economic benefit of this new service and the addition of associated jobs, and no reason to make the injured patients of HSS continue to travel to New York when HSS is ready to accommodate them here in Connecticut.

II. Exceptions to Findings of Fact

HSS takes exception to the following findings of fact in addition to those described in Sections III and IV below:

A. **Finding of Fact #16** – "HSS stated that it had only anecdotal cases to support its claim that HSS MRI protocols are better than those used by Connecticut providers. HSS' peer-reviewed literature is not based on any specific Connecticut facility. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Dr. Hollis Potter, Chief of the MRI department at the Hospital for Special Surgery."

Finding of Fact 16 relates to a statement made by Dr. Potter during the public hearing in this matter. In response to a question asked by Mr, Carney regarding whether HSS had "comparative scientific studies or empirical evidence to support that [HSS'] MRI protocols are better than MRI protocols used by Connecticut providers," Dr. Potter stated that HSS has anecdotal cases and continued on to mention peer reviewed literature. (Tr., Testimony of Dr. Potter, p. 28.) In making this finding, OHCA relies on the first part of Dr. Potter's statement, ignoring her following remarks and HSS' application which presents several peer-reviewed publications documenting that the MRI imaging techniques utilized by HSS result in higher quality images than typical imaging techniques as well as other advantages. (Ex. A, Attachment IV.) These higher quality images:

1. Obviate the need for intra-articular injections and limit the use of contrast injections increasing patient safety. (Ex. A, p. 19.)

2. Provide each surgeon with sufficient information to identify all issues to be operated upon prior to surgery and to limit the need for diagnostic surgery (Ex. A., p. 19.), and

3. Allow for early detection of osteoarthritis, determination of timing of treatment and assessing surgical cartilage repair. (Ex. A, p. 19.)

While the studies included in Attachment IV of HSS' application do not specifically compare results of Connecticut providers to results of HSS, they do document that the techniques utilized by HSS produce higher quality images than typical MRI techniques and that the use of these images allows physicians to ensure accurate diagnoses, efficient treatment plans and ultimately superior patient outcomes. In addition, HSS is not aware of or identified any documented or published rigorous clinical data demonstrating the reliability and reproducibility of the MRI scans that are currently performed by Connecticut providers, making head to head comparison of MRI reliability impossible. Furthermore, producing these images is only one part of a process that integrates the equipment, software, processes and protocols with HSS' specially trained musculoskeletal radiologists and world-class physicians. Even if others providers were able to reproduce the high quality image with the available equipment, software, processes and protocols, it is HSS' integrated delivery network that allows it to achieve the patient outcomes that have made it the #1 ranked orthopedic hospital in the U.S.

At and prior to the hearing, HSS presented detailed evidence of some of the other unique benefits of HSS' techniques. (Ex. A, pp. 18-20, 31-33; Ex. F, pp. 340-342; Tr., Testimony of Dr. Potter, pp. 7-9.) These include checking of scans by a musculoskeletal radiologist prior to the patient leaving the facility in order to potentially require additional sequences before the patient leaves, vigilant patient positioning techniques, proprietary and prototype means for early detection and treatment of osteoarthritis and assessment of bone loss and regional adverse tissue reactions around joint replacements, and better interpretation due to the highly specialized experience of HSS' specially trained musculoskeletal radiologists. (Id.)

In addition, it would be nearly impossible to get a Connecticut MRI provider or multiple Connecticut MRI providers, to participate in a study or other scholarly piece indicating that HSS' techniques (whether due to higher quality images, unique protocols or integrated delivery) are superior. The peer reviewed literature provided should provide OHCA with comfort regarding HSS' MRI protocols.

B. **Finding of Fact #17** – "HSS stated that it had not specifically addressed improvement in surgical outcomes as a result of using its MRI protocols. Transcript of

December 18, 2012 Public Hearing ("Tr."), Testimony of Dr. Hollis Potter, Chief of the MRI department at the Hospital for Special Surgery."

Again, OHCA relies on a statement made by Dr. Potter during the public hearing in response to a question asked by Mr. Carney without considering the evidence presented as a whole. (Tr., Testimony of Dr. Potter, p. 29.) HSS is the #1 ranked orthopedic hospital in the country. An important factor contributing to this success is the quality of the HSS MRI scan. (Ex. A., pp. 18-20, 31-33.) As discussed above, the MRI imaging techniques utilized by HSS result in higher quality images than typical imaging techniques. (Id.) Producing these images is only one part of a process that integrates the equipment, software and processes & protocols with HSS' specially trained musculoskeletal radiologists and world-class physicians. (Tr., Mr. Louis A Shapiro, President and Chief Executive Officer, HSS, pp. 24, 30.) Even if other providers were able to reproduce the high quality image with the available equipment, software and processes and protocols, it is HSS' integrated delivery system that allows HSS to achieve the outcomes that earn it this #1 ranking.

HSS quality is further evidenced by the following measures:

1. Infection rates significantly lower than the national average for hip and knee replacements,

2. Readmission rates that are significantly lower than the national average for spine fusion cases and hip and knee replacements, and

3. Higher than average Patient Experience rating (HCAHPS) and Patient Satisfaction scores (Press Ganey).

The quality of HSS' surgical outcomes is widely documented and results from integrating many components of the HSS continuum of care including MRI.

C. **Finding of Fact #22** – "Although HSS does not market its services to non-HSS physicians, testimony received stated that HSS does currently accept referrals from non-HSS orthopedic surgeons in New York. HSS also stated that it would like to market its MRI services to an orthopedic practice affiliated with the Stamford Hospital and located within the same building (Chelsea Piers complex) where the proposed MRI would be operated. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Louis A. Shapiro, President and Chief Executive Officer for the Hospital for Special Surgery."

In its application, HSS indicated that it will not market its MRI to non-HSS physicians nor will it have the capacity to accommodate such volume. (Ex. A, p. 25.) Subsequent to HSS' filing the application, Brian G. Grissler, President and CEO of Stamford Hospital expressed an interest in giving Stamford Hospital the ability to refer patients to this facility in order to address capacity constraints at their existing MRI facilities. (Ex. S.) In this letter, Mr. Grissler states that "…to the extent that the proposed MRI has capacity, it would help fill a need created by constraints on our MRI units if patients could be served on the unit HSS is proposing to install." (Ex. S.) It is in response to this stated need that Mr. Shapiro indicated that the HSS MRI would be made available to Stamford Hospital's affiliated group practice. HSS did not and does not have any intent to market the MRI in Stamford, and HSS is willing to close its facility to non-HSS patients if OHCA feels such is necessary.

D. **Finding of Fact #28** – "The Applicant has failed to establish that there is a clear public need for its proposal. (Conn. Gen. Stat. § 19a-639(a)(2))"

HSS' CON application as well as the additional information included as part of the public record clearly demonstrates that there is a clear public need for a HSS MRI in Stamford. Specifically:

1. Over 3,300 individuals from Connecticut and nearby Westchester County in New York choose to get their MRI scans at HSS in New York City, indicating that there is a need for HSS' specialized MRI service in the region. HSS projected volume represents referrals from HSS physicians of patients residing in Connecticut and Westchester County who would no longer need to travel into New York City for their HSS MRI. (Ex. A., pp. 27-30.)

2. Moreover, if one applies the newly published Statewide Health Care Facilities and Services Plan (the "Plan") to HSS' proposed primary service area (although the Plan is not applicable to HSS' application), it is clear that there is a need for the proposed MRI. Pursuant to the Statewide Plan, in order to establish need, the applicant must demonstrate that utilization of existing capacity in the primary service area exceeds 85%. Using OHCA's information, there are 7 MRI scanners in the primary service area. (FF 18.) The assumption in the Statewide Plan is that a MRI scanner's maximum capacity is 4,000 scans per year. Statewide Plan, p. 61. Thus, maximum capacity in the service area under this methodology is 28,000 scans per year (7 x 4,000). Eighty-five (85%) of this figure is 23,800 scans. Thus, in order to meet OHCA's need criteria, more than 23,800 scans must be performed in HSS' primary service area annually. If one uses OHCA's volume data (as cited in FF 19), 27,192 scans were performed in

the service area in 2010, well above the threshold. Described another way, utilization of existing capacity is approximately 97%, well above the 85% requirement, and volumes have only increased since OHCA's 2010 data.

It is also worth noting that even if one includes the four MRI scanners in Norwalk, which are outside of the primary services area and not as heavily utilized, maximum capacity increases to 44,000 scans (11 x 4,000) and 85% of maximum capacity increases to 37,400. Since the 2010 utilization for these 11 MRIs was 38,551 (FF 18), utilization is still at approximately 88% (again above the 85% threshold). The Proposed Decision does not explain OHCA's conclusion that there is no need for additional capacity despite the fact that current utilization of existing capacity exceeds 85%.

3. Finally, as mentioned above, Brian G. Grissler, President and CEO of Stamford Hospital, submitted a letter to the Commissioner of the Connecticut Department of Public Health supporting HSS' proposed MRI on the basis that "... it would help fill a need created by constraints on our MRI units." In addition, Mr. Grissler states in his letter that "Overall, such flexibility could improve accessibility to MRI for patients throughout the service area." (Ex. S.)

E. **Finding of Fact #30** – "The Applicant has failed to satisfactorily demonstrate that the proposal would improve quality, accessibility and cost effectiveness of health care delivery in the area. (Conn. Gen. Stat. § 19a-639(a)(5))"

HSS CON application as well as the additional information included as part of the public record demonstrates that the proposal will improve quality, accessibility and cost effectiveness of health care delivery in the area. Specific examples are as follows:

Quality – As more fully described above with regard to Finding of Fact 16, HSS' CON application presents several peer-reviewed publications, testimony from two world renowned physicians and other extensive evidence of the recognized quality at HSS and the many advances and unique protocols which it offers (Ex. A, pp. 31-33, Attachment IV.)

Accessibility - Over 3,300 individuals from Connecticut and nearby Westchester County in New York choose to get their MRI scans at HSS in New York City. Many of these patients are experiencing mobility issues which is why they have sought care at HSS in the first place. For these patients, traveling to NYC for services can be difficult and costly. The addition of a HSS MRI scanner in Stamford eliminates the need for most of these patients to travel to NYC in order to have a HSS MRI scan that is integrated into the HSS continuum of care. This ensures a timely diagnosis and development of a treatment plan that allows the patient to regain their mobility and return to full function as quickly as possible. (Ex. A, pp. 7, 13, 21.)

Cost Effectiveness – Delivering services closer to home reduces the cost of health care by eliminating the need for patients to travel to New York City, possibly requiring medical transport, and potentially lose time at work to receive their MRI scan. It also allows for more timely MRI scanning meaning that physicians can render their diagnosis and prepare the required treatment plans sooner ensuring that patients can regain their mobility and return to full function sooner. (Tr., Testimony of Dr. Jo Hannafin, orthopedic surgeon, pp. 11-12.) Further, HSS' pioneering techniques are producing huge cost savings. Examples include reduction of infection risk by avoiding use of contrast and protocols for post operative assessment of cartilage repair which replaces the more expensive alternative of surgery. In addition, HSS' customized MRI protocols provide each surgeon with sufficient information to identify all issues prior to surgery and limit the need for diagnostic surgery. It is difficult to understand why the Proposed Decision ignores the fact that HSS' leadership in musculoskeletal MRI not only means better quality but also lower cost.

F. **Finding of Fact #32** – "The Applicant has satisfactorily identified the population to be served by its proposal, but has failed to satisfactorily demonstrate that this population has a need as proposed. (Conn. Gen. Stat. § 19a-639(a)(7)"

With regard to establishing need for its proposal, HSS refers OHCA back to item D. above as well as to Sections III and IV below.

G. **Finding of Fact #33** – "The overall historical utilization of MRIs in the service area does not support this proposal. (Conn. Gen. Stat. § 19a-639(a)(8))"

Even if one disregards the notion that HSS' projected volume is based solely on a shift of current HSS cases from New York City to Stamford (Ex. A., pp. 27-30), historical utilization of MRIs in the proposed service area still establishes need. As is pointed out above and as is discussed in more detail in Section IV below, if one applies the Statewide Plan to the service area, current MRI utilization is at a level that establishes need for an additional MRI scanner.

H. **Finding of Fact #34** – "The Applicant has failed to satisfactorily demonstrate that its proposal would not result in an unnecessary duplication of existing MRI services in the area. (Conn. Gen. Stat. § 19a-639(a)(9))"

HSS' CON application as well as the additional information included as part of the public record demonstrates that the proposal will not result in unnecessary duplication of existing MRI services in the area as follows:

1. Over 3,300 individuals from Connecticut and nearby Westchester County in New York choose to get their MRI scans at HSS in New York City, indicating that there is a need for HSS' specialized MRI service in the region. HSS' projected volume represents a shift in its own cases and does not rely on referrals from any physicians outside HSS. (Ex. A, pp. 27-30.)

2. Even if one disregards item 1 immediately above, as is mentioned numerous times above and described in more detail in Sections III and IV below, utilization is currently at such a level that another MRI scanner is needed in the area.

3. Further, HSS demonstrated in numerous ways as detailed above how its services offer unique elements not available at current Stamford area MRI locations. See especially items A and B above. In addition, a further review of the 2010 OHCA Imaging providers' survey utilized to prepare Table 3 in the Proposed Decision indicates that none of these scanners is capable of running certain prototype imaging techniques such as the multi-acquisition variable-resonance image combination (MAVRIC) - this is a GE product that is released for very specific, high end MRI units only (GE models 450,450 wide and 750). This technique was co-developed by Dr. Potter and scientists at GE and is useful

in scanning patients with existing hardware, a situation that is common among HSS patients. (Ex. F, p. 341.) Since none of the scanners within or in proximity to the proposed service area is capable of running these types of prototype imaging techniques, this is an additional reason that the proposal does not duplicate any existing MRI services in the service area. Furthermore, through HSS' research agreement with GE, HSS is able to access improvements in technology years in advance of commercial availability further differentiating HSS' MRI service from that of other providers.

III. HSS Showed Clear Public Need and Other Evidence that Clearly Supports the Granting of the CON

OHCA concludes in its Proposed Decision that there is "adequate MRI capacity to serve HSS patients residing in the primary services area" and that "approval of this proposal would lead to decreased patient volumes and revenues for existing MRI providers in the service area and result in unnecessary duplication of MRI services in the region." (Proposed Decision, pp. 10, 11.) These conclusions are not supported by HSS' CON application, by the record or by OHCA's Findings of Fact.

As discussed in HSS' CON application and herein, the addition of HSS' MRI in Stamford will have no impact on existing Connecticut MRI providers. (Ex. A, pp. 25-26.) If OHCA prefers that HSS close its Stamford MRI to patients from outside of HSS, HSS is willing to so restrict its use. In indicating that HSS would accept patients referred by Stamford Hospital physicians, HSS was only trying to meet Stamford Hospital's request for capacity, if HSS should have capacity. The fact that Stamford Hospital expressed an interest in being able to refer patients to the HSS MRI facility due to its own capacity constraints only reinforces the case for public need and does not support the conclusion that there will be duplication of existing services or that existing MRI providers will lose patient volume or revenue. Furthermore, since the capacity of the proposed MRI unit will be quickly filled with scans currently performed at HSS in Manhattan, capacity to absorb volume from existing Connecticut MRI providers will not be available. (Ex. A., pp. 25, 27-29.) As a result of these factors, no impact on existing MRI providers in the area is anticipated.

In fact, as HSS does not expect to be able to assist Stamford Hospital or other MRI providers with volume constraints, HSS anticipates that others in the Stamford area are likely to request approval from OHCA to acquire and install MRI scanners. When one looks at the volume of MRI scans performed in Stamford in 2010 (without considering the increase in volume in the most recent two years), it is obvious that Stamford's MRI scanners are operating at full capacity or worse, over capacity. (See FF 19.) Using the methodology from the Statewide Plan, explained in more detail below, Stamford's MRI scanners have an annual capacity of 16,000 scans (4 scanners x 4,000 scans/year). However, there were 18,567 scans performed on these scanners in 2010. This data alone, even without regard to the letter submitted by Stamford Hospital (Ex. S), establishes need in the Stamford area.

In light of the above information, it is difficult to understand OHCA's determination that there is no clear public need for the proposal. OHCA provides the volume for each of the service area MRI scanners, as well as four MRI scanners in nearby Norwalk, but does not cite any standards or methods by which it came to this conclusion, other than to make reference to the Statewide Plan. (See FF 18.) Thus, it appears that OHCA either (i) erroneously applied the Statewide Plan, which on its face is not applicable to HSS' CON application, without providing notice of its use to HSS, as discussed below or (ii) applied a different standard without providing notice of such standard's use to HSS. In either case, OHCA seems to have applied need-based criteria without informing HSS of the criteria it was supposed to meet. In a case involving OHCA's predecessor, the Commission on Hospitals and Health Care, the court held that the procedures utilized by the agency in reviewing the expenditures budgets of various Connecticut hospitals were illegal, unconstitutional and arbitrary. New Britain General Hospital v. Commission on Hospitals and Health Care, (Ct. Com. Pleas. Hartford Co., D.N. 13-24-86-1, June 21, 1977; copy attached). The court so held because the agency's failure to define the criteria that it intended to apply made it impossible for the hospital to adequately present its case. The same can be said for OHCA's approach in this matter. By seemingly applying need-based criteria of which HSS was/is not aware, HSS had/has no ability to adequately meet the criteria or refute its application. Even in the Proposed Decision, it does not explain what standard is used to determine that there is "adequate capacity", when the cited volumes clearly show otherwise.

IV. OHCA Failed to Provide Required Notice to Applicant

As has been mentioned many times herein, OHCA cites the Statewide Plan as support for the existence of seven MRI scanners within HSS' proposed service area and an additional four scanners in close proximity to the service area and the 2010 OHCA Imaging providers' survey for the volumes of each of these scanners. (FF 18 and 19.) The manner in which OHCA uses this information is improper for two reasons.

A. Lack of Proper Notice OHCA never notified HSS of its intent to use the data described above in its analysis. Pursuant to Conn. Gen. Stat. § 4-178, "parties shall be notified in a timely manner of any material noticed, *including agency memoranda or data,* and they shall be afforded an opportunity to contest the material so noticed." (emphasis added). Based on this statute, OHCA should have provided notice of its intent to include the survey data in the record so HSS could have had an opportunity to review and respond to the data. Here such a response would have included the observation that the volumes shown in the survey under OHCA's own criteria and any other criteria demonstrate a need for additional MRI capacity in the service area. This point is particularly relevant because OHCA *knew* that HSS did not have the volume data for the non-hospital MRI scanners in its service area - HSS explicitly stated that such data was not available in its CON Application. Ex. A, p. 24. (HSS was unaware that this data was available at the time its CON application was filed.) Without the data having been properly noticed, these Findings of Fact should not now be used against HSS as evidence of existing capacity and duplication of services, particularly when OHCA's own methodology proves otherwise. (See Proposed Decision, pp. 10-11.) In fact, in a similar case in which OHCA's predecessor, the Commission on Hospitals and Health Care, denied a CON for a CT scanner to The Stamford Hospital based on information not introduced into the record, the court stated that "in attempting to justify its claims and conclusions by reference to matters outside the record, without notifying the [h]ospital of the matter relied upon, the Commission acted illegally, arbitrarily, unconstitutionally, and in an abuse of its discretion." The Stamford Hospital v. Commission on Hospitals and Health Care, (Ct. Com. Pleas, Fairfield Co., Jan. 27, 1978; copy attached). There is no reason that OHCA's use of the MRI volume data in this instance should be viewed any differently.

B. Statewide Plan As OHCA acknowledged in Findings of Fact 26 and 27 of the Proposed Decision, the Statewide Plan is not applicable to HSS' CON Application. The Statewide Plan states that it becomes effective on publication (which was in October 2012) and will become applicable to CON Applications effective ninety (90) days after its effective date. HSS' CON Application was deemed complete prior to publication of the Statewide Plan. In addition, the Statewide Plan is very clear that the guidelines and standards contained within it will not be final until adopted as regulation pursuant to Chapter 54 of the Connecticut General Statutes, and such adoption has not yet occurred.

Despite OHCA's acknowledgement that the Statewide Plan does not apply to HSS' CON Application, OHCA seems to suggest that it is the number of MRI machines in the service area and in close proximity to the service area, as well as the existing volume and capacity of these machines, that leads OHCA to conclude that there is no clear public need for HSS' proposal. (See FF 18 and 19; see also Proposed Decision, pp. 10-11.) While not explicitly stated, such a conclusion seems to be based on the notion that the CON Application should not be approved because the existing MRI scanners are not utilized to capacity.

Importantly, in light of the foregoing, if one applies the need methodology standards from the Statewide Plan, utilization in HSS' proposed primary service area is at a level sufficient to demonstrate need as demonstrated in section II. D. above.

V. Conclusion

The best orthopedic hospital in the country and arguably the world is offering to bring world class musculoskeletal healthcare, convenience and new jobs to Stamford. Stamford Hospital has embraced the application. The Mayor, all the area legislators and a Who's Who of business leaders have written to OHCA asking for approval. The Department of Community and Economic Development has offered $2,000,000 in support for the project, recognizing how beneficial it would be to the state. Yet OHCA is proposing to deny the CON.

The need is clear--HSS has a significant number of patients coming from this area. These mobility challenged patients will be spared the need to travel to New York. At the same time, even if OHCA determines to disregard this as contemplated by the Proposed Decision, using

OHCA's own formulas or any other reasonable standard, it is clear that there is a need for additional capacity in the Primary Service Area.

Also clear is that this proposal will improve quality and reduce costs. HSS's physicians regularly travel throughout the world to present on their cutting edge advancements in musculoskeletal MRI, they are hired by GE to develop additional advancements, they have published hundreds of peer reviewed articles and book chapters on their work, and they provided examples of their superior images to OHCA and testimony of the benefits of customized patient radiology plans. And they explained and documented how their advances reduce the need for exploratory surgery, reduce infections and improve outcomes, all of which are important cost saving breakthroughs.

Finally, HSS is willing to accept a condition limiting the availability of the MRI at the proposed site to HSS patients only if OHCA believes this to be best for the community and the residents of Connecticut.

This is a unique opportunity for Connecticut and its patients, which should not be squandered.

Therefore, it is respectfully requested that the Proposed Decision be revised so as to grant the requested Certificate of Need.

Respectfully Submitted,

The Hospital for Special Surgery

By: ______________________

Paul E. Knag
Murtha Cullina LLP
177 Broad Street
Stamford, CT 06901
Tel: (203) 653-5407

NO. 13 24 86-1

NEW BRITAIN GENERAL HOSPITAL) COURT OF COMMON PLEAS
v.) HARTFORD COUNTY
COMMISSION ON HOSPITALS AND HEALTH CARE) JUNE 21, 1977

MEMORANDUM OF DECISION

The plaintiff is a private, non-profit general teaching hospital which pursuant to § 19-73o of the General Statutes is required to submit to the defendant Commission on Hospitals and Health Care, hereinafter called the Commission, its proposed operating and capital expenditure budget for its next fiscal year at least ninety days prior to the proposed adoption date of the plaintiff's budget. The plaintiff duly submitted to the Commission a proposed budget of $27,915,000 for its next fiscal year beginning on October 1, 1976. The Commission ordered the plaintiff to adopt a patient revenue budget in the amount of $25,743,504 and the plaintiff has appealed pursuant to General Statutes § 19-73p, claiming that the Commission's decision was arbitrary, capricious, based upon unlawful procedure, violated applicable statutes, and deprived the plaintiff of rights guaranteed by the Connecticut Constitution and the Constitution of the United States, claims which the Commission has denied. The action of the Commission has been stayed by court order pending the appeal which has been referred to the undersigned for trial. By agreement of the parties the issue to be heard was limited to the legality of the Commission's procedure.

Section 19-73k of the General Statutes, then in force, provided that the Commission in its deliberations under General Statutes § 19-73o "may take into consideration the necessary expenses of the institution or facility concerned, the effectiveness of its delivery of health care services, the quality of available health care, the duplication of service by institutions and facilities in the area served, the community or regional need for any particular function or service, and any other factors which the commission deems relevant."

The Commission, in 1975, had adopted published regulations applicable to hospitals, which defined the accepted category of rate charges, revenue, expense and current and budgeted fiscal years, (regulations 19-73a-48) and budget filing requirements, (regulations 19-73a-55, 19-73a-56). Section 19-73a-57 of the regulations provided that in reviewing proposed operating and capital expenditure hospital budgets the Commission "will follow the criteria of Sec19-73k G.S., to determine whether to approve, deny, modify, or issue any order concerning any budget or any rate or charge proposed by the applicant", and that in conducting hearings or administrative proceedings authorized by statute in connection with budgets, it would "follow chapter 54, G.S." Administrative rules and regulations are given the force and effect of law. Hartford Electric Light Co. v. Sullivan, 161 Conn. 145, 154. Chapter 54 of the General Statutes, which is the Uniform Administrative Procedure Act, provides in § 4-177 so far as now material that "(a) In a contested case, all parties shall be afforded an opportunity for hearing after reasonable notice; . . . (3) a reference to the particular sections of the statutes and regulations involved; (4) a short and plain statement of the matters asserted. If the agency or other party is unable to state the matters in detail at the time the notice is served, the initial notice may be limited to a statement of the issues involved. Thereafter upon application a more definite and detailed statement shall be furnished. (c) Opportunity shall be afforded all parties to respond and present evidence and argument on all issues involved. . . . (g) Findings of fact shall be based exclusively on the evidence and all matters officially noticed."

Section 4-178 of chapter 54 provides in material part "In contested cases: (1) Any oral or documentary evidence may be received . . . when a hearing will be expedited and the interests of the parties will not be prejudiced substantially, any part of the evidence may be received in written form . . . a party may conduct cross-examination required for a full and true disclosure of the facts. . . . notice may be taken of generally recognized technical or scientific facts within the agency's specialized knowledge. Parties shall be notified either before or during the hearing, or by reference in preliminary reports or otherwise, of the material noticed, including any staff memoranda or data, and they shall be afforded an opportunity to contest the material so noticed."

Section 4-179 of chapter 54 provides that "When in a contested case a majority of the officials of the agency who are to render the final decision have not heard the case or read the record, the decision, if adverse to a party to the proceedings other than the agency itself, shall not be made until a proposal for decision is served upon the parties, and an opportunity is afforded to each party adversely affected to file exceptions and present briefs and oral argument to the officials who are to render the decision. The proposal for decision shall contain a statement of the reasons therefor and of each issue of fact or law necessary to the proposed decision, prepared by the person who conducted the hearing or one who has read the record. The parties by written stipulation may waive compliance of this section."

The plaintiff is a private, non-profit, teaching hospital with an in-patient capacity of 436 beds. It is the seventh largest hospital in Connecticut with an activity of about 130,000 bed patient days and some 100,000 out-patient visits each year.

Its patient revenue per bed ranks among the ten lowest of all the thirty-five private hospitals in the state. It employs from 1,300 to 1,500 skilled and unskilled persons and serves a population including surrounding towns of about 140,000 to 150,000 people. Its annual budget is carefully restricted by a six months study and review by supervisory personnel knowledgeable of the needs which the demands on its service to the public require. The proposed budget which it submitted to the Commission for approval underwent this scrutiny.

The General Assembly intended that, for a meaningful review of hospital budgets, the fifteen member Commission established by § 19-73c of the General Statutes should include persons having expertise in hospital management and health care. It requires that the membership include a hospital administrator, a nursing home administrator, a practicing licensed physician, a practicing registered nurse, the commissioner of health, the commissioner of mental health and the insurance commissioner or his designee, and by § 19-73f it directs the Commission to "appoint an executive director to serve at its pleasure, who shall be experienced in the field of hospital administration [who] shall, subject to the rules of the commission, administer and coordinate the functions of the commission and shall have overall supervisory authority and responsibility for its operations."

By the time limitations imposed by General Statutes § 19-73q, later referred to, the General Assembly has imposed an onerous burden on the Commission in performing its duty concerning hospital budgets. There are thirty-five private hospitals throughout the state, each with a fiscal year commencing annually on October 1. That the Commission was hard pressed by the demands of the statute when confronted by the voluminous material submitted by thirty-five hospitals including that of the plaintiff could be sensed at the hearing.

A several hundred page record of the proceedings before the Commission relating to the plaintiff's budget has been submitted, properly supplemented by extensive evidence offered at the trial by the plaintiff concerning matters which were not of record in order to assist the court in a determination of whether, in the actual procedure adopted by the Commission, it acted illegally or arbitrarily. Hotchkiss Grove Assn., Inc. v. Water Resources Commission, 161 Conn. 50, 56. The Commission offered no evidence beyond the procedures recorded. The pagination of the recorded procedures, embracing duplicated and indistinct page numbering and unnumbered pages, defies intelligible reference to the recorded proceedings. The issue to be resolved on all the evidence is whether the Commission acted illegally or arbitrarily and whether its conduct was in violation of the powers granted to it and the duties imposed upon it. Conley v. Board of Education, 143 Conn. 488, 492.

To meet the task confronting it the Commission employed a staff of some twenty-three persons about twelve of whom were substantially involved in reading the proposed budgets submitted. There is no proof that the staff were instructed, in their study of the budgets, to give consideration to any of the factors enumerated in General Statutes § 19-73k. On the contrary the staff work appears to have been concerned with classification, recording, synopsis and comparison of the data contained in the various proposed budgets under "criteria" hereafter referred to.

After the Commission had conferred with the representatives of the Connecticut Hospital Association and Blue Cross an agreement had been reached upon a standard form of budget report to be used by each hospital. Based on these instructions the plaintiff filed a proposed operating and capital budget of some two hundred pages on July 2, 1976. The proposed operating budget set forth in minute detail the plaintiff's authorized budget for the prior year, its actual expense for that year and the proposed budget which it considered necessary to meet the demands which it faced in the forthcoming year, in each instance itemizing the expenditures for its several activities and the need for any proposed increase with supporting schedules. The proposed capital budget identified the claimed need for any capital expenditure, and the estimated cost thereof. The information thus furnished was supplemented by letters to the Commission's director on August 5 and 6 furnishing further information on subjects suggested by him or his deputy director. There is no proof that any individual commissioner or the Commission as a body ever studied the budget or other information which the plaintiff had submitted or analyzed it from the standpoint of the considerations set forth in General Statutes § 19-73k.

Dissatisfaction had been expressed by members of the Commission concerning their procedures in prior years. In the early spring of 1976 they chose as director of the Commission, contrary to the requirement in General Statutes § 19-73f, a man who had had no experience in the field of hospital administration. It was to him that the plaintiff's letters of August 5 and 6, 1976, above mentioned, had been written. At the director's recommendation a sub-committee of the Commission called an "ad hoc budget committee," hereafter called the ad hoc committee, was appointed by the Chairman of the Commission without formal Commission action. Six members of the Commission comprised the ad hoc committee. The newly appointed director of the Commission with the aid of his deputy director prepared proposed "guidelines" for Commission use in acting on all hospital budgets. With the approval of the ad hoc committee it was suggested that the proposed "guidelines" be adopted as emergency regulations of the Commission. Without being generally publicized, copies of the proposed "guidelines" were sent by the director to the administrators of private hospitals around the state and comment concerning them was invited. The declared purpose of the proposed "guidelines" was to limit the increase in any hospital budget arbitrarily to an amount not exceeding eight to ten percent above the hospital's "adjusted base levels" for the previous year.

It appears that slight, if any, regard was given to the proposition "that in all its proceedings the regulatory body must act strictly within its statutory authority, within constitutional limitations, and in a lawful manner." Southern New England Telephone Co. v. Public Utilities Commission, 144 Conn. 516, 523.

"No administrative or regulatory body can modify, abridge or otherwise change the statutory provisions under which it acquires authority unless the statute specifically grants it that power." South East Prop. Owners & Residents Assn. v. City Plan Commission, 156 Conn. 587, 592; Finn v. Planning & Zoning Commission, 156 Conn. 540, 546; State ex rel. Huntington v. McNulty, 151 Conn. 447, 449.

A flood of objections to the adoption of the proposed "guidelines" was received from hospitals throughout the state. The plaintiff was among those who objected and in addition sought a public hearing on the proposed "guidelines." The Connecticut Hospital Association not only objected but also requested a hearing. No public hearing was granted, however, by the Commission. The ad hoc committee had approved the proposed "guidelines" "by consensus" without formal vote, but because of the strenuous and voluminous opposition which had been received that committee recommended to the Commission that the "guidelines" not be adopted as emergency regulations but instead that their substance be adopted as "criteria" to be used as a tool in the budget review in the current year. The reason asserted by the Commission for adopting "criteria" rather than emergency regulations was that "criteria" were more flexible and could be used as a "point of departure" whereas regulations must be strictly followed. The specific recommendation of the ad hoc committee to the Commission was "That the proposed criteria, as amended on this date, be used to develop staff memoranda and data concerning all budgets as a group and individually and that the product of such analysis, consistent with the provisions of § 4-178, G.S., be made part of the evidence to be weighed by each panel in each and every case before the Commission, and that each hospital be afforded full opportunity to present evidence in support of applications which vary from that developed in the staff memoranda and data." Upon this recommendation of the ad hoc committee the Commission, on August 10, 1976, adopted the proposed "criteria" which in major substance embodied the rejected emergency regulations. This formal action by the Commission marked the start of the activity which poses the question whether the Commission acted illegally or exceeded or abused its powers or acted arbitrarily. Southern New England Telephone Co. v. Public Utilities Commission, supra, 524.

Over a month's time had intervened between this action of the Commission and the prior submission to the Commission of the plaintiff's proposed budget along with the many other budgets of private hospitals throughout the state. The plaintiff's proposed budget had been prepared in the form established by the Commission on the basis of the Commission's 1975 published regulations. On receipt of the proposed budgets the Commission's staff had commenced its assigned work on the many budgets. As a result of the August 10 action of the Commission, however, the "criteria" which had been adopted was put to use by the staff in preparing its report relating to the budgets which it would recommend for approval by the Commission. The thirteen pages of "criteria" phrased in bureaucratic lingo is difficult to summarize briefly. In general it would test the base costs of an individual hospital against those of all Connecticut private hospitals as a group in order to set an individual hospital's operating budget on the basis of a state wide norm. The capital budget was not affected. For volume increases, specified expenses would be considered fixed and all others would be considered to be 50% variable. Unit cost would be tested by the state wide hospital median cost. A unit cost test would be applied to non-volume increases in the budget. An arbitrary inflationary factor of six percent would be applied based on the published consumer price index which, of course, is computed on a variety of activities unrelated to hospital operation. Weight would be given to the state-wide increase in the hourly wages of manufacturing and production workers which, of course, bears little relation to the employment rates demanded of trained hospital personnel. An arbitrary and inaccurate thirty-five percent estimated increase in malpractice insurance premiums would be applied, and the financing of capital expenditures from gross patient income would be prohibited. Capital expenditures under $25,000 would be considered acceptable if limited to an expenditure not exceeding a rate of $700 per bed, but any capital expenditure over $25,000 must be deferred. Further attempted interpretation of the "criteria" is unimportant because its admitted purpose was principally to limit arbitrarily any increase in an individual hospital budget regardless of its need as tested by the statutory considerations enumerated in General Statutes § 19-73k. Moreover, the "criteria" adopted by the Commission were varied without notice to the Commission as the staff work progressed because the ad hoc committee considered that it had the authority to do so.

Following the adoption of the "criteria" by the Commission on August 10, 1976 copies were sent on August 11 to the administrators of hospitals including the plaintiff's. Included in this notice was the Commission's edict that all testimony of a hospital in support of a budget request must be pre-filed at least twenty-four hours before a hearing thereon. There is no proof that, upon receipt of notice of the adoption of the "criteria," the hospitals, including the plaintiff, were informed that the "criteria" were already being applied by the Commission's staff in reviewing budget requests.

Prior to the Commission's notice to hospital administrators of the adoption of the "criteria" there is no proof that either a member of the Commission or the Commission as a body, had examined the plaintiff's proposed budget, was aware of its contents, or had individually evaluated its suggested necessary expenses, the effectiveness of its delivery of health care services, the quality of available health care which it furnished, the duplication of service by institutions and facilities in the area which it served, or the community or regional need for any particular function or service. See General Statutes § 19-73k. Up to this time only the Commission's staff had acted on any budget.

Section 19-73o of the General Statutes provides in part that "The commission shall review such proposed budget and notify the facility or institution of its approval, denial or modification of such budget not later than forty-five days before such proposed adoption date. Failure of the commission so to notify the facility or institution shall be deemed approval of such budget. If the commission denies or modifies a budget, it shall hold a hearing within ten days of such denial or modification with representatives of the institution, to consider and evaluate such data and information as it considers relevant. Within fifteen days of the hearing, the commission shall recommend a budget for the institution which it deems to be reasonable under the circumstances. If the institution refuses to accept such budget recommendations, and agreement cannot be reached by the commission and the institution at least fifteen days before the proposed budget adoption date, the commission shall order the institution to adopt a budget which the commission deems acceptable for the coming fiscal period."

The Commission's staff had made a report concerning the plaintiff's budget listing, item by item, the plaintiff's actual prior year expense, its proposed budget request, the staff recommended budget with a summary of proposed expense reductions, a summation of unit patient costs, unit medical, surgical and drug costs of all Connecticut hospitals, working capital requirements, contractual allowances and comparisons of individual expense and other items with those of all hospitals in the state. While the report is voluminous and denotes extensive work by the staff, one searches in vain for the application of an analysis of the individual needs of the plaintiff to meet the considerations listed in the statute § 19-73k. No proof is offered concerning the composition or operational functioning of the staff, or whether the statutory considerations of § 19-73k were ever considered by it.

By virtue of General Statutes § 19-73o the Commission was faced with a deadline of August 16, 1976 for approval, denial or modification of any hospital's proposed budget, including that of the plaintiff. Accordingly, the ad hoc committee held concentrated meetings devoted to the staff report and recommended budgets on August 12, 13, 14 and 15, 1976. Not all members of the committee were present at all meetings and not all committee members who did attend were present for the entire duration of the meetings which they did attend. No minutes of these ad hoc committee meetings were kept and consequently there is no knowledge of the discussion which may have occurred concerning any budget. Several budgets were the subject of each meeting and only members of the ad hoc committee reviewed any budget in depth. There is no proof that the plaintiff's budget was ever reviewed by any commissioner but the unconfirmed assertion is that all ad hoc committee commissioners considered each budget. The ad hoc committee meetings concluded at midnight on October 15, with the ad hoc committee's recommendation that all proposed budgets, including the plaintiff's should be modified.

At 9 a.m. on the next morning, August 16, 1976, the ad hoc committee reported its recommendations to a meeting of the Commission. The majority of the members of the Commission had not participated in any budget review. Eleven members of the Commission were present. The report of the ad hoc committee was brief and included a listing of the thirty-five requested budgets, the thirty-five recommended budgets, and the amount of the modifications made in the thirty-five requested budgets, including the plaintiff's. The Commission meeting lasted for eleven minutes. The minutes of the meeting disclose no discussion by the Commission of any of the budgets. The "criteria" had been applied in fixing the amounts of the recommended budgets. On motion made, the thirty-five budgets recommended by the ad hoc committee were adopted by a Commission vote of nine to one, the hospital administrator member of the Commission voting "no." Four of the members of the ad hoc committee were among those who voted in favor of the adoption of the ad hoc committee's recommendation. Only the members of the ad hoc committee had reviewed any budget in depth.

The requirements of procedural due process apply to the deprivation of interests encompassed by the Fourteenth Amendment's protection of liberty and property. When protected interests are implicated, the right to some kind of prior hearing is paramount.

Board of Regents v. Roth, 408 U.S. 564, 569. Consequently hearing panels consisting of three commissioners each were designated to hear the anticipated hospital appeals.

Following the meeting of the Commission on August 16, 1976 the plaintiff received notice on that same date that its budget had been modified with attached "source and application of funds data." The notice recited that if the hospital wished to contest the modification a hearing would be held at 8 a.m. on August 20, 1976, "notice of which has been previously issued to you." Strangely enough, the notice "previously issued" was a letter dated August 12, 1976, four days before the Commission had voted to accept the ad hoc committee's recommended modification of the plaintiff's budget and was therefore a notice of a hearing on a modification not yet made. The August 12 letter specified that "you are required to present all your basic testimony in written form, substantially complete except for cross-examination and such minor additions as the presiding officer is authorized to make at the time of the hearing." Added was the statement that cumulative evidence might be offered in written form.

In a hearing before an administrative board the guiding rule is that at the hearing no one may be deprived of the right to produce relevant evidence or to be fairly appraised of the facts upon which the board is asked to act. Welch v. Zoning Board of Appeals, 158 Conn. 208, 212-213.

The due process clause of the Constitution of the United States which has substantially the same meaning as article first,

§ 10 of the 1965 Connecticut Constitution does not guarantee any particular form of state procedure. Regard must be had, however, to the nature of the proceeding and the individual right affected by it. Katz v. Brandon, 156 Conn. 521, 537.

The August 12 letter had contained no information concerning what issue the plaintiff's prefiled written evidence should meet. It was merely notice of a hearing on a modification of the plaintiff's budget. The August 16 notice was accompanied by seven pages of staff notes one of which listed pen and ink notations of the items of the plaintiff's authorized budget and six pages of typewritten figures relating to totals of various items relating to a large number of Connecticut hospitals. What then was the plaintiff supposed to meet by its prefiled written evidence?

The plaintiff immediately engaged in a studied effort to understand the basis of the Commission's action from the data in the August 16 notice. The time allowed between the receipt of the August 16 notice of modification and the August 20 date set for the hearing was inadequate to afford the plaintiff a hearing on reasonable notice to which it was entitled by virtue of General Statutes § 4-177 and, in particular, to present all its evidence "in written form, substantially complete."

Two of three commissioners designated as a hearing panel to hear the plaintiff's appeal were members of the ad hoc committee which had recommended the modification appealed from. The panel had imposed the requirement that the plaintiff's written testimony be filed twenty-four hours before the hearing, namely on August 19, 1976. In the three days between receipt of the notice of modification on August 16 and the required filing of all evidence in written form by August 19, the plaintiff used every effort to understand and respond to the material submitted with the August 16 notice of modification. The testimony which it managed to prepare was filed on August 19 as demanded. On August 20 the plaintiff appeared with several other hospitals which had been summoned for hearing on the same date.

At the start of the hearing plaintiff's counsel made formal objection that no reasonable notice of the hearing had been given to the plaintiff. He also remonstrated that, in addition to the material furnished to the plaintiff with the August 16 notice of modification, additional material had been submitted to it on August 18 which the plaintiff considered it necessary to meet with evidence which it was required to file in writing by August 19. Objection was also made that the plaintiff was only being allowed the period referred to within which to contest a decision reached by the Commission and its staff during a six-week period available to evaluate a budget which had been carefully prepared by a hospital staff concerned with costs and committed to the quality and availability of care. The chairman acknowledged the objections but ignored them and proceeded with the hearing. Several credible witnesses testified concerning matters which could reasonably have had important bearing on the accuracy and reasonableness of the Commission's decision if attention was paid to the considerations enumerated in General Statutes § 19-73k which the Commission's published regulations had undertaken to observe. The hearing of the appeals of all the several hospitals present on August 20, 1976 consumed some two hours.

Late filing of further exhibits was called for by the hearing panel and the hearing panel without further hearing formally concluded its consideration of the plaintiff's appeal on September 1, 1976. On September 10, 1976, again without further hearing, the decision of the hearing panel recommended to the Commission the approval of the budget previously recommended by the ad hoc committee to the Commission which had modified the plaintiff's requested budget. The described proceeding initiated by the Commission and held by the hearing panel violated the principles of due process and the dictates of General Statutes § 4-177.

The panel hearing having been held before less than a majority of the Commission who had heard the case or read the record but were responsible for rendering the final decision, no final Commission decision on the plaintiff's appeal could be rendered until a proposal for decision was served on the plaintiff and the plaintiff was afforded an opportunity to file exceptions and present briefs and oral arguments to the whole Commission. General Statutes § 4-179.

Quasi judicial duty such as that conferred on the Commission cannot be delegated. While the work of subordinates may be considered by the body empowered to act the culminating misfeasance in this case was the subsequent hearings of September 13 and 14, 1976 conducted by the Commission. Dan M. Creed, Inc. v. Tynan, 151 Conn. 677, 679-680.

The hearing panel's proposal for final decision adverse to the plaintiff was accompanied by some nine pages of explanatory matter. At 7:30 p.m. on September 10, 1976 a representative of the plaintiff journeyed to the Commission's office to obtain a copy of the hearing panel's proposal and accompanying data. September 10 was a Friday and on that date the plaintiff received notice that a hearing would be held by the Commission on the following Monday, September 13, 1976, for final action on the proposal for decision. The plaintiff was thus allowed the intervening Saturday and Sunday in which to attempt to study and prepare a response to the hearing panel's proposal for decision and nine pages of explanatory matter. "Failure to give proper notice constitutes a jurisdictional defect. . . . Such a defect would result in lack of due process of law." Hartford Electric Light Co. v. Water Resources Commission, 162 Conn. 89, 109. "Adequate notice will enable parties having an interest to know what is projected and, thus, to have an opportunity to protest." Idem, p. 110. The notice of the Commission hearing which was given to the plaintiff was a clear violation of the requirements of due process. See also General Statutes § 4-177.

Nevertheless the plaintiff appeared at the September 13, 1976 Commission hearing which had been called for 1:26 p.m. The plaintiff's appeal was reached at 6:55 p.m. after several other hospitals had been heard. Thirteen Commissioners were present, one of whom appeared at 1:52 p.m., one appeared at 2:37 p.m. and one appeared at 5:05 p.m. The hearing commenced with the Chairman of the Commission announcing that, as a result of panel hearings, a recommended increase of 10.4% over the last year's budget level was being recommended to the Commission. Members of the Commission were instructed by the chairman to ask no questions of any hospital representative. Each hospital was allowed ten minutes in which to present an oral summary of its argument after which the Commission would recess, consider the pre-filed testimony and at the conclusion of the recess would announce its decision concerning the appeals of the hospitals which had been heard. No provision was made for the filing of briefs as permitted by General Statutes § 4-179. The hospitals were heard in numerous groups, hearings of the several appeals being followed by recesses after which decision on the appeals which had been heard were announced. How much time during recesses was devoted to a discussion of any hospital appeal is not disclosed, but following each recess all budgets of the hospitals previously heard were modified. When the plaintiff came on for hearing it appeared that at about 4:20 on that very afternoon (September 13) the report from the hearing panel which had been submitted to the plaintiff with its notice of hearing three days before (September 10) was incomplete. A full page of data had been omitted. The missing page was furnished to the plaintiff. Counsel protested that in addition to the inadequate time allowed to meet the original report, no time had been allowed to meet the missing portion. The plaintiff was then allowed until the next day, September 14, to present its appeal.

The Commission meeting reconvened at 1:51 p.m. on September 14, twelve Commissioners being present. Hearings on September 14 consumed some five hours interspersed with some three hours of recesses. The procedure of September 13 was followed and several hospitals were again heard in groups followed by recesses and the announcement of decisions. Seven minutes was devoted to hearings on matters concerning the Hartford Hospital and the plaintiff's appeal, after which their budgets were modified after some amendments. The plaintiff's modified budget was approved by eight votes. The hospital administrator member of the Commission voted "Nay." Ten members of the Commission constitute a quorum. § 19-73c. Thereafter other appeals were heard, recesses declared and final action taken.

The procedure by which the Commission presumed to perform its statutory duty to approve, reject or modify hospital budgets including the plaintiff's has been detailed at this length to illustrate its illegal, unconstitutional and arbitrary nature. Hospital costs are extremely high, but if they are to be decreased the decrease must be accomplished by fair and legal methods.

Our Supreme Court, in New Haven v. New Haven Water Co., 132 Conn. 496 has quoted with approval at page 512 from Morgan v. United States, 304 U.S. 1, 14, stating in part "The vast expansion of this field of administrative regulation in response to the pressure of social needs is made possible under our system by adherence to the basic principles that the legislature shall appropriately determine the standards of administrative action and that in administrative proceedings of a quasi-judicial character the liberty and property of the citizen shall be protected by the rudimentary requirements of fair play. These demand 'a fair and open hearing'----essential alike to the legal validity of the administrative regulation and to the maintenance of public confidence in the value and soundness of this governmental process. Such a hearing has been described as an 'inexorable safeguard.'"

In an appeal from an administrative board the propriety of its decision may be attacked upon the ground that it was not legally warranted by the facts upon which the board acted as they appear in its records, or that the conclusion of the board was one which it could not reasonably reach upon the evidence before it and the matters properly to be considered, or upon the basis of a determination by the court of what the facts really were and the assumption that those were the ones upon which the board acted. Grady v. Katz, 124 Conn. 525, 530; Jaffe v. State Department of Health, 135 Conn. 339, 354. Relief is called for when the Commission has acted illegally, arbitrarily, or in abuse of its discretion. Welch v. Zoning Board of Appeals, 158 Conn. 208, 215.

In summary, the actual procedure followed by the Commission was unconstitutional, illegal and arbitrary. Commencing with the arbitrary purpose to limit all hospital budgets to an eight to ten percent increase, its staff arrived, using the "criteria" adopted, at budgets which in turn met the approval of the ad hoc committee and the Commission as described. Panel and Commission hearings on the plaintiff's appeal from the Commission's decision were held without reasonable notice and were not fair hearings.

The remaining question is the form of a decree which is appropriate to the facts established and which will best promote equal justice to the parties. General Statutes § 19-73p permits the granting of "such relief as to equity may appertain." The Uniform Administrative Procedure Act, General Statutes, Chapter 54, § 4-183g permits a remand for further proceedings; or, if substantial rights of the appellant have been prejudiced because the administrative decision has violated constitutional or statutory provisions, has been made upon unlawful procedure, or is arbitrary or capricious, a reversal of the decision. For reasons already stated the Commission's decision must be reversed. What then is the relief which equity and justice demand? It is not the undersigned's function to determine the reasonableness of either the plaintiff's budget or the budget ordered by the Commission, nor could it be done on the evidence presented. Because of the stay order which was passed by the court on September 23, 1976 the plaintiff has been operating under its own proposed budget ever since October 1, 1976. On July 1, 1977 the Commission will be confronted with the review of another mass of proposed hospital budgets for the forthcoming fiscal year. To remand the plaintiff's 1977 proposed budget for further consideration by the Commission in the face of the imminent burden facing it in the review of the 1978 proposed budgets, including that of the plaintiff, would place an undue burden on both of the parties to this appeal. Taking all factors into consideration, the just result appears to be to allow the plaintiff to continue to operate as it has done for almost nine full months, and for the parties to face, without further hindrance, the determination of any 1978 budget request.

Enter judgment sustaining the plaintiff's appeal, reversing the Commission's order appealed from, and permitting the plaintiff to operate until October 1, 1977 under the budget which it proposed to the Commission on July 2, 1976.

HOWARD W. ALCORN
STATE REFEREE

Notification of entry of Judgment or Order given all Counsel of record June 21 1977
Lucian J. Dackiewicz
~~Asst.~~ Clerk

Continued from Page 13 Column 4

and the Commission did not make clear what action would be applied in judging the application. The hospital met the criteria which it was asked to address at the time of the hearing, and the Commission's decision was therefore arbitrary, illegal, unconstitutional and void.

(2) The Commission acted illegally, arbitrarily and in abuse of its discretion by considering evidence not on the record. Both the Uniform Administrative Procedure Act and the Commission's regulations prohibit consideration of such evidence.

(3) The Commission's findings and conclusions are not supported by and are contrary to the evidence of record.

(4) Denial of the application, in view of the Commission's approval of similar applications from other hospitals with less need, violated plaintiff's right to equal protection.

(5) Denial of the application was arbitrary, illegal and an abuse of discretion where the Scanner was to be purchased with private funds raised by the hospital, the Commission did not contest the cost savings claimed, and the needs of the sick and the poor were being disregarded.

(6) Under UAPA, § 4-183(g) of the Statutes, the appropriate remedy is reversal. (Kulawiz, Jr.) *The Stamford Hospital v. State of Connecticut Commission on Hospitals and Health Care, Court of Common Pleas, Fairfield County (Stamford), No. 17334, January 27, 1978.*

Court of Common Pleas
Fairfield County
At Stamford
January 27, 1978
No. 17334
The Stamford Hospital
v.
State of Connecticut Commission on Hospitals and Health Care

Memorandum of Decision

[Text] The plaintiff-appellant, The Stamford Hospital, hereinafter referred to as "the hospital", is a private 388 bed acute, short-term teaching hospital located in Stamford, in southwestern Connecticut. The hospital's primary service area includes Stamford, Old Greenwich, Darien and New Canaan — an area encompassing a population of approximately 150,000. The hospital is affiliated with New York Medical College as a major teaching facility. All services typical of a general community hospital are available to inpatients and outpatients, including a full spectrum of medical and specialty care. Further, the hospital is a regional center for neurology, neurosurgery, neuroradiology, radiology, oncology and psychiatry.

The defendant-appellee, Commission on Hospitals and Health Care, hereinafter referred to as The Commission, was created by the Connecticut General Assembly pursuant to Public Act 73-117 now Section 19-73a of the Connecticut General Statutes after a legislative finding "that the mutual interest of the state and the administrators and trustees of health care institutions and facilities within the state for the provision of health care to our citizens and the control of costs of such health care creates a need for a partnership to provide for the effective promotion of such interest and the necessity in the public interest for the provisions hereinafter enacted is declared as a matter of legislative determination."

Sec. 19-73m provides in part as follows:

Any health care facility or institution proposing a capital expenditure of one hundred thousand dollars or more, including the leasing of equipment or a facility, which expenditure was not included in a budget approved under Sec. 19-73o, shall submit a request for approval of such expenditure to the commission, with such data, information and plans as the commission requires, ninety days in advance of the proposed initiation date of such project. The commission shall thereupon hold a public hearing with respect to such request, at least two weeks' notice of which shall be given to the facility or institution by certified mail and to the public by publication in a newspaper having a circulation in the area served by the facility or institution. Such hearing shall be held at the discretion of the commission in Hartford or in the area so served. The commission shall consider such request in relation to the community or regional need for such capital program, the possible effect on the operating costs of the health care facility or institution, the recommendations of the Comprehensive Health Planning Agency regarding such proposal, and such other relevant factors as the commission deems necessary. Within ninety days after receiving such request, and such data as it may require, the commission shall either approve, modify or deny such request, or make a finding of recommendations based upon the said request....

By application dated March 31, 1976, the Stamford Hospital proposed to construct a 1725 square foot addition to its radiology department at an approximate cost of $333,960 to house a Computerized Axial Tomography Facility (hereinafter referred to as a "C.T. Scanner") also to be acquired at a capital cost of $500,000 for a total project cost of $833,960. On May 12, 1976, a panel designated by the Commission, consisting of three members of the Commission, held a public hearing at the Hospital on said application. The panel thereafter issued a report citing information completed May 21, 1976 recommending that the application be denied. Certain late exhibits which the Hospital ws permitted to file were not filed until after "information completed date." Said report was transmitted to the Hospital by letter dated June 11, 1976. On or about June 22, 1976, the Commission held a meeting at which time the Commission adopted the panel report as its decision, thereby denying the Hospital's application.

From that decision the Hospital has appealed to this Court.

In summarizing evidence before it the panel indicated that the Hospital by certain appendices submitted by it as uncontroverted exhibits summarized criteria for C.T. Scanning which have been established by other health planning agencies. The panel also in summarizing evidence indicated that testimony was introduced to prove that Stamford Hospital met substantially all of the criteria from all of the agencies.

As part of its findings the panel found that clinical trials of the C.T. Scanner were designed to find out if the machine "worked at all" and the evidence is that "it does work as a diagnostic tool." However, the Commission held that "the mere fact that it works is not sufficient evidence to justify the capital expense necessary to acquire one..." Further the Commission held in paragraph 2 of its Finding: "There is little doubt that C.T. Scanning is a significant diagnostic tool which is invaluable in visualizing some lessions of the head. The seven scanners approved so far in Connecticut are *probably sufficient* to provide services for all patients who may suffer from that specific illnesses for which C.T. Scanning has been shown to be the superior diagnostic technique." (Emphasis added) The report mentions other scanners already approved by the Commission for Greenwich Hospital and Bridgeport Hospital — both in the general areas of Stamford.

In this case as in all administrative appeals the Court cannot substitute its judgment for that of the Commission. The issue to be resolved on all the evidence is whether the Commission acted illegally or arbitrarily and whether its conduct was in violation of the powers granted to it and the duties imporved upon it. Conley v. Board of Education 143 Conn. 488, 492, (1956) In the instant matter of denying the application of the Stamford Hospital for installation of the C.T. Scanner, the Court is of the opinion that the Board did so act in an arbitrary manner.

I. Because the Commission Acted Without Regard to Any Standards, the Commission's Decision Is Invalid.

Apparently, several weeks before the May hearing on the application of the Hospital certain "criteria" had been promulgated which essentially were the same as federal criteria for or desirability for C.T. Scanner placement.

Before denying the Hospital's application, the Commission granted the first seven C.T. Scanner applications which it received.

Conn. Gen. Stat. § 19-73k (as then in effect) lists certain "factors" which the Commission "may" follow, in deciding a case such as this. In turn, Commission Reg. § 19-73a-67 indicates that the Commission "will follow" these factors. In addition, certain other factors are mentioned in Conn. Gen. Stat. § 19-73m and Reg. § 19-73a-69(f). Furthermore, under § 19-73k and the various other provisions, the Commission purportedly is given the right to consider *"any other factors which the commission deems relevant"*.

Thus, in ruling on the first seven applications, the Commission was required to apply these statutory factors and whatever other factors it deemed relevant.

However, the Commission did not regard these standards as sufficient, since, according to the Commission Execu[illegible] Director F. Bernard Forand, there w[illegible] feeling on the Commission that there was a need to promulgate "definitive standards" regarding C.T. Scanners. (June T., p. 31) In view of this feeling, Mr. Forand was asked to prepare a report (the "Forand Report") detailing the criteria which had been established by various other agencies throughout the nation to limit installation of C.T. Scanners to certain key hospitals. (June T., p. 31) This report was issued on April 23, 1976, and at approximately the same time, a Task Force was established and charged with the task of developing criteria for use by the Commission. (May T., p. 18)

Since the Task Force had not acted at the time of the May 12 panel hearing (or any other time here relevant), the Hospital proceeded to examine the various criteria of other agencies set forth in the Forand Report.

Of particular relevance in this case is the recent decision of former Chief Justice Howard Alcorn sitting as a State Referee in *New Britain General Hospital v. Commission on Hospitals and Health Care*, (Ct. Com. Pleas, Hartford Co., D.N. 13-24-86-1, June 21, 1977) which held that the procedures which the Commission followed in 1976 in reviewing the operating and capital expenditures budgets of the various Connecticut Hospitals were "illegal, unconstitutional and arbitrary".

In that decision, Justice Alcorn took particular note of the importance of adequate standards and fair play as the "inexorable safeguard" of the administrative process, noting that:

"...Hospital costs are extremely high, but if they are to be decreased the decrease must be accomplished by fair and legal methods.

Our Supreme ourt, in *New Haven v. New Haven Water co.*, 132 Conn. 496 has quoted with approval at page 512 from *Morgan v. United States*, 304 U.S. 1, 14, stating in part 'The vast expansion of this field of administrative regulation in response to the pressure of social needs is made possible under our system by adherence to the basic principles that the legislature shall appropriately determine the *standards* of administrative action and that in administrative proceedings of a quasi-judicial character the liberty and property of the citizen shall be protected by the rudimentary requirements of fair play.'..." (Memorandum of Decision, pp. 22-23, emphasis added.)

* * * *

"...In a hearing before an administrative board the guiding rule is that at the hearing no one may be deprived of the right to produce relevant evidence or to be *fairly appraised of the facts upon which the board is asked to act.* Welch v. Zoning Board of Appeals, 158 Conn. 208, 212-213." (Memorandum of Decision, p. 16, emphasis added.)

This means that unless the Commission advises a Hospital in advance of the hearing of the standards, claims and criteria which are going to apply, the Hospital is denied its right to a fair and meaningful hearing. As our Supreme Court stated in *Hart Twin Volvo Corp. v. Commissioner of Motor Vehicles*, 165 Conn. 42, 44, 327 A.2d 588, 590 (1973):

Continued on Page 15 Column 1

ontinued from Page 14 Column 4

"...The right to a hearing means the ight to a meaningful hearing with the wareness of what matters must be ountered..."

In this case, the Hospital claimed and ie Court concurs that the decision ppealed from is void (A) because as in the *lew Britain* case, the Commission did not iake clear what action would be applied in idging the Hospital's application (B) ause the Hospital demonstrated that it the criteria which it was asked to dress at the time of the hearing, and (C) ecause, contrary to statute and its own egulations, the Commission in fact acted ithout regard to any standards.

I. The Commission's Failure to Define the tandards Which It Would Follow Made It npossible For The Hospital to Adequately resent Its Case.

As mentioned above, Conn. Gen. Stat. cc. 9-73k and 91-73m and Reg. Sec. 9-73a-67 and 19-73a-69(f) require the ommission to consider a variety of pecific factors *and* "any other factors the ommission deems relevant."

The problem in this case is that neither ie statute, nor the regulations, nor any ther statement of the Commission advised ie Hospital as to what criteria the ommission would deem relevant in this ase.

As Commissioner Mike admitted at the ommission meeting, the net result of iese conflicting and confusing statements hich were made at the panel hearing was iat "*We didn't say what the criteria was* sic]."

In fact, in this case, the Commission did iore than simply not tell the Hospital what ie criteria were, since the promulgation of ie Forand criteria two weeks before the lospital's hearing, and Commissioner fike's own statements at the hearing, ffirmatively indicated to the Hospital that should prepare for and conduct the earing as if such criteria would be pplied. The hospital followed these sug- estions. Nevertheless, the Forand criteria ere not followed.

As in the *New Britain* case, the Hospital as confronted before it's hearing with nalysis prepared by the Commission staff, ut was given no explanation of what riteria the Commission actually intended apply, and was not told what it was supposed to meet by its ... evidence" at hearing. (*New Britain General Hospital Commission on Hospitals and Health ure, supra*, Memorandum of Decision, p. 7).

The failure to properly state the criteria nders the Commission decision void. *art Twin Volvo Corp. v. Commissioner of fotor Vehicles*, supra, 165 Conn. 42, 327 2d 588, 590 (1973).

Since The Hospital Met The Forand riteria, There Was No Basis For Denying he Application.

Despite the conflicting statements made y the Commissioners concerning the uestion of what, if any, criteria would be pplied in judging the application, the ospital finally proceeded on the under- ding that it was the panel's "sugges- that we go ahead and respond to the iteria that is in this (Forand) report". lay T., transcript lines 19-21) The ospital then proceeded to prove that it et all of the criteria of all of the agencies nd the Commission so found. Therefore, iere ws no basis in the record for the erial of the Hospital's application.

The Factors Prescribed By Statute and egulation Were Disregarded.

Conn. Gen. Stat. Sec. 19-73k (as then in ffect) on its face imposes no standards of ny kind on the Commission, since it ierely states that the Commission "may" onsider:

...the necessary expenses of the istitution or facility concerned, the ffectiveness of its delivery of health ire services, the quality of available ealth care, the duplication of service y institutions and facilities in the area served, the community or regional need for any particular function or service, and *any other factors which the commission deems relevant.*" (Emphasis added).

However, by Regulation Sec. 19-73a-67 the Commission indicated that it "*will* follow the criteria prescribed (sic) in Sec. 19-73k, G.S." (Emphasis added)*

Also, Conn. Gen. Stat. Sec. 19-73m and Reg. Sec. 19-73a-69(f) require considera- tion of the community or regional need for such capital program and the possible effect upon the operating costs of the facility. In addition, Conn. Gen. Stat. Sec. 19-73m (as then in effect) required consi- deration of recommendations of the "Com- prehensive Health Planning Agency", while Reg. Sec. 19-73a-69(f) refers to recommendations of the "area wide health systems agency".

Even if the Commission had followed these enumerated criteria, its failure to advise the Hospital as to all the criteria it "deemed relevant" would still render the Commission action void.

However, in this case, as in the *New Britain* case, the record shows that the Commission did not consider the criteria prescribed by statute and regulations.

Rather, the expressed view was that "this Commission has no criteria" to apply to Hospital's application. (June T., p. 50)

This is reflected by the fact that the Panel Report, which pursuant to Conn. Gen. Stat. Sec. 4-179 is required to contain "a statement ... of each issue of fact or law necessary to the proposed decision", contains no mention of *any* of the statutory criteria. Thus, for example, although the Hospital introduced substantial evidence, which, as outlined above, detailed the "effectiveness of its delivery of health care services" and the "quality of available health care" in the areas impacted by the C.T. Scanner, this evidence was ignored. Similarly, the Commission ignored the fact that there is no "duplication of services by institutions and facilities in the area served" (Stamford, Darien, New Canaan and Old Greenwich). It also disregarded "the community or regional need" indi- cated by its own finding that the Hospital met substantially all of the criteria from all of the agencies mentioned in the Forand Report, and, of course it did not mention that the charitable source of the necessary funds for the proposed acquisition esta- blished that there will be no increased operating costs for existing hospital ser- vices.

Instead, the Panel Report discusses certain factors not mentioned in the statute, such as the fact that seven scanners have already been approved. Thus, as in the *New Britain* case,

"It appears that slight, if any, regard was given to the proposition 'that in all its proceedings the regulatory body must act strictly within its statutory authority, within constitutional limita- tions, and in a lawful manner.' *Southern New England Telephone Co. v. Public Utilities Commission*, 144 Conn. 516, 523.

No administrative or regulatory body can modify, abridge or otherwise change the statutory provisions under which it acquires authority unless the statute specifically grants it that power. *South East Prop. Owners & Residents Assn. v. City Plan Commis- sion*, 156 Conn. 587, 592; *Finn v. Planning & Zoning Commission*, 156 Conn. 540, 546; *State ex rel. Hunting- ton v. McNulty*, 151 Conn. 447, 449." (Memorandum of decision, p. 9)

Since the Commission ignored this principle, its decision is arbitrary, illegal, unconstitutional and void.

II. The Commission Acted Illegally, Arbi- trarily and in Abuse of its Discretion by Considering Evidence not on the Record.

At the June Commission meeting, the Hospital was advised for the first time that evidence outside the record was being considered in connection with this applica- tion. Several Commissioners made clear that they were considering *particular* factual instances that did not appear on the record (June T., pp. 41-44). More ominous- ly, Mr. Forand advised the Hospital that it was up against outside evidence since "(t)here had been several scanners ap- proved every year long before I came on the scene and the Commission, through these hearings, built up a considerable body of *evidence* which not necessarily was included in this document." (June T., p. 35, emphasis added).

Nevertheless, he declined to advise the Hospital precisely what "information ... included in all the other hearings" was being considered. Instead, he simply stated that "I can't give you specifically all what that means." (June T., p. 36)

While these statements are characteris- tic of the ambiguities with which the Hospital was confronted, they at least make clear that the Commission was taking official notice of the facts produced in prior applicatons without notifying the Hospital as to the particular materials within those applications that it was noticing.

Under the Connecticut Uniform Admin- istrative Procedure Act, the Commission has a right to use its specialized knowledge to evaluate whatever evidence the Hospital submits, but it cannot rely on purported facts with respect to which the Hospital has not been notified prior to or during the hearing.

Conn. Gen. Stat. § 4-166(2) defines a contested case as "...a proceeding, inclu- ding but not restricted to ratemaking, price fixing, and licensing, in which the legal rights, duties or privileges of a party are required by statute to be determined by an agency after an opportunity for hearing or in which a hearing is in fact held but does not include hearings referred to in section 4-168." The present case ws a contested cased in that the Hospital's rights were determined at a hearing pursuant to Conn. Gen. Stat. § 19-73m. Section 4-177(e) provides that "(t)he record in a contested case shall include ... (2) evidence received or considered;", and § 4-177(g) requires that "(f)indings of fact shall be based *exclusively* on the evidence and on matters officially noticed." (Emphasis added)

In turn, Section 4-178(4) of the General Statutes permits the Commission to take administrative notice of "judicially cogni- zable facts" and "generally recognized technical or scientific facts within the agency's specialized knowledge", pro- vided that the Commission notifies the Hospital "*either before or during the hearing ... of the material noticed...*" (Emphasis added)

While no Connecticut case has, as yet, fully defined the limits of "judicially cognizable" or "generally recognized tech- nical or scientific facts", it seems clear that these terms should not include facts produced at prior hearings involving different parties.

As the court noted in *Dayco Corporation v. FTC*, 362 F. 2d 180, 185 (6th Cir. 1966), an agency cannot make a case against the first several parties and then merely rest upon the evidence from those cases in subsequent hearings with different parties, for to do so would "do violence to fair play and due process". Thus, if an agency wants to consider facts from prior hear- ings, it must introduce them into evidence and give the party to the hearing a chance to explain or rebut them.

However, even if facts established in the course of prior hearings involving different parties are judicially noticeable, the actions of the Commission in this case would still be at odds with Conn. Gen. Stat. § 4-178(4) because the Commission did not notify the Hospital before or during its May 12 hearing, of what facts were being so noticed.

The only notice the Hospital got was a belated statement at the time of the Commission meeting, a month after its hearing was concluded, that the Commis- sion would consider "information ... from all the other hearings" but that "I can't give you specifically all what that means." (June T., p. 36) That remark, even if it had been timely, certainly would not have been adequate notice, for as Justice Cardozo stated in *Ohio Bell Tel. Co. v. Commission*, 301 U.S. 292, 303 (1937):

"The Commission, withholding from the record the evidential facts that it has gathered here and there, contents itself with saying that in gathering them it went to journals and tax lists, as if a judge were to tell us, 'I looked at the statistics in the Library of Con- gress, and they teach me thus and so.' *This will never do if hearings and appeals are to be more than empty forms.*" (Emphasis added)

In any event, the Commission's consi- deration was in direct violation of Section 19-73a-42(d) of its own Regulations which provides that:

"d. Facts noticed, commission re- cords. The commission may take notice of judicially cognizable facts, including prior decisions and orders of the commission. *Any exhibit admitted as evidence by the commission in a prior hearing may be offered as evidence in a subsequent contested case and admitted as an exhibit therein; but the commission shall not deem such exhibit to be judicially cognizable in whole or in part and shall not consider any facts set forth herein unless such exhibit is duly admitted as evidence in the contested case then being heard.*" (Emphasis added)

The import of this regulation is eminent- ly clear. The Commission can only consider evidence produced at prior hearings if it

Continued on Page 16 Column 1

*P.A. 77-192 Sec. 6 deletes the word "may" for this section and substitutes the word "shall". However even as amended, Sec. 19-73k still authorizes consideration of "any other factors which the commission deems relevant."

Continued from Page 15 Column 4

introduces it into evidence. Thus, the Commission's action is illegal because it was reached in violation of its own regulations which themselves have the force of law. See *Hartford Electric Light Co. v. Sullivan*, 161 conn. 145, 154, 285 A.2d 352 (1971); *Fidelity and Casualty Company v. Darrow*, 161 Conn. 169, 286 A.2d 288, 292 (1971); *Duval v. Brown*, 31 Conn. Sup. 373, 333 A.2d 63, 64 (1974).

Both the Uniform Administrative Procedure Act, and the regulations promulgated by the Commission, are clear in their prohibiton of the consideration of evidence not on the record. That prohibiton is at the very heart of a fair hearing, for such a hearing requires that all parties be afforded an opportunity to examine, analyze, explain or rebut the evidence, and subject adverse witnesses to cross-examination. This is particularly so in the present case where lay Commissioners are attempting to deal with complex scientific and medical issues. Moreover, a contrary rule would make it impossible for a reviewing court to examine whether administrative findings of fact have a sufficient foundation in the evidence. As the United States Supreme Court said in *Interstate Commerce Commission v. Louisville and Nashville Railroad Company*, 227 U.S. 88, 93-94 (1913):

"The Commission is an administrative body and, even where it acts in a quasi-judicial capacity, is not limited by the strict rules, as to the admissibility of evidence, which prevail in suits between private parties. *Int. Com. Comm. v. Baird*, 194 U.S. 25. But the more liberal the practice in admitting testimony, the more imperative the obligation to preserve the essential rules of evidence by which rights are asserted or defended. In such cases the Commissioners cannot act upon their own information as could jurors in primitive days. All parties must be fully apprised of the evidence submitted or to be considered, and must be given opportunity to cross-examine witnesses, to inspect documents and to offer evidence in explanation or rebuttal. In no other way can a party maintain its rights or make its defense. In no other way can it test the sufficiency of the facts to support the finding; for otherwise, even though it appeared that the order was without evidence, the manifest deficiency could always be explained on the theory that the Commission had before it extraneous, unknown but presumptively sufficient information to support the finding."

Thus, in attempting to justify its claims and conclusions by reference to matters outside the record, without notifying the Hospital of the matter relied upon, the Commission acted illegally, arbitrarily, unconstitutionally, and in an abuse of its discretion.

III. The Findings And Conclusions Of The Commission Are Not Supported By And Are Contrary To The Evidence Of Record

As has been previously noted, in reviewing the factual determination of an administration agency, "(t)he trial court is not to substitute its own judgment or discretion for that of the agency." *Hartford Electric Light Co. v. Water Resources Commission*, 162 Conn. 89, 107-108; 291 A.2d 721, 732 (1971). On the other hand, the court is required 'to determine from the record whether the facts found by the Commission are supported by the record, whether they furnish justifiable reasons for the action ... and whether it has acted illegally or has exceeded or abused its powers.' Id., 162 Conn. at 107; *Wilson Point Property Owners Assn. v. Connecticut Light and Power Co.*, 145 Conn. 243, 252; 140 A.2d 874." *Hartford Electric Light Co. v. Water Resource Commission, supra*, 162 Conn. at 107.

Facts found are not adequately supported by the record unless there exists:

"...such relevant evidence as a reasonable mind might accept as adequate to support a conclusion. *Consolidated Edison Co. v. National Labor Relations Board*, 305 U.S. 197, 229, 59 S. Ct. 206, 83 L.Ed. 126. (Such evidence must be) something more than a mere scintilla and must do more than create a suspicion of the existence of the fact to be established. *Purity Food Co. v. Connecticut State Board of Labor Relations*, 17 Conn. Sup. 199, 204; *National Labor Relations Board v. Columbian Enameling & Stamping Co.*, 306 U.S. 292, 300, 50 S.Ct. 501, 83 L.Ed. 660; *McCague v. New York, C. & St. L.R. Co.*, 225 Ind. 83, 89, 71 N.E. 2d 569; *Pennsylvania State Board v. Schireson*, 360 Pa. 129, 133, 61 A.2d 343.' *Imperial Laundry, Inc. v. Connecticut State Board of Labor Relations*, 142 Conn. 457, 461, 115 A.2d 439." *New Canaan v. Connecticut State Board of Labor Relations*, 160 Conn. 285, 289, (1971).

Here, a review of the evidence shows that the findings and conclusions of the Commission on which its decision is based are unsupported by and contrary to the evidence of record and that such findings were prepared before the Hospital had completed its evidentiary submission.

A. The Inaccuracy of the Commission's Basic Premise.

A reading of the Commission decision leaves no doubt that the basic premise of the decision is that

"...The seven scanners approved so far in Connecticut are probably sufficient to provide services for all patients who may suffer from those specific illnesses for which C.T. scanning has been shown to be the superior diagnostic technique. As these scanners are put in operation, statewide referral patterns should develop to assure appropriate access to all citizens in the state." (Emphasis added)

This finding, in particular, is entirely without basis in the record.

To the contrary, the very criteria attached to the report of Commission Executive Director Forand, as set forth in the record, demonstrate the need for a C.T. Scanner at the Stamford Hospital. It is a major medical school affiliated teaching hospital, serves over twice the population for which a C.T. Scanner is appropriate, has more than four times the recommended number of neurological/neurosurgical admissions and performs more than a suficient number of the various tests mentioned in the criteria.

Indeed, the Hospital's own estimate was that the utilization of the C.T. Scanner at the Hospital would be so substantial that after a short time the Hospital would be unable to accept referrals from sister hospitals.

In its decison, the Commission itself admits that the Hospital met substantially *all* of the criteria of *all* of the agencies, yet still recites this unsupported conclusion that seven scanners are enough.

Thus, the Commission's conclusion that, based on the referral paterns which "should develop", the seven approved scanners are "probably sufficient", is predicated not on the evidence, but rather on the Commissioner's "suspicion of the existence of the fact to be established". *See Cory v. Avco-Lycoming Division*, 162 Conn. 309, 322, 307 A.2d 155, cert. den. 409 U.S. 1116 (1972).

Furthermore, the definitive and uncontradicted testimony of all the experts who discussed the issue was that, "at any given time", there are patients for whom the C.T. Scanner is "crucial for diagnosis and treatment", but who are too ill to be moved. (May T., p. 46) As Dr. Deck stated, there "may well be a hundred patients a year that will ... warrant a CT scan, but (who are) too sick to be transported to Greenwich Hospital." (June T., p. 40).

In Addition, even when a patient can be moved by ambulance to another institution such as Greenwich Hospital, the cost of transportation would equal or exceed the cost of the C.T. scan itself. (May T., p. 46)

In view of this uncontradicted evidence, the Commission's finding that the seven scanners already approved "assure appropriate access to *all* citizens in the state" simply serves to demonstrate the extent to which the Commission was willing to go in its capricious disregard of the facts of record.

B. The Inaccuracy of the Remainder of the Commission Decision

The summary of the evidence contained in the Panel Report ignores the testimony of most of the thirteen witnesses who testified at the May 12 hearing.

In addition, the Commission decision is unchanged from the Panel Report which was prepared based on "information completed" on May 21, 1976 (Panel Report, R. § 9, p. 1), five days *before* the Commission received the Hospital's supplemental "late filed" submission which Chairman Mike requested and permitted the Hospital to file, and which was authorized by Commission regulations. (R. §7)

Because of this, the Panel Report (which became the Commission decision), while referring to the late filed exhibits, does not take their content into account. If it had, most of the inaccurate and misleading statements in the Panel Report would presumably have been eliminated.

IV. The Commission Violated The Hospital's Constitutional Right to Equal Protection By Denying Its Application While Permitting Other Hospitals With Less Need To Have Such C.T. Scanners.

It may not be appropriate for every hospital to have every sophisticated piece of equipment that is medically desirable. But this hardly justifies denying an instrument to a major regional teaching hospital, which is established as the center for those areas of specialization for which the equipment is most significant, when the evidence is that the C.T. Scanner is an instrument that every Hospital will need (May T., pp. 102-103, June T., pp. 40-41) and when this Commission felt it appropriate to permit acquisition of C.T. Scanners by private doctors, and hospitals like Greenwich Hospital, which applied only weeks before this Hospital, and which has less need for the C.T. Scanner than this Hospital. (June T., pp. 20-21; , § 2) It also does not justify an approach whereby five of the seven approved C.T. Scanners are in Hartford or New Haven. (See R. §2)

This lack of equal treatment itself renders the Commission decison invalid. For even if the Commission is deemed to have authority to select the most qualified hospitals to receive C.T. Scanners, it does not have the right to deny a scanner to a hospital that is more qualified than one already authorized to acquire one.

As the United States Court of Appeals noted in *Hornsby v. Allen*, 326 F. 2d 605, 609 (5th Cir. 1964):

"...the Supreme Court has held that the arbitrary refusal to grant a license or permit to one group when other groups have obtained permits under similar circumstances constitutes a denial of equal protection of the law. *Niemotko v. Maryland*, 340 U.S. 268, 71 S.Ct. 325, 95 L.Ed. 267 (1951) (alternative holding)."

Rather, if the number of scanners should be limited, there should be a rational process to insure that they are authorized at the institutions most in need of them. *See Ashbaker Radio Co. v. Federal Communicaitons Commission*, 326 U.S. 327 (1945).

Here, though, instead of rational health planning, there was an arbitrary and capricious abuse of discretion of the first order, which threatens the lives and health of those who look to the Hospital as the regional center for neurology, neurosurgery, neuroradiology, radiology, psychiatry and oncology, and, which, in addition, prevents the Hospital's patients from enjoying the cost benefits which such C.T.

Continued on Page 17 Column 1

[C]ontinued from Page 16 Column 4

[S]canner will bring with it.

[I]V. It was Arbitrary, Illegal And An Abuse [O]f Discretion for the Commission to Deny [t]he Hospital's Application to Purchase The [C].T. Scanner With The Private Funds The [H]ospital Has Raised When the Commis[s]ion Does Not Contest The Cost Savings [C]laimed And Disregards The Needs Of The [S]ick And The Poor.

The arbitrary and capricious character is ... indicated by the fact that the [Com]mission did not contest the cost [s]avings to the Hospital's patients which [w]ill result from the acquisition of the C.T. [S]canner with the charitable funds which [h]ave been donated to the Hospital for their [p]urpose, and ignored the impact its [d]ecision will have on the very sick and the [v]ery poor who the Hospital's benefactors [w]ish to assist.

In creating the Commission on Hospitals [a]nd Health Care, the Legislature, while [c]oncerned about cost, clearly indicated its [i]ntention that the quality of medical care [s]hould be safeguarded. As § 19-73a makes [c]lear, the purpose of the legislation was to [a]ssure "the provision of health care to our [c]itizens" as well as "the control of the [c]osts of such health care". Conn. Gen. [S]tat. § 19-73a.

In this case, even the Commission [c]oncedes that the C.T. Scanner is "invalu[a]ble" from a medical point of view. Hence, [b]efore the Commission would deny such an [a]pplication, one would assume that it [s]hould find that granting it would add [s]ignificantly to the patients' cost.

Here, however, there isn't even a [s]uggestion that acquisition of the C.T. [S]canner, which the Hospital wishes to [a]cquire with charitable contributions, will [i]ncrease the cost of health care to the [p]atients by even one cent.

Rather, the acquisition cost of the C.T. [S]canner will be borne entirely by the [b]enefactors of the Hospital who have [a]lready donated a substantial portion of the [t]otal amount needed, and will not affect [r]ates at the Hospital in any way. (May T., [p]. 113, Application, item 20, R. §2)

Furthermore, patients choosing to use [t]he C.T. Scanner will be able to realize [s]ignificant cost savings.

As noted above, the savings occasioned [b]y the C.T. Scanner will be substantial. To begin with, as a substitute for [e]xpensive, painful and risky invasive [p]rocedures, including exploratory surgery, [th]e C.T. scan will involve real cost savings. [I]n addition, there will be cost savings in the [f]orm of shortened hospital stays, voided [h]ospital stays, more effective treatment, [f]ewer malpractice suits, and avoidance of [u]nnecessary surgery.

In fact, even to the extent C.T. Scanners [at] the other facilities might someday [b]ecome available to those patients of the [H]ospital who can be transported else[w]here, the transportation cost may well [e]qual or exceed the cost of the C.T. scan [it]self.

The Commission makes no finding as to [t]hat price outside profit making doctors, [w]ho are beyond its control, would charge [for] the C.T. Scanner. However, as the [Court] noted in *Re Certificate of Need for [As]ton Park Hospital Inc.*, 283 N.C. 542, 193 [S.]E. 2d 729, 61 A.L.R. 3rd 268, 275 (1973), [th]e normal assumption, as reflected by the [an]ti-trust laws, would be that preventing a [ho]spital from implementing scanners [wo]uld tend to lead to increased rather than [de]creased prices elsewhere, especially [wh]en the alternative provider is a self [se]rving profit-making enterprise.

However, the Commission ignored these [ma]tters, and, hence, acted arbitrarily, [ill]egally and in an abuse of its discretion. There appears nothing in the record to [in]dicate that costs of health care to the [pa]tients would increase. On the contrary [th]e acquisition cost of the C.T. Scanner will [be] born entirely by charitable donations [fro]m private benefactors of the Hospital. [Th]e bulk of such funding has already been [rai]sed or pledged for the specific purpose

Continued on Page 18 Column 1

Residential Mortgage Rates

The following mortgage interest rates are from a survey of representative mortgage lenders throughout the State of Connecticut, who are contacted monthly for up-to-date revisions. The information is based on data supplied by the lenders and The Law Tribune is not responsible for inaccuracies in such data or for failure of the lenders to furnish current revisions. Mortgage departments of banks not represented may be included by writing to the Financial Editor. All banks updating their recorded rates should revise their rates by mail notification to The Connecticut Law Tribune, Attn: Financial Editor, 106 Ann Street, Hartford, Conn. 06103.

BANK	TYPE	DOWN PAYMENT	RATE	PRIVATE MORTGAGE INSURANCE
HARTFORD AREA				
United Bank and Trust	Conv.	50%	8.75%	
	Conv.	20%-49%	9.00%	
	MGIC	10%-19%	9.25% + ¼ pt. + ½ pt. for MGIC	
CBT	Conv.	20%	8.75%	
	Conv.	10%	9.25% $100 app. fee	
Hartford National	Conv.	20%	8.75%	$100 app. fee
	P.M.I.	10%	9.25%	½
Society for Savings	Conv.	20%-50%	8.75% or 8 5/8 + 1 pt.	
	Conv.	10%-19%	9.25%	
	Conv.	5%-9%	9.50% Plus MGIC	
	ARM Loans	20%-50%	8.25% + 1% to $75,000; 8.50% + 1% over $75,000; $75 app. fee	
Mechanics Savings Bank	Conv.	20%-50%	8.75% or 8.63% + 1 pt.	
	Conv.	10%-19%	9.25% + 1 pt.	Inc. in Rate
	Conv.	5%-9%	9.50% + 1 pt.	Inc. in Rate
			$50 app. fee	
State Bank for Savings	Conv.	20%	8.75%	
	P.M.I.	10%	9.00% + 1 pt.	
	P.M.I.	5%	9.50% + 1 pt.	
Hartford Federal Savings	Conv.	20%	8.75% + 1 pt. $75 app. fee	
	P.M.I.	10%	9.25% + 1 pt. $75 app. fee	
	P.M.I.	5%	9.50% + 1 pt. $75 app. fee	
Hartford Home	Conv.	34% (or more)	8.50%	
	Conv.	20%-33%	8.75%	
	P.M.I.	10%	9.00% + 1 pt.	Inc. in Rate
New Britain Federal S & L	Conv.	20%	8.50% + 1 pt. or 8.75%	
	Conv.	10%	9.00% + 1½ pts.	
The Savings Bank of Manchester	Conv.	20%	8.75%	
	P.M.I.	10%	9.25% + ½pt.	Inc. in Rate
	P.M.I.	5%	9.50% + ¼ pt.	Inc. in Rate
Burritt Mutual	Conv.	20%	9.00%	
	P.M.I.	10%	9.25% + 1 pt.	
	P.M.I.	5%	9.50% + 1 pt. (for all, above 50,000, rate is .25% higher)	
American Savings Bank	Conv.	20%	8.75%	
	P.M.I.	10%	9.25% ½ + ¼	
			9.50% + 1 pt.	
Northern Conn. Nat'l Bank	Conv.	20%	9.00% + $100 fee	
	Conv.	21-49%	8.75% + $100 fee	
	Conv.	50%	8.50% + $100 fee	
MIDDLESEX COUNTY AREA				
Liberty Bank for Savings	Conv./PMI	50% +	8.50% - $100 fee	
	Conv./PMI	20%-49%	8.75% - $100 fee	
	Conv./PMI	10%	9.00%-$100 fee	Paid from interest
NEW HAVEN COUNTY AREA				
Connecticut Savings Bank	Conv.	20%	8.50% + 1 pt.	
	MGIC	10%	8.50% + ¼% + 1 pt.	
	Plan-5 VRM	10%	8.25% + 1 pt.	
New Haven Savings Bank	Conv.	50%	8.50%	$50 app. fee
	Conv.	20%	8.75%	$50 app. fee; 1% commitment fee on each
	P.M.I.	10-19%	9.00%	$50 app. fee; 1½% commitment fee
	P.M.I.	5-9%	9.00%	$50 app. fee; 2% commitment fee
New Haven Savings & Loan	Conv.	25%	8.75% + ½ pt.	
	Conv.	20%	8.75% + 1 pt.	
	P.M.I.	10%	9.00% + 1 pt.	
First Federal S & L of New Haven	Conv.	25%	8.50% + 1 pt.	
	Conv.	20%	8.75% + 1 pt.	
	P.M.I.	10%	8.75% + 1½ pt.	½ + ¼
	P.M.I.	5%	9.25% + 2 pt.	1% + ¼
			$50 app. fee refunded at closing	
Housatonic Bank & Trust	Conv.	20%-49%	8.75% + 1 pt.	$50 app. fee
Jefferson Federal Savings & Loan	Conv.	20%	8.75% + 1 pt.	
	Conv.	10%	9.25% + 1½ pt.	
	Conv.	5%	9.25% + 2 pt.	
FAIRFIELD COUNTY AREA				
Connecticut National Bank	Conv.	25%	9% + 1 pt. + $100 nonrefundable app. fee	
	MGIC	10%	9.50% + 1 pt. + $100 nonrefundable app. fee	
State National	Conv.	20% (up to 75,000)	8.75% + 1 pt.	
	Conv.	25% (75,000 to 100,000)	8.75% + 1 pt.	
Peoples Savings	Conv.	20%	9% + 1% commitment fee	
	P.M.I.	10%	9.25% + 1% commitment fee	
Stamford Savings	Conv.	25%	9.00%	
The Westport Bank & Trust Co.	Conv.	25% (up to 100,000)	8.75% + 1 pt. $50 app. fee refundable at closing	
Constitution Federal Savings & Loan	Conv.	30% 100,000 to 125,000)	9.00% + 1 pt.	
	Conv.	25% (80,000 to 100,000)	8.75% + 1 pt.	
	Conv.	20% (up to 80,000)	8.50% + 1 pt.	
	P.M.I.	10% - 19% (75,000 max)	9.00% + 1 pt.	
Union Trust	Conv.	40% (150,000 & over)	9.25%	
	Conv.	25% (150,000 & over)	9.75%	
	Conv.	25% (100,000 to 150,000)	9.25%	
	Conv.	25% (75,000 to 100,000)	9.00%	
	Conv.	25% (up to 75,000)	8.75% + 1 pt.	
County Federal Savings & Loan	Conv.	20% (125,000 max)	9.00% + 1 pt.	
	Conv.	20% (160,000 max)	9.00% + 2 pt.	
	P.M.I.	10% (75,000 max)	9.25% + 1½ pts.	
	P.M.I.	5% (60,000 max)	9.00% + 2 pts.	
South Norwalk Savings	Conv.	20%	8.75% + 1 pt.	$50 app. fee
	MGIC	10%	9.00% + 1 pt.	Inc. in Rate
	CHFA	5%	7.25% + 1 pt. plus PMI ins. premium	
Norwalk Savings Society	Conv.	25% (75,000 max)	8.75%	
	Conv.	33⅓% (75,000 to 125,000)	9.00%	
First Federal S & L	Conv.	20%	8.75% + 1 pt.	$50.00 min. app. fee
	Ins.	10%	9.00% + 1 pt.	
	CHFA	5%	7.25% + 1 pt. PMI Ins. Premium	
Bridgeport Savings & Loan	Conv.	20%	8.75% + 1% orig. fee	
	P.M.I.	10%	9.00% + 1% orig. fee	
Mechanics & Farmers Savings Bank	Conv.	20% + (to 100,000)	9.00% + 1% orig. fee	
	P.M.I.	10% - 20% (75,000 max)	9.00% + ¼% + 1% orig. fee	
	P.M.I.	10% - 20% (75,000 - 100,000)	9.25% + ¼% + 1%	
EASTERN CONNECTICUT AREA				
Savings Bank of New London	Conv.	50%	8.75%	$100 app. fee
	Conv.	25%	9.00%	$100 app. fee
	P.M.I.	10%	9.25% + 1 pt.	+ $100 app. fee
	P.M.I.	5%	9.25% + 2 pts.	+ $100 app. fee
The Norwich Savings Society	Conv.	50%	8.50%	$35 app. fee
	Conv.	20%-49%	8.75%	$35 app. fee
	P.M.I.	10%	9% + 1 pt. Orig. Fee	$35 app. fee
	P.M.I.	5%	9% + 2 pts. Orig. Fee	$35 app. fee
	V.A.	none	8.50% + 1% Orig. Fee	$35 app. fee
Danielson Federal Savings & Loan Assoc.	Conv.	35%	8.50%	
	Conv.	20%	8.75%	
	Conv./Insured	5%-19%	8.75%	MGIC
	V.A.	none	8.50%	
WESTERN CONNECTICUT AREA				
Bristol Savings	Conv.	30%	8.50%	
	Conv.	20%	8.75%	
	P.M.I.	10%	9.00% + 1 pt.	
	P.M.I.	5%	9.00% + 2 pts.	
The Banking Center	Conv.	20% +	9.00% + 2 pt.	
	P.M.I.	10%-19%	9.25% + 1 pt.	Inc. in Rate
Torrington Savings	Conv.	25%	8.50%	
	Conv.	20%-25%	8.75% Orig. fees $100 to $150	

Continued from Page 17 Column 1

of acquiring the C.T. Scanner. (May T., p. 113; Application, Items 19 & 20, R. §2). Therefore no portion of acquisition costs will be borne by patients.

Further, patients choosing to use the C.T. Scanner will be able to realize significant cost savings. Necessity for Hospitalization will be eliminated for some as C.T. scanning can in some circumstances be done on an outpatient basis. Further necessity for other costly studies such as isotope brain scans and pneumoncephalography will be eliminated (May T., p. 46). The scanner often eliminates potentially dangerous, painful and invasive diagnostic techniques. Unnecessary brain surgery is often eliminated and necessary surgery facilitated by the C.T. scan accurately and safely demonstrating the location and extent of tumors. (May T., pp. 69 & 70).

If patients were to be transported to Bridgeport or Greenwich for scans, the cost of transportation might well equal or exceed the cost of the scan itself. (May T., pp. 45-46) Further, the ultimate cost to the patient might be the unavailibility of a scanner causing loss of life since there are a significant number of patients in acute care hospitals that are sufficiently ill, but cannot safely be moved to another institution several miles away according to testimony of Dr. Deck of the Sloan-Kettering Institute. (June T., pp. 25-26)

VI. Under the Administrative Procedure Act, The Remedy For Violations Of The Sort Here Alleged Is For The Court To Reverse The Decision Of The Commission.

Under the Uniform Administrative Procedure Act, Conn. Gen. Stat. § 4-183(g), the court is empowered to

"...*reverse* or modify the decision if substantial rights of the appellant have been prejudiced because the administrative findings, inferences, conclusions, or decisons are: (i) in violation of constitutional or statutory provisions; (ii) in excess of the statutory authority of the agency; (iii) made upon unlawful procedure; (iv) affected by other error of law; (v) clearly erroneous in view of the reliable, probative and substantial evidence on the whole record; or (vi) arbitrary or capricious or characterized by abuse of discretion or clearly unwarranted exercise of discretion." (Emphasis added)

This is particularly so in the instance of Conn. Gen. Stat. § 19-73m, since that statute contains a clear legislative recognition of the prejudice which a hospital and its patients suffer if a decision on a hospital's request for capital equipment is delayed for any substantial period of time. thus, § 19-73m provides specifically that "(t)he commission shall grant or deny such request within ninety days ... of receipt (of the application) and failure of the commission to act thereon within such period shall be deemed approval of such request." Hence, if this court finds that the Commission decision denying the Hospital's application is invalid, such application should now be deemed approved.

Here, in addition, the Commission delayed the resolution of this matter in this court for nearly a year, by its noncompliance with the specific statutory requirement set forth in Conn. Gen. Stat. § 4-183(d) requiring the Commission to submit the entire record to the court within thirty days of the commencement of the appeal.

Since the court finds that appellant's rights were prejudiced by the actions of the committee particularly in view of Conn. Stat. § 19-73m, which contains a clear legislative recognition of prejudice which a hospital and its patients suffer if a decision on a hospital's request for capital equipment is delayed for any substantial period of time, thus, the necessity for a decision within 90 days is incorporated in that statute.

Conclusion

The court, therefore, reverses the order of the Commission and orders that the application filed March 31, 1976 of Plaintiff-Appellant Stamford Hospital for a C.T. Scanner and facility within which to house same be deemed approved.

Kulawiz, J.

Judicial opinions and agency rulings reported in full text in The Connecticut Law Tribune should be cited by the volume and number of the issue in which such opinion or ruling is published. Thus, any opinion or ruling published in today's issue should properly be cited:

4 CLT No. 18

Please note that quarterly indices are prepared for all opinions and rulings published. Each item in the index is captioned and listed under the appropriate topical law reference, and contains a brief statement of the rule of law decided and the citation for The Connecticut Law Tribune.

Attorney General

State Traffic Commission-Cost of Roadway Improvements-Manufacturers and Businesses as "Developers"-Timex Office Building Is Development

[Headnote] Leter to the Executive Secretary, State Traffic Commission advising that: (1) Manufacturing and/or business firms are "developers" within the meaning of § 14-311 of the General Statutes and therefore responsible for the cost of roadway improvements when meeting the criteria of said statute; and (2) Timex Corporation can be held responsible for such improvements to Route 63 in connection with its proposed office building in the Town of Middlebury. *Dated April 11, 1978.*

Attorney General Opinion

[Text] In your letter dated March 23, 1978, you state that the Timex Corporation is proposing to construct an office building on Route 63 in the Town of Middlebury with proposed parking for 425 vehicles. An application for Certificate was filed with the State Traffic Commission, which resulted in Traffic Investigation Report #080-7707-01 which recommends the issuance of a Certificate subject to certain roadway improvements, the cost of which would be borne by Timex Corporation.

Timex Corporation has objected to being responsible for the costs of the roadway improvements arguing that the proposed office building is not a "development" and Timex Corporation is not a "developer," and further that the legislative intent was not to include manufacturing firms with shopping centers and other profit making ventures as "developments" within the framework of Section 14-311.

You have asked our advice on the following questions:

1. Are manufacturing and/or business firms considered "developments" within the language of Section 14-311 and subsequently responsible for roadway improvements when meeting the other criteria of Section 14-311?

2. Specifically, can Timex Corporation be held financially responsible for the roadway improvements to Route 63, as required in the issuance of a Certificate?

The Times Corporation states that the proposed office building is not a development.

The word develop is defined in Ballantine's Law Dictionary, 3rd Edit., as "Improving a tract of land preparatory to the erection of residential, commercial or industrial buildings."

The New Century, Webster's Seventh New Collegiate and Webster's New World Dictionary, Second College Edition, all define development as a bringing out of the latent capabilities of anything; a bringing or coming to a more mature, advanced or effective state; expansion or growth; a bringing or coming gradually into existence or activity.

"Development" is also defined "To convert from a tract of raw land into an area suitable for residential or business uses." *People v. Embassy Realty Associates*, 167 P. 2d 797, 800, 73 Cal. App. 2nd 901; *Muirhead v. Pilot Productions*, 258 So. 2d 232, 237.

"Development" is also "activity which changes the basic character or the use of the land on which the activity or construction occurs." *City of Louisville v. District Court in and for oulder County, Colorado*, 543 P. 2d 67, 70.

As stated in the Office of Legislative Research Summary of 1976 Public Acts, p. 209:

P.A. 76-412 — xSB 420
Transportation Committee
Amending Section 14-311

An Act Concerning Developments Generating Large Volumes of Traffic on State Highways.

SUMMARY: State law requires a person developing a shopping center, open air theater, or other facility generating large volumes of traffic which abuts, adjoins, or has an exit or entrance on a state highway to obtain certification from the State Traffic Commission that operation of the facility will not imperil public safety. This certification is necessary before the facility can be built, expanded, established, or operated.

This act extends the certification requirement to similar facilities developed by state or municipal agencies and also requires private persons and state or municipal agencies to obtain certification when their facilities substantially affect state highway traffic, whether or not they actually adjoin the highway.

In addition to calling it an Act concerning developments generating large volumes of traffic on state highways, the Senate and House proceedings emphasize highway safety, and nowhere are the words developer or development limited as proposed by Timex.

The legislature was concerned about the peril to the safety of the public created by the operation of a development which by its nature generates large volumes of traffic. Such concern of the legislature finds expression in the specific provisions of Section 14-311. In its mandate to the State Traffic Commission, the legislature requires that in its consideration the commission shall include "highway safety, the width and character of the highways affected, the density of traffic thereon and the character of such traffic." The law then states that if the State Traffic Commission determines that pavement widening or other changes or traffic control devices are required on the state highway to handle traffic safely and efficiently, one hundred percent of the cost of such changes determined by the State Traffic Commission shall be borne by the person building, establishing or operating such development generating large volumes of traffic.

The phrase "generating large volumes of traffic" is interpreted as two hundred (200) parking spaces as specified in Section 14-298-261a of the Regulations of the State Traffic Commission.

The proposed parking for the Timex building is 425 vehicles.

Statutes are to be construed so that they carry out the intent of the legislature, which intent is to be ascertained from the language of the statute itself if such language is plain and unambiguous, and where the legislative intent is clear and the language used to express it is unambiguous there is no room for statutory construction. *Hurlbut v. Lemelin*, 325 A.2d 537, 31 Conn. Supp. 130; *Housing Authority of City of Waterbury v. White*, 287 A. 2d 644, 29 Conn. Supp. 346.

Courts cannot import into legislation an intent not expressed in some appropriate manner. *Loew v. Falsey*, 127 A.2d 67, 144 Conn. 67.

In construing statutes, the question before the court is not what did the Legislature actually intend, but what intention has it expressed. *McAdams v. Barbieri*, 123 A.2d 182, 143 Conn. 405; *Connecticut Light & Power Co. v. Walsh*, 57 A.2d 128, 134 Conn. 295, 1 A.L.R. 2d 453; *Institute of Living v. Town & City of Hartford*, 50 A.2d 822, 133 Conn. 258; *Finoia v. Winchester Repeating Arms Co.*, 34 A.2d 636, 130 conn. 381.

In Seciton 14-311, Connecticut General Statutes, the Legislature gave authority to the State Traffic Commission to require roadway construction because it was dealing with developments generating large volumes of traffic.

There is no ambiguity in the wording of the statute. The legislative intent is clear and there is no attempt anywhere to restrict the meaning of "developer" or "development."

Historically, since Section 14-311 was enacted, the State Traffic Commission has applied its provisions to all developments.

Continued on Page 19 Column 1

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.
Commissioner

Dannel P. Malloy
Governor
Nancy Wyman
Lt. Governor

TO: Kevin Hansted, Esq.
Hearing Officer

FROM: Jewel Mullen, M.D., M.P.H., M.P.A., Commissioner

DATE: May 20, 2013

RE: Certificate of Need Application; Docket Number: 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and Installation of an MRI in Stamford

---

The public hearing record was closed in this matter on December 24, 2012. I hereby remand this matter back to Hearing Officer Kevin Hansted to take further evidence.

DPH
Connecticut Department of Public Health

Phone: (860) 509-8000 • Fax: (860) 509-7184 • VP: (860) 899-1611
410 Capitol Avenue, P.O. Box 34038
Hartford, Connecticut 06134-0308
www.ct.gov/dph
Affirmative Action/Equal Opportunity Employer

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

May 21, 2013

VIA FACSIMILE ONLY

Ms. Stacey L. Malakoff
Executive Vice President/CFO
Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

RE: Certificate of Need Application, Docket Number 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and installation of an MRI in Stamford

NOTICE OF ORAL ARGUMENT CANCELLATION

Dear Ms. Malakoff:

The Oral Argument for the above referenced matter, scheduled for May 23, 2013 at 2:00 p.m., has been **cancelled.** This will allow the Applicant additional time to submit evidence in response to the Exception claim relating to Finding of Fact #19 of the Proposed Final Decision, dated April 8, 2013 (see attached letter dated May 21, 2013 – Opening of the Public Hearing).

Following receipt of the evidence, due on or before June 7, 2013, the hearing will be closed and a new proposed final decision will be issued.

Please contact me at (860) 418-7014, if you have any questions concerning this matter.

Sincerely,

Brian A. Carney
Associate Research Analyst

cc: Paul E. Knag, Esq.

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

May 21, 2013

VIA FACSIMILE ONLY

Stacey L. Malakoff
Executive Vice President/CFO
Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

RE: Certificate of Need Application; Docket Number: 12-31780-CON
New York Society for the Reliefof the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and Installation of an MRI in Stamford
Opening of the Public Hearing

Dear Ms. Malakoff:

On or about December 21, 2012, the Office of Health Care Access ("OHCA") closed the hearing in the above-referenced matter. Thereafter, on May 10, 2013, OHCA received Exceptions to its Proposed Final Decision dated April 8, 2013. Included in the Exceptions is a claim that the Applicant was not given advance notice of certain information as required by Connecticut General Statutes § 4-178. Specifically, the Applicant claims that it was not given advance notice of the scanner/volume information contained in Finding of Fact #19 of the Proposed Final Decision dated April 8, 2013.

Therefore, the hearing in the above-referenced matter is hereby opened for the limited purpose of allowing the Applicant to submit written evidence in response to Finding of Fact #19 of the Proposed Final Decision dated April 8, 2013. The Applicant shall submit its evidence on or before June 7, 2013. Following receipt of the evidence, the hearing will be closed and a new proposed final decision will be issued.

If you have any questions regarding this matter, please feel free to contact Brian Carney at (860) 418-7014.

Sincerely,

Kevin Hansted, Esq.
Hearing Officer

cc: Paul E. Knag, Esq.

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3492
RECIPIENT ADDRESS	98602405711
DESTINATION ID	
ST. TIME	05/21 10:35
TIME USE	01'40
PAGES SENT	4
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: PAUL E. KNAG, ESQ.

FAX: (860) 240-5711

AGENCY: MURTHA CULLINA LLP / HOSPITAL FOR SPECIAL SURGERY

FROM: BRIAN CARNEY

DATE: 5/21/13 TIME:

NUMBER OF PAGES: 4
(including transmittal sheet)

DOCKET: 12-31780-CON

CC: STACEY L. MALAKOFF

Comments:
OPENING OF THE PUBLIC HEARING
ORAL ARGUMENT CANCELLATION

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3491
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	05/21 10:34
TIME USE	00'44
PAGES SENT	4
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: STACEY L. MALAKOFF

FAX: (212) 774-2620

AGENCY: HOSPITAL FOR SPECIAL SURGERY

FROM: BRIAN CARNEY

DATE: 5/21/13 TIME:

NUMBER OF PAGES: 4
(including transmittal sheet

DOCKET: 12-31780-CON

CC: PAUL E. KNAG, ESQ.

Comments: OPENING OF THE PUBLIC HEARING ORAL ARGUMENT CANCELLATION

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

DEPARTMENT OF PUBLIC HEALTH
OFFICE OF HEALTH CARE ACCESS

NEW YORK SOCIETY FOR THE RELIEF OF THE RUPTURED AND CRIPPLED, MAINTAINING THE HOSPITAL FOR SPECIAL SURGERY - ACQUISITION AND INSTALLATION OF A MAGNETIC RESONANCE IMAGING SCANNER TO BE LOCATED IN STAMFORD, CONNECTICUT	DOCKET NO. 12-31780-CON June 20, 2013

RECEIVED
JUN 20 2013
OFFICE OF HEALTH CARE ACCESS

REQUEST FOR RECONSIDERATION

Applicant New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery ("HSS" or "Hospital for Special Surgery" or "Applicant") submits this Request for Reconsideration of the Final Decision rendered by Deputy Commissioner Lisa Davis and dated June 14, 2013 in the above-mentioned matter (the "Final Decision") pursuant to Conn. Gen. Stat. § 4-181a.

Applicant requests that the Office of Health Care Access division of the Department of Public Health ("OHCA") reverse its Final Decision and grant HSS' CON application.

Pursuant to Conn. Gen. Stat. § 4-181a(a),

> A party in a contested case may, within fifteen days after personal delivery or mailing of the final decision, file with the agency a petition for reconsideration of the decision on the grounds that (A) an error of fact or law should be corrected; (B) new evidence has been discovered which materially affects the merits of the case and which for good reason was not presented in the agency proceeding; or (C) other good cause for reconsideration has been shown. . . .

Applicant files this Request for Reconsideration because there are errors of fact that should be corrected and for other good cause as set forth below.

In particular, (1) Applicant requests that OHCA grant the CON based on the utilization numbers supplied by OHCA which show a need for additional capacity in the Stamford-Greenwich area, and (2) Applicant requests that OHCA grant the CON based on the fact that HSS hereby agrees to limit use of its MRI to patients who have been seen by a member of HSS' medical staff and referred by such physician for an MRI, to have its CEO certify compliance with this restriction to OCHA on a quarterly basis, and to provide a third party audit of such compliance, by a reputable accounting firm and subject to applicable patient privacy laws, at the end of the first year, and annually thereafter if requested by OHCA.

I. There Was Clear Proof of a Need for an Additional MRI in the Stamford/ Greenwich Area

A simple review of the utilization data supplied by OHCA demonstrates the need for the proposed MRI.

The data supplied by OHCA in paragraphs 18 and 19 its Proposed Final Decision ("Proposed Decision") shows that there are seven MRIs in the primary service area. Based on an annual capacity of 4,000 scans per machine, total capacity in the primary service area is 28,000. That is the conclusion of the OHCA Statewide Healthcare Facilities and Services Plan ("Statewide Plan") and that should be the conclusion of OHCA in this matter. Under the Statewide Plan, utilization more than 85% of capacity (in this case, 23,800 scans per year) indicates a need for more capacity. That is the is the conclusion of the Statewide Plan and should be the conclusion of OHCA in this matter. The seven MRIs in the primary service area performed 27,192 MRI scans in 2010, well in excess of 23,800, thus clearly indicating that there is]a need for more capacity in the Stamford-Greenwich area.

The Final Decision does not include the data from paragraphs 18 and 19 of the Proposed Decision. HSS respectfully requests that such data be reinserted, and that the CON be granted based on the need indicated by the utilization figures contained therein.

II. HSS Agrees to Limit Use to Patients Seen and Referred by Members of HSS' Medical Staff

In addition, HSS notes that the Final Decision is based in part on concerns that HSS indicated a willingness to make its MRI available, where possible, for referrals from non-HSS physicians. (Final Decision, paragraph 20 and discussion section.)

HSS was merely trying to respond to a request from Stamford Hospital and has no intention of marketing its MRI to non-HSS physicians in the Stamford-Greenwich area. Nonetheless, HSS hereby agrees as follows as to the proposed MRI: (1) it will only accept patients who have been seen by a member of HSS' medical staff and referred by such physician for an MRI, (2) its CEO will certify compliance with this restriction to OHCA on a quarterly basis and (3) it will provide a third party audit of such compliance, by a reputable accounting firm and subject to applicable patient privacy laws, at the end of the first year and annually thereafter if requested by OHCA.

Such a restriction would be responsive to the request of Greenwich Hospital's CEO, Frank Corvino, as set forth in his letter to OHCA dated November 9, 2012 (see Exhibit L of hearing record). In this letter, Mr. Corvino requested that HSS' proposed MRI scanner be limited to providing MRI scans only for HSS' own patients. He indicated that such a limitation would be consistent with previous CON applications, specifically Docket No. 06-30674 (modified by Docket No. 09-31347-CON) which restricts Neurology Associates, LLC to offering MRI services only to patients of the practice and Docket No. 08-31120-CON which restricts

Orthopaedic & Neurosurgery Specialists, P.C. to providing MRI services only to its own patients.

III. Extension of Lease

HSS previously advised OHCA that its lease contingency relating to this CON required action by June 17. In order to facilitate further consideration of this matter by OHCA, HSS has obtained a 30 day extension of this date. HSS does not anticipate that it will be able to further extend this date. Therefore, it is respectfully requested that OHCA act on this matter prior to July 17, 2013.

IV. Uniqueness of HSS MRI

HSS is the top-ranked orthopedic hospital in the country and is singularly focused on the care of patients with musculoskeletal diseases and conditions. The highly integrated and specialized nature of the HSS system of care is what has created its leading patient outcomes and world-class status. A key component of this care delivery system is HSS' approach to and use of MRI imaging. HSS radiologists have worked collaboratively with HSS' medical staff over 20 plus years to develop proprietary protocols that are customized to meet the specific needs of its patient population. In addition, HSS has access to GE proprietary MRI protocols (through its comprehensive research agreement) years in advance of commercial availability and HSS' radiologists are specially trained in and do solely musculoskeletal imaging. It is for these and many other reasons why, in 2012, approximately 3,300 HSS patients from Connecticut and nearby Westchester County traveled to HSS in Manhattan to have their MRI scans. The objective of HSS' proposed Stamford MRI is to provide more convenient access for these patients, who are often mobility-impaired.

V. Summary

This application represents an exciting opportunity for HSS' Connecticut patients to have more convenient access to the expertise of a hospital that has been rated as the top orthopedic hospital in the country. If the denial is allowed to stand, this opportunity will be lost.

Notwithstanding that HSS' proposed Stamford MRI will serve those HSS Connecticut and Westchester County patients who currently travel to HSS in Manhattan for their MRI scans, the utilization data supplied by OHCA demonstrates that there is a need for additional MRI capacity in the Stamford-Greenwich area.

Moreover, we believe that the foregoing proposal, restricting the use of the MRI to the patients of HSS' medical staff should alleviate the concerns that HSS will market to and/or accept referrals from non-HSS physicians. HSS stands willing to discuss an agreed settlement reflecting this proposal, along with other reasonable requirements which might be suggested by OHCA.

Applicant respectfully requests that OHCA consider the information set forth in this Request for Reconsideration, reverse its Final Decision and grant the CON based on the information set forth herein.

Respectfully Submitted,

The Hospital for Special Surgery

By: ____________________

Paul E. Knag, Esq.
pknag@murthalaw.com
Murtha Cullina LLP
177 Broad Street – 4th Floor
Stamford, CT 06901
(203) 653-5400
(203) 653-5444
Attorneys for The Hospital for Special Surgery

Greer, Leslie

From: Carney, Brian
Sent: Tuesday, May 21, 2013 3:17 PM
To: Greer, Leslie; Olejarz, Barbara
Cc: Riggott, Kaila
Subject: FW: Hospital for Special Surgery

Leslie/Barbara,

Please include the email below in the Table of Record.

Thanks,
Brian

From: Paul E. Knag [mailto:PKNAG@murthalaw.com]
Sent: Tuesday, May 21, 2013 2:56 PM
To: Hansted, Kevin
Cc: Carney, Brian
Subject: Hospital for Special Surgery

Reference is made to the communications faxed this morning cancelling the oral argument and reopening the hearing.

As previously indicated, Hospital for Special Surgery needs to get a final decision in this matter before June 17 in order to proceed with its proposed lease of Stamford space.

We therefore request that the oral argument proceed as scheduled for Thursday. We are willing to rely at that time on the matters set out in our exceptions.

Thanks for your consideration of this request.

Paul E. Knag
Partner
PKNAG@murthalaw.com

Murtha Cullina LLP | Attorneys at Law | www.murthalaw.com
177 Broad Street | Stamford | CT | 06901
Direct: 203-653-5407
Fax: 860-240-5711
Mobile: 203-561-6438

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

May 21, 2013 VIA FACSIMILE ONLY

Stacey L. Malakoff
Executive Vice President/CFO
Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

RE: Certificate of Need Application; Docket Number: 12-31780-CON
New York Society for the Reliefof the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and Installation of an MRI in Stamford
Closure of the Public Hearing

Dear Ms. Malakoff:

On May 21, 2013, OHCA received a response from the Applicant requesting that oral argument, previously scheduled for May 23, 2013 at 2:00 p.m., proceed as planned. The Applicant has further stated that it will rely on the matters set out in the exceptions submitted to OHCA on May 10, 2013. Accordingly, the hearing on the above application is hereby closed.

If you have any questions regarding this matter, please feel free to contact Brian Carney at (860) 418-7014.

Sincerely,

Kevin Hansted, Esq.
Hearing Officer

cc: Paul E. Knag, Esq.

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3495
RECIPIENT ADDRESS	98602405711
DESTINATION ID	
ST. TIME	05/21 15:59
TIME USE	00'59
PAGES SENT	2
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: PAUL E. KNAG, ESQ.

FAX: (860) 240-5711

AGENCY: MURTHA CULLINA LLP / HOSPITAL FOR SPECIAL SURGERY

FROM: BRIAN CARNEY

DATE: 5/21/13 TIME:

NUMBER OF PAGES: 2
(including transmittal sheet)

DOCKET: 12-31780-CON

CC: STACEY L. MALAKOFF

Comments:
CLOSURE OF THE PUBLIC HEARING

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3494
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	05/21 15:58
TIME USE	00'25
PAGES SENT	2
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: STACEY L. MALAKOFF

FAX: (212) 774-2620

AGENCY: HOSPITAL FOR SPECIAL SURGERY

FROM: BRIAN CARNEY

DATE: 5/21/13 TIME:

NUMBER OF PAGES: 2
(including transmittal sheet)

DOCKET: 12-31780-CON

CC: PAUL E. KNAG, ESQ.

Comments: CLOSURE OF THE PUBLIC HEARING

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

June 14, 2013

IN THE MATTER OF:

An Application for a Certificate of Need filed Pursuant to Section 19a-638, C.G.S. by:	Notice of Final Decision Office of Health Care Access Docket Number: 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery	**Acquisition of a Magnetic Resonance Imaging Scanner to be Located in Stamford, Connecticut**

To: Stacey L. Malakoff
Executive Vice President/CFO
The Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

Dear Ms. Malakoff:

This letter will serve as notice of the Final Decision of the Office of Health Care Access in the above matter, as provided by Section 19a-638, C.G.S. On June 14, 2013, the Final Decision was rendered as the finding and order of the Office of Health Care Access. A copy of the Final Decision is attached hereto for your information.

Kimberly R. Martone
Kimberly R. Martone
Director of Operations

Enclosure
KRM:av

Department of Public Health
Office of Health Care Access
Certificate of Need Application

Final Decision

Applicants:	**New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery 535 East 70th Street, New York, New York 10021**
Docket Number:	**12-31780-CON**
Project Title:	**Acquisition of a Magnetic Resonance Imaging Scanner to be Located in Stamford, Connecticut**

Project Description: New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("HSS" or "Applicant") seeks to acquire a Magnetic Resonance Imaging ("MRI") scanner to be located in Stamford, Connecticut, with an associated capital expenditure of $3,245,583.

Procedural History: The Applicant published notice of its intent to file a CON application in The Advocate (Stamford) on June 26, 27 and 28, 2012. On August 13, 2012, the Office of Health Care Access ("OHCA") received the Certificate of Need ("CON") application from the Applicant for the above-referenced project. On November 2, 2012, OHCA deemed the application complete.

On November 16, 2012, the Applicant was notified of the date, time, and place of the public hearing. On November 19, 2012, a notice to the public announcing the hearing was published in the *Record Journal*, *The Advocate* and *The News Times*. Thereafter, pursuant to Conn. Gen. Stat. § 19a-639a, a public hearing regarding the CON application was held on December 18, 2012.

Commissioner Jewel Mullen designated Attorney Kevin T. Hansted as the hearing officer in this matter. The hearing was conducted as a contested case in accordance with the provisions of the Uniform Administrative Procedure Act (Chapter 54 of the General Statutes) and Conn. Gen. Stat. § 19a-639a. The public hearing record was closed on December 24, 2012.

A Proposed Final Decision was issued on April 8, 2013. Thereafter, the Applicant filed Exceptions to the Proposed Final Decision on May 10, 2013. Included in the Exceptions was a claim that the Applicant had not been given notice that OHCA would rely on certain information in its Proposed Final Decision. In order to allow the Applicant an opportunity to submit evidence to refute the information upon which OHCA partially relied, the matter was remanded back to the Hearing Officer and the public hearing record was opened on May 21, 2013. In response, the Applicant notified OHCA on May 21, 2013 that it would not be submitting additional evidence, but rather, would rely on the information included in its Exceptions. The public hearing record was closed again on May 21, 2013.

Findings of Fact

1. HSS is a not-for-profit, acute care, academic medical center located at 535 East 70th Street, New York, NY 10021. HSS is a health care facility or institution as defined by Conn. Gen. Stat. § 19a-630. Ex. A, p. 8.

2. HSS currently provides physician services, diagnostic x-ray and fluoroscopic guidance imaging services at 143 South Beach Avenue, in Old Greenwich, Connecticut. Ex. A, p. 6.

3. HSS is a top ranked hospital in the orthopedic and rheumatology fields; its MRI centers specialize in musculoskeletal exams. Ex. A, p. 6; Ex. F, p. 340.

4. HSS is planning to expand and relocate its services from 143 South Beach Avenue, Old Greenwich, Connecticut to 1 Blachley Road, Stamford, Connecticut. Ex. A, p. 6.

5. HSS is seeking approval for the acquisition of a 1.5 Tesla Magnetic Resonance Imaging (MRI) unit at this new location. Ex. A, p. 6.

6. HSS currently operates ten MRI units at or in close proximity to its main hospital campus in Manhattan, and has received approval from the state of New York to operate a new unit at a satellite location in Uniondale, NY. Ex. A, p. 7; Ex. B, p. 347.

7. Table 1 shows historical, current and projected utilization for all MRI scanners operated by HSS.

Table 1: HSS Existing MRI Units and Volumes by Location:

	Actual Volume (Last 3 Completed CYs)			CY Vol. (d)	Projected Volume (First 3 Full Operational CYs)		
	2009	2010	2011	2012	2014	2015	2016
HSS Main Campus (a)(b):							
- Unit A	4,555	4,054	3,825	3,267	3,359	3,464	3,568
- Unit B	3,700	3,232	3,244	3,008	3,094	3,191	3,287
- Unit C	3,892	3,963	3,996	3,810	3,919	4,042	4,162
- Unit D	4,194	4,031	3,863	3,567	3,667	3,781	3,895
- Unit E	3,787	3,420	3,382	3,215	3,306	3,409	3,512
- Unit F	2,974	3,648	3,835	3,470	3,568	3,679	3,790
- Unit G (11/3/09)	754	3,754	3,654	3,489	3,587	3,699	3,811
- Unit H (c)	1,708	1,303	2,327	3,397	3,491	3,600	3,709
- Unit I (3/26/12)	-	-	-	1,934	2,591	2,672	2,753
75th St (11/28/11)	-	-	190	2,443	2,512	2,590	2,668
Uniondale, NY (1/1/13)	-	-	-	-	2,400	2,400	2,400
Stamford, CT (1/1/14)	-	-	-	-	2,175	2,540	2,540
Total	25,564	27,405	28,316	31,600	37,669	39,067	40,095

Ex. F, p. 347.

(a) HSS Main Campus MRIs operate 13.5 hours/day (Unit A – 16 hours/day) and on weekends (limited hours), whereas the units at the offsite locations operate 10 hours/day and no weekends. 75Th St, which is in close proximity to the Main Campus, operates 11.5 hours/day.

(b) Nine of the above listed units are 1.5 Tesla units and three are 3.0 Tesla units. Tesla measures the strength of the magnet. HSS operates mostly 1.5T units since these are most effective for orthopedic imaging in most cases.

(c) Unit H was converted from an Open to a 1.5T MRI in May 2011 due to obsolescence.

(d) Represents projected 2012 totals based on actual volumes through August 2012.

Note: All above years represent calendar years (CYs). Above totals are for outpatients only.

8. The Applicant states that the proposed service area would include the following towns: Stamford, Greenwich, Darien and New Canaan, Connecticut, and Scarsdale, Rye, and Mamaroneck, New York. Ex. A, p. 15.

9. Based on CY 2012 volumes, HSS projects that it will perform approximately 3,250 MRI scans for its patients residing in Connecticut and Westchester County. Of the total projected volume, 896 scans (28%) would originate from the Connecticut portion of the proposed service area. Ex. A, p. 7.

Table 2: HSS Historical/Projected MRI Volumes for the Proposed Service Area:

Town	2011	Actual through June 2012	Projected through end of 2012
Stamford	144	67	134
Greenwich	454	243	486
Darien	174	68	136
New Canaan	109	70	140
CT Portion of Proposed Service Area	**881**	**448**	**896**
Scarsdale	229	114	228
Rye	217	110	220
Mamaroneck	219	144	288
NY Portion of Proposed Service Area	**665**	**368**	**736**
Total Proposed Service Area	**1,546**	**816**	**1,632**
Other CT Residents	725	465	930
Other NY Residents	616	344	688
Total HSS MRI Volume	**2,887**	**1,625**	**3,250**

Ex. A, p. 15.

10. HSS claims that the maximum capacity of the MRI requested in this proposal will be 2,540 scans; based on a five day-per-week, 10-hour-per-day schedule. As the projected volume of 3,250 scans exceeds the claimed maximum capacity of 2,540 scans, a portion of patients would thus need to receive their MRI scan in Manhattan. Ex. A, pp. 16-17.

11. HSS is projecting the following utilization for its proposed MRI scanner:

Projected MRI Volume

	Projected Volume		
	FY 2014	FY 2015	FY 2016
MRI Total	**2,175**	**2,540**	**2,540**

Ex. A, p. 27.

12. HSS states that its MRI scans use proprietary protocols that are customized to meet the needs and specifications of individual patients and their physicians. HSS claims the protocols/customization allows each physician to maximize the usefulness of the MRI as a tool for diagnosis and to help develop effective treatment plans. The protocols used by HSS do not require specialized equipment; however, they do require specialized software for prototype pulse sequences, which is the property of General Electric (GE). Ex. A, pp. 6-7; Ex. F, p. 340.

13. HSS has a comprehensive and collaborative research agreement with GE, allowing it to use these newer sequence and MRI techniques that are not currently available to other providers in the tri-state area. Ex. F, p. 341.

14. HSS sends the majority of its patients (approximately 3,250) to its Manhattan campus to receive MRI scans. Only a small percentage of patients are referred to Connecticut providers. HSS will continue to refer patients to the HSS MRI department, regardless of whether the MRI is located in Manhattan, Stamford or another location. Ex. A, p. 7; Ex. F, pp. 349, 352.

15. HSS stated that patients are sent to New York to be imaged due to the focus on MRI quality. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Dr. Jo A. Hannafin, Attending Orthopedic Surgeon at the Hospital for Special Surgery.

16. HSS stated that it had only anecdotal cases to support its claim that HSS MRI protocols are better than those used by Connecticut providers. HSS' peer-reviewed literature is not based on any specific Connecticut facility. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Dr. Hollis Potter, Chief of the MRI department at the Hospital for Special Surgery.

17. HSS stated that it had not specifically addressed improvement in surgical outcomes as a result of using its MRI protocols. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Dr. Hollis Potter, Chief of the MRI department at the Hospital for Special Surgery.

18. The Applicant asserts that clear public need for this proposal is demonstrated by the following:
    - An MRI site in Stamford provides a more convenient location for Connecticut and Westchester County, NY patients than the HSS main campus in Manhattan. Ex. A, pp. 7, 13.
    - The ability to free up needed capacity and alleviate current issues with MRI backlog at HSS's Manhattan location. Ex. A, pp. 7, 13.

19. The Applicant asserts that this proposal will not impact the volumes of existing Connecticut MRI providers, due to the following:
    - MRI volume will shift from Manhattan to Stamford;
    - HSS can fill the capacity of the proposed MRI with its own patients;
    - The proposed MRI scanner will not be marketed to non-HSS physicians or patients.

    Ex. A, p. 7.

20. Although HSS does not directly market it services to non-HSS physicians, testimony received stated that HSS does currently accept referrals from non-HSS orthopedic surgeons in New York. HSS also stated that it would like to market its MRI services to an orthopedic practice affiliated with The Stamford Hospital and located within the same building (Chelsea Piers complex) where the proposed MRI would be operated. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Lou Shapiro, President and Chief Executive Officer for the Hospital for Special Surgery.

21. The projected patient population mix presented below is based on HSS's current MRI payer mix and assumes that the mix of patients treated in Stamford will be similar:

Table 4: HSS Projected Payer Mix:

Coverage Type	Year 1 FY 2014	Year 2 FY 2015	Year 3 FY 2016
Medicare*	18.1%	18.1%	18.1%
Medicaid*	2.1%	2.1%	2.1%
CHAMPUS & TriCare	0.0%	0.0%	0.0%
Total Government	**20.2%**	**20.2%**	**20.2%**
Commercial Insurers*	74.7%	74.7%	74.7%
Uninsured	1.4%	1.4%	1.4%
Workers Compensation	3.7%	3.7%	3.7%
Total Non-Government	**79.8%**	**79.8%**	**79.8%**
Total Payer Mix	**100.0%**	**100.0%**	**100.0%**

Ex. A, p. 36.

*Includes managed care activity.

22. The total capital expenditure is $3,245,583 and will be funded from HSS operations. The capital costs include: $1,800,000 for imaging equipment and $1,445,583 for construction and renovation.

23. The Applicant projects incremental gains from operations of $1,341,000 in FY 2014, $1,659,000 in FY 2015, and $1,708,000 in FY 2016.

Table 5: Financial Projections Incremental to the Project:

Description	FY 2014	FY 2015	FY 2016
Incremental Revenue from Operations[1]	$2,176	$2,614	$2,686
Incremental Total Operating Expenses[2]	$835	$955	$978
Incremental Gain from Operations	**$1,341**	**$1,659**	**$1,708**

Ex. A, pp. 336-339.

Note: figures are in thousands.

[1] Forecasts consider volume, payer mix and payment rate trends as well as the impacts of proposed regulatory reforms, capacity constraint, and anticipated capital initiatives.

[2] Operating expenses include rent, depreciation, facility, supply and staffing costs needed to operate the MRI unit and support the forecasted volumes.

24. OHCA is currently in the process of establishing its policies and standards as regulations. Therefore, OHCA has not made any findings as to this proposal's relationship to any policies and standards not yet adopted as regulations by OHCA. (Conn. Gen. Stat. § 19a-639(a)(1))

25. This CON application was deemed complete by OHCA prior to the state wide health care facilities and services plan being published. Therefore, OHCA has not made any findings as to the relationship between this CON application and the state wide health care facilities and services plan. (Conn. Gen. Stat. § 19a-639(a)(2))

26. The Applicant has failed to establish that there is a clear public need for its proposal. (Conn. Gen. Stat. § 19a-639(a)(3))

27. The Applicant has satisfactorily demonstrated that the proposal is financially feasible. (Conn. Gen. Stat. § 19a-639(a)(4))

28. The Applicant has failed to satisfactorily demonstrate that the proposal would improve quality, accessibility and cost effectiveness of health care delivery in the region. (Conn. Gen. Stat. § 19a-639(a)(5))

29. The Applicant has shown that there would be no change to the provision of health care services to the relevant populations and payer mix. (Conn. Gen. Stat. § 19a-639(a)(6))

30. The Applicant has satisfactorily identified the population to be served by its proposal, but has failed to satisfactorily demonstrate that this population has a need as proposed. (Conn. Gen. Stat. § 19a-639(a)(7))

31. The utilization of existing health care facilities and services in the service area does not support this proposal. (Conn. Gen. Stat. § 19a-639(a)(8))

32. The Applicant has failed to satisfactorily demonstrate that its proposal would not result in an unnecessary duplication of existing MRI services in the area. (Conn. Gen. Stat. § 19a-639(a)(9))

Discussion

CON applications are decided on a case by case basis and do not lend themselves to general applicability due to the uniqueness of the facts in each case. In rendering its decision, OHCA considers the factors set forth in General Statutes § 19a-639(a). The Applicant bears the burden of proof in this matter by a preponderance of the evidence. *Goldstar Medical Services, Inc., et al. v. Department of Social Services, 288 Conn. 790 (2008).*

The New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("Applicant" or "HSS"), a not-for-profit hospital located in New York City, proposes to acquire a 1.5 Tesla MRI scanner to be located in Stamford, Connecticut. *FF1&5.*

The proposal is based upon the assertion that a new MRI unit in Stamford would provide a more convenient location for HSS patients residing in Connecticut and Westchester County to receive HSS' MRI services. The relevant portion of HSS' patient volume would shift from Manhattan to a new location in Stamford. HSS has stated that the approval of this proposal would help alleviate capacity constraints and backlog at the hospital's main campus in Manhattan. *FF18-19.*

HSS claims that its use of proprietary and customized MRI protocols result in higher quality images and improved diagnostic accuracy. *FF12-13&15.* Thus, the application is not based on whether the service area needs additional capacity, but rather upon the claimed unique benefits of HSS' MRI protocols.

Although HSS has provided credible testimony as to its experience and expertise generating musculoskeletal MRI scans, it has failed to provide conclusive evidence (i.e., comparative scientific studies or empirical evidence) to validate their claim that HSS' MRI protocols provide significantly better imaging results or lead to better surgical outcomes than MRI protocols used by existing Connecticut providers. *FF3; FF16-17.* Given this lack of evidence to substantiate the Applicant's claim of a unique benefit, approval of this proposal would result in the duplication of services in the region.

HSS represented that it would not directly market its services to non-HSS physicians even though HSS' current practice is to accept referrals from non-HSS physicians, if presented. In addition, HSS stated that it would like to provide MRI services to a local orthopedic practice located within the same building as the proposed MRI. *FF20.* Both of these factors support the conclusion that approval of this proposal would lead to decreased patient volumes and revenues for existing MRI providers in the service area and result in an unnecessary duplication of MRI services in the region.

OHCA's determination on the acquisition of an MRI is based, in part, on the demonstrated need for the acquisition, not whether an MRI may provide a more convenient location for the patient or help to address capacity issues outside of Connecticut. *FF18.* Although HSS provided numerous anecdotal examples and testimony about the quality of its MRI services and overall system of care, both the application and testimony lack evidence to substantiate that access or health care outcomes for Connecticut patients would be improved as a result of this proposal. After considering all of the factors listed above, OHCA concludes that the Applicant did not demonstrate clear public need for its proposal.

Order

Based upon the foregoing Findings and Discussion, the Certificate of Need application of New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery to acquire a Magnetic Resonance Imaging scanner to be located in Stamford, Connecticut, with an associated capital expenditure of $3,245,583, is hereby **DENIED**.

All of the foregoing constitutes the final order of the Office of Health Care Access in this matter.

By Order of the
Office of Health Care Access

6/14/2013
Date

Lisa A. Davis
Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3530
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	06/14 15:33
TIME USE	02'20
PAGES SENT	13
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: STACEY L. MALAKOFF

FAX: (212) 774-2620

AGENCY: HOSPITAL FOR SPECIAL SURGERY

FROM: BRIAN CARNEY

DATE: 6/14/13 TIME:

NUMBER OF PAGES: 13.
(including transmittal sheet)

DOCKET: 12-31780-CON

CC: PAUL E. KNAG, ESQ.

Comments:
NOTICE OF FINAL DECISION

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3531
RECIPIENT ADDRESS	98602405711
DESTINATION ID	
ST. TIME	06/14 15:36
TIME USE	06'10
PAGES SENT	13
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: PAUL E. KNAG, ESQ.

FAX: (860) 240-5711

AGENCY: MURTHA CULLINA LLP / HOSPITAL FOR SPECIAL SURGERY

FROM: BRIAN CARNEY

DATE: 6/14/13 TIME:

NUMBER OF PAGES: 13
(including transmittal sheet)

DOCKET: 12-31780-CON

CC: STACEY L. MALAKOFF

Comments:
NOTICE OF FINAL DECISION

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

DEPARTMENT OF PUBLIC HEALTH
OFFICE OF HEALTH CARE ACCESS

NEW YORK SOCIETY FOR THE RELIEF OF THE RUPTURED AND CRIPPLED, MAINTAINING THE HOSPITAL FOR SPECIAL SURGERY - ACQUISITION AND INSTALLATION OF A MAGNETIC RESONANCE IMAGING SCANNER TO BE LOCATED IN STAMFORD, CONNECTICUT	)	DOCKET NO. 12-31780-CON June 20, 2013

REQUEST FOR RECONSIDERATION

Applicant New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery ("HSS" or "Hospital for Special Surgery" or "Applicant") submits this Request for Reconsideration of the Final Decision rendered by Deputy Commissioner Lisa Davis and dated June 14, 2013 in the above-mentioned matter (the "Final Decision") pursuant to Conn. Gen. Stat. § 4-181a.

Applicant requests that the Office of Health Care Access division of the Department of Public Health ("OHCA") reverse its Final Decision and grant HSS' CON application.

Pursuant to Conn. Gen. Stat. § 4-181a(a),

> A party in a contested case may, within fifteen days after personal delivery or mailing of the final decision, file with the agency a petition for reconsideration of the decision on the grounds that (A) an error of fact or law should be corrected; (B) new evidence has been discovered which materially affects the merits of the case and which for good reason was not presented in the agency proceeding; or (C) other good cause for reconsideration has been shown. . . .

Applicant files this Request for Reconsideration because there are errors of fact that should be corrected and for other good cause as set forth below.

In particular, (1) Applicant requests that OHCA grant the CON based on the utilization numbers supplied by OHCA which show a need for additional capacity in the Stamford-Greenwich area, and (2) Applicant requests that OHCA grant the CON based on the fact that HSS hereby agrees to limit use of its MRI to patients who have been seen by a member of HSS' medical staff and referred by such physician for an MRI, to have its CEO certify compliance with this restriction to OCHA on a quarterly basis, and to provide a third party audit of such compliance, by a reputable accounting firm and subject to applicable patient privacy laws, at the end of the first year, and annually thereafter if requested by OHCA.

I. There Was Clear Proof of a Need for an Additional MRI in the Stamford/ Greenwich Area

A simple review of the utilization data supplied by OHCA demonstrates the need for the proposed MRI.

The data supplied by OHCA in paragraphs 18 and 19 its Proposed Final Decision ("Proposed Decision") shows that there are seven MRIs in the primary service area. Based on an annual capacity of 4,000 scans per machine, total capacity in the primary service area is 28,000. That is the conclusion of the OHCA Statewide Healthcare Facilities and Services Plan ("Statewide Plan") and that should be the conclusion of OHCA in this matter. Under the Statewide Plan, utilization more than 85% of capacity (in this case, 23,800 scans per year) indicates a need for more capacity. That is the is the conclusion of the Statewide Plan and should be the conclusion of OHCA in this matter. The seven MRIs in the primary service area performed 27,192 MRI scans in 2010, well in excess of 23,800, thus clearly indicating that there is]a need for more capacity in the Stamford-Greenwich area.

The Final Decision does not include the data from paragraphs 18 and 19 of the Proposed Decision. HSS respectfully requests that such data be reinserted, and that the CON be granted based on the need indicated by the utilization figures contained therein.

II. HSS Agrees to Limit Use to Patients Seen and Referred by Members of HSS' Medical Staff

In addition, HSS notes that the Final Decision is based in part on concerns that HSS indicated a willingness to make its MRI available, where possible, for referrals from non-HSS physicians. (Final Decision, paragraph 20 and discussion section.)

HSS was merely trying to respond to a request from Stamford Hospital and has no intention of marketing its MRI to non-HSS physicians in the Stamford-Greenwich area. Nonetheless, HSS hereby agrees as follows as to the proposed MRI: (1) it will only accept patients who have been seen by a member of HSS' medical staff and referred by such physician for an MRI, (2) its CEO will certify compliance with this restriction to OHCA on a quarterly basis and (3) it will provide a third party audit of such compliance, by a reputable accounting firm and subject to applicable patient privacy laws, at the end of the first year and annually thereafter if requested by OHCA.

Such a restriction would be responsive to the request of Greenwich Hospital's CEO, Frank Corvino, as set forth in his letter to OHCA dated November 9, 2012 (see Exhibit L of hearing record). In this letter, Mr. Corvino requested that HSS' proposed MRI scanner be limited to providing MRI scans only for HSS' own patients. He indicated that such a limitation would be consistent with previous CON applications, specifically Docket No. 06-30674 (modified by Docket No. 09-31347-CON) which restricts Neurology Associates, LLC to offering MRI services only to patients of the practice and Docket No. 08-31120-CON which restricts

Orthopaedic & Neurosurgery Specialists, P.C. to providing MRI services only to its own patients.

III. Extension of Lease

HSS previously advised OHCA that its lease contingency relating to this CON required action by June 17. In order to facilitate further consideration of this matter by OHCA, HSS has obtained a 30 day extension of this date. HSS does not anticipate that it will be able to further extend this date. Therefore, it is respectfully requested that OHCA act on this matter prior to July 17, 2013.

IV. Uniqueness of HSS MRI

HSS is the top-ranked orthopedic hospital in the country and is singularly focused on the care of patients with musculoskeletal diseases and conditions. The highly integrated and specialized nature of the HSS system of care is what has created its leading patient outcomes and world-class status. A key component of this care delivery system is HSS' approach to and use of MRI imaging. HSS radiologists have worked collaboratively with HSS' medical staff over 20 plus years to develop proprietary protocols that are customized to meet the specific needs of its patient population. In addition, HSS has access to GE proprietary MRI protocols (through its comprehensive research agreement) years in advance of commercial availability and HSS' radiologists are specially trained in and do solely musculoskeletal imaging. It is for these and many other reasons why, in 2012, approximately 3,300 HSS patients from Connecticut and nearby Westchester County traveled to HSS in Manhattan to have their MRI scans. The objective of HSS' proposed Stamford MRI is to provide more convenient access for these patients, who are often mobility-impaired.

V. Summary

This application represents an exciting opportunity for HSS' Connecticut patients to have more convenient access to the expertise of a hospital that has been rated as the top orthopedic hospital in the country. If the denial is allowed to stand, this opportunity will be lost.

Notwithstanding that HSS' proposed Stamford MRI will serve those HSS Connecticut and Westchester County patients who currently travel to HSS in Manhattan for their MRI scans, the utilization data supplied by OHCA demonstrates that there is a need for additional MRI capacity in the Stamford-Greenwich area.

Moreover, we believe that the foregoing proposal, restricting the use of the MRI to the patients of HSS' medical staff should alleviate the concerns that HSS will market to and/or accept referrals from non-HSS physicians. HSS stands willing to discuss an agreed settlement reflecting this proposal, along with other reasonable requirements which might be suggested by OHCA.

Applicant respectfully requests that OHCA consider the information set forth in this Request for Reconsideration, reverse its Final Decision and grant the CON based on the information set forth herein.

Respectfully Submitted,

The Hospital for Special Surgery

By: ______________________

Paul E. Knag, Esq.
pknag@murthalaw.com
Murtha Cullina LLP
177 Broad Street – 4th Floor
Stamford, CT 06901
(203) 653-5400
(203) 653-5444
Attorneys for The Hospital for Special Surgery

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

July 11, 2013

IN THE MATTER OF:

Reconsideration of the Final Decision
Rendered in Docket Number 12-31780-CON

Notice of Reconsideration Decision
Office of Health Care Access
Docket Number 12-31780-RCN

New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery

Reconsideration of Final Decision for the Acquisition of a Magnetic Resonance Imaging Scanner to be Located in Stamford, Connecticut.

To: Stacey L. Malakoff
Executive Vice President/CFO
The Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

Dear Ms. Malakoff:

This letter will serve as notice of the Response to Petition of New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery to the Office of Health Care Access for reconsideration of the above matter, as provided by Section 4-181b, C.G.S. On July 11, 2013, the response to petition of New York Society for the Relief of the Ruptured and rippled, Maintaining the Hospital for Special Surgery was rendered. A copy of the response to the petition of New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery is attached hereto for your information.

By Order of the
Office of Health Care Access

Kimberly R. Martone
Director

cc: Paul E. Knag, Esquire, Murtha Cullina LLP

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.
Commissioner

Dannel P. Malloy
Governor
Nancy Wyman
Lt. Governor

IN RE: New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery

DOCKET NUMBER: 12-31780-RCN

RESPONSE TO REQUEST FOR RECONSIDERATION

On June 14, 2013, the Office of Health Care Access ("OHCA") denied the Certificate of Need ("CON") application of New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery ("Applicant") under Docket Number: 12-31780-CON for the acquisition of a Magnetic Resonance Imaging Scanner to be Located in Stamford, Connecticut. On June 20, 2013, the Applicant filed a Request for Reconsideration of the decision.

After careful consideration, OHCA has decided to reconsider the final decision rendered on June 14, 2013, under Docket Number: 12-31780-CON. OHCA may render a decision modifying, affirming or reversing the Final Decision not later than 90 days following the date of this notice. If OHCA does not render such decision within such 90 day period, the original Final Decision shall remain the final decision for purposes of any appeal under Conn. Gen. Stat. § 4-183.

7/11/13
Date

Lisa A. Davis
Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner

Keeping Connecticut Healthy
DPH
Connecticut Department of Public Health

Phone: (860) 509-8000 • Fax: (860) 509-7184 • VP: (860) 899-1611
410 Capitol Avenue, P.O. Box 340308
Hartford, Connecticut 06134-0308
www.ct.gov/dph
Affirmative Action/Equal Opportunity Employer

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3569
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	07/12 11:43
TIME USE	00'41
PAGES SENT	3
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: STACEY L. MALAKOFF / HOSPITAL FOR SPECIAL SURGERY

FAX: (212) 774-2620

AGENCY:

FROM: BRIAN A. CARNEY DPH/OHCA

DATE: 7/12/13 TIME:

NUMBER OF PAGES: 3
(including transmittal sheet

Comments: DOCKET # 12-31780-RCN
SEE ATTACHED RESPONSE FOR REQUEST FOR RECONSIDERATION

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3570
RECIPIENT ADDRESS	98602405711
DESTINATION ID	
ST. TIME	07/12 11:44
TIME USE	01'34
PAGES SENT	3
RESULT	OK

STATE OF CONNECTICUT
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: PAUL E. KNAG, ESQ.

FAX: (860) 240-5711

AGENCY: MURTHA CULLINA LLP / HOSP. FOR SPECIAL SURGERY

FROM: BRIAN A. CARNEY DPH / OHCA

DATE: 7/12/13 TIME: ______

NUMBER OF PAGES: 3
(including transmittal sheet)

Comments: DOCKET 12-31780-RCN
RESPONSE FOR REQUEST FOR RECONSIDERATION

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

OFFICE OF COMMISSIONER

Office of Health Care Access

August 12, 2013 VIA FAX ONLY

Stacey L. Malakoff
Executive Vice President/CFO
Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

RE: Certificate of Need Application; Docket Number: 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery
Proposal for the Acquisition and Installation of an MRI in Stamford
Interrogatories

Dear Ms. Malakoff:

Please address the following questions to be filed with the Office of Health Care Access ("OHCA") regarding your Certificate of Need ("CON") proposal filed with OHCA:

1. The Applicant is proposing the acquisition and installation of an MRI in Stamford, Connecticut. Has any consideration been given to collaborating with other area providers for the acquisition and use of the MRI to resolve any potential capacity issues in the area? Please explain in detail.

2. Is the specific MRI protocol, as explained in the Application, currently available to other providers? If not, has any consideration been given to sharing the MRI protocol with other providers in Connecticut? Please explain in detail.

The response to these interrogatories must be submitted, **in writing under oath**, to OHCA no later than **12:00 pm, on Friday, August 23, 2013.** If you are unable to meet the specified time for filing the interrogatories, you must request a time extension in writing, detailing the reasons for not being able to meet the specified deadline.

Sincerely,

Lisa A Davis

Lisa A. Davis, MBA, BS, RN
Deputy Commissioner

cc: Paul Knag, Esq.

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3630
RECIPIENT ADDRESS	912127742620
DESTINATION ID	
ST. TIME	08/12 15:50
TIME USE	00'26
PAGES SENT	2
RESULT	OK

ST. TE OF CONNECTICUT
DEPAR MENT OF PUBLIC HEALTH
OFFIC OF HEALTH CARE ACCESS

FAX SHEET

TO: **STACEY L. M LAKOFF**

FAX: **(212) 774-2620**

AGENCY: **HOSPITAL FC R SPECIAL SURGERY**

FROM: **BRIAN CARN Y**

DATE: **8/12/13** **TIME:**

NUMBER OF PAGES: **2**
(in uding transmittal sheet

Comments: DN: 12-31780 CON Interrogatories

PLEASE PHONE IF T ERE ARE ANY TRANSMISSION PROBLEMS.

Phone: (8 50) 418-7001 ***Fax: (860) 418-7053***

MURTHA

PAUL E. KNAG
203.653.5407 DIRECT TELEPHONE
860.240.5711 DIRECT FACSIMILE
PKNAG@MURTHALAW.COM

August 20, 2013

VIA HAND-DELIVERY

Deputy Commissioner Lisa Davis
Department of Health
Office of Health Care Access
410 Capitol Avenue
Hartford, CT 06134

Re: Hospital for Special Surgery 12-31780

Dear Commissioner Davis:

Please find enclosed Hospital for Special Surgery's answers to OHCA questions received on August 9. While my client answered the questions to the best of their ability based on their understanding and interpretation of the questions, they felt the process would be best served by an opportunity for them to meet with you or your designee and discuss the essence of what is being asked and hopefully find a path towards a successful settlement on their behalf.

Thank you very much for considering this request.

Very truly yours,

Paul E. Knag

4746392v1

1) **The Applicant is proposing the acquisition and installation of an MRI in Stamford, Connecticut. Has any consideration been given to collaborating with other area providers for the acquisition and use of the MRI to resolve any potential capacity issues in the area?**

Joint purchase of an MRI with another area provider is not feasible for the following reasons:

a) Capacity constraints – HSS currently performs approximately 3,300 MRI scans annually on patients from Connecticut and nearby Westchester County at its New York City campus. The capacity of the proposed MRI is 2,540 scans per year. Thus, the proposed MRI will be used to accommodate HSS's own volume, leaving little or no capacity for other area providers.

b) Regulatory constraints – Federal regulations inhibit the ability to collaborate though joint purchase of an MRI. For example, 42 CFR § 413.65(f) specifically requires that a joint venture for a hospital-based service operate on the main campus of the provider, which requirement would not be met here. In addition, 42 CFR § 413.65(d) would require, among other things, that each hospital have its own MRI staff, its own medical records (which in this case would mean there would need to be a separate PAC system) and take steps such that persons coming to the facility would understand that the provider is the particular hospital (which likely means that there would need to be separate entrances). Moreover, the attestation process at CMS is lengthy, with no guarantee that there will be approval. See 42 CFR § 413.65(b).

HSS currently collaborates with several Connecticut providers in other ways:

a) HSS will be working with Stamford Hospital at their Chelsea Piers site to develop a rehab service for their patients based on HSS best practices. HSS and Stamford Hospital are also exploring other areas for collaboration which are dependent on HSS establishing a site at Chelsea Piers. which is further dependent on approval of the MRI by OHCA.

b) HSS has and continues to work with Yale-New Haven Hospital in providing education and assistance with best practices. In particular, Dr. Hollis Potter, Chief of MRI, has given both orthopaedic and radiology grand rounds at Yale-New Haven Hospital, and Yale-New Haven Hospital recently had a tour and meetings at HSS to discuss best practices in musculoskeletal treatment. In addition, another visit to HSS by Yale-New Haven leadership will be held within the next thirty days, this time focusing on operating room issues. This demonstrates HSS's willingness to collaborate; however, this does not enable HSS to function without its own MRI at the Chelsea Piers site.

Continuation of these collaborative efforts as well as future collaboration is dependent upon HSS establishing a site in Stamford. This cannot be accomplished without the availability of an MRI at the site.

In addition, HSS stands ready to make available any (not presently contemplated) excess capacity to patients of other hospitals or area physicians as requested by Stamford Hospital or restrict its services to its own patients as requested by Greenwich Hospital.

2) **Is the specific MRI protocol, as explained in the Application, currently available to other providers? If not, has any consideration been given to sharing the MRI protocol with other providers in Connecticut?**

Protocols include a combination of technology (hardware and software) and how the technology is utilized by the staff (physicians, radiologists, technologists, etc.) as part of HSS's integrated delivery system focused on the care of patients with Musculoskeletal conditions.

a) Hardware and software is or will be available to all providers. HSS benefits from its relationship with GE in that this technology is made available to HSS 2-3 years in advance of other providers because HSS participates with GE in the development of the technology. Unitil the development phase is complete, GE does not permit other providers to access the software. Once the development is completed, GE makes the software available to all providers. For example, at the present time HSS is working with GE on two pulse sequence protocols which are available now to HSS but will not be made available by GE to other providers until development is complete. One is known as T1rho, for noninvasive detection of matrix depletion in articular cartilage. The other is known as ultrashort TE, which provides insight into the ultrastructure of tendons, meniscus and ligaments. On the other hand, ground breaking new software, known as MAVRIC (Multi-Acquisition Variable-Resonance Image Combination), which was developed by HSS in partnership with GE, has just been released for sale. However, MAVRIC, which is specifically designed to be used with high-end GE MRI units, will not run on the MRI scanners currently existing in the Stamford area. MRI units would need to be replaced in order to utilize this software. Please see the attached GE press release announcing the MAVRIC release and related study published in the Journal of Bone and Joint Surgery which demonstrates how patients benefit from this technology. This is just one example of how HSS' patients benefit from the HSS/GE relationship

b) Coordination between the MRI technician, the MRI radiologist and the physician is essential to the development of HSS's patient specific protocols. While HSS is more than willing to share the nature of these protocols with local MRI providers and to educate them on best practices, these protocols cannot be replicated for HSS patients and physicians by other providers since they are customized based on the needs of particular patients and physicians. HSS's integrated deliver system can not be replicated for patients who are under the care of HSS and its physicians. HSS MRI is dedicated to superior orthopaedic MRI and our diagnostic expertise is critical in the daily work up of patients seeking care by HSS clinical staff.

c) HSS radiologists must obtain training in a musculoskeletal fellowship following completion of their residency training and specialize solely in musculoskeletal radiology. This is not likely to be feasible for community MRI radiologists.

Magnetic Resonance Imaging Findings in Symptomatic Versus Asymptomatic Subjects Following Metal-on-Metal Hip Resurfacing Arthroplasty

Danyal H. Nawabi, MD, FRCS(Orth), Catherine L. Hayter, MBBS, FRANZCR, Edwin P. Su, MD, Matthew F. Koff, PhD, Giorgio Perino, MD, Stephanie L. Gold, BA, Kevin M. Koch, PhD, and Hollis G. Potter, MD

Investigation performed at the Hospital for Special Surgery, New York, NY

Background: Although pseudotumors have been reported at the sites of well-functioning and painful metal-on-metal hip prostheses, there are no objective data on the magnitude of the adverse reaction. This observational study was performed to investigate the ability of modified magnetic resonance imaging (MRI) to detect and quantify adverse synovial responses in symptomatic and asymptomatic subjects following metal-on-metal hip resurfacing. We hypothesized that the magnitude of the synovial reactions would be greater in symptomatic patients.

Methods: Sixty-nine patients (seventy-four hips) with hip resurfacing were divided into three groups: asymptomatic (twenty-two hips), symptomatic with a mechanical cause (twenty), and unexplained pain (thirty-two). The volume of synovitis was calculated on MRI for all patients.

Results: Synovitis was detected in fifteen asymptomatic hips (68%), fifteen (75%) with symptoms with a mechanical causes, and twenty-five (78%) with unexplained pain. The mean volume (and standard deviation) of the synovitis in these groups was 5 ± 7 cm^3, 10 ± 16 cm^3, and 31 ± 47 cm^3, respectively. The coefficient of repeatability between the examiners was 1.8 cm^3 for measurement of synovitis. Of the thirteen subjects with revision arthroplasty, six had an adverse local tissue reaction. This subgroup had the highest volumes of synovitis on MRI.

Conclusions: An adverse synovial reaction was detected on MRI in both symptomatic and asymptomatic subjects. We found a larger volume of synovitis in symptomatic patients; this increase reached significance only in the group with an adverse local tissue reaction. Synovial volume on MRI may be a valuable marker in the longitudinal assessment of asymptomatic patients with a metal-on-metal hip resurfacing and in identifying patients with adverse local tissue reaction.

Level of Evidence: Diagnostic Level III. See Instructions for Authors for a complete description of levels of evidence.

Metal-on-metal hip resurfacing arthroplasty is associated with failures attributed to adverse local tissue reactions[1]. Patients with adverse local tissue reaction present with periprosthetic fluid collections, which have been termed "pseudotumors"[2,3] and typically are not detectable on radiographs or computed tomography. Patients with adverse local tissue reaction may present a challenge as a result of tissue necrosis at revision surgery[4] and poor outcomes following revision[5].

Magnetic resonance imaging (MRI) is ideally suited for evaluation of patients with metal-on-metal hip resurfacing arthroplasty because of its high soft-tissue contrast and lack of ionizing radiation. MRI is the most accurate method for detecting and quantifying osteolysis and wear-induced synovitis in patients with metal-on-polyethylene implants, which typically have less artefact than metal-on-metal implants[6-9]. More recently, prototype pulse sequences have shown marked reduction in artefact and improved assessment[9,10].

Disclosure: One or more of the authors received payments or services, either directly or indirectly (i.e., via his or her institution), from a third party in support of an aspect of this work. In addition, one or more of the authors, or his or her institution, has had a financial relationship, in the thirty-six months prior to submission of this work, with an entity in the biomedical arena that could be perceived to influence or have the potential to influence what is written in this work. No author has had any other relationships, or has engaged in any other activities, that could be perceived to influence or have the potential to influence what is written in this work. The complete **Disclosures of Potential Conflicts of Interest** submitted by authors are always provided with the online version of the article.

Previous investigators have used MRI to report the presence of pseudotumors around hip resurfacing components[3,11-15]. Because of the absence of quantitative data, it remains unclear whether there is a difference in the magnitude of synovial reaction between symptomatic and asymptomatic individuals. Therefore, MRI showing an abnormal synovial reaction has limited utility for a surgeon attempting to decide whether to proceed with revision in an asymptomatic patient. The purpose of this observational, cross-sectional study was to investigate the ability of MRI to detect and reproducibly quantify adverse synovial reactions in symptomatic and asymptomatic subjects following metal-on-metal hip resurfacing. We hypothesized that the magnitude of the synovial reactions would be greater in symptomatic patients.

Materials and Methods

Subject Cohort

The first sixty-nine consecutive subjects (seventy-four hips) referred from three surgical practices to a tertiary referral center for MRI after a metal-on-metal hip resurfacing arthroplasty were included in this cross-sectional study. All methods were approved by the local institutional review board, and informed consent was obtained from subjects before enrollment in the study. Demographic data, including age, sex, body-mass index (BMI), and length of time since the arthroplasty, were collected.

Diagnostic Categories

Subjects were divided into three groups: asymptomatic, symptomatic with a mechanical cause, and unexplained pain. These groups were adopted on the basis of categories used by the National Joint Registry of England and Wales[16]. The asymptomatic cohort of subjects consisted of volunteers who had no pain or other symptoms referable to the resurfaced hip. The mechanical cause cohort presented with pain attributed to aseptic implant loosening (confirmed intraoperatively by gross movement of the implant on manual testing), dislocation, periprosthetic fracture, or component malposition. The cohort with unexplained pain presented with pain that was not attributed to the causes listed for the mechanical cause group.

Implant Types

The Birmingham Hip Resurfacing system (Smith & Nephew, Memphis, Tennessee) was used in sixty-two hips (84%); the Conserve Plus system (Wright Medical, Arlington, Tennessee), in seven (9%); the ReCap Acetabular cup (Biomet Orthopedics, Warsaw, Indiana), in three (4%); and the Cormet Hip Resurfacing system (Stryker Orthopedics, Kalamazoo, Michigan), in two (3%).

The serum cobalt (Co) and chromium (Cr) ion levels measured closest to the date of the MRI were recorded when available. All three surgeons participating in this study tested all of their patients with metal-on-metal implants for Co and Cr levels at routine annual follow-up visits. The patients in this study had the index surgery from 2006 to 2010, but monitoring of metal ion levels was not initiated until 2009. As a result, ion levels were not available for three patients in the asymptomatic group, seven patients in the mechanical cause group, and seven patients in the unexplained-pain group. All serum analyses were performed by the same pathology laboratory using high-resolution inductively coupled mass spectrometry.

MRI Acquisition

All subjects underwent MRI with use of standard clinical protocols optimized to minimize metallic susceptibility artefact[17] (Fig. 1). Scanning was performed with 1.5-T clinical scanners (GE Healthcare, Waukesha, Wisconsin) with use of a three-element shoulder coil (MedRad, Indianola, Pennsylvania) or an eight-channel cardiac coil (GE Healthcare). The specific pulse sequence parameters are noted in the Appendix.

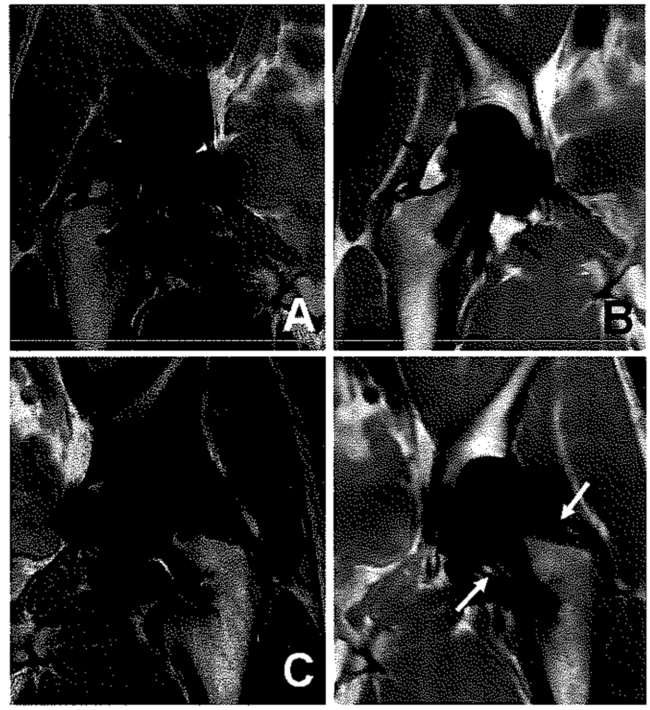


Fig. 1

Coronal fast-spin-echo images of the right (A) and left (C) hips in an asymptomatic subject who underwent bilateral metal-on-metal hip resurfacing arthroplasty. Note the susceptibility artefact generated by the cobalt-chromium prostheses, which obscures visualization of the synovium. On the MAVRIC SL image of the right hip (B), synovitis is evident with fluid-signal-intensity expansion of the pseudocapsule (black arrows). On the MAVRIC SL image of the left hip (D), there is no synovitis and the pseudocapsule (white arrows) is closely applied to the femoral neck.

MRI Analysis

MRIs were evaluated by two musculoskeletal radiologists (H.G.P. and C.L.H.) via consensus; both were blinded to the patient group and the radiographs. One was a senior musculoskeletal radiologist with more than ten years of experience; the other was a musculoskeletal radiologist with eighteen months of experience. Images were assessed for synovitis, osteolysis, neurovascular compression, femoral neck erosion, bone resorption around the femoral stem, and fibrous membrane formation.

The volumes of synovitis and osteolysis were calculated from the axial fast spin-echo images or coronal MAVRIC SL (multi-acquisition variable-resonance image combination) images with use of a previously validated manual segmentation method[4,6]. Synovitis was defined as fluid signal intensity or solid-appearing material within, or directly communicating with, the pseudocapsule of the hip. Osteolysis was defined as well-demarcated intermediate-signal-intensity material replacing the normal high-signal-intensity intramedullary fat. The area of synovitis or osteolysis was calculated on each slice; the sum of the areas was multiplied by the slice thickness to obtain a volume. All volume measurements were performed by one musculoskeletal radiologist (H.G.P.). In three-quarters of the subjects, measurements were performed by a second musculoskeletal radiologist (C.L.H.) to allow assessment of interobserver reliability.

Radiographic Analysis

Anteroposterior radiographs of the pelvis obtained at the time of MRI were evaluated by one orthopaedic surgeon (D.H.N.). The reader was blinded to the patient group as well as the MRI results. Assessment of acetabular component

TABLE I Demographic Data, Radiographic Measurements, and Serum Ion Levels in Asymptomatic, Mechanical Cause, and Unexplained-Pain Groups

	Group		
	Asymptomatic (N = 22)	Mechanical Cause (N = 20)	Unexplained Pain (N = 32)
Demographics			
Age* *(yr)*	49.0 ± 8.8 (45.1 to 52.9)	52.0 ± 9.3 (47.6 to 56.3)	51.7 ± 7.8 (48.9 to 54.5)
Sex (M:F) *(no.)*	14:8	12:8	11:21
% Female†	36% (17% to 59%)	40% (19% to 64%)	66% (47% to 81%)
BMI* *(kg/m²)*	27.3 ± 4.4 (25.3 to 29.4)	24.6 ± 3.8 (22.8 to 26.3)	26.8 ± 6.6 (24.2 to 29.4)
Follow-up interval* *(mo)*	27.4 ± 19.0 (18.9 to 35.8)	24.1 ± 14.2 (17.4 to 30.7)	24.4 ± 18.4 (17.7 to 31.0)
Harris hip score			
≥80:<80 *(no.)*	19:0	14:6	16:9
% <80†	0% (0% to 18%)	30% (12% to 54%)	36% (18% to 57%)
Radiographic measurements			
Inclination* *(deg)*	44.9 ± 7.0 (41.8 to 48.0)	47.0 ± 5.8 (44.2 to 49.8)	47.2 ± 7.2 (44.5 to 49.8)
Anteversion* *(deg)*	13.0 ± 4.3 (11.1 to 14.9)	14.1 ± 5.3 (11.6 to 16.7)	15.8 ± 7.2 (13.9 to 17.7)
Safe:non-safe‡ *(no.)*	15:7	16:3	19:11
% Safe†	68% (45% to 85%)	84% (60% to 96%)	63% (44% to 79%)
Serum ion levels* *(µg/L)*			
Chromium	3.7 ± 2.8 (2.5 to 4.9)	2.9 ± 1.9 (1.8 to 4.1)	18.6 ± 34.3 (4.4 to 32.7)
Cobalt	2.0 ± 0.7 (1.7 to 2.3)	2.3 ± 1.7 (1.3 to 3.3)	20.3 ± 39.4 (4.1 to 36.6)

*The values are expressed as the mean and standard deviation with the 95% confidence interval in parentheses. †The 95% confidence interval is given in parentheses. ‡Safe and non-safe acetabular component positioning as defined by Lewinnek et al.[19].

position was carried out with use of Einzel-Bild-Roentgen-Analysis (EBRA) software (University of Innsbruck, Innsbruck, Austria)[18]. Acetabular component position was classified as "safe" or "non-safe," as defined by Lewinnek et al.[19], with use of an inclination angle of 40° ± 10° and anteversion angle of 15° ± 10° as the thresholds.

Operative and Histological Analysis

At the time of the study, thirteen subjects (seven female and six male) had undergone revision to total hip arthroplasty; five were in the mechanical cause group and eight were in the unexplained-pain group. An additional six subjects were scheduled for revision at the time of writing. Infection was excluded in all cases by aspiration, intraoperative frozen sections, and culture of specimens obtained at the revision.

The operative notes and intraoperative photographs were reviewed by the treating surgeon (E.P.S.). The presence of gross soft-tissue necrosis, osteolysis, and gray "metallic" staining of tissue was recorded, as were other complications including fracture, implant loosening, and implant impingement.

TABLE II MRI Findings in Asymptomatic, Mechanical Cause, and Unexplained-Pain Groups

	Group		
MRI Finding	Asymptomatic (N = 22)	Mechanical Cause (N = 20)	Unexplained Pain (N = 32)
Osteolysis			
No. of subjects	0	2 (10%)	4 (13%)
Volume* *(cm³)*		0.6 ± 0.5 (0 to 1.4)	21.3 ± 22.9 (0 to 43.8)
Synovitis			
No. of subjects	15 (68%)	15 (75%)	25 (78%)
Volume* *(cm³)*	5.0 ± 6.9 (1.2 to 8.7)	10.2 ± 15.9 (1.4 to 19.4)	31.0 ± 47.3 (11.5 to 50.5)
Extracapsular disease			
No. of subjects	0	0	3 (9%)
Volume* *(cm³)*			25.0 ± 33.8 (0 to 63.3)

*The values are expressed as the mean (of the volumes in the subjects with osteolysis, synovitis, or extracapsular disease) and standard deviation with the 95% confidence interval in parentheses.

TABLE III Demographic, Radiographic, MRI, Operative, and Histological Findings in Subjects with Revision Surgery ➤

						Volume on MRI *(cm³)*		
Subject	Group	Sex	Age *(yr)*	Duration of Implantation *(mo)*	Acetab. Comp. Position*	Synovitis	Osteolysis	Extracapsular Disease
1	Unexplained pain	F	47	13	Non-safe	1.1		
2	Unexplained pain	F	51	30	Non-safe	50.1		
3	Unexplained pain	F	63	40	Safe	13.8	16.5	
4	Unexplained pain	F	60	33	Non-safe	65.5		63.8
5	Unexplained pain	M	61	12	Safe	0.6		
6	Unexplained pain	M	56	64	Non-safe	129.7		
7	Unexplained pain	F	55	11	Safe	0.0		
8	Unexplained pain	F	51	27	Non-safe	57.8		
9	Mechanical cause	M	46	17	Safe	0.0		
10	Mechanical cause	M	65	12.0	Safe	1.6		
11	Mechanical cause	M	29	18.0	Safe	20.0		
12	Mechanical cause	F	59	16.0	Safe	0.4		
13	Mechanical cause	M	50	61.0	Non-safe	0.0		

*Safe and non-safe acetabular component positioning as defined by Lewinnek et al.[19]. †As defined by Campbell et al.[20].

The histological characteristics of the tissue obtained from subjects who had undergone revision surgery were analyzed by one musculoskeletal pathologist (G.P.). All tissue excised at surgery was submitted for histological examination, serially cut, and extensively sampled to obtain maximum information. Tissue was routinely processed, cut, and stained with hematoxylin and eosin (H & E). Histological sections were examined with light microscopy without knowledge of the MRI findings. Sections were evaluated for the presence of fibrinous exudate, necrosis, metallic debris, and corrosion products. The status of the synovial lining, presence of an inflammatory infiltrate, and tissue organization were scored with use of the aseptic lymphocyte-dominated vasculitis-associated lesion (ALVAL) score described by Campbell et al.[20].

A final diagnosis for each subject was agreed on by the treating surgeon (E.P.S.) and pathologist (G.P.), and the subjects were classified into two groups. Group 1 consisted of subjects with a final diagnosis of adverse local tissue reaction. This group included subjects with "moderate" or "severe" ALVAL (an ALVAL score of ≥5), with or without metallic debris[1]. Group 2 consisted of subjects without histological features of an adverse local tissue reaction.

Statistical Methods

Descriptive statistics were generated for the subjects in each of the groups. A Kruskal-Wallis test was performed to detect differences between continuous variables, and post-hoc comparisons were performed when significance was found.

Chi-square tests of association (2 × 3 contingency tables) were performed to compare the ratio of patients with a safe acetabular component position to those with a non-safe position and the ratio of males to females among the groups and to detect differences in the proportions of individuals with osteolysis, synovitis, and extracapsular disease.

The Wilcoxon rank-sum test was performed for the thirteen subjects who had undergone revision surgery to detect differences in age, duration of implantation, synovial volume, and serum ion levels between individuals with and those without adverse local tissue reaction. Chi-square tests (2 × 2 contingency tables) were performed to evaluate proportions of adverse local tissue reaction by sex and by acetabular component position.

Significance was set at $p < 0.05$. Interclass correlation coefficients and coefficients of repeatability[21] were calculated for the two examiners with regard to their measurements of synovitis and osteolysis volume.

Source of Funding

GE Healthcare provided funding for the scanning of asymptomatic subjects. The fellowship training for one of the authors (D.H.N.) was supported by the British Hip Society Charnley Latta Fund and the Norman Capener Award.

Results

Seventy-four hips with a metal-on-metal resurfacing were scanned in sixty-nine subjects (thirty-four male and thirty-five female). There were twenty-two hips (eighteen subjects) in the asymptomatic group, twenty hips (twenty subjects) in the mechanical cause group, and thirty-two hips (thirty-one subjects) in the unexplained-pain group. The three groups were similar with respect to age, BMI, and duration of implantation (Table I). There was a higher proportion of females in the unexplained-pain group (66%, 95% confidence interval [CI]: 47% to 81%) compared with the asymptomatic (36%, 95% CI: 17% to 59%) and mechanical cause (40%, 95% CI: 19% to 64%) groups.

Radiographs of the pelvis were evaluated for twenty-two asymptomatic hips, nineteen symptomatic hips with a mechanical cause, and thirty hips with unexplained pain. Radiographs that were of inadequate quality for determination of cup with orientation with EBRA (eleven of the seventy-four hips) were excluded. The acetabular inclination was similar among the three groups (Table I). Anteversion angles tended to be higher in the unexplained-pain group.

Serum chromium and cobalt levels were available for nineteen asymptomatic hips, thirteen symptomatic hips with a mechanical cause, and twenty-five hips with unexplained pain (Table I).

TABLE III (*continued*)

Op. Findings				
Soft-Tissue Necrosis	"Metallic" Staining of Soft Tissues	Other	ALVAL Score†	Final Diagnosis
			6 (2+3+1)	ALVAL
Yes			7 (2+3+2)	ALVAL
Yes		Osteolysis, pathologic fracture	10 (3+4+3)	ALVAL
Yes	Yes		10 (3+4+3)	ALVAL + metallic debris
			3 (0+2+1)	Metal hypersensitivity
	Yes		4 (1+2+1)	Metallosis
			3 (0+2+1)	Metal hypersensitivity
	Yes		6 (2+3+1)	ALVAL + metallic debris
		Impingement, loose head	1 (0+1+0)	Impingement and loose head
		Component malalignment	*	Component malalignment
		Loose cup	3 (1+1+1)	Loose cup
		Loose cup	3 (1+1+1)	Loose cup
			3 (1+1+1)	Unexplained, ongoing pain

MRI Findings

Osteolysis was detected in two (10%) of the symptomatic hips with a mechanical cause (mean volume [and standard deviation]: 0.6 ± 0.5 cm^3, 95% CI: 0 to 1.4 cm^3) and four (13%) of those with unexplained pain (mean volume: 21.3 ± 22.9 cm^3, 95% CI: 0 to 43.8 cm^3). Osteolysis was not detected in any of the asymptomatic hips (Table II).

Synovitis was detected in fifteen (68%) of the asymptomatic hips, fifteen (75%) of the symptomatic hips with a mechanical cause, and twenty-five (78%) of the hips with unexplained pain. The mean volume of synovitis was 5.0 ± 6.9 cm^3 (95% CI: 1.2 to 8.7 cm^3) in the asymptomatic group, 10.2 ± 15.9 cm^3 (95% CI: 1.4 to 19.4 cm^3) in the mechanical cause group, and 31.0 ± 47.3 cm^3 (95% CI: 11.5 to 50.5 cm^3) in the unexplained-pain group (Fig. 2). Extracapsular disease was present in three (9%) of the hips with unexplained pain, with a mean volume of 25.0 ± 33.8 cm^3 (95% CI: 0 to 63.3 cm^3). There were no cases of extracapsular disease in the asymptomatic or mechanical cause group.

The coefficient of repeatability between the two examiners was 0.3 cm^3 for osteolysis and 1.8 cm^3 for synovitis. The interclass correlation coefficient was 0.99 for osteolysis and 0.97 for synovitis.

Histological Analysis

The histological findings in the subjects who underwent revision surgery are outlined in the Appendix. The operative findings, ALVAL scores, and final diagnoses for those subjects are shown in Table III.

In the subset of thirteen subjects who underwent revision surgery, the volume of synovitis on MRI was higher in those with adverse local tissue reaction (53.0 ± 45.4 cm^3, 95% CI: 5.3 to 100.6 cm^3) than it was in those without adverse local tissue reaction (5.6 ± 9.6 cm^3, 95% CI: 0 to 20.9 cm^3) (see Appendix). Osteolysis and extracapsular disease were seen only in subjects with adverse local tissue reaction (Figs. 3 and 4; Table III).

There was only a small difference (5%) in subject age between the group with adverse local tissue reaction and the group without adverse local tissue reaction, but the proportion of females in the group with adverse local tissue reaction (83%, 95% CI: 36% to 99%) was higher than that in the group without one (29%, 95% CI: 4% to 71%). The duration of implantation tended to be longer in the group with adverse local tissue reaction, and a higher proportion of the patients in that group had an implant in the non-safe zone (p = 0.03). Subjects with adverse local tissue reaction had higher levels of serum cobalt and chromium (see Appendix).

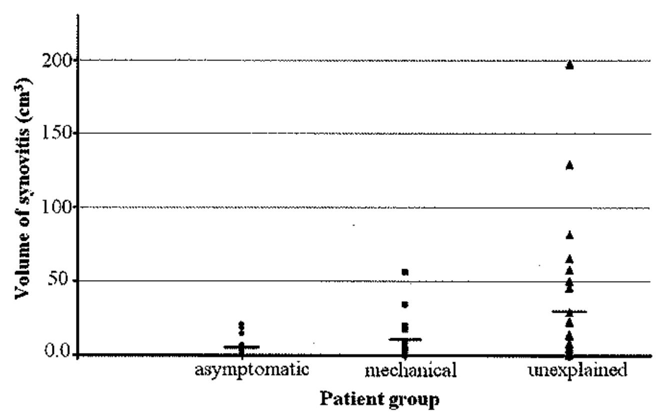


Fig. 2

Box-and-whisker plot of synovial volume (cm^3) on MRI versus subject group. The horizontal lines represent the mean volume of synovitis (cm^3).

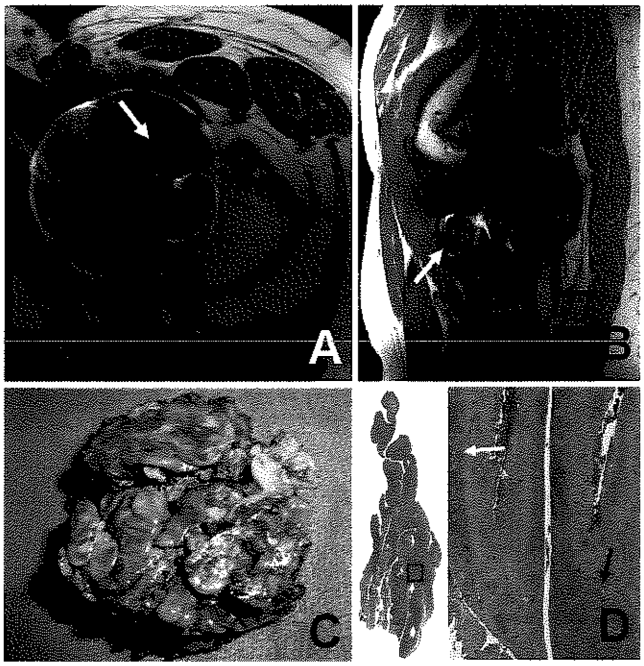


Fig. 3

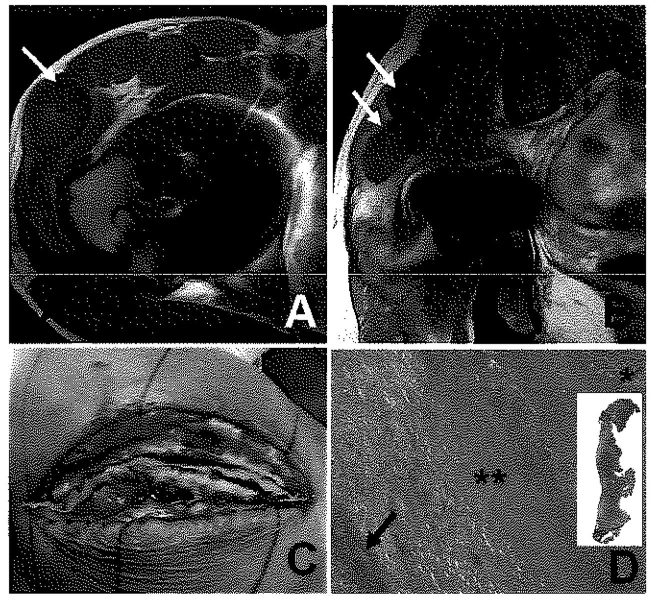


Fig. 4

Fig. 3 Axial (A) and sagittal (B) fast-spin-echo images of a fifty-one-year-old woman demonstrate synovitis with fluid signal intensity decompressing into the trochanteric bursa (black arrows). There is solid-appearing papillary material in the anterior aspect of the joint (white arrows). The gross specimen (C) demonstrates thickened papillary synovium with gray "metallic" staining. The whole-mount histological preparation (D, left) shows a papillary synovium, correlating with the gross specimen and MRI findings (H & E). The high-power (100×) image (D, right) shows a mixed lymphocytic (white arrow) and histiocytic (black arrow) infiltrate. The final diagnosis was ALVAL (a score of 6) with metallic debris. **Fig. 4** Axial (A) and coronal (B) fast-spin-echo images of a sixty-year-old woman demonstrate synovitis decompressing from the hip into the trochanteric bursa (black arrows). Low-signal-intensity material is seen in the abductor musculature (white arrows). The intraoperative photograph (C) demonstrates turbid, grayish-white fluid in the deep tissues of the hip joint, after division of the tensor fasciae latae distally and the fascia overlying the gluteus maximus proximally. This corresponded to the low-signal-intensity material seen on the MRI. The corresponding whole-mount histological preparation (D, inset) shows a thickened synovium (H & E). At higher power (40×), there is stratification of the synovial lining with an inner layer of fibrin (*), a middle later of necrotic/infarcted tissue (**), and an outer layer composed of an inflammatory cell infiltrate (arrow). The final diagnosis was ALVAL (a score of 10) with metallic debris.

Discussion

The purpose of this study was to evaluate the ability of MRI to detect and quantify adverse synovial reactions in asymptomatic and symptomatic subjects following metal-on-metal hip resurfacing arthroplasty. The improved depiction of synovitis with the use of the MAVRIC SL technique allowed us to detect small volumes of synovitis that would have previously been undetectable because of susceptibility artefact[9]. To our knowledge, this is the first study to quantify synovial reactions around metal-on-metal hip implants. The two examiners in our study were able to measure the volume of synovitis with a coefficient of repeatability of 1.8 cm^3 and an interclass correlation coefficient of 0.97. They detected synovitis in a similar proportion of subjects in the asymptomatic, mechanical cause, and unexplained-pain groups. Osteolysis was uncommon after a mean duration of follow-up of twenty-four to twenty-seven months, a finding that corresponded to the fact that metal-on-metal bearings have lower volumetric wear and resultant osteolysis than conventional metal-on-polyethylene articulations[22]. We observed synovial expansion in nearly three-quarters of the asymptomatic subjects, suggesting that mild synovitis is common and does not result in functional impairment. Our results parallel the findings of MRI studies of ceramic-on-ceramic and metal-on-polyethylene total hip arthroplasties, which have demonstrated synovitis in up to 39% of asymptomatic subjects[23]. Similarly, in an MRI study of twelve asymptomatic subjects with metal-on-metal total hip arthroplasty, synovitis was observed in seven[24].

The mean volume of synovitis tended to be higher in the unexplained-pain group than in the mechanical cause and asymptomatic groups, but this difference was not significant. Eight of the patients in the unexplained-pain group had revision surgery, and an adverse local tissue reaction was confirmed with histological analysis in six of them. Observational MRI studies of hip resurfacing have demonstrated findings of periprosthetic fluid collections or soft-tissue masses, many of which correlated with adverse local tissue reaction on histological analysis of specimens obtained at revision surgery[12-14]. This may explain the higher volumes of synovitis detected on MRI in the unexplained-pain group. There may be two reasons for the lack of a significant difference in the volume of synovitis in our study. First, the numbers of patients in this study were relatively small. Second, there are individuals who clearly exhibit a more aggressive and rapid adverse synovial reaction that may, in part, be genetically mediated[25]. These patients may have accounted for the large standard deviations and outliers in the unexplained-pain group (Fig. 2).

The long-term clinical relevance of high volumes of synovitis in asymptomatic patients remains uncertain. In an ultrasound study of 201 hips in 158 asymptomatic subjects, "pseudotumors" were seen in seven subjects[2]. Previous MRI studies have demonstrated the presence of "pseudotumors" in the contralateral asymptomatic hip following bilateral metal-on-metal resurfacing arthroplasty[3,12]. Therefore, a finding of synovitis on MRI may indicate adverse local tissue reaction despite the absence of clinical symptoms. We are not aware of any longitudinal data in the literature to indicate whether or not asymptomatic patients with synovitis are at a higher risk for implant failure. Thirteen of our sixty-nine subjects underwent revision surgery, and an additional six were awaiting revision at the time of writing. This represents a relatively high revision rate in our cohort. However, it must be noted that all of the patients in this study were seen in a specialist tertiary referral unit and the revision rate may not be representative of that in a single-surgeon community practice. Of the thirteen subjects who underwent revision surgery, the six with adverse local tissue reaction had significantly higher volumes of synovitis on MRI compared with the subjects without such a reaction. The subjects with adverse local tissue reaction were also significantly more likely to have higher metal ion levels, to be female, and to have an implant in the non-safe zone described by Lewinnek et al.[19]. This confirms the results of prior studies, which have demonstrated a higher risk of adverse local tissue reaction[4] and a higher incidence of pseudotumors[3,26] in females and in hips with a high acetabular inclination angle.

The sex distributions were not similar across the groups, and this was a limitation of our study. As a result of the consecutive nature of enrollment, the proportion of female subjects was higher in the unexplained-pain group, which may have affected our results. In general, however, the three groups were similar with respect to patient demographics.

The results of this study confirm the ability of modified MRI to detect and reproducibly quantify adverse synovial reactions in patients with metal-on-metal hip resurfacing. We found a greater synovial volume in symptomatic patients, but the increase reached significance only in cases of adverse local tissue reaction. Synovial volume on MRI may prove to be a valuable marker in the surveillance of patients with metal-on-metal hip resurfacing and help detect cases of adverse local tissue reaction before the onset of symptoms. Further longitudinal assessment with MRI of asymptomatic subjects is required to indicate the predictive value of a specific synovial volume threshold beyond which revision surgery should be considered.

Appendix

eA Tables showing the parameters of the MRI as well as the histological findings and results of subset analysis of subjects with revision surgery are available with the online version of this article as a data supplement at jbjs.org. ■

NOTE: The authors acknowledge Parina Shah, MS, Friedrich Boettner, MD, David Mayman, MD, and Stephen Lyman, PhD, for their contributions to the study.

Danyal H. Nawabi, MD, FRCS(Orth)
Catherine L. Hayter, MBBS, FRANZCR
Edwin P. Su, MD
Matthew F. Koff, PhD
Giorgio Perino, MD
Stephanie L. Gold, BA
Hollis G. Potter, MD
Adult Reconstruction and Joint Replacement Division (D.H.N.),
Department of Radiology and Imaging (C.L.H., M.F.K., S.L.G., and H.G.P.), Center for Hip Pain and Preservation (E.P.S.), and
Department of Pathology and Laboratory Medicine (G.P.),
Hospital for Special Surgery,
535 East 70th Street,
New York, NY 10021.
E-mail address for H.G. Potter: potterh@hss.edu

Kevin M. Koch, PhD
Applied Science Laboratory,
General Electric Healthcare,
3200 North Grandview Boulevard,
Waukesha, WI 53188

References

1. Amstutz HC, Le Duff MJ, Campbell PA, Wisk LE, Takamura KM. Complications after metal-on-metal hip resurfacing arthroplasty [viii.]. Orthop Clin North Am. 2011 Apr;42(2):207-30: viii.

2. Kwon YM, Ostlere SJ, McLardy-Smith P, Athanasou NA, Gill HS, Murray DW. "Asymptomatic" pseudotumors after metal-on-metal hip resurfacing arthroplasty: prevalence and metal ion study. J Arthroplasty. 2011 Jun;26(4):511-8.

3. Pandit H, Glyn-Jones S, McLardy-Smith P, Gundle R, Whitwell D, Gibbons CL, Ostlere S, Athanasou N, Gill HS, Murray DW. Pseudotumours associated with metal-on-metal hip resurfacings. J Bone Joint Surg Br. 2008 Jul;90(7):847-51.

4. Ollivere B, Darrah C, Barker T, Nolan J, Porteous MJ. Early clinical failure of the Birmingham metal-on-metal hip resurfacing is associated with metallosis and soft-tissue necrosis. J Bone Joint Surg Br. 2009 Aug;91(8):1025-30.

5. Grammatopolous G, Pandit H, Kwon YM, Gundle R, McLardy-Smith P, Beard DJ, Murray DW, Gill HS. Hip resurfacings revised for inflammatory pseudotumour have a poor outcome. J Bone Joint Surg Br. 2009 Aug;91(8):1019-24.

6. Potter HG, Nestor BJ, Sofka CM, Ho ST, Peters LE, Salvati EA. Magnetic resonance imaging after total hip arthroplasty: evaluation of periprosthetic soft tissue. J Bone Joint Surg Am. 2004 Sep;86(9):1947-54.

7. Walde TA, Weiland DE, Leung SB, Kitamura N, Sychterz CJ, Engh CA Jr, Claus AM, Potter HG, Engh CA Sr. Comparison of CT, MRI, and radiographs in assessing pelvic osteolysis: a cadaveric study. Clin Orthop Relat Res. 2005 Aug;(437):138-44.

8. Weiland DE, Walde TA, Leung SB, Sychterz CJ, Ho S, Engh CA, Potter HG. Magnetic resonance imaging in the evaluation of periprosthetic acetabular osteolysis: a cadaveric study. J Orthop Res. 2005 Jul;23(4):713-9.

9. Hayter CL, Koff MF, Shah P, Koch KM, Miller TT, Potter HG. MRI after arthroplasty: comparison of MAVRIC and conventional fast spin-echo techniques. AJR Am J Roentgenol. 2011 Sep;197(3):W405-11.

10. Koch KM, Lorbiecki JE, Hinks RS, King KF. A multispectral three-dimensional acquisition technique for imaging near metal implants. Magn Reson Med. 2009 Feb;61(2):381-90.

11. Toms AP, Marshall TJ, Cahir J, Darrah C, Nolan J, Donell ST, Barker T, Tucker JK. MRI of early symptomatic metal-on-metal total hip arthroplasty: a retrospective review of radiological findings in 20 hips. Clin Radiol. 2008 Jan;63(1):49-58.

12. Fang CS, Harvie P, Gibbons CL, Whitwell D, Athanasou NA, Ostlere S. The imaging spectrum of peri-articular inflammatory masses following metal-on-metal hip resurfacing. Skeletal Radiol. 2008 Aug;37(8):715-22.

13. Hart AJ, Sabah S, Henckel J, Lewis A, Cobb J, Sampson B, Mitchell A, Skinner JA. The painful metal-on-metal hip resurfacing. J Bone Joint Surg Br. 2009 Jun;91(6):738-44.

14. Toms AP, Nolan J, Barker T, Darrah C, Malcolm P. Early failure of a Birmingham resurfacing hip replacement with lymphoreticular spread of metal debris: pre-operative diagnosis with MR. Br J Radiol. 2009 May;82(977):e87-91.

15. Sabah SA, Mitchell AW, Henckel J, Sandison A, Skinner JA, Hart AJ. Magnetic resonance imaging findings in painful metal-on-metal hips: a prospective study. J Arthroplasty. 2011 Jan;26(1):71-6: e1-2.

16. National Joint Registry for England and Wales: 6th Annual Report. 2009. http://www.njrcentre.org.uk/NjrCentre/Portals/0/Sixth%20annual%20NJR%20report.pdf. Accessed 2012 Dec 12.

17. Potter HG, Foo LF. Magnetic resonance imaging of joint arthroplasty [vi-vii.]. Orthop Clin North Am. 2006 Jul;37(3):361-73:vi-vii.

18. Langton DJ, Sprowson AP, Mahadeva D, Bhatnagar S, Holland JP, Nargol AV. Cup anteversion in hip resurfacing: validation of EBRA and the presentation of a simple clinical grading system. J Arthroplasty. 2010 Jun;25(4):607-13.

19. Lewinnek GE, Lewis JL, Tarr R, Compere CL, Zimmerman JR. Dislocations after total hip-replacement arthroplasties. J Bone Joint Surg Am. 1978 Mar;60(2):217-20.

20. Campbell P, Ebramzadeh E, Nelson S, Takamura K, De Smet K, Amstutz HC. Histological features of pseudotumor-like tissues from metal-on-metal hips. Clin Orthop Relat Res. 2010 Sep;468(9):2321-7.

21. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. Lancet. 1986 Feb 8;1(8476):307-10.

22. Callaghan JJ, Cuckler JM, Huddleston JI, Galante JO; Implant Wear Symposium 2007 Clinical Work Group. How have alternative bearings (such as metal-on-metal, highly cross-linked polyethylene, and ceramic-on-ceramic) affected the prevention and treatment of osteolysis? J Am Acad Orthop Surg. 2008;16(Suppl 1):S33-8.

23. Cooper HJ, Ranawat AS, Potter HG, Foo LF, Koob TW, Ranawat CS. Early reactive synovitis and osteolysis after total hip arthroplasty. Clin Orthop Relat Res. 2010 Dec;468(12):3278-85.

24. Mistry A, Cahir J, Donell ST, Nolan J, Toms AP. MRI of asymptomatic patients with metal-on-metal and polyethylene-on-metal total hip arthroplasties. Clin Radiol. 2011 Jun;66(6):540-5.

25. Malik MH, Jury F, Bayat A, Ollier WE, Kay PR. Genetic susceptibility to total hip arthroplasty failure: a preliminary study on the influence of matrix metalloproteinase 1, interleukin 6 polymorphisms and vitamin D receptor. Ann Rheum Dis. 2007 Aug;66(8):1116-20.

26. Smith SL, Dowson D, Goldsmith AA. The effect of femoral head diameter upon lubrication and wear of metal-on-metal total hip replacements. Proc Inst Mech Eng H. 2001;215(2):161-70.

Business Wire
A Berkshire Hathaway Company

May 15, 2013 01:30 PM Eastern Daylight Time

GE Healthcare Unveils Exclusive Imaging Technology for Joint Replacements and Implanted Devices

Breakthrough Technology Addresses Growing Clinical Need for Imaging Soft Tissue around Metal Implants

WAUKESHA, Wisc.--(BUSINESS WIRE)--At an event held today at Hospital for Special Surgery, GE Healthcare (NYSE: GE) introduced MAVRIC SL, a novel magnetic resonance (MR) imaging technique designed to address the growing clinical need to more accurately image soft tissue and bone in patients with MR Conditional-labeled implants, such as joint replacements and other instrumentation. According to a Hospital for Special Surgery study published today in *The Journal of Bone & Joint Surgery*, MR imaging can detect inflammation of the joint lining (synovitis) in patients with metal-on-metal hip implants long before symptoms appear, allowing for a more conclusive diagnosis and effective planning for follow-up care.

There are more than 1 million hip or knee replacement (arthroplasty) procedures performed each year in the U.S.[1] and more than 250,000 procedures are performed in Europe annually.[2] The need for arthroplasty revision procedures (a second surgery to correct the failure of an artificial joint) is accelerating significantly due to the increased frequency of joint replacements and the younger ages at which they are being performed. It is estimated that by 2030, the number of revision procedures will increase by 137 percent for hips and 601 percent for knees from 2005.[3]

"The addition of MAVRIC SL to a standardized MR protocol is instrumental in providing accurate, reproducible diagnosis of adverse tissue reactions around implants"

Patients with complications from joint replacement surgeries may present with pain and/or altered gait mechanics, or may have no symptoms at all. Prior to the availability of MAVRIC SL, achieving quality diagnostic MR images of the anatomy near implants was often not possible due to image distortion caused by metal used in implanted devices. MAVRIC SL reduces image distortion in the regions near MR Conditional metal implants, enabling physicians to see tissue surrounding an implant to help them with diagnosis and defining a course of treatment. In some cases, MAVRIC SL can reduce the need for biopsy or exploratory surgery.

"The addition of MAVRIC SL to a standardized MR protocol is instrumental in providing accurate, reproducible diagnosis of adverse tissue reactions around implants," said Dr. Hollis Potter, Chief of MR Imaging at Hospital for Special Surgery in New York and a lead member of the development team. "Even in asymptomatic patients, the MAVRIC SL technology can recognize an issue that needs to be monitored, providing valuable clinical information for an issue that can have significant human and economic costs, particularly when diagnosis is delayed."

According to data published by Hospital for Special Surgery today, patients may be experiencing tissue damage from metal-on-metal hip implants before pain symptoms appear. MR imaging was able to detect inflammation in both symptomatic and asymptomatic patients, helping to identify those patients who may need revision surgery before the surrounding tissue sustains further damage that makes revision more difficult. The study findings also underscore that commonly-used markers for tissue damage are insufficient in their ability to accurately identify those patients who may require revision surgery.[4]

"The development of the MAVRIC protocol has given us a window into the local tissue response to implants and a better understanding of the underlying cause of patients' pain and poor function," said Mathias P. Bostrom, MD, Attending Orthopedic Surgeon, Hospital for Special Surgery. "It is well established that there is more morbidity associated with revision in the setting of severe tissue loss, and MAVRIC SL positions clinicians to provide an early and accurate diagnosis."

MAVRIC SL was developed as an innovative solution to a major clinical problem, uncovered as a result of a collaborative effort between GE, Hospital for Special Surgery and Stanford University. It is one of the latest offerings in GE's MR portfolio designed to increase access to MR imaging for patients with metallic implants, all while maximizing patient care and reducing costs on the patient and healthcare system as a whole.

"GE Healthcare is committed to Humanizing MR by focusing on the needs of the patient, technologist and clinician," said Richard Hausmann, President and CEO of GE Healthcare's Magnetic Resonance business unit. "Current MR technology is limited and MAVRIC SL addresses this major gap in patient care, as the number of procedures requiring MR technologies continues to grow."

References:

1. Centers for Disease Control and Prevention/National Center for Health Statistics. National Hospital Discharge Survey: 2010 table, Procedures by selected patient characteristics - Number by procedure category and age. Retrieved May 6, 2013, available at: http://www.cdc.gov/nchs/fastats/insurg.htm

2. Organisation for Economic Co-operation and Development (OECD). Health at a Glance: Europe 2012 (Hip and Knee Replacement). Retrieved May 6, 2013, available at: http://www.oecd-ilibrary.org/social-issues-migration-health/health-at-a-glance-europe-2012_9789264183896-en

3. Kurtz S, Mowat F, Ong K, et al. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. J Bone Joint Surg Am 2007;89:780–785.

4. Nawabi D, Potter HG, et al. Magnetic Resonance Imaging Finding in Symptomatic versus Asymptomatic Subjects Following Metal-on-Metal Hip Resurfacing Arthroplasty. Journal of Bone & Joint Surgery. Vol 95, Issue 9.

About MAVRIC SL

MAVRIC SL is a combination of an acquisition technique and post-processing software intended for use on GE 1.5T and 3.0T MR systems. MAVRIC SL is suitable for use on all patients with passive MR Conditional orthopedic implants that are scanned according to the conditions of safe use for the specific MR Conditional implant being scanned. In addition, MAVRIC SL is suitable for use on patients without implants that are cleared for MR exams. MAVRIC SL helps reduce artifacts caused by presence of metal in both in-plane and through-plane dimensions compared to conventional MR imaging techniques. Thus MAVRIC SL allows visualizing more tissue in the vicinity of MR Conditional implanted metal instrumentation. When interpreted by a trained physician, images generated by MAVRIC SL provide information that can be useful in determining a diagnosis. MAVRIC SL is non-invasive, radiation-free and needle-free as it requires no contrast media injection. MAVRIC SL received Food and Drug Administration (FDA) 501(k) clearance in December 2012 and is available in most markets.

About GE Healthcare

GE Healthcare provides transformational medical technologies and services to meet the demand for increased access, enhanced quality and more affordable healthcare around the world. GE (NYSE: GE) works on things that matter - great people and technologies taking on tough challenges. From medical imaging, software & IT, patient monitoring and diagnostics to drug discovery, biopharmaceutical manufacturing technologies and performance improvement solutions, GE Healthcare helps medical professionals deliver great healthcare to their patients.

Contacts

GE Healthcare
Amanda Gintoft, +1 414-412-7062
Amanda.Gintoft@ge.com

Smart Multimedia Gallery

How GE Healthcare Addresses a Growing Clinical Need: Introducing MAVRIC SL, an exclusive imaging technology for joint replacements and implanted devices. (Graphic: Business Wire)

MAVRIC SL demonstrates evidence of an abnormal synovial response indicative of an adverse tissue reaction (arrow). Disclaimers: These images were generated using the MAVRIC SL software feature and are... More »

Note visualization of bone interface around the femur (red arrow), and posterior tibial osteolysis (blue arrow) on the MAVRIC SL image (right). MAVRIC demonstrates clear outline of polyethylene (red a... More »

GE Healthcare

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3633
RECIPIENT ADDRESS	98602405711
DESTINATION ID	
ST. TIME	08/12 15:57
TIME USE	01'05
PAGES SENT	2
RESULT	OK

ST. .TE OF CONNECTICUT
DEPAR] MENT OF PUBLIC HEALTH
OFFICI OF HEALTH CARE ACCESS

FAX SHEET

TO: PAUL KNAG,] ;SQ.

FAX: (860)240-5711

AGENCY: MURTHA CUI LINA/HOSPITAL FOR SPECIAL SURGERY

FROM: BRIAN CARNI .Y

DATE: 8/12/13 **TIME:**

NUMBER OF PAGES: 2
(inc uding transmittal sheet

Comments: DN: 12-31780· CON Interrogatories

PLEASE PHONE IF TI 'ERE ARE ANY TRANSMISSION PROBLEMS.

Phone: (8 50) 418-7001 *Fax: (860) 418-7053*

****
*** TX REPORT ***
****

TRANSMISSION OK

TX/RX NO	3655
RECIPIENT ADDRESS	912036535444
DESTINATION ID	
ST. TIME	08/23 13:13
TIME USE	00'27
PAGES SENT	2
RESULT	OK

ST. ,TE OF CONNECTICUT
DEPAR] MENT OF PUBLIC HEALTH
OFFICI OF HEALTH CARE ACCESS

FAX SHEET

TO: PAUL KNAG

FAX: 203 653-5444

AGENCY: MURTHA CUL LINA

FROM: KEVIN HANST ED

DATE: 8/23/13 **Time:**

NUMBER OF PAGES: 2
(incl ding transmittal sheet

Comments:
Please see attach ed regarding your request for a meeting for DN: 12-31780.

PLEASE PHONE Barba ı K. Olejarz IF THERE ARE ANY TRANSMISSION

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: PAUL KNAG

FAX: 203 653-5444

AGENCY: MURTHA CULLINA

FROM: KEVIN HANSTED

DATE: 8/23/13 **Time:**

NUMBER OF PAGES: 2
(including transmittal sheet

Comments:
Please see attached regarding your request for a meeting for DN: 12-31780.

PLEASE PHONE Barbara K. Olejarz IF THERE ARE ANY TRANSMISSION PROBLEMS.

Phone: (860) 418-7001 ***Fax: (860) 418-7053***

410 Capitol Ave., MS#13HCA
P.O.Box 340308
Hartford, CT 06134

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

August 23, 2013

VIA FACSIMILE ONLY

Paul E. Knag, Esq.
Murtha Cullina LLP
177 Broad Street
Stamford, CT 06901

RE: Hospital for Special Surgery
Docket #12-31780-CON

Dear Attorney Knag:

The Connecticut Department of Public Health Office of Health care Access ("OHCA") is in receipt of your letter dated August 20, 2013 wherein you request a meeting to discuss the above-referenced Application.

Please be advised that the Hospital for Special Surgery's ("HSS") Interrogatory responses have been received by OHCA and were appropriately interpreted by HSS in terms of the responses. Therefore, Deputy Commissioner Davis will not hold a meeting to discuss the Interrogatories or any other issues pertaining to this contested matter.

Sincerely,

Kevin T. Hansted

cc: Deputy Commissioner Lisa Davis

An Equal Opportunity Employer
410 Capitol Ave., MS#13HCA, P.O.Box 340308, Hartford, CT 06134-0308
Telephone: (860) 418-7001 Toll-Free: 1-800-797-9688
Fax: (860) 418-7053

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

September 20, 2013

IN THE MATTER OF:

An Application for a Certificate of Need filed Pursuant to Section 19a-638, C.G.S. by:
New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery

Notice of Reconsideration of Final Decision
Office of Health Care Access
Docket Number: 12-31780-RCN
Acquisition of a Magnetic Resonance Imaging Scanner to be Located in Stamford, Connecticut.

To: Stacey L. Malakoff
Executive Vice President/CFO
The Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

Dear Ms. Malakoff:

This letter will serve as notice of the Reconsideraiton of the Final Decision of the Office of Health Care Access in the above matter, as provided by Connecticut General Statutes § 4-181a(3) On September 20, 2013, the Final Decision was affirmed by Deputy Commissioner Davis as the final decision of the Office of Health Care Access. A copy of the Final Decision is attached hereto for your information.

Kimberly R. Martone
Director of Operations

Enclosure
KRM:bac

cc: Paul E. Knag, Esq., Murtha Cullina LLP

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.
Commissioner

Dannel P. Malloy
Governor

Nancy Wyman
Lt. Governor

IN THE MATTER OF:

An Application for a Certificate of Need filed Pursuant to Conn. Gen. Stat. § 19a-638 by:
New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery

Affirmation of Final Decision
Office of Health Care Access
Docket Number: 12-31780-RCN
Acquisition of a Magnetic Resonance Imaging Scanner to be Located in Stamford, Connecticut.

This letter will serve as notice that, after reconsideration, the Final Decision rendered in this matter on June 14, 2013 is affirmed and remains the Final Decision for purposes of any appeal under Conn. Gen. Stat. § 4-183. A copy of the Final Decision dated June 14, 2013 is attached hereto for your reference.

9/20/13
Date

Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

June 14, 2013

IN THE MATTER OF:

An Application for a Certificate of Need filed Pursuant to Section 19a-638, C.G.S. by:	Notice of Final Decision Office of Health Care Access Docket Number: 12-31780-CON
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery	**Acquisition of a Magnetic Resonance Imaging Scanner to be Located in Stamford, Connecticut**

To: Stacey L. Malakoff
Executive Vice President/CFO
The Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

Dear Ms. Malakoff:

This letter will serve as notice of the Final Decision of the Office of Health Care Access in the above matter, as provided by Section 19a-638, C.G.S. On June 14, 2013, the Final Decision was rendered as the finding and order of the Office of Health Care Access. A copy of the Final Decision is attached hereto for your information.

Kimberly R. Martone
Director of Operations

Enclosure
KRM:av

Department of Public Health
Office of Health Care Access
Certificate of Need Application

Final Decision

Applicants:	**New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery 535 East 70th Street, New York, New York 10021**
Docket Number:	**12-31780-CON**
Project Title:	**Acquisition of a Magnetic Resonance Imaging Scanner to be Located in Stamford, Connecticut**

Project Description: New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("HSS" or "Applicant") seeks to acquire a Magnetic Resonance Imaging ("MRI") scanner to be located in Stamford, Connecticut, with an associated capital expenditure of $3,245,583.

Procedural History: The Applicant published notice of its intent to file a CON application in The Advocate (Stamford) on June 26, 27 and 28, 2012. On August 13, 2012, the Office of Health Care Access ("OHCA") received the Certificate of Need ("CON") application from the Applicant for the above-referenced project. On November 2, 2012, OHCA deemed the application complete.

On November 16, 2012, the Applicant was notified of the date, time, and place of the public hearing. On November 19, 2012, a notice to the public announcing the hearing was published in the *Record Journal*, *The Advocate* and *The News Times*. Thereafter, pursuant to Conn. Gen. Stat. § 19a-639a, a public hearing regarding the CON application was held on December 18, 2012.

Commissioner Jewel Mullen designated Attorney Kevin T. Hansted as the hearing officer in this matter. The hearing was conducted as a contested case in accordance with the provisions of the Uniform Administrative Procedure Act (Chapter 54 of the General Statutes) and Conn. Gen. Stat. § 19a-639a. The public hearing record was closed on December 24, 2012.

A Proposed Final Decision was issued on April 8, 2013. Thereafter, the Applicant filed Exceptions to the Proposed Final Decision on May 10, 2013. Included in the Exceptions was a claim that the Applicant had not been given notice that OHCA would rely on certain information in its Proposed Final Decision. In order to allow the Applicant an opportunity to submit evidence to refute the information upon which OHCA partially relied, the matter was remanded back to the Hearing Officer and the public hearing record was opened on May 21, 2013. In response, the Applicant notified OHCA on May 21, 2013 that it would not be submitting additional evidence, but rather, would rely on the information included in its Exceptions. The public hearing record was closed again on May 21, 2013.

Findings of Fact

1. HSS is a not-for-profit, acute care, academic medical center located at 535 East 70th Street, New York, NY 10021. HSS is a health care facility or institution as defined by Conn. Gen. Stat. § 19a-630. Ex. A, p. 8.

2. HSS currently provides physician services, diagnostic x-ray and fluoroscopic guidance imaging services at 143 South Beach Avenue, in Old Greenwich, Connecticut. Ex. A, p. 6.

3. HSS is a top ranked hospital in the orthopedic and rheumatology fields; its MRI centers specialize in musculoskeletal exams. Ex. A, p. 6; Ex. F, p. 340.

4. HSS is planning to expand and relocate its services from 143 South Beach Avenue, Old Greenwich, Connecticut to 1 Blachley Road, Stamford, Connecticut. Ex. A, p. 6.

5. HSS is seeking approval for the acquisition of a 1.5 Tesla Magnetic Resonance Imaging (MRI) unit at this new location. Ex. A, p. 6.

6. HSS currently operates ten MRI units at or in close proximity to its main hospital campus in Manhattan, and has received approval from the state of New York to operate a new unit at a satellite location in Uniondale, NY. Ex. A, p. 7; Ex. B, p. 347.

7. Table 1 shows historical, current and projected utilization for all MRI scanners operated by HSS.

Table 1: HSS Existing MRI Units and Volumes by Location:

	Actual Volume (Last 3 Completed CYs)			CY Vol. (d)	Projected Volume (First 3 Full Operational CYs)		
	2009	2010	2011	2012	2014	2015	2016
HSS Main Campus (a)(b):							
- Unit A	4,555	4,054	3,825	3,267	3,359	3,464	3,568
- Unit B	3,700	3,232	3,244	3,008	3,094	3,191	3,287
- Unit C	3,892	3,963	3,996	3,810	3,919	4,042	4,162
- Unit D	4,194	4,031	3,863	3,567	3,667	3,781	3,895
- Unit E	3,787	3,420	3,382	3,215	3,306	3,409	3,512
- Unit F	2,974	3,648	3,835	3,470	3,568	3,679	3,790
- Unit G (11/3/09)	754	3,754	3,654	3,489	3,587	3,699	3,811
- Unit H (c)	1,708	1,303	2,327	3,397	3,491	3,600	3,709
- Unit I (3/26/12)	-	-	-	1,934	2,591	2,672	2,753
75th St (11/28/11)	-	-	190	2,443	2,512	2,590	2,668
Uniondale, NY (1/1/13)	-	-	-	-	2,400	2,400	2,400
Stamford, CT (1/1/14)	-	-	-	-	2,175	2,540	2,540
Total	25,564	27,405	28,316	31,600	37,669	39,067	40,095

Ex. F, p. 347.

(a) HSS Main Campus MRIs operate 13.5 hours/day (Unit A – 16 hours/day) and on weekends (limited hours), whereas the units at the offsite locations operate 10 hours/day and no weekends. 75th St, which is in close proximity to the Main Campus, operates 11.5 hours/day.

(b) Nine of the above listed units are 1.5 Tesla units and three are 3.0 Tesla units. Tesla measures the strength of the magnet. HSS operates mostly 1.5T units since these are most effective for orthopedic imaging in most cases.

(c) Unit H was converted from an Open to a 1.5T MRI in May 2011 due to obsolescence.

(d) Represents projected 2012 totals based on actual volumes through August 2012.

Note: All above years represent calendar years (CYs). Above totals are for outpatients only.

8. The Applicant states that the proposed service area would include the following towns: Stamford, Greenwich, Darien and New Canaan, Connecticut, and Scarsdale, Rye, and Mamaroneck, New York. Ex. A, p. 15.

9. Based on CY 2012 volumes, HSS projects that it will perform approximately 3,250 MRI scans for its patients residing in Connecticut and Westchester County. Of the total projected volume, 896 scans (28%) would originate from the Connecticut portion of the proposed service area. Ex. A, p. 7.

Table 2: HSS Historical/Projected MRI Volumes for the Proposed Service Area:

Town	2011	Actual through June 2012	Projected through end of 2012
Stamford	144	67	134
Greenwich	454	243	486
Darien	174	68	136
New Canaan	109	70	140
CT Portion of Proposed Service Area	**881**	**448**	**896**
Scarsdale	229	114	228
Rye	217	110	220
Mamaroneck	219	144	288
NY Portion of Proposed Service Area	**665**	**368**	**736**
Total Proposed Service Area	**1,546**	**816**	**1,632**
Other CT Residents	725	465	930
Other NY Residents	616	344	688
Total HSS MRI Volume	**2,887**	**1,625**	**3,250**

Ex. A, p. 15.

10. HSS claims that the maximum capacity of the MRI requested in this proposal will be 2,540 scans; based on a five day-per-week, 10-hour-per-day schedule. As the projected volume of 3,250 scans exceeds the claimed maximum capacity of 2,540 scans, a portion of patients would thus need to receive their MRI scan in Manhattan. Ex. A, pp. 16-17.

11. HSS is projecting the following utilization for its proposed MRI scanner:

Projected MRI Volume

	Projected Volume		
	FY 2014	FY 2015	FY 2016
MRI Total	**2,175**	**2,540**	**2,540**

Ex. A, p. 27.

12. HSS states that its MRI scans use proprietary protocols that are customized to meet the needs and specifications of individual patients and their physicians. HSS claims the protocols/customization allows each physician to maximize the usefulness of the MRI as a tool for diagnosis and to help develop effective treatment plans. The protocols used by HSS do not require specialized equipment; however, they do require specialized software for prototype pulse sequences, which is the property of General Electric (GE). Ex. A, pp. 6-7; Ex. F, p. 340.

13. HSS has a comprehensive and collaborative research agreement with GE, allowing it to use these newer sequence and MRI techniques that are not currently available to other providers in the tri-state area. Ex. F, p. 341.

14. HSS sends the majority of its patients (approximately 3,250) to its Manhattan campus to receive MRI scans. Only a small percentage of patients are referred to Connecticut providers. HSS will continue to refer patients to the HSS MRI department, regardless of whether the MRI is located in Manhattan, Stamford or another location. Ex. A, p. 7; Ex. F, pp. 349, 352.

15. HSS stated that patients are sent to New York to be imaged due to the focus on MRI quality. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Dr. Jo A. Hannafin, Attending Orthopedic Surgeon at the Hospital for Special Surgery.

16. HSS stated that it had only anecdotal cases to support its claim that HSS MRI protocols are better than those used by Connecticut providers. HSS' peer-reviewed literature is not based on any specific Connecticut facility. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Dr. Hollis Potter, Chief of the MRI department at the Hospital for Special Surgery.

17. HSS stated that it had not specifically addressed improvement in surgical outcomes as a result of using its MRI protocols. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Dr. Hollis Potter, Chief of the MRI department at the Hospital for Special Surgery.

18. The Applicant asserts that clear public need for this proposal is demonstrated by the following:
    - An MRI site in Stamford provides a more convenient location for Connecticut and Westchester County, NY patients than the HSS main campus in Manhattan. Ex. A, pp. 7, 13.
    - The ability to free up needed capacity and alleviate current issues with MRI backlog at HSS's Manhattan location. Ex. A, pp. 7, 13.

19. The Applicant asserts that this proposal will not impact the volumes of existing Connecticut MRI providers, due to the following:
    - MRI volume will shift from Manhattan to Stamford;
    - HSS can fill the capacity of the proposed MRI with its own patients;
    - The proposed MRI scanner will not be marketed to non-HSS physicians or patients.

    Ex. A, p. 7.

20. Although HSS does not directly market it services to non-HSS physicians, testimony received stated that HSS does currently accept referrals from non-HSS orthopedic surgeons in New York. HSS also stated that it would like to market its MRI services to an orthopedic practice affiliated with The Stamford Hospital and located within the same building (Chelsea Piers complex) where the proposed MRI would be operated. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Lou Shapiro, President and Chief Executive Officer for the Hospital for Special Surgery.

21. The projected patient population mix presented below is based on HSS's current MRI payer mix and assumes that the mix of patients treated in Stamford will be similar:

Table 4: HSS Projected Payer Mix:

Coverage Type	Year 1 FY 2014	Year 2 FY 2015	Year 3 FY 2016
Medicare*	18.1%	18.1%	18.1%
Medicaid*	2.1%	2.1%	2.1%
CHAMPUS & TriCare	0.0%	0.0%	0.0%
Total Government	**20.2%**	**20.2%**	**20.2%**
Commercial Insurers*	74.7%	74.7%	74.7%
Uninsured	1.4%	1.4%	1.4%
Workers Compensation	3.7%	3.7%	3.7%
Total Non-Government	**79.8%**	**79.8%**	**79.8%**
Total Payer Mix	**100.0%**	**100.0%**	**100.0%**

Ex. A, p. 36.

*Includes managed care activity.

22. The total capital expenditure is $3,245,583 and will be funded from HSS operations. The capital costs include: $1,800,000 for imaging equipment and $1,445,583 for construction and renovation.

23. The Applicant projects incremental gains from operations of $1,341,000 in FY 2014, $1,659,000 in FY 2015, and $1,708,000 in FY 2016.

Table 5: Financial Projections Incremental to the Project:

Description	FY 2014	FY 2015	FY 2016
Incremental Revenue from Operations[1]	$2,176	$2,614	$2,686
Incremental Total Operating Expenses[2]	$835	$955	$978
Incremental Gain from Operations	**$1,341**	**$1,659**	**$1,708**

Ex. A, pp. 336-339.

Note: figures are in thousands.

[1] Forecasts consider volume, payer mix and payment rate trends as well as the impacts of proposed regulatory reforms, capacity constraint, and anticipated capital initiatives.

[2] Operating expenses include rent, depreciation, facility, supply and staffing costs needed to operate the MRI unit and support the forecasted volumes.

24. OHCA is currently in the process of establishing its policies and standards as regulations. Therefore, OHCA has not made any findings as to this proposal's relationship to any policies and standards not yet adopted as regulations by OHCA. (Conn. Gen. Stat. § 19a-639(a)(1))

25. This CON application was deemed complete by OHCA prior to the state wide health care facilities and services plan being published. Therefore, OHCA has not made any findings as to the relationship between this CON application and the state wide health care facilities and services plan. (Conn. Gen. Stat. § 19a-639(a)(2))

26. The Applicant has failed to establish that there is a clear public need for its proposal. (Conn. Gen. Stat. § 19a-639(a)(3))

27. The Applicant has satisfactorily demonstrated that the proposal is financially feasible. (Conn. Gen. Stat. § 19a-639(a)(4))

28. The Applicant has failed to satisfactorily demonstrate that the proposal would improve quality, accessibility and cost effectiveness of health care delivery in the region. (Conn. Gen. Stat. § 19a-639(a)(5))

29. The Applicant has shown that there would be no change to the provision of health care services to the relevant populations and payer mix. (Conn. Gen. Stat. § 19a-639(a)(6))

30. The Applicant has satisfactorily identified the population to be served by its proposal, but has failed to satisfactorily demonstrate that this population has a need as proposed. (Conn. Gen. Stat. § 19a-639(a)(7))

31. The utilization of existing health care facilities and services in the service area does not support this proposal. (Conn. Gen. Stat. § 19a-639(a)(8))

32. The Applicant has failed to satisfactorily demonstrate that its proposal would not result in an unnecessary duplication of existing MRI services in the area. (Conn. Gen. Stat. § 19a-639(a)(9))

Discussion

CON applications are decided on a case by case basis and do not lend themselves to general applicability due to the uniqueness of the facts in each case. In rendering its decision, OHCA considers the factors set forth in General Statutes § 19a-639(a). The Applicant bears the burden of proof in this matter by a preponderance of the evidence. *Goldstar Medical Services, Inc., et al. v. Department of Social Services, 288 Conn. 790 (2008).*

The New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("Applicant" or "HSS"), a not-for-profit hospital located in New York City, proposes to acquire a 1.5 Tesla MRI scanner to be located in Stamford, Connecticut. *FF1&5.*

The proposal is based upon the assertion that a new MRI unit in Stamford would provide a more convenient location for HSS patients residing in Connecticut and Westchester County to receive HSS' MRI services. The relevant portion of HSS' patient volume would shift from Manhattan to a new location in Stamford. HSS has stated that the approval of this proposal would help alleviate capacity constraints and backlog at the hospital's main campus in Manhattan. *FF18-19.*

HSS claims that its use of proprietary and customized MRI protocols result in higher quality images and improved diagnostic accuracy. *FF12-13&15.* Thus, the application is not based on whether the service area needs additional capacity, but rather upon the claimed unique benefits of HSS' MRI protocols.

Although HSS has provided credible testimony as to its experience and expertise generating musculoskeletal MRI scans, it has failed to provide conclusive evidence (i.e., comparative scientific studies or empirical evidence) to validate their claim that HSS' MRI protocols provide significantly better imaging results or lead to better surgical outcomes than MRI protocols used by existing Connecticut providers. *FF3; FF16-17.* Given this lack of evidence to substantiate the Applicant's claim of a unique benefit, approval of this proposal would result in the duplication of services in the region.

HSS represented that it would not directly market its services to non-HSS physicians even though HSS' current practice is to accept referrals from non-HSS physicians, if presented. In addition, HSS stated that it would like to provide MRI services to a local orthopedic practice located within the same building as the proposed MRI. *FF20.* Both of these factors support the conclusion that approval of this proposal would lead to decreased patient volumes and revenues for existing MRI providers in the service area and result in an unnecessary duplication of MRI services in the region.

OHCA's determination on the acquisition of an MRI is based, in part, on the demonstrated need for the acquisition, not whether an MRI may provide a more convenient location for the patient or help to address capacity issues outside of Connecticut. *FF18*. Although HSS provided numerous anecdotal examples and testimony about the quality of its MRI services and overall system of care, both the application and testimony lack evidence to substantiate that access or health care outcomes for Connecticut patients would be improved as a result of this proposal. After considering all of the factors listed above, OHCA concludes that the Applicant did not demonstrate clear public need for its proposal.

Order

Based upon the foregoing Findings and Discussion, the Certificate of Need application of New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery to acquire a Magnetic Resonance Imaging scanner to be located in Stamford, Connecticut, with an associated capital expenditure of $3,245,583, is hereby **DENIED**.

All of the foregoing constitutes the final order of the Office of Health Care Access in this matter.

By Order of the
Office of Health Care Access

6/14/2013
Date

Lisa A. Davis
Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner

```
********************
***   TX REPORT   ***
********************
```

TRANSMISSION OK

TX/RX NO	3709
RECIPIENT ADDRESS	98602405711
DESTINATION ID	
ST. TIME	09/20 16:43
TIME USE	00'36
PAGES SENT	1
RESULT	OK

STA [E OF CONNECTICUT
DEPARTI 1ENT OF PUBLIC HEALTH
OFFICE)F HEALTH CARE ACCESS

FAX SHEET

TO: **PAUL KNAG, E ;Q.**

FAX: **860-240-5711**

AGENCY: **MURTHA CULI ,INA**

FROM: **OHCA**

DATE: **9/20/13** **Time:**

NUMBER OF PAGES:
(inclu 'ing transmittal sheet

Comments:

Sorry, I sent you :he wrong fax sheet. It should have been addressed to Murtha Cullina. Could you please switch the fax sheet I sent with this one. The attachr ıent was correct.

Thank you

See attached reg: rding DN: 12-31780, The Hospital for Special Surgery

MURTHA

PAUL E. KNAG
203.653.5407 DIRECT TELEPHONE
860.240.5711 DIRECT FACSIMILE
PKNAG@MURTHALAW.COM

October 15, 2013

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Jewel Mullen, MD, MPH, MPA
Commissioner of Public Health
Department of Public Health
410 Capitol Avenue
P.O. Box 340308
Hartford, CT 06134-0308

Re: New York Society for the Relief of the Ruptured and Crippled
Maintaining the Hospital for Special Surgery
Office of Health Care Access Division
Docket No. FST-CV-13-6020149S
Superior Court, Judicial District of Stamford-Norwalk at Stamford

Dear Commissioner Mullen:

This firm represents New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital For Special Surgery ("HSS").

Pursuant to Section 4-183(c) of the Connecticut General Statutes, HSS here serves the Department of Public Health, Office of Health Care Access Division, with the Administrative Appeal of HSS referenced above. In accordance with the statute, service is being made by United States certified mail, postage prepaid, return receipt requested.

This Administrative Appeal has been filed in the Superior Court, Judicial District of Stamford-Norwalk at Stamford.

Very truly yours,

Paul E. Knag

Enclosures

cc: Attorney General George Jepsen
Deputy Commissioner Lisa A. Davis, MBA, BSN, RN

MURTHA

PAUL E. KNAG
203.653.5407 DIRECT TELEPHONE
860.240.5711 DIRECT FACSIMILE
PKNAG@MURTHALAW.COM

October 15, 2013

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner
Department of Public Health
Health Care Access Division
410 Capitol Avenue, MS#13HCA
P.O. Box 340308
Hartford, CT 06134-0308

Re: New York Society for the Relief of the Ruptured and Crippled
Maintaining the Hospital for Special Surgery
Office of Health Care Access Division
Docket No. FST-CV-13-6020149S
Superior Court, Judicial District of Stamford-Norwalk at Stamford

Dear Deputy Commissioner Davis:

This firm represents New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital For Special Surgery ("HSS").

Pursuant to Section 4-183(c) of the Connecticut General Statutes, HSS here serves the Department of Public Health, Office of Health Care Access Division, with the Administrative Appeal of HSS referenced above. In accordance with the statute, service is being made by United States certified mail, postage prepaid, return receipt requested.

This Administrative Appeal has been filed in the Superior Court, Judicial District of Stamford-Norwalk at Stamford.

Very truly yours,

Paul E. Knag

Enclosures

cc: Attorney General George Jepsen
Commissioner Jewel Mullen, MD, MPH, MPA

MURTHA

PAUL E. KNAG
203.653.5407 DIRECT TELEPHONE
860.240.5711 DIRECT FACSIMILE
PKNAG@MURTHALAW.COM

October 15, 2013

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Attorney General George Jepsen
Office of the Attorney General
55 Elm Street
Hartford, CT 06106

Re: New York Society for the Relief of the Ruptured and Crippled Maintaining the Hospital for Special Surgery
Office of Health Care Access Division
Docket No. FST-CV-13-6020149S
Superior Court, Judicial District of Stamford-Norwalk at Stamford

Dear Attorney General Jepsen:

This firm represents New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital For Special Surgery ("HSS").

Pursuant to Section 4-183(c) of the Connecticut General Statutes, HSS here serves the Department of Public Health, Office of Health Care Access Division, with the Administrative Appeal of HSS referenced above. In accordance with the statute, service is being made by United States certified mail, postage prepaid, return receipt requested.

This Administrative Appeal has been filed in the Superior Court, Judicial District of Stamford-Norwalk at Stamford.

Very truly yours,

Paul E. Knag

Enclosures

cc: Commissioner Jewel Mullen, MD, MPH, MPA
Deputy Commissioner Lisa A. Davis, MBA, BSN, RN

RETURN DATE: NOVEMBER 5, 2013

NEW YORK SOCIETY FOR THE RELIEF OF THE RUPTURED AND CRIPPLED, MAINTAINING THE HOSPITAL FOR SPECIAL SURGERY	:	SUPERIOR COURT
v.	:	JUDICIAL DISTRICT OF STAMFORD-NORWALK AT STAMFORD
CONNECTICUT DEPARTMENT OF PUBLIC HEALTH, OFFICE OF HEALTH CARE ACCESS DIVISION	:	OCTOBER 15, 2013

SUMMONS

BY AUTHORITY OF THE STATE OF CONNECTICUT, the Connecticut Department of Public Health, Office of Health Care Access Division, 410 Capitol Avenue, Hartford, Connecticut 06134-0308, is hereby summoned to appear before the Superior Court for the Judicial District of Stamford-Norwalk, 123 Hoyt Street, Stamford, Connecticut 06905 on or before the second day following the return date of November 5, 2013, such appearance to be made by its authorized representatives or their attorneys by filing written statements of appearance with the Clerk of the Court on or before the second day following the above return date, then and there to answer the within Administrative Appeal brought by New York Society for the Relief of the Ruptured and Crippled maintaining the Hospital for Special Surgery.

Dated at Stamford, Connecticut, this 15th day of October, 2013.

Paul E. Knag
Commissioner of the Superior Court

Raphaline Voccia, 10 Garfield Avenue, Derby, Connecticut 06418 is hereby recognized to prosecute in the sum of $500.00.

Paul E. Knag
Commissioner of the Superior Court

Please enter the appearance of
Murtha Cullina LLP
177 Broad Street
Stamford, Connecticut 06901
Telephone: (203) 653-5400
Juris No. 424154
As Attorneys for the Plaintiff/Appellant
in the above action.

RETURN DATE: NOVEMBER 5, 2013

NEW YORK SOCIETY FOR THE RELIEF OF THE RUPTURED AND CRIPPLED, MAINTAINING THE HOSPITAL FOR SPECIAL SURGERY	SUPERIOR COURT
v.	JUDICIAL DISTRICT OF STAMFORD-NORWALK AT STAMFORD
CONNECTICUT DEPARTMENT OF PUBLIC HEALTH, OFFICE OF HEALTH CARE ACCESS DIVISION	OCTOBER 15, 2013

ADMINISTRATIVE APPEAL

To the Superior Court for the Judicial District of Stamford-Norwalk comes New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery, appealing from the final decision of the Connecticut Department of Public Health, Office of Health Care Access Division, dated September 20, 2013, in Docket No. 12-31780-CON (the "Final Decision") and complains and says:

Introduction and Parties

1. The Plaintiff, New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("HSS" or the "Hospital"), is a not-for-profit, acute care, academic medical center, located at 535 East 70th Street, New York, N.Y. HSS is a top ranked hospital in the orthopedic and rheumatology fields. HSS presently offers physician services, diagnostic x-ray, and fluoroscopic guidance imaging services at its Old Greenwich, Connecticut location.

2. HSS is a "health care facility or institution" as defined by Section 19a-630 of the Connecticut General Statutes.

3. The Defendant is the Connecticut Department of Public Health, Office of Health Care Access Division. This division, under the direction of the Commissioner of Public Health, is a successor to the former Office of Health Care Access and is overseen by a Deputy Commissioner of Public Health who exercises independent decision-making authority over all certificate of need related matters. <u>See</u> Conn. Gen. Stat. § 19a-612(a), 19a-612d. The defendant will be referred to herein as OHCA.

4. This is an appeal by HSS from a final decision of OHCA denying the Certificate of Need Application of HSS to acquire a magnetic resonance imaging ("MRI") scanner to be located in Stamford, Connecticut. This appeal is authorized by Sections 19a-641 and 4-183 of the Connecticut General Statutes. Section 19a-641 provides, in pertinent part, that "[a]ny health care facility or institution . . . aggrieved by any final decision of [OCHA] under the provisions of Sections 19a-630 to 19a-639e, inclusive, may appeal from such decision in accordance with the provisions of section 4-183 . . . ."

Background

5. Section 19a-638(a)(9) of the Connecticut General Statutes requires a health care facility or institution such as HSS to obtain a certificate of need from OHCA prior to acquiring certain imaging equipment, including an MRI scanner.

6. Section 19a-639 of the Connecticut General Statutes sets forth the guidelines and principles which must be considered by OHCA in its deliberations involving a certificate of need application pursuant to 19a-638. OHCA must make written findings concerning each of these guidelines and principles. See Conn. Gen. Stat. § 19a-639(a).

7. On August 13, 2012, HSS submitted its certificate of need application to OHCA (the "Application"). In its Application, HSS sought approval to purchase a 1.5 Tesla MRI unit and to perform related renovations to accommodate the unit at 1 Blachley Road, Stamford, Connecticut. The estimated total capital expenditure was $3,245,583. HSS also planned to relocate physician services, diagnostic x-ray, and fluoroscopic guidance imaging services which it offers in Greenwich, Connecticut to this Stamford location. The purpose of this proposal is to accommodate Connecticut and other Stamford area HSS patients, who currently must go to HSS in Manhattan for their MRI, at a location closer to their homes.

8. In accordance with its regular procedures, OHCA subsequently requested additional information and/or clarification regarding the Application from HSS. HSS provided the requested information and/or clarification in a timely manner in accordance with OHCA's procedures.

9. OHCA determined that the Application was complete on November 2, 2012 and held a hearing in this matter on December 18, 2012. The hearing was conducted as a contested case in accordance with the provisions of the Uniform

Administrative Procedure Act (Chapter 54 of the General Statutes) and Section 19a-639a of the Connecticut General Statutes. The Commissioner of Public Health designated Kevin T. Hansted as the hearing officer to conduct the hearing and to render a proposed decision.

10. In the Application, at the December 18, 2012 hearing and in subsequent filings described below, HSS submitted substantial evidence on the relevant statutory criteria set forth in Conn. Gen. Stat. Section 19a-639(a) in support of its Application. HSS submitted evidence on the following, in addition to other evidence:

(a) Evidence that as of 2012 approximately 3,300 patients from Connecticut and nearby Westchester County travelled to HSS in Manhattan to have their MRIs performed on one of the ten MRI scanners located there.

(b) Evidence that HSS' proposed new MRI in Stamford would be fully utilized by accommodating 2,450 of these 3,300 patients at the Stamford location, thus providing much improved access for a patient population that often has limited mobility due to orthopedic injury, and thus showing a clear public need for the proposed MRI.

(c) Evidence that because HSS would not be able to fully accommodate its own area patients at this new location, the proposed MRI would not have any impact on volumes at existing facilities.

(d) Evidence that even without the contemplated transfer of patients from HSS in New York to HSS in Stamford, OHCA's own formula as set out in its new Statewide Facilities and Service Plan (the "Plan"), published in October, 2012, shows that the Stamford area is in need of additional MRI capacity. Pursuant to the Plan, in order to establish need, the applicant must demonstrate that utilization of existing capacity in the primary service area exceeds 85%. Doing the necessary math, using OHCA's own data, utilization of existing capacity in the primary service area is approximately 97%, well above the 85% requirement. Thus, there is a clear public need for the proposal for this reason as well.

(e) Evidence that HSS is ranked number one in the United States for Orthopedics, and number three for Rheumatology, by U.S. News and World Report in its 2012 "Best Hospitals" issue, and is a leader in the development of musculoskeletal MRI techniques and training therein. It has a development agreement with General Electric, and has and continues to work on new cutting-edge protocols for the use of MRI in the musculoskeletal area. Its physicians have published numerous articles and books on this subject and have lectured throughout the world.

(f) Evidence that a key component of HSS' high ranking is HSS' approach to, and use of, MRI imaging. HSS radiologists have worked collaboratively with HSS physicians for over 20 years to develop proprietary protocols that are customized to meet its patients' needs. This allows the HSS team to create diagnostic and treatment plans that are truly unique and based on each patient's individual needs and goals. In addition, HSS has access to GE proprietary MRI protocols years in advance of commercial availability. This level of collaboration and these proprietary protocols are not available through the use of any other MRI scanners in the area.

(g) Evidence of HSS' superior outcomes, as evidenced by its infection rates which are significantly lower than the national average, readmission rates that are significantly lower than the national average and high patient satisfaction scores.

(h) Evidence that the proposal is cost-effective for a number of reasons including the delivery of high quality HSS health care services closer to the homes of many Connecticut patients, the reduction in infection risk by avoiding the use of contrast, and the use of protocols for post-operative assessment of cartilage repair which replaces the more expensive surgical option. In addition, HSS' customized MRI protocols provide each surgeon with sufficient information to identify all issues prior to surgery and limit the need for diagnostic surgery.

11. On April 8, 2012, the Hearing Officer, Kevin T. Hansted, issued a proposed final decision (the "Proposed Final Decision") recommending that the HSS application for the acquisition and operation of an MRI scanner in Stamford, Connecticut, be denied. In correspondence transmitting the Proposed Final Decision, OHCA also notified HSS that, pursuant to Connecticut General Statutes Section 4-

179, HSS could request the opportunity to file exceptions or a brief or a request to present an oral argument with the OHCA Deputy Commissioner who was to render the final decision, within twenty-one (21) days from the mailing of the Proposed Final Decision. In response to this offer, HSS filed detailed exceptions to various findings of fact and conclusions set forth in the Proposed Final Decision. HSS also excepted to the utilization by OHCA of a survey conducted in connection with the Plan published in October 2012 to conclude that the primary service area identified by HSS in the Application had adequate MRI capacity to allow patients to utilize existing MRI facilities rather than the MRI facility proposed by HSS. HSS argued that OHCA had, in violation of Conn. Gen. Stat. Section 4-178, failed to notify HSS of its intent to use the data described in the Plan and despite OHCA's own acknowledgement that the Plan was not applicable to HSS' Application.

12. On June 14, 2013, Deputy Commissioner Lisa A. Davis issued OHCA's Final Decision on the HSS Application denying the HSS Application. In its Final Decision, OHCA deleted two findings of fact and conclusions based on the data in the Plan which had been included in the Proposed Final Decision, but did not explain how it could conclude that there was no showing of need when its own formulas showed to the contrary. The decision also does not explain why the fact that HSS' own volume transfer from New York does not justify of finding of public need; and, it does not explain how, in view of the overwhelming evidence presented, OHCA could conclude that having the world's leading orthopedic hospital in Stamford to serve patients who

are currently forced to go to New York would not promote accessibility, quality and cost effectiveness.

13. HSS subsequently requested reconsideration of the final Decision pursuant to Conn. Gen. Stat. Section 4-181a(3). On September 20, 2013, Deputy Commissioner Davis rendered a decision that, after reconsideration, the June 14, 2013 Final Decision was affirmed and remained the Final Decision for purposes of any appeal pursuant to Conn. Gen. Stat. Section 4-183. A copy of the Final Decision is attached to this Administrative Appeal as Exhibit A.

Reasons for Appeal

14. HSS has exhausted all administrative remedies and is aggrieved by the Final Decision which is a final decision within the meaning of Conn. Gen. Stat. § 4-183(a). HSS is aggrieved by OHCA's findings, inferences, conclusions, decision and order in various ways including, but not limited to, the following:

(a) OHCA's failure to consider, in making is finding that there was no showing of need, the fact that HSS' proposed MRI would be fully utilized by scanning HSS patients who are currently scanned in Manhattan, resulting in convenience to HSS patients (which OHCA indicates it is not concerned with), but resulting in no impact on existing Stamford area MRI provider volumes;

(b) OHCA's failure to consider, in making its finding that there was no showing of need, HSS' willingness to limit its MRI service to HSS patients, thus further insuring no impact on existing providers in the area;

(c) OHCA's failure to articulate, in making its finding that there was no showing of need, why it deemed that there was insufficient need for additional MRI capacity when, even aside from the fact that HSS would be transferring its own volume from New York City, OHCA's own formulas indicate that there is a need for additional MRI capacity in the Stamford area;

(d) OHCA's failure to consider the substantial evidence presented by HSS that its MRI protocols result in higher quality images than typical imaging techniques and have other advantages which result in improved care for its patients (Finding of Fact 16);

(e) OHCA's finding of fact that HSS had failed to satisfactorily demonstrate that the proposal would improve quality, accessibility and cost effectiveness of health care delivery in the region (Finding of Fact 28) when in fact there was uncontested evidence that HSS is the leading orthopedic hospital in the country, that its physicians are leaders in the development of musculoskeletal MRI through the HSS development agreement with General Electric, that they have published widely and have provided education and seminars through the world, and that its MRI protocols are cutting-edge, patient specific and not available elsewhere, and when the access to this service is currently in New York where mobility challenged patients must currently travel at great cost and travail;

(f) OHCA's apparent finding that HSS has not specifically addressed improvement in surgical outcomes as a result of using its MRI protocols when in fact the literature provided fully documented this (Finding of Fact 17);

(g) OHCA's finding that HSS has failed to establish that there is a clear public need for its proposal (Finding of Fact 26);

(h) OHCA's finding of fact that while HSS has satisfactorily identified the population to be served by its proposal, it failed to satisfactorily demonstrate that this population had a need for its proposal (Finding of Fact 30);

(i) OHCA's finding of fact that the overall historical utilization of MRIs in the service area does not support this proposal (Finding of Fact 31);

(j) OHCA's finding of fact that HSS has failed to satisfactorily demonstrate that its proposal would not result in unnecessary duplication of existing MRI services in the area (Finding of Fact 32);

(k) OHCA's ignoring of substantial evidence submitted by HSS to establish the various factors which OHCA was required to decide;

(l) OHCA's inferences, analysis, and conclusions in its "Discussion" section of the Final Decision;

(m) OHCA's failure to determine that all statutory criteria necessary for approval were met; and

(n) OHCA's Order denying the Application.

15. Substantial rights of HSS have been prejudiced because OHCA's findings, inferences, conclusions, decision and/or order are:

(a) in violation of constitutional or statutory provisions;

(b) made upon unlawful procedure;

(c) affected by other error of law;

(d) clearly erroneous in view of the reliable, probative, and substantial evidence on the whole record; and/or

(e) arbitrary or capricious or characterized by an abuse of discretion or clearly unwarranted exercise of discretion.

See Conn. Gen. Stat. § 4-183(j).

16. HSS is also aggrieved because, as a result of the Final Decision, it will be unable to contribute to improved access to world-class musculoskeletal health care for patients in its service area and throughout Connecticut.

WHEREFORE, pursuant to Sections 19a-641 and 4-183 of the Connecticut General Statutes, HSS hereby appeals from the Final Decision and Order in this matter and asks that the Court review the Final Decision and, pursuant to Section 4-183(j) and (k) of the Connecticut General Statutes:

(1) sustain this appeal;

(2) modify the Decision to find that correct application of the applicable statutory guidelines and principles in Conn. Gen. Stat. Section 19a-639 require that the application of HSS to acquire a 1.5 Tesla MRI scanner and locate the MRI scanner in Stamford should be approved;

(3) order OHCA to approve the Application; and/or

(4) grant such other relief pursuant to Section 4-183 of the Connecticut General Statutes or otherwise in law or in equity as is required or appropriate.

Dated at New Haven, Connecticut, this 15th day of October, 2013.

Plaintiff/Appellant
New York Society for the Relief of the
Relief of the Ruptured and Crippled,
Maintaining the Hospital for Special Surgery

By ____________________
Paul E. Knag
Murtha Cullina LLP
177 Broad Street
Stamford, CT 06901
Telephone: (203) 653-5407
Juris No. 424154

Please enter the appearance of
Murtha Cullina LLP
177 Broad Street
Stamford, Connecticut 06901
Telephone: (203) 653-5400
Juris No. 424154
as Attorneys for the Plaintiff/Appellant
in the above action.

STATI; OF CONNECTICUT
DEPAR' MENT OF PUBLIC HEALTH
Offi e of Health Care Access

September 20, 2013

IN THE MATTER OF:

An Application for a Certificate of Ne d filed Pursuant to Section 19a-638, C.(.S. by:
New York Society for the Relief of t e Ruptured and Crippled, Maintaining he Hospital for Special Surgery

Notice of Reconsideration of Final Decision
Office of Health Care Access
Docket Number: 12-31780-RCN
Acquisition of a Magnetic Resonance Imaging Scanner to be Located in Stamford, Connecticut.

To: Stacey L. Malakoff
Executive Vice President/CF(
The Hospital for Special Surg ry
535 East 70th Street
New York, NY 10021

Dear Ms. Malakoff:

This letter will serve as notice of the ːeconsideraiton of the Final Decision of the Office of Health Care Access in the above matt :r, as provided by Connecticut General Statutes § 4-181a(3) On September 20, 2013, the Final De :ision was affirmed by Deputy Commissioner Davis as the final decision of the Office of Health Care Access. A copy of the Final Decision is attached hereto for your information.

Kimberly R. Martone
Director of Operations

Enclosure
KRM:bac

cc: Paul E. Knag, Esq., Murtha Culli a LLP

A : Equal Opportunity Provider
(If you require aid/accommodation to p articipate fully and fairly, contact us either by phone, fax or email)
410 Capitol Ave., MS# 3HCA, P.O.Box 340308, Hartford, CT 06134-0308
Telephone: (860) 418-7)01 Fax: (860) 418-7053 Email: OHCA@ct.gov

Exhibit A

STATE OF CONNECTICUT
DEPAR' MENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.
Commissioner

Dannel P. Malloy
Governor

Nancy Wyman
Lt. Governor

IN THE MATTER OF:

An Application for a Certificate of Ne ed filed Pursuant to Conn. Gen. Stat. § 19a-63 3
by:
New York Society for the Relief o the Ruptured and Crippled, Maintaini g the Hospital for Special Surgery

Affirmation of Final Decision
Office of Health Care Access
Docket Number: 12-31780-RCN
Acquisition of a Magnetic Resonance Imaging Scanner to be Located in Stamford, Connecticut.

This letter will serve as notice that, af er reconsideration, the Final Decision rendered in this matter on June 14, 2013 is affirmed a d remains the Final Decision for purposes of any appeal under Conn. Gen. Stat. § 4-183. A co y of the Final Decision dated June 14, 2013 is attached hereto for your reference.

9/20/13
Date

Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner

STAT E OF CONNECTICUT
DEPAI TMENT OF PUBLIC HEALTH
Off ce of Health Care Access

June 14, 2013

IN THE MATTER OF:

An Application for a Certificate of Need filed Pursuant to Section 19a-638, C G.S. by:	Notice of Final Decision Office of Health Care Access Docket Number: 12-31780-CON
New York Society for the Relief c the Ruptured and Crippled, maintain ng the Hospital for Special Surgery	**Acquisition of a Magnetic Resonance Imaging Scanner to be Located in Stamford, Connecticut**

To: Stacey L. Malakoff
Executive Vice President/CFO
The Hospital for Special Surger
535 East 70th Street
New York, NY 10021

Dear Ms. Malakoff:

This letter will serve as notice of the Final Decision of the Office of Health Care Access in the above matter, as provided by Section 19a-638, C.G.S. On June 14, 2013, the Final Decision was rendered as the finding and order of t e Office of Health Care Access. A copy of the Final Decision is attached hereto for your i formation.

Kimberly R. Martone
Kimberly R. Martone
Director of Operations

Enclosure
KRM:av

Depart nent of Public Health
Office f Health Care Access
Certific te of Need Application

Final Decision

Applicants: **New York S ciety for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery**
535 East 70 h Street, New York, New York 10021

Docket Number: **12-31780-C N**

Project Title: **Acquisition f a Magnetic Resonance Imaging Scanner to be Located in tamford, Connecticut**

Project Description: New York Soci ty for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special S rgery ("HSS" or "Applicant") seeks to acquire a Magnetic Resonance Imaging ("MRI) scanner to be located in Stamford, Connecticut, with an associated capital expenditure of $3,2 5,583.

Procedural History: The Applicant ublished notice of its intent to file a CON application in The Advocate (Stamford) on June 26, 27 and 28, 2012. On August 13, 2012, the Office of Health Care Access ("OHCA") received the ertificate of Need ("CON") application from the Applicant for the above-referenced pr ject. On November 2, 2012, OHCA deemed the application complete.

On November 16, 2012, the Applican was notified of the date, time, and place of the public hearing. On November 19, 2012, a no ice to the public announcing the hearing was published in the *Record Journal*, *The Advocate* an *The News Times*. Thereafter, pursuant to Conn. Gen. Stat. § 19a-639a, a public hearing regardin the CON application was held on December 18, 2012.

Commissioner Jewel Mullen designat d Attorney Kevin T. Hansted as the hearing officer in this matter. The hearing was conducted as a contested case in accordance with the provisions of the Uniform Administrative Procedure A t (Chapter 54 of the General Statutes) and Conn. Gen. Stat. § 19a-639a. The public hearing recor was closed on December 24, 2012.

A Proposed Final Decision was issue . on April 8, 2013. Thereafter, the Applicant filed Exceptions to the Proposed Final De sion on May 10, 2013. Included in the Exceptions was a claim that the Applicant had not been given notice that OHCA would rely on certain information in its Proposed Final Decision. In or er to allow the Applicant an opportunity to submit evidence to refute the information up n which OHCA partially relied, the matter was remanded back to the Hearing Officer and the p iblic hearing record was opened on May 21, 2013. In response, the Applicant notified OHC A on May 21, 2013 that it would not be submitting additional evidence, but rather, woul rely on the information included in its Exceptions. The public hearing record was closed agai 1 on May 21, 2013.

Findings of Fact

1. HSS is a not-for-profit, acute are, academic medical center located at 535 East 70th Street, New York, NY 10021. HSS is a health care facility or institution as defined by Conn. Gen. Stat. § 19a-630. E . A, p. 8.

2. HSS currently provides physi ian services, diagnostic x-ray and fluoroscopic guidance imaging services at 143 South Beach Avenue, in Old Greenwich, Connecticut. Ex. A, p. 6.

3. HSS is a top ranked hospital i the orthopedic and rheumatology fields; its MRI centers specialize in musculoskeletal xams. Ex. A, p. 6; Ex. F, p. 340.

4. HSS is planning to expand an relocate its services from 143 South Beach Avenue, Old Greenwich, Connecticut to 1 1 lachley Road, Stamford, Connecticut. Ex. A, p. 6.

5. HSS is seeking approval for t e acquisition of a 1.5 Tesla Magnetic Resonance Imaging (MRI) unit at this new locatio . Ex. A, p. 6.

6. HSS currently operates ten M I units at or in close proximity to its main hospital campus in Manhattan, and has receive approval from the state of New York to operate a new unit at a satellite location in U iondale, NY. Ex. A, p. 7; Ex. B, p. 347.

7. Table 1 shows historical, curre nt and projected utilization for all MRI scanners operated by HSS.

Table 1: HSS Existing MRI Units a ıd Volumes by Location:

	Act ıal Volume (Last 3 ompleted CYs)			CY Vol. (d)	Projected Volume (First 3 Full Operational CYs)		
	2009	2010	2011	2012	2014	2015	2016
HSS Main Campus (a)(b):							
- Unit A	4,555	4,054	3,825	3,267	3,359	3,464	3,568
- Unit B	3,700	3,232	3,244	3,008	3,094	3,191	3,287
- Unit C	3,892	3,963	3,996	3,810	3,919	4,042	4,162
- Unit D	4,194	4,031	3,863	3,567	3,667	3,781	3,895
- Unit E	3,787	3,420	3,382	3,215	3,306	3,409	3,512
- Unit F	2,974	3,648	3,835	3,470	3,568	3,679	3,790
- Unit G (11/3/09)	754	3,754	3,654	3,489	3,587	3,699	3,811
- Unit H (c)	1,708	1,303	2,327	3,397	3,491	3,600	3,709
- Unit I (3/26/12)	-	-	-	1,934	2,591	2,672	2,753
75th St (11/28/11)	-	-	190	2,443	2,512	2,590	2,668
Uniondale, NY (1/1/13)	-	-	-	-	2,400	2,400	2,400
Stamford, CT (1/1/14)	-	-	-	-	2,175	2,540	2,540
Total	25,564	27,405	28,316	31,600	37,669	39,067	40,095

Ex. F, p. 347.

(a) HSS Main Campus MRIs opera e 13.5 hours/day (Unit A – 16 hours/day) and on weekends (limited hours), whereas the units at the offsite locations operate 10 hours/day and no weekends. 75[Th] St, which is in close proximity to the Mai Campus, operates 11.5 hours/day.

(b) Nine of the above listed units a e 1.5 Tesla units and three are 3.0 Tesla units. Tesla measures the strength of the magnet. HSS op rates mostly 1.5T units since these are most effective for orthopedic imaging in most cases.

(c) Unit H was converted from an open to a 1.5T MRI in May 2011 due to obsolescence.

(d) Represents projected 2012 total based on actual volumes through August 2012.

Note: All above years represent cale ıdar years (CYs). Above totals are for outpatients only.

8. The Applicant states that the p oposed service area would include the following towns: Stamford, Greenwich, Darien and New Canaan, Connecticut, and Scarsdale, Rye, and Mamaroneck, New York. Ex. , p. 15.

9. Based on CY 2012 volumes, F SS projects that it will perform approximately 3,250 MRI scans for its patients residing i Connecticut and Westchester County. Of the total projected volume, 896 scans (8%) would originate from the Connecticut portion of the proposed service area. Ex. A, p. 7.

Table 2: HSS Historic l/Projected MRI Volumes for the Proposed Ser ice Area:

Town	2011	Actual through June 2012	Projected through end of 2012
Stamford	144	67	134
Greenwich	454	243	486
Darien	174	68	136
New Canaan	109	70	140
CT Portion of Proposed Service Area	**881**	**448**	**896**
Scarsdale	229	114	228
Rye	217	110	220
Mamaroneck	219	144	288
NY Portion of Proposed Service Area	**565**	**368**	**736**
Total Proposed Service Area	**1,546**	**816**	**1,632**
Other CT Residents	725	465	930
Other NY Residents	616	344	688
Total HSS MRI Volume	**2,887**	**1,625**	**3,250**

Ex. A, p. 15.

10. HSS claims that the maximum capacity of the MRI requested in this proposal will be 2,540 scans; based on a five d y-per-week, 10-hour-per-day schedule. As the projected volume of 3,250 scans exceed the claimed maximum capacity of 2,540 scans, a portion of patients would thus need to eceive their MRI scan in Manhattan. Ex. A, pp. 16-17.

11. HSS is projecting the followin utilization for its proposed MRI scanner:

Projected MRI V lume

	Projected Volume		
	FY 2014	FY 2015	FY 2016
MRI Total	**2,175**	**2,540**	**2,540**

Ex. A, p. 27.

12. HSS states that its MRI scans use proprietary protocols that are customized to meet the needs and specifications of individual patients and their physicians. HSS claims the protocols/customization allows each physician to maximize the usefulness of the MRI as a tool for diagnosis and to help develop effective treatment plans. The protocols used by HSS do not require specialized equipment; however, they do require specialized software for prototype pulse sequences, which is the property of General Electric (GE). Ex. A, pp. 6-7; Ex. F, p. 340.

13. HSS has a comprehensive and collaborative research agreement with GE, allowing it to use these newer sequence and MRI techniques that are not currently available to other providers in the tri-state area. Ex. F, p. 341.

14. HSS sends the majority of its patients (approximately 3,250) to its Manhattan campus to receive MRI scans. Only a small percentage of patients are referred to Connecticut providers. HSS will continue to refer patients to the HSS MRI department, regardless of whether the MRI is located in Manhattan, Stamford or another location. Ex. A, p. 7; Ex. F, pp. 349, 352.

15. HSS stated that patients are sent to New York to be imaged due to the focus on MRI quality. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Dr. Jo A. Hannafin, Attending Orthopedic Surgeon at the Hospital for Special Surgery.

16. HSS stated that it had only anecdotal cases to support its claim that HSS MRI protocols are better than those used by Connecticut providers. HSS' peer-reviewed literature is not based on any specific Connecticut facility. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Dr. Hollis Potter, Chief of the MRI department at the Hospital for Special Surgery.

17. HSS stated that it had not specifically addressed improvement in surgical outcomes as a result of using its MRI protocols. Transcript of December 18, 2012 Public Hearing ("Tr."), Testimony of Dr. Hollis Potter, Chief of the MRI department at the Hospital for Special Surgery.

18. The Applicant asserts that cle : public need for this proposal is demonstrated by the following:
    - An MRI site in Stamfo d provides a more convenient location for Connecticut and Westchester County, N Y patients than the HSS main campus in Manhattan. Ex. A, pp. 7, 13.
    - The ability to free up n eded capacity and alleviate current issues with MRI backlog at HSS's Man attan location. Ex. A, pp. 7, 13.

19. The Applicant asserts that this proposal will not impact the volumes of existing Connecticut MRI providers, d e to the following:
    - MRI volume will shift from Manhattan to Stamford;
    - HSS can fill the capaci y of the proposed MRI with its own patients;
    - The proposed MRI sca mer will not be marketed to non-HSS physicians or patients.

    Ex. A, p. 7.

20. Although HSS does not direct y market it services to non-HSS physicians, testimony received stated that HSS does currently accept referrals from non-HSS orthopedic surgeons in New York. HSS a so stated that it would like to market its MRI services to an orthopedic practice affiliated with The Stamford Hospital and located within the same building (Chelsea Piers compl x) where the proposed MRI would be operated. Transcript of December 18, 2012 Public Heari g ("Tr."), Testimony of Lou Shapiro, President and Chief Executive Officer for the Hospital for Special Surgery.

21. The projected patient populati n mix presented below is based on HSS's current MRI payer mix and assumes that th : mix of patients treated in Stamford will be similar:

Table 4: HSS Projected Payer Mix:

Coverage Type	Year 1 FY 2014	Year 2 FY 2015	Year 3 FY 2016
Medicare*	18.1%	18.1%	18.1%
Medicaid*	2.1%	2.1%	2.1%
CHAMPUS & TriCare	0.0%	0.0%	0.0%
Total Government	**20.2%**	**20.2%**	**20.2%**
Commercial Insurers*	74.7%	74.7%	74.7%
Uninsured	1.4%	1.4%	1.4%
Workers Compensation	3.7%	3.7%	3.7%
Total Non-Government	**79.8%**	**79.8%**	**79.8%**
Total Payer Mix	**100.0%**	**100.0%**	**100.0%**

Ex. A, p. 36.

*Includes managed care activity.

22. The total capital expenditure i: $3,245,583 and will be funded from HSS operations. The capital costs include: $1,800,0)0 for imaging equipment and $1,445,583 for construction and renovation.

23. The Applicant projects increm ntal gains from operations of $1,341,000 in FY 2014, $1,659,000 in FY 2015, and $,708,000 in FY 2016.

Table 5: Financial Projectio s Incremental to the Project:

Description	FY 2014	FY 2015	FY 2016
Incremental Revenue from Operat ons[1]	$2,176	$2,614	$2,686
Incremental Total Operating Expe ses[2]	$835	$955	$978
Incremental Gain from Operatio s	**$1,341**	**$1,659**	**$1,708**

Ex. A, pp. 336-339.
Note: figures are in thousands.
[1] Forecasts consider volume, payer nix and payment rate trends as well as the impacts of proposed regulatory reforms, capacity constr int, and anticipated capital initiatives.
[2] Operating expenses include rent, (epreciation, facility, supply and staffing costs needed to operate the MRI unit and support the forecast d volumes.

24. OHCA is currently in the proc ss of establishing its policies and standards as regulations. Therefore, OHCA has not ma e any findings as to this proposal's relationship to any policies and standards not yet dopted as regulations by OHCA. (Conn. Gen. Stat. § 19a-639(a)(1))

25. This CON application was dee ned complete by OHCA prior to the state wide health care facilities and services plan bei g published. Therefore, OHCA has not made any findings as to the relationship between his CON application and the state wide health care facilities and services plan. (C nn. Gen. Stat. § 19a-639(a)(2))

26. The Applicant has failed to es ablish that there is a clear public need for its proposal. (Conn. Gen. Stat. § 19a-639(a (3))

27. The Applicant has satisfactori / demonstrated that the proposal is financially feasible. (Conn. Gen. Stat. § 19a-639(a (4))

28. The Applicant has failed to sa sfactorily demonstrate that the proposal would improve quality, accessibility and cost ffectiveness of health care delivery in the region. (Conn. Gen. Stat. § 19a-639(a)(5))

29. The Applicant has shown that here would be no change to the provision of health care services to the relevant popula ions and payer mix. (Conn. Gen. Stat. § 19a-639(a)(6))

30. The Applicant has satisfactorily identified the population to be served by its proposal, but has failed to satisfactorily demonstrate that this population has a need as proposed. (Conn. Gen. Stat. § 19a-639(a)(7))

31. The utilization of existing health care facilities and services in the service area does not support this proposal. (Conn. Gen. Stat. § 19a-639(a)(8))

32. The Applicant has failed to satisfactorily demonstrate that its proposal would not result in an unnecessary duplication of existing MRI services in the area. (Conn. Gen. Stat. § 19a-639(a)(9))

Discussion

CON applications are decided on a case by case basis and do not lend themselves to general applicability due to the uniqueness of the facts in each case. In rendering its decision, OHCA considers the factors set forth in General Statutes § 19a-639(a). The Applicant bears the burden of proof in this matter by a preponderance of the evidence. *Goldstar Medical Services, Inc., et al. v. Department of Social Services, 288 Conn. 790 (2008).*

The New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("Applicant" or "HSS"), a not-for-profit hospital located in New York City, proposes to acquire a 1.5 Tesla MRI scanner to be located in Stamford, Connecticut. *FF1&5.*

The proposal is based upon the assertion that a new MRI unit in Stamford would provide a more convenient location for HSS patients residing in Connecticut and Westchester County to receive HSS' MRI services. The relevant portion of HSS' patient volume would shift from Manhattan to a new location in Stamford. HSS has stated that the approval of this proposal would help alleviate capacity constraints and backlog at the hospital's main campus in Manhattan. *FF18-19.*

HSS claims that its use of proprietary and customized MRI protocols result in higher quality images and improved diagnostic accuracy. *FF12-13&15.* Thus, the application is not based on whether the service area needs additional capacity, but rather upon the claimed unique benefits of HSS' MRI protocols.

Although HSS has provided credible testimony as to its experience and expertise generating musculoskeletal MRI scans, it has failed to provide conclusive evidence (i.e., comparative scientific studies or empirical evidence) to validate their claim that HSS' MRI protocols provide significantly better imaging results or lead to better surgical outcomes than MRI protocols used by existing Connecticut providers. *FF ; FF16-17.* Given this lack of evidence to substantiate the Applicant's claim of a unique benefit, approval of this proposal would result in the duplication of services in the region.

HSS represented that it would not directly market its services to non-HSS physicians even though HSS' current practice is to accept referrals from non-HSS physicians, if presented. In addition, HSS stated that it would like to provide MRI services to a local orthopedic practice located within the same building as the proposed MRI. *FF20.* Both of these factors support the conclusion that approval of this proposal would lead to decreased patient volumes and revenues for existing MRI providers in the service area and result in an unnecessary duplication of MRI services in the region.

OHCA's determination on the acquisition of an MRI is based, in part, on the demonstrated need for the acquisition, not whether an MRI may provide a more convenient location for the patient or help to address capacity issues outside of Connecticut. *FF18*. Although HSS provided numerous anecdotal examples and testimony about the quality of its MRI services and overall system of care, both the application and testimony lack evidence to substantiate that access or health care outcomes for Connecticut patients would be improved as a result of this proposal. After considering all of the factors listed above, OHCA concludes that the Applicant did not demonstrate clear public need for its proposal.

Order

Based upon the foregoing Findings an l Discussion, the Certificate of Need application of New York Society for the Relief of the Ru ured and Crippled, maintaining the Hospital for Special Surgery to acquire a Magnetic Resona ice Imaging scanner to be located in Stamford, Connecticut, with an associated capit expenditure of $3,245,583, is hereby **DENIED**.

All of the foregoing constitutes the fir l order of the Office of Health Care Access in this matter.

By Order of the
Office of Health Care Access

6/14/2013
Date

Lisa A. Davis
Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner

IN RE: New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery

DOCKET NUMBER: 12-31780-CON

AGREED SETTLEMENT

On or about August 13, 2012, New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("HSS or the "Applicant") submitted a certificate of need ("CON") application to the Office of Health Care Access ("OHCA") seeking approval to acquire a 1.5 Tesla Magnetic Resonance Imaging ("MRI") unit to be located in Stamford, Connecticut with an associated capital expenditure of $3,245, 583.

The application was filed under Docket No. 12-31780-CON. On September 20, 2013, OHCA issued its Final Decision denying the Applicant's CON application. On or about October 15, 2013, HSS filed an administrative appeal in the Superior Court for the Judicial District of Stamford-Norwalk at Stamford bearing Docket No. FST-CV-13-6020149-S. By order of the Superior Court, this appeal was transferred to the Tax and Administrative Appeals Session of the Superior Court for the Judicial District of New Britain bearing Docket No. HHB-CV-13-6022722-S (hereinafter the administrative appeal is referred to as, "Docket No. HHB-CV-13-6022722-S").

Wherefore, HSS and OHCA sought to resolve the issues raised under Docket No. HHB-CV-13-6022722-S and entered into good-faith settlement discussions in order to avoid the continued expense of litigation;

Wherefore, HSS's original proposal sought to acquire an MRI scanner to serve its own patients who are commercially insured or who privately pay for services received; HSS now proposes to acquire an MRI scanner to serve all Connecticut residents, including Medicaid recipients and the uninsured;

ORDER

NOW, THEREFORE, OHCA and the Applicant, HHS, hereby stipulate and agree to the terms of settlement with respect to the Applicant's request to acquire a 1.5 Tesla MRI unit to be located in Stamford, Connecticut with an associated capital expenditure of $3,245, 583:

1. HHS's request to acquire a 1.5 Tesla MRI unit to be located in Stamford, Connecticut with an associated capital expenditure of $3,245, 583 is **approved.**

2. HSS shall ensure that there is equal access to the MRI service located in Stamford to all patients, including Medicaid recipients and the uninsured;

7. HSS shall apply to the Connecticut Medicaid program and make all efforts to comply with the requirements of participation;

8. HSS shall institute the same Financial Assistance Program at its Connecticut site that is in place at its main campus in New York. Currently under this program, uninsured patients with income levels below 500% of the U.S. Health and Human Services Poverty Guidelines will be eligible for a discounted patient bill. In addition, insured patients may be eligible for discounts toward their copayments, deductibles and other fees depending on income and reasonably available assets;

9. HSS shall establish clinic sessions to provide additional physician services at its Connecticut site for Medicaid recipients and the uninsured to improve the accessibility of services for this patient population;
   a. Clinic sessions shall run two days per month.
   b. Clinic sessions shall be staffed by fully credentialed Medical Doctors employed by HSS.
   c. All services available during private sessions shall be available during clinic sessions and shall be subject to the same quality standards applicable at all HSS locations.
   d. Clinic patients shall have access to all HSS services.

10. Availability of the aforementioned services to Medicaid and uninsured patients at HSS's Connecticut site shall be communicated to area health care providers, including community based health centers. HSS shall accept referrals for:
    a. Musculoskeletal MRI services at its Connecticut site from local health care providers as needed; and
    b. Other specialized musculoskeletal services available during clinic sessions from local health care providers, community based health centers or other sources as needed.

11. HSS shall allocate or block not less than one-third of its Connecticut MRI appointment slots to Connecticut residents;

12. Appointments for MRI services at the Connecticut site shall be scheduled on a "first come, first served" basis, regardless of referral source or payer. If wait times consistently exceed one week, strategies for expanding capacity (e.g. extending hours of operation) shall be considered;

13. HSS shall take all practical steps to achieve a payer mix that includes 10% Connecticut Medicaid and 2% uninsured patients for its Connecticut MRI service within the first year of operation, including but not limited to outreach efforts described in 9 and 10 above. HSS shall provide a plan detailing the foregoing steps to be taken within sixty (60) days of the execution of this settlement. HSS shall report such payer mix to OHCA at the end of its first year of operation and if this threshold is not met, HSS shall work with OHCA

to re-evaluate its outreach initiatives and develop strategies to increase utilization by Connecticut Medicaid and uninsured patients;

14. HSS shall implement educational and community outreach programs in the communities served by its Connecticut site. Implementation efforts shall include the following:
    a. Establishing a Community Service Committee, led by HSS with representation from local Connecticut communities as well as partnering organizations, i.e. Stamford Hospital, community based health centers, local school systems, consumers, etc.;
    b. Conducting a community needs health assessment in the catchment area around the Connecticut site within the first six months of operation and providing the results of the needs assessment to OHCA within thirty (30) days of completion;
    c. Identifying community partners that work with the underserved;
    d. Developing select programs to be offered to address the needs identified in the community needs health assessment, i.e., wellness classes, lectures, etc., either independently or in partnership with local providers (e.g. Stamford Hospital) based upon the results of the community needs health assessment;
    e. Distributing publications via regular mail and/or electronically to the community, i.e., Health Connection newsletter; Health Connection Fast Facts;
    f. Considering extension of existing HSS community outreach programs to the Connecticut service areas, as needed, based on the community needs health assessment. Programs may include, but are not limited to:
        i. The Leon M. Root, MD Pediatric Outreach Program (POP).
        ii. SNEAKER© (Super Nutrition Education for All Kids to Eat Right).
    g. HSS community outreach programs shall include free health screening programs, including free musculoskeletal screening and education sessions to be offered at least quarterly; and
    h. Include the Connecticut communities served by the Connecticut site within the HSS eAcademy consumer/patient programs, i.e., live streaming, webinars, etc.

15. HSS shall provide continuing professional/medical education on musculoskeletal magnetic resonance imaging to providers in the Connecticut service areas as follows:
    a. HSS shall provide educational conferences on musculoskeletal magnetic resonance imaging targeted to at least the two following groups:
        i. Program for Radiologists
        ii. Program for Technologists
    b. Conferences shall include education on musculoskeletal magnetic resonance imaging software, applications and best practices developed by HSS in collaboration with GE Healthcare.
    c. Conferences shall be provided to meet demand but occur no less frequently than annually.

d. HSS shall communicate the availability of its fellowship programs to Connecticut Radiology Residency programs and encourage application to these fellowship programs.

16. HSS shall seek to fill any additional non-medical doctor positions created as a result of the relocation and expansion of its Old Greenwich office to Stamford (approximately 25 positions) with qualified Connecticut residents;

17. Reporting to OHCA shall be required for a period of five (5) years following the opening of the Connecticut site. HSS shall immediately report to OHCA the date that the project has become fully implemented and the MRI service operational at the Connecticut location. This date shall be considered the implementation date for reporting purposes;

18. HSS shall provide documentation to OHCA evidencing acceptance within the Connecticut Medicaid Program in accordance with Condition 7. Such documentation shall be filed within thirty (30) days of approval as a Connecticut Medicaid provider;

19. HSS shall provide documentation to OHCA evidencing that HSS has provided notice to providers of its participation in the Connecticut Medicaid Program, in accordance with Condition 7 above. Such documentation shall be filed within thirty (30) days of approval as a Connecticut Medicaid provider;

20. The following shall be filed with OHCA within sixty (60) days subsequent to the one year anniversary of the implementation date for a period of five (5) years:

    a. A report of the quality data on patient outcomes regarding HSS MRI Service Integration during the past operating year, including:
        i. Report on the use of contrast for non MRI Angiography and report on comparison of the repeat studies where the base study from the outside institution used contrast ,
        ii. Report on the number of repeat studies where it was determined that the outside study was not adequate for diagnosis,
        iii. Summary of research findings from clinical practice studies (findings will also be incorporated into community based education for local radiologists where appropriate), and
        iv. Hospital wide publicly reported measures enabled by HSS integrated care which includes MRI (readmission rates, surgical site infection rates, etc.);
    b. The number of Connecticut Medicaid recipients and uninsured utilizing the clinic sessions during the past operating year, in accordance with Condition 9 above;

c. Quantification of the discounts provided through the Financial Assistance Program for the approved site during the past operating year in accordance with Condition 8 above. The information shall be provided as both a dollar amount and a volume figure (i.e., the number of scans for which a discount was provided);
d. A description of, as well as the frequency of, the free health screening programs during the past operating year and the area providers involved, in accordance with Condition 9 above;
e. A description of, as well as the frequency of, educational sessions held during the past operating year and the topics discussed, in accordance with Conditions 14 and 15 above;
f. A summarization of the collaborative efforts and the discussions with area hospitals and providers during the past operating year, in accordance with Condition 14 and 15 above;
g. A summary of communication to Connecticut Residency programs regarding HSS's Fellowship programs, in accordance with Condition 15 above;
h. The names of the radiologists from or licensed in Connecticut who participated in and completed the magnetic resonance imaging fellowship during the past operating year, in accordance with Condition 15 above.
i. A listing of the positions, both employed or under contract, at the Connecticut site for the past operating year and the State in which the individuals that hold the listed positions, reside;
j. A listing of the community needs identified and the community benefit activities undertaken during the past operating year, in accordance with Condition 14 above;
k. A copy of the Community Service Plan Report, including a summary of Community Service Committee activities and a summary of completed and planned health screening and education activities during the past operating year, in accordance with Condition 14 above;
l. Annual magnetic resonance utilization data based on number of scans shall be provided by zip code and by payer type. This data shall be filed in the following table format in Excel:

Zip Code	Medicare	CT Medicaid	Other States' Medicaid	Other Government (CHAMPUS & Tricare)	Commer-cially Insured	Uninsured	Workers Compensation	Total for Zip Code
06001	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
06002	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
#####	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans

#####	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
#####	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
Total for CT zip codes	# and %	# and %	N/A	# and %	# and %	# and %	# and %	N/A
Total for other states zip codes	# and %		# and %	# and %	# and %	# and %	# and %	N/A
Total all zip codes	# and %	# and %	# and %	# and %	# and %	# and %	# and %	N/A

m. Annual MR utilization data based on number of scans shall be provided by zip code and by diagnostic category. This data shall be filed in the following table format in Excel:

Zip Code	Diagnostic Category	Diagnostic Category	Diagnostic Category	Diagnostic Category	Diagnostic Category	Diagnostic Category	Diagnostic Category	Diagnostic Category
06001	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
06002	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
#####	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
#####	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
#####	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans

n. Other reporting as reasonably required by OHCA.

21. OHCA and HSS agree that this settlement represents a final agreement between the OHCA and HSS with respect to Docket No. 12-31780-CON. The execution of this settlement resolves all objections, claims and disputes, which may have been raised by HSS with regard to Docket Number 12-31780-CON;

22. HSS hereby agrees to withdraw its administrative appeal filed under Docket No. HHB-CV-13-6022722-S within two (2) business days of the execution of this settlement and provide evidence thereof to OHCA.

23. OHCA may enforce this settlement under the provisions of Conn. Gen. Stat. §§ 19a-642 and 19a-653 with all fees and costs of such enforcement being the responsibility of HSS; and

24. This settlement shall be binding upon HSS and its successors and assigns.

Signed by Louis Shapiro, President & CEO
(Print name) (Title)

12/23/13
Date

Duly Authorized Agent for
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery

The above Agreed Settlement is hereby accepted and so ordered by the Department of Public Health Office of Health Care Access on December 26, 2013.

Lisa A. Davis, MBA, BSN, RN
OHCA Commissioner

HOSPITAL
FOR
SPECIAL
SURGERY

Specialists in Mobility

Lisa A. Davis, MBA, BSN, RN
Deputy Commissioner
Connecticut Department of Public Health
Office of Health Care Access
410 Capitol Avenue, P.O. Box 340308
Hartford, CT 06134-0308

Dear Commissioner Davis,

As is outlined in section 13 of the Agreed Settlement dated December 26, 2013 between the Connecticut Department of Public Health ("DPH") and Hospital for Special Surgery ("HSS") (the "Agreement"), "HSS shall take all practical steps to achieve a payer mix that includes 10% Connecticut Medicaid and 2% uninsured patients for its Connecticut MRI service within the first year of operation..." Furthermore, this section requires HSS to "provide a plan detailing the foregoing steps to be taken within 60 days of the execution of this settlement."

HSS shall take the following actions in order to achieve the targets set out in the Agreement:

I. **Connecticut Medicaid Enrollment** – HSS shall enroll in Connecticut's Medicaid program in order to accommodate Medicaid beneficiaries at the Stamford site.

II. **Clinic Sessions** – In accordance with section 9 of the Agreement, HSS shall operate two clinic sessions per month. Each clinic session will be staffed with fully accredited HSS physicians accepting Medicaid and uninsured patients. A portion of these patients will require MRI services that will be delivered at the Stamford site.

III. **Outreach** – In accordance with section 10 of the Agreement, HSS shall communicate the availability of its Connecticut MRI service to area health care providers, including community based health care centers. HSS has already initiated discussions with several regional healthcare providers and will work with them to develop linkages with HSS to address the needs of their patient population. HSS will continue this process over the next several months. Additionally, we will reach out to area hospitals and emergency departments to make them aware of the availability of services to Medicaid beneficiaries and the uninsured. Other providers and health care centers to be notified will be

Louis A. Shapiro
President and
Chief Executive Officer

535 East 70th Street
New York, NY 10021
tel 212.606.1625
fax 212.606.1628
e-mail: shapirol@hss.edu

identified as part of HSS's community needs assessment to be conducted under section 14 of the Agreement.

Through these activities, HSS will communicate its presence in Southern Connecticut, create a referral network for local providers and community based organizations seeing Medicaid and uninsured patients, and provide services to these patients in its clinic and MRI services. The site is anticipated to be operational by the first quarter of 2015.

Please let us know if you require further information.

Sincerely,

Louis A. Shapiro
President/CEO

Huber, Jack

From: Martone, Kim
Sent: Tuesday, April 01, 2014 9:35 AM
To: Roberts, Karen; Huber, Jack
Cc: Greer, Leslie
Subject: FW: Read the 2013 Community Benefit Report

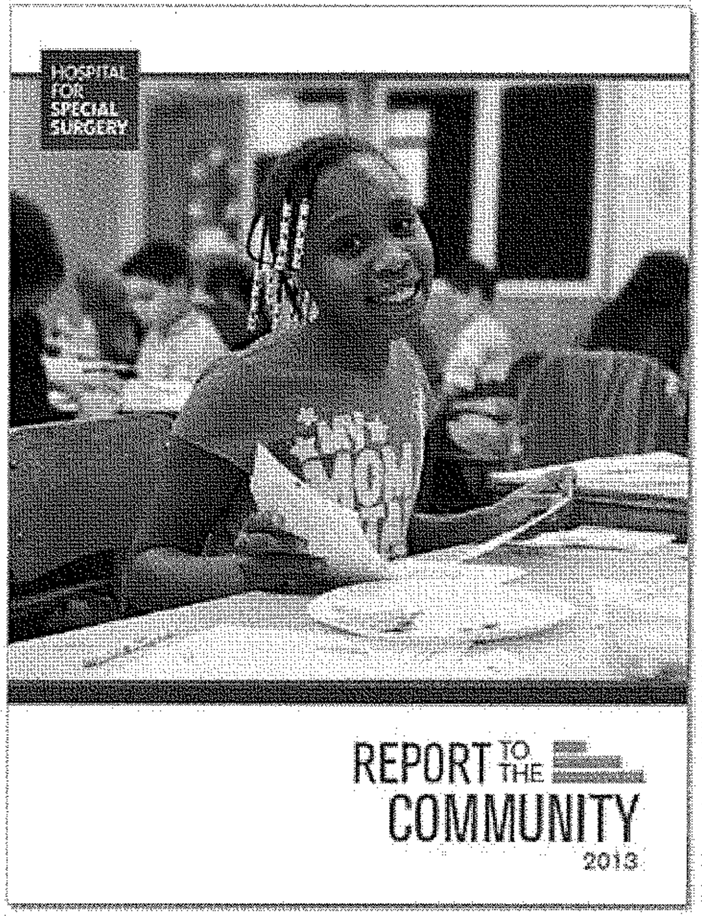
From: Buscemi, Peter [mailto:BuscemiP@HSS.EDU]
Sent: Monday, March 31, 2014 5:30 PM
To: Martone, Kim
Subject: FW: Read the 2013 Community Benefit Report

Good Afternoon Kim. Below is a link to HSS's 2013 Community Benefit Report. When we met in November, we discussed some of what HSS does to benefit the communities it serves. This report gives a more complete picture of our community benefit activities. Please feel free to share this with your colleagues and let me know if there are any questions or problems. I can also give your contact information to our Education & Academic Affairs department so you can receive this report and other like it in the future. Please let me know if this is ok and if there is anyone else you think should be added to the mailing list.

Best regards,

Peter Buscemi
Assistant Vice President, Financial Planning
Tel: (646) 797-8228
Fax: (212) 774-7841
buscemip@hss.edu

From: Ennis, Marcia
Sent: Monday, March 31, 2014 1:53 PM
To: HSSALL
Subject: Read the 2013 Community Benefit Report



We are pleased to introduce the HSS 2013 Community Benefit Report, which describes the Hospital's extensive community programs and services, research activities and medical education efforts.

Download the Report

If you would like hard copies, please contact Sandie Goldsmith at goldsmiths@hss.edu

We encourage you to forward this message to a friend or colleague

Learn more about:

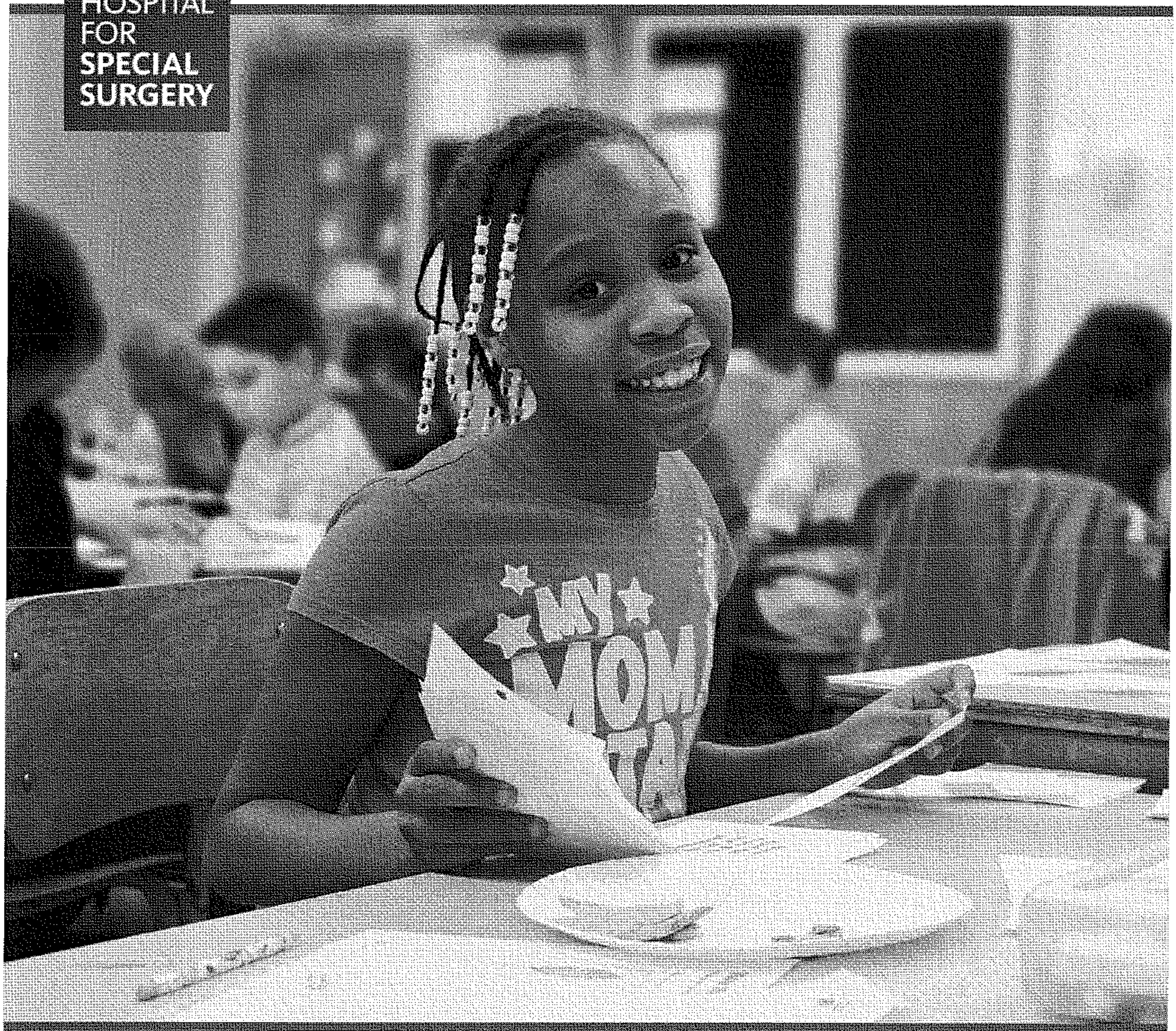
HSS Community Outreach • Public & Patient Education Programs • Patient & Consumer Resources

Visit us on

Education & Academic Affairs, 535 East 70th Street, New York, NY 10021 | 212.606.1057

For technical support, please email: professionaleducation@hss.edu.

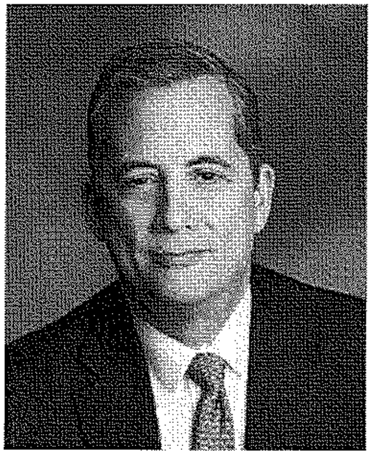
HOSPITAL FOR SPECIAL SURGERY



REPORT TO THE COMMUNITY

2013

Dear friends,

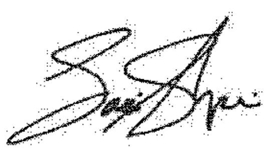


It gives me great pleasure to release this year's Community Benefit Report on behalf of Hospital for Special Surgery. Caring for our community is one of our Hospital's core values. We define our community broadly to include our staff, patients, Upper East Side neighbors, neighbors in all five boroughs of New York City, and everyone across the United States and around the world who would benefit from world-class prevention and care in our areas of specialty – orthopedics, rheumatology, and rehabilitation.

This report highlights the many educational, clinical, and research programs we have instituted to serve our local, national, and international communities. In every effort, HSS is committed to raising the bar for excellence, innovation, and compassion.

In today's complex and multicultural world, collaboration is essential to achieve extraordinary outcomes. HSS collaborates with local, national, and international partners to address key public health concerns and enhance wellness and care in underserved communities. As a world leader in musculoskeletal care, we are proud to offer our skills, expertise, and knowledge to enrich programs that make a real difference in people's lives. Our goal is to advance the field of musculoskeletal medicine while increasing access to care for patients around the world, so that more can benefit from medical and health systems advances.

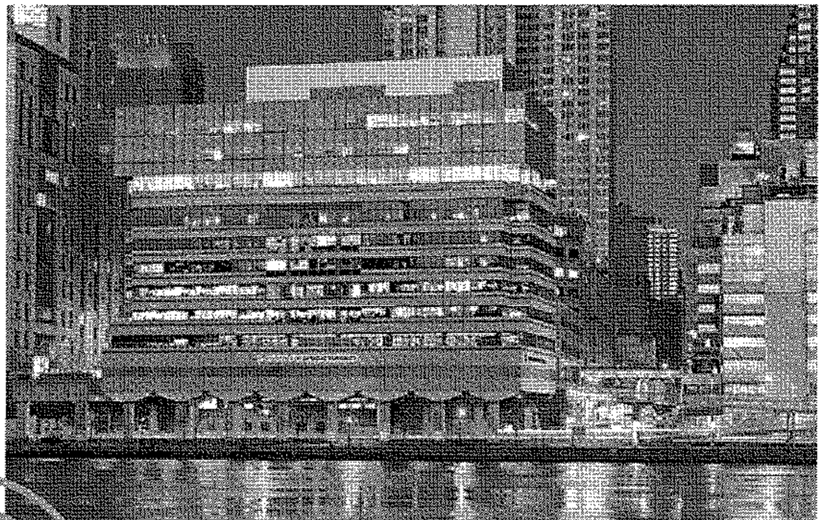
We are proud of what we have accomplished and look forward to continuing to lead efforts to elevate care and access to care for patients in our local community and around the world.



LOUIS A. SHAPIRO
President and CEO

TABLE OF CONTENTS

ON THE COVER: A student participates in the SNEAKER® program at PS 140 Nathan Straus on the Lower East Side of Manhattan. Read more about SNEAKER® and other HSS community programs on page 8.



1 About Hospital for Special Surgery

Hospital for Special Surgery (HSS) celebrated our 150th anniversary in 2013. Founded in 1863, at the height of the Civil War, HSS – the country's oldest orthopedic hospital – has grown to become a world leader in orthopedics, rheumatology, and rehabilitation. The Hospital has achieved continued success by maintaining our culture of excellence, innovation, and caring in a rapidly changing external environment.

Today HSS maintains our dedication to delivering exceptional care to people from all backgrounds. Through a variety of programs, the Hospital strengthens public health efforts by disseminating information, providing comprehensive services, and partnering with organizations which share our passion for nurturing good health for the diverse communities we serve. Our enthusiastic staff understands that their skills and talents are not just valued within our walls, but beyond them as well.

All great medical advances have been achieved through research. HSS maintains a robust Research Division which supports a vigorous program of basic science and clinical investigation. Throughout our long and distinguished history, the innovation and expertise of HSS investigators have enhanced our understanding of musculoskeletal and rheumatologic disorders and led to the development of technologies that have greatly improved patients' quality of life.

HSS is also committed to training the leaders of the future through our residency and fellowship programs. Many of the leaders in orthopedics today across the country and around the world honed their skills through the Hospital's educational programs.

SERVING OUR DIVERSE COMMUNITY

HSS reaches many communities in New York City, the Tri-State area and around the world. The Hospi-

ACHIEVING EXCELLENCE

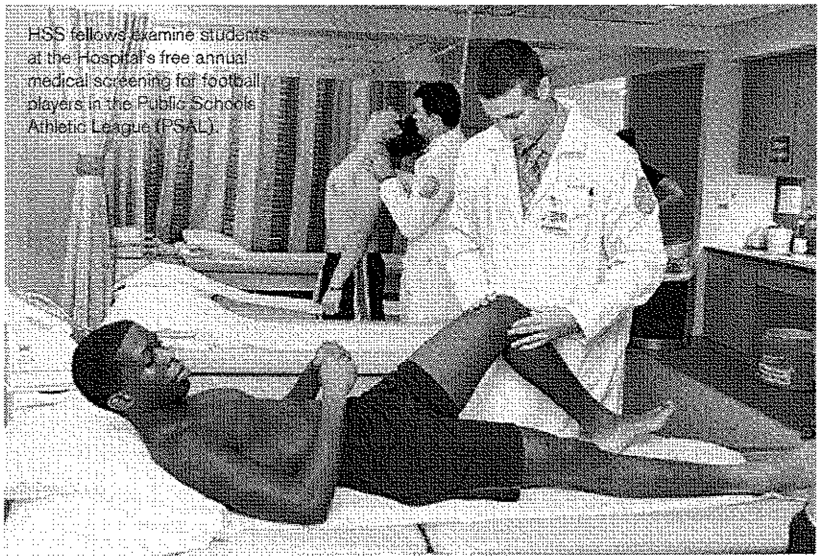
The commitment of every member of the HSS family to raise the bar in patient care through research, innovation, education, and compassion is stronger than ever, and has resulted in external recognition and, most importantly, positive feedback from patients.

HSS is nationally ranked No. 1 in Orthopedics, No. 4 in Rheumatology, and No. 5 in Geriatrics by *U.S.News & World Report* ("Best Hospitals" 2013-2014), and was the first hospital in New York State to receive Magnet Recognition® for Excellence in Nursing Service from the American Nurses Credentialing Center three consecutive times.

HSS has been cited as having one of the lowest infection rates in the country. From 2007 to 2012, we were also a recipient of the HealthGrades Joint Replacement Excellence Award.

HSS has been named a 2013 Guardian of Excellence Award winner by Press Ganey Associates, Inc., which recognizes top-performing facilities for patient satisfaction, employee engagement, physician engagement, and clinical quality performance. We won the award for our extraordinary results in the Patient Satisfaction category.

Pictured above: Hospital for Special Surgery is located on the Upper East Side of Manhattan.



HSS fellows examine students at the Hospital's free annual medical screening for football players in the Public Schools Athletic League (PSAL).

tal's primary service area consists of the five boroughs of New York City. Our immediate community lies within the boundaries of New York City's Community Board 8, which extends north from 59th Street to 96th Street and east from Fifth Avenue to the East River. The suburban counties surrounding New York City are our secondary service areas, including New Jersey, Connecticut, Westchester County, and Long Island.

The commitment of HSS to caring for the public can be traced back to our roots. James Knight, MD, our founder and first Surgeon-in-Chief, established The New York Society for the Relief of the Ruptured and Crippled (the forerunner of HSS) in 1863 as a 28-bed facility in his own home on Second Avenue at 6th Street. Dr. Knight felt a need to provide healthcare to the poor and the crippled on the streets of New York.

Today HSS continues to provide care to medically underserved populations through our outpatient clinics, maintaining our commitment to caring for those patients most in need. They often come to us seeking relief of pain due to arthritis and other rheumatologic conditions or traumatic injury, hoping to be helped by an intervention that would restore their mobility and ability to complete the activities of daily living.

HSS BY THE NUMBERS
More than
25,000
HSS outpatient clinic visits

Many of them have disorders that are complex and/or chronic, such as scoliosis, lupus, rheumatoid arthritis, and cerebral palsy – disorders that are best treated at an institution with the level of expertise and resources found at HSS.

FINANCIAL ASSISTANCE

The Hospital's Financial Assistance Program ensures the provision of quality healthcare to patients of all backgrounds across the United States. We carefully take into account the ability of each patient to pay. The Hospital extended our program beyond the state-mandated level of 300 percent of the federal poverty level to include patients whose income is at or below 500 percent of the federal poverty level.

We have also extended our policy to consider a patient's insurance co-pay, deductible, and co-insurance when considering eligibility for a discount.

In addition, in 2013, HSS increased the number of Medicaid managed care plans in which we participate from two to four.

HSS OUTPATIENT CLINICS: ENSURING ACCESS TO CARE

HSS has more than **20 specialty clinics** serving the medically underserved, including those focusing on the Hip/Knee, Sports and Shoulder, Spine, Metabolic Bone, Physiatry, Pain Management, Foot, Hand, Neurology, Rheumatology, Pediatric Neurology, Dermatology, Adult Limb Lengthening, Skeletal Dysplasia, Pre-surgical Screening, and the Comprehensive Arthritis Program. The Pediatric Orthopedic Clinic addresses all orthopedic concerns of children. Specialized clinics are geared toward the needs of children with scoliosis, cerebral palsy, lupus, juvenile rheumatoid arthritis, pediatric limb lengthening, spina bifida, child foot, child hand, and clubfoot.

2 Commitment to Community

HSS continues its commitment to helping our diverse community started by our founder James Knight, MD, in 1863 by offering many vital services and resources to vulnerable populations. The number of beds we have may be higher, the number of patients we serve may be greater, and the technology we use is far more advanced than it was in Civil War times. But one thing has not changed: our desire to help those who need it most.

IDENTIFYING THE COMMUNITY'S NEEDS

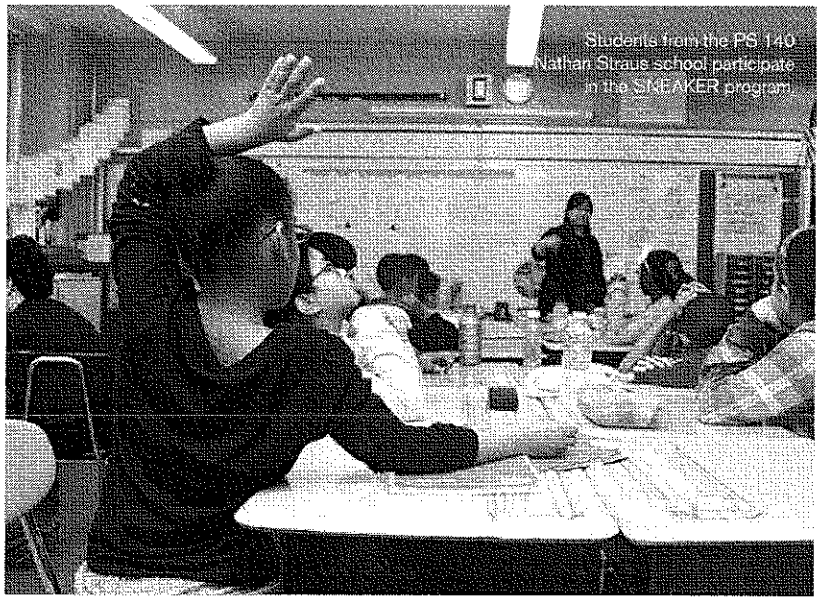
HSS gathers feedback from local organizations, city and state agencies, colleges and universities, public schools, the private sector, our patients, and the broader community to identify the community's needs, ascertain healthcare gaps, and inform new directions for efforts to improve public health.

These continuous interactions are vital to ensuring that we remain aware of the community's changing needs and use this information to adapt our programs accordingly.

In 2013, the Hospital performed a formal community health needs assessment (CHNA) to evaluate musculoskeletal and rheumatologic health conditions and management; quality of life; use of and access to healthcare; and socio-demographic characteristics (including health literacy).

The public and community partners helped design the CHNA by providing input about survey gaps, length, and construction; health literacy; and cultural relevance.

Nearly 1,100 people responded to the survey, which was given in English, Spanish, and Chinese. The responses provided a useful look at the makeup of the HSS community, which can be seen on page 6.



Students from the PS 140 Nathan Straus school participate in the SNEAKER program.

MEETING THE NEEDS OF THE COMMUNITY

Community Service Plan

Using the results of the CHNA and other needs assessments, input from key partners, and public health data, the Hospital designs and coordinates programs to meet the community's needs. HSS details these programs in a comprehensive three-year Community Service Plan (CSP), which is required by the New York State Department of Health (NYSDOH). The CSP outlines how the Hospital will address the needs of our community while aligning with the NYSDOH public health improvement plan.

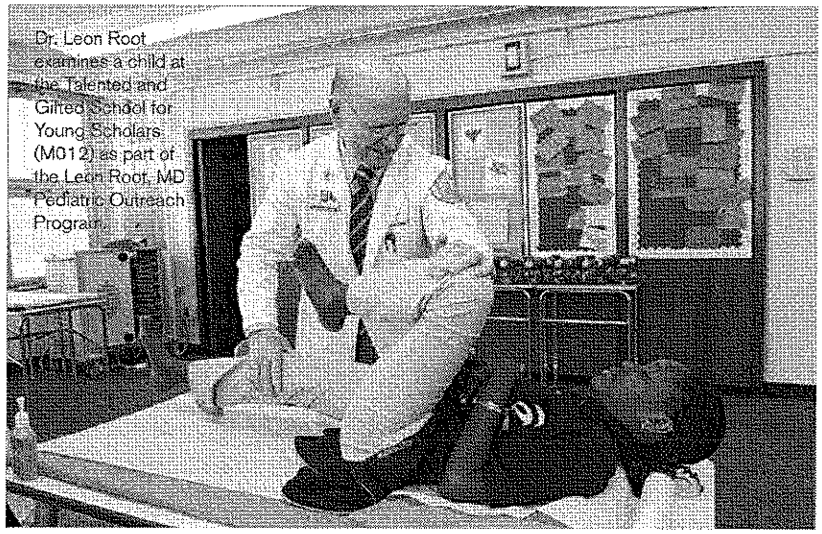
The focus of the HSS CSP is on preventing chronic disease, with the Hospital concentrating on musculoskeletal and rheumatologic conditions. The 10 programs outlined in the CSP will contribute to the NYSDOH priorities to reduce obesity in children and adults and increase access to high-quality chronic disease preventive care and management in clinical and community settings.

HSS Community Service Plan programs include:

1. **SNEAKER© (Super Nutrition Education for All Kids to Eat Right)** provides culturally-sensitive nutrition education to New York City's children and their families.
2. **HSS Asian Community Bone Health Initiative** addresses musculoskeletal issues in

the Asian community through culturally relevant education and exercise programs.

3. **The Leon Root, MD Pediatric Outreach Program (POP)** screens children for musculoskeletal issues in New York City schools and daycare centers located in medically underserved neighborhoods.



Dr. Leon Root examines a child at the Talented and Gifted School for Young Scholars (M012) as part of the Leon Root, MD Pediatric Outreach Program.

4. **The Osteoarthritis Wellness Initiative** provides educational and exercise programs to the public to raise awareness of, provide education about, and reduce the impact of osteoarthritis.

5. **The Osteoporosis Wellness Initiative** helps those living with osteoporosis better manage their condition through education and exercise programs.

6. **The Geriatric Resident Training Program** provides third-year orthopedic surgery residents with enhanced communication skills to improve provider-patient communication, while also empowering older patients to be better advocates and partners in their own healthcare.

7. **VOICES 60+ Senior Advocacy Program** helps older adults navigate and access the support, education, and communication resources needed to manage their rheumatologic and musculoskeletal disorders and enhance their quality of life.

8. **Charla de Lupus/Lupus Chat®** is a national program offering underserved communities with lupus (including African Americans and Spanish speakers)

SNAPSHOT OF CHNA RESULTS

Nearly 1,100 people responded to the **Community Health Needs Assessment** (CHNA) survey. Here's a look at our respondents and their reported needs.

Gender

82% female

18% male

Age

11% under 40

25% age 40–59

47% age 60–79

17% age 80 and older

Ethnicity

60% white

16% black

14% Hispanic/Latino

10% Asian

Education

10% less than high school

12% completed high school

21% more than high school

22% completed college

35% post-college

Leading health conditions

- Osteoarthritis
- Rheumatoid Arthritis
- Osteoporosis

17% could not access a healthcare provider when needed

60% needed help understanding their healthcare coverage

Top barriers to accessing healthcare

- Service not covered
- Affordability issues

34% reported **having fallen** in the last year

15% reported a **fracture** sustained from the fall

40% **did not report the fall** to a healthcare provider and their families peer health support and education.

9. **LANtern® (Lupus Asian Network)** is a national support and education program designed specifically for Asian Americans with lupus and their loved ones.

10. **HSS Nursing Community Education Outreach** works with local senior centers and community-based organizations to provide self-management education to older adults.

Over the next three years, HSS expects to reach nearly 14,000 participants/contacts through its education, support, and exercise programming. The HSS CSP can be viewed at www.hss.edu/community.

HSS BY THE NUMBERS

HSS expects to reach nearly **14,000** participants/contacts through its education, support, and exercise programs over the next **3** years.

KEEPING THE COMMUNITY IN MOTION

Partnering with several local and national groups, the Hospital's community initiatives promote health education, support and outreach services, and communication, enhancing the mobility and quality of life of our community. While the CSP outlines many of the efforts of HSS to improve public health, there are many other programs not highlighted in this document. A comprehensive list follows here.

Educating to Improve Public and Patient Health

HealthConnection: Hospital for Special Surgery's Good Health Newsletter informs the community about the latest information and research in musculoskeletal health. *HealthConnection* has expanded its reach through publication on the HSS website.

HealthConnection Fast Facts is our online health education newsletter designed to provide the public with fast, current, and accurate information about musculoskeletal and general health, and is available on the HSS website.

Integrative Care Center (ICC): The Hospital offers public education programs, private classes, and alternative care services under the supervision of HSS physicians, physical therapists, and complementary care providers.

Nursing Community Education Outreach: HSS nurses provide educational workshops to older adults at local senior centers to help them develop self-care knowledge and provide self-management support strategies on issues important to seniors.

Public & Patient Education: HSS offers a wide variety of programming and practical information on musculoskeletal conditions and other health and wellness topics for patients and the general public through community education programs, lectures, workshops, support groups, publications, and a patient education library.

Focusing on Musculoskeletal Health

Musculoskeletal Wellness Initiatives: Osteoarthritis and Osteoporosis Wellness Initiatives were developed to raise awareness

SPOTLIGHT: Nursing Community Education & Outreach Initiative

"Magnet nurses are committed to the public health needs of the communities we serve. The Nursing Community Education & Outreach Initiative affords nurses the opportunity to connect with the community through teaching and help them to lead healthy lives – an important and satisfying part of our scope of practice."
—Trish Quinlan, PhD, MPA, RN, CPHQ

The HSS Nursing Community Education & Outreach initiative aims to develop self-care knowledge and provide self-management support strategies for issues that are important to seniors.

Launched in August 2012, the program has grown from a small circle of nurse volunteers to a robust, structured program that addresses the public health needs of New York City's older adult population. Select HSS nursing staff work with local senior centers to assess the educational needs of this population and develop evidence-based content to provide workshops and seminars.

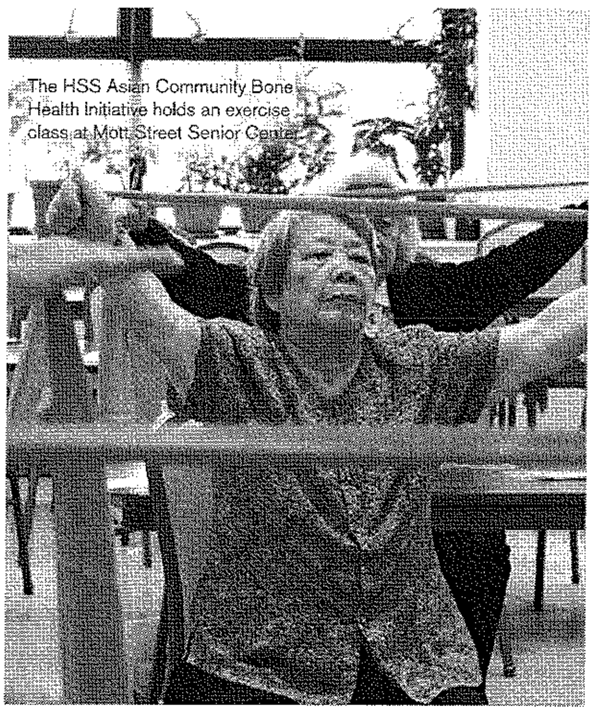
Falls prevention, nutrition, and medication safety are just a few of the topics that have been addressed to date.

of, provide education about, and reduce the impact of these diseases in older adults. Free or low-cost education and exercise programs aim to improve fitness, increase mobility, decrease pain, and enhance quality of life.

Encouraging Safe Exercise

Exercise Wellness Program: For people who have completed their formal physical therapy regimen and choose to continue under the guidance of therapists at the HSS Joint and Mobility Center.

Osteofitness, a group exercise mat class, was developed especially for patients with osteoporosis or osteopenia. The classes follow the HSS Rehabilitation Department's 5-Point Program, focusing on posture, flexibility, strengthening, weight-bearing, and balance.



The HSS Asian Community Bone Health Initiative holds an exercise class at Mott Street Senior Center

Pre-Season Football Medical Screening: HSS teamed up with the Public School Athletic League to offer public high school students screenings that include, but are not limited to, orthopedic screening, flexibility testing, and body fat percentage assessment – all provided at no cost.

HSS BY THE NUMBERS

More than **29,000** community contacts were made through **9** Department of Social Work Programs

Support for People with Chronic Musculoskeletal Conditions

Living with RA is a monthly support and education program for HSS patients with severe rheumatoid arthritis (RA). The group features RA-related lectures, and is followed by a support group facilitated by a social work manager and nurse manager in rheumatology.

The Early RA Support and Education Program focuses on early intervention for people with newly diagnosed RA by providing essential RA-related group support and education. The group meets monthly and is co-led by a licensed social worker and nurse manager.

The Myositis Support and Education Group meets monthly to help patients cope with the disease, reduce isolation, and increase understanding of inflammatory myopathies. A monthly newsletter is sent to all group members.

The Scleroderma, Vasculitis, and Myositis Center Education and Support Forum features disease-specific talks by expert healthcare professionals, followed by a social work-facilitated support and discussion hour. It is open to community members and to HSS patients.

Caring for Children and Families

The Leon Root, MD Pediatric Outreach Program is a community-based musculoskeletal screening program, conducted in New York City schools, and is designed to prevent long-term musculoskeletal disorders and severe joint disability in children living in medically underserved communities.

SNEAKER© (Super Nutrition Education for All Kids to Eat Right) provides culturally sensitive nutrition education to New York City children and their families residing in underserved communities.

Improving Health Among Older Adults

HSS Speaker's Bureau matches professionals to organizations around New York City to present educational programs on various topics, such as elder abuse, diabetes, heat safety, osteoporosis, and arthritis.

Greenberg Academy for Successful Aging develops and implements health education and exercise programs aimed at the interests and needs of people age 65 and over.

VOICES 60+ Senior Advocacy Program assists ethnically diverse HSS patients, age 60 and older, with arthritis and related orthopedic conditions. The program's goal is to enhance the medical care experience and improve quality of life by helping older adults navigate and access the care, community resources, and education they need.

Helping People with Lupus

Charla de Lupus/Lupus Chat® is a national program offering underserved communities with lupus (including African Americans and Spanish speakers) and their families peer health support and education.

LANtern® (Lupus Asian Network) is the only national support and education program designed specifically to serve Asian Americans with lupus and their loved ones through its national SupportLine and many other related services. The initiative has also published "LANtern e-News – Building Community Partnerships."

LupusLine® is the only national telephone peer support program offering one-to-one emotional support and information to people with lupus across the country and internationally. The program links people who need the service with trained volunteers who have lupus or are family members of someone with lupus.

The SLE Workshop is one of the country's longest-standing support and education groups for people with lupus. The program offers free monthly meetings at HSS for individuals with lupus, their families, and their friends.

Reaching the Asian-American Community

HSS Asian Community Bone Health Initiative aims to improve the quality of life of at-risk older adult members of the New York City Asian community by helping them stay active and better manage chronic bone and joint diseases through exercise classes and educational workshops.

Assisting with Access to Care

VOICES Medicaid Managed Care Education Program provides bilingual (English/Spanish) education, support, and advocacy to help patients and the community understand and navigate insurance options under Medicaid managed care.

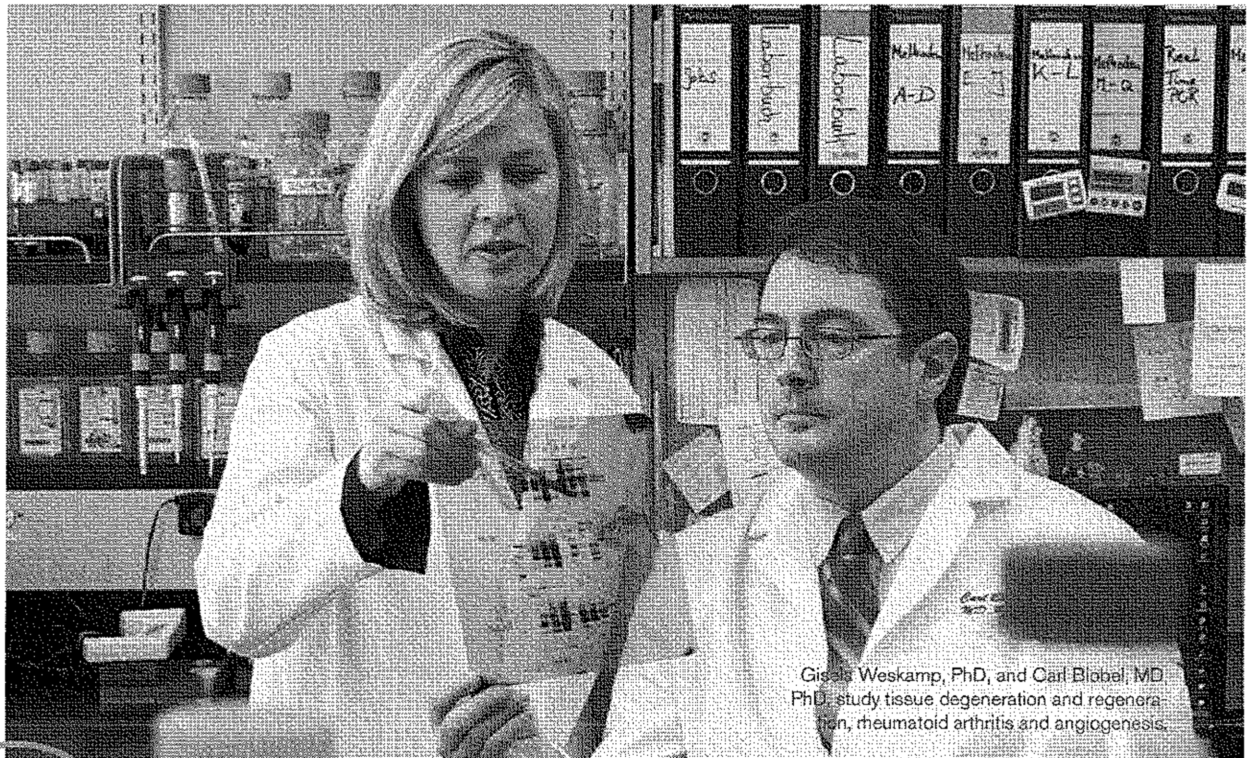
Reaching the International Community

Foundation of Orthopedics and Complex Spine (FOCOS) is a non-profit organization that was established by the Chief of the Scoliosis Service at HSS. The organization's mission is to provide comprehensive, affordable orthopedic and spine care to people in medically underserved areas – primarily in Ghana, West Africa – through an international network of volunteer nurses, surgeons, and other medical providers.

HSS supports this humanitarian work by offering employees 40 hours per year of paid time off for humanitarian service projects.

HEALING THROUGH ART AND WORDS

HSS has created a new online narrative journal, **Rheum to Heal**, where people affected by rheumatic diseases can share their experiences, thoughts, and feelings through poetry, prose, artwork, and photography. Rheum to Heal, available through a free subscription, accepts submissions from patients with arthritis, autoimmune diseases, pain disorders affecting joints, and osteoporosis, as well as the healthcare professionals who care for them. In sponsoring Rheum to Heal, HSS hopes to build a sense of community among people with similar health struggles and reduce the sense of isolation that often accompanies chronic illness. For more information, **visit www.hss.edu/rheumtoheal**.



Gisela Weskamp, PhD, and Carl Blobel, MD, PhD, study tissue degeneration and regeneration, rheumatoid arthritis and angiogenesis.

3 Enhancing Care through Research

New knowledge of how diseases work has led to more effective treatments that allow people around the world to live healthier, more active lives. Many of these advances originated at HSS, where physicians and scientists continue to conduct cutting-edge research in orthopedics and rheumatology.

Our research projects are strongly supported by a history of basic scientific investigation, a high volume of patients with musculoskeletal disorders, and an interdisciplinary alliance between scientists, physicians, and surgeons who share a passion for rapidly translating research findings into better ways to improve our patients' lives.

In 2013, we conducted $34.2 million in research projects at HSS. Examples of research projects in 2013 include:

- **The Value of Partnership:** A study, presented at the Annual Meeting of the American College of Rheumatology (ACR) in October, showed that joining forces with the community-based S.L.E. Lupus Foundation to publicize a Facebook chat sponsored by the HSS Lupus Center of Excellence tripled the number of participants compared with previous HSS-sponsored chats. The collaboration attracted 123 participants to the chat from 28 U.S. states and six countries.

HSS BY THE NUMBERS

$34.2 million spent on research in 2013, supporting more than **300** research projects

- **The Risks of Social Isolation:** A survey reported that people who lacked strong social ties – such as having several close friends or relatives or associations with community or religious groups – are more likely to experience serious, ongoing pain after total hip replacement two or more years

"Lupus patients are hungry for information, and with social media, we can address their specific concerns in real time."

— *Jane E. Salmon, MD, Director, Lupus Center of Excellence*

after the procedure. There was a strong link between lack of social interaction and increased pain.

- **Using MRI to Pinpoint Early Arthritis**
  HSS received funding from the Arthritis Foundation to evaluate MRI and biomarker studies to identify which patients who suffer from an anterior cruciate ligament (ACL) tear in the knee are most likely to develop osteoarthritis – information that could be used to start testing new treatments sooner.

A BOOST FOR GENOMICS

HSS received a $5.6 million grant from The Tow Foundation to establish the HSS David Z. Rosensweig Genomics Research Center, which will seek to further understand the genes associated with rheumatoid arthritis and lupus.

The Center will collaborate with scientists at the New York Genome Center in lower Manhattan, known for its genome-sequencing machines and other state-of-the-art resources. The goal is to develop more effective treatments with fewer side effects.

SPOTLIGHT: Honoring Lupus Heroes

"We are deeply grateful that they have allowed us to learn from their journey and grow as caregivers."
–Peggy Crow, MD, HSS Physician-in-Chief

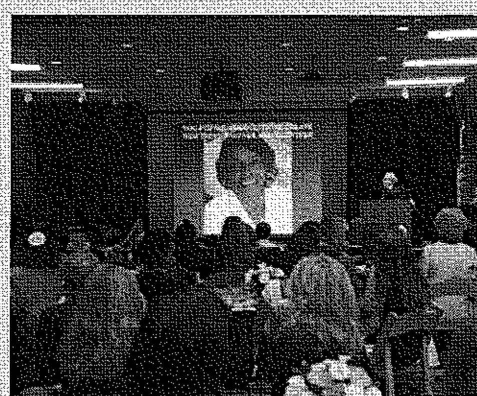
As part of HSS's 150th Anniversary celebration, the Division of Rheumatology honored the thousands of lupus patients, past and present, who have inspired each member of the healthcare team and helped advance research through participation in clinical research studies. "Honoring Lupus Heroes," held in September 2013, celebrated patients' wisdom, generosity, and invaluable contributions to lupus care and research.

Lupus is an autoimmune disease that can impact the joints, skin, kidneys, heart, and other organs and affects more than 600,000 people in the United States.

At the event, a historical timeline of lupus and HSS was presented, including important milestones representing significant breakthroughs in research and treatment. Several lupus patients and their family members reflected on their experiences at HSS and how they were inspired to make a difference in the lives of other patients.

"Our goal is to bring hope and provide enlightenment concerning this complex illness," said Karen Ng, HSS patient and Lupus Hero. Ms. Ng helped launch the HSS LANtern® Lupus Asian Network (read more about the program on page 9).

HSS team members – including physicians, nurses, social workers, and others – also paid tribute to specific "Lupus Heroes" for their involvement in helping to advance research, care, and the initiation of support programs.



Right: Patients and HSS staff gathered to honor Lupus Heroes. Above: Karen Ng presents at the event.

4 Educating Tomorrow's Leaders

The commitment of HSS to train doctors to become musculoskeletal specialists dates back to 1887, when Virgil P. Gibney, MD — the second Surgeon-in-Chief of HSS — established the nation's first program to educate orthopedic surgeons. The program quickly set the standard for orthopedics education. Nearly 1,000 orthopedic surgeons have since come through the doors of HSS, finishing well-prepared to take their talents and expertise to top academic medical centers and hospitals all over the country.

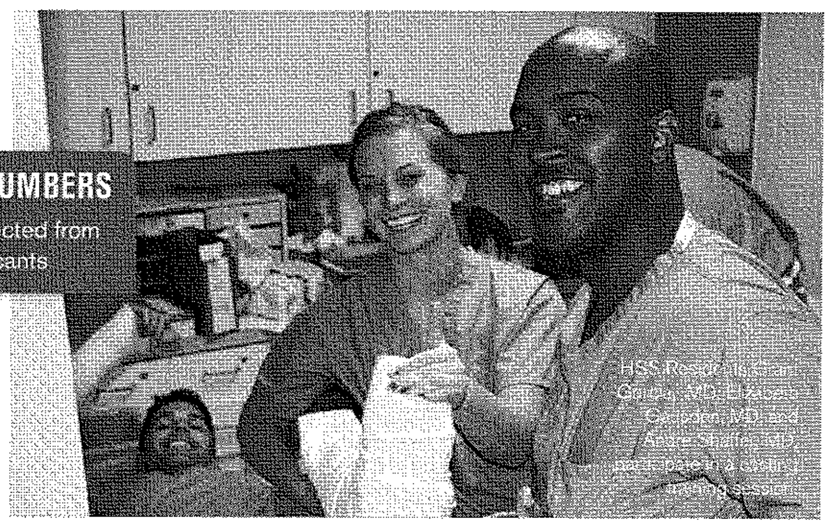
In 2013, some 660 applicants vied for just nine coveted spots in the Accreditation Council for Graduate Medical Education (ACGME)-accredited Orthopedic Surgery Residency program at HSS, which offers five years of education, during which our residents also rotate to other hospitals like New York Hospital Queens and the Bronx VA. This enables them to gain different experiences caring for patients. Surgeons who wish to further specialize can pursue fellowships in joint replacement, sports medicine, and rare specialties such as limb lengthening and metabolic bone disorders.

Technical expertise is a must in orthopedics, but so is the ability to communicate compassionately and effectively with patients. Toward that goal, through a collaboration with the Greenberg Academy for Successful Aging, third-year residents make presentations to groups of our older patients. Similarly, the Leon Root, MD Pediatric Outreach Program helps residents hone their cultural sensitivity skills and improve their ability to communicate with patients from different cultures and those who may speak a language other than English – factors which may impede the ability or desire of these patients to seek healthcare.

HSS BY THE NUMBERS
9 residents selected from
660 applicants

Many people from our community come to us for knee and shoulder surgeries. HSS has implemented an ACGME-mandated simulation-based training program for orthopedic surgery residents. As part of this curriculum, the residents practice on anatomical models or cadavers. HSS also has an arthroscopy simulator which enables them to practice arthroscopy on "virtual" knees and shoulders. Once the simulator's computer scores their performance, they can repeat the procedure over and over – something they can't do on a human being – to improve their skills and achieve a higher score.

Such technology makes it possible for surgical residents to gain more experience than ever before early in their careers, enabling them to be exceptionally well-prepared when their mentors deem them ready to operate on patients.



HSS Residents [illegible] MD, [illegible] MD, and [illegible] MD, [illegible] training session.

"People describe running, dancing, and walking among their interests and passions. These physical activities add immense pleasure and quality to people's lives. To be able to restore their movement and relieve pain is a profound privilege for me."

—Andre Shaffer, MD, second-year Orthopedic Resident

5 Investing in the Community through Effective Partnerships

As strong as HSS is in the world of orthopedics and rheumatology, we cannot accomplish our community-focused initiatives alone. Key to the success of our efforts are strong, effective partnerships with stakeholder groups, with whom we have formed lasting and effective collaborations. Active partnerships include:

CLINICAL/ACADEMIC PARTNERSHIPS

- Asian American/Asian Research Institute, City University of New York
- Burke Rehabilitation Center
- Charles B. Wang Community Health Center
- Chinese Community Partnership for Health, NewYork-Presbyterian/Lower Manhattan Hospital
- Clinical Translational Science Center, Community Engagement Core, Weill Cornell Medical College
- Gouverneur Healthcare Services, New York City Health and Hospitals Corporation
- HSS China Orthopedic Education Exchange
- Mt. Sinai Medical Center, Adolescent Health Center
- NewYork-Presbyterian Morgan Stanley Children's Hospital, Pediatric Rheumatology Service, Columbia University Medical Center
- NewYork-Presbyterian Hospital/Weill Cornell Medical College – Health Outreach® Program
- NewYork-Presbyterian Hospital
- Silberman School of Social Work at Hunter College
- SUNY Downstate Medical Center's Asian Pacific-American Medical Students Association
- Translational Research Institute for Pain in Later Life (TRIPLL)
- University of Delaware
- Weill Cornell Medical College, Department of Psychiatry

COMMUNITY-BASED ORGANIZATION PARTNERS

- All Community Adult Day Centers
- Arthritis Foundation – NY Chapter
- Asian Health and Social Service Council
- Brown Gardens Assisted Living Facility
- CenterLight Healthcare

SPOTLIGHT: HSS Asian Community Bone Health Initiative

"Strong partnerships are essential to the success of this program." *—Huijuan Huang, MPA, Program Coordinator*

The HSS Asian Community Bone Health Initiative was launched in response to the health needs of the growing number of older Asian adults living in New York City. Its goal is to help Asian seniors better manage chronic musculoskeletal disorders, while also increasing access to care in this medically underserved community through culturally relevant educational workshops, self-management education, yoga, and low-impact chair exercise programs. The program funded by HSS and The Fan Fox & Leslie R. Samuels Foundation, has produced positive results, with participants reporting decreased pain, stiffness, and fatigue, and improvement in various aspects of quality of life.

HSS has partnered with many different organizations – including the New York City Department for the Aging, local senior centers, the New York Public Library and the HSS-China Orthopedic Education Exchange – in an effort to bring vital programming to this population.

"This program provides useful, accurate information about the treatment and prevention of common musculoskeletal conditions in the participants' native language. The program was very beneficial to the Asian older adult community," say Drs. Li Feng, Hu Li and Tiezheng Sun (HSS-China Orthopedic Educational Exchange Program).

"We can only accomplish our mission of meeting the needs of our community through partnerships and collaboration with organizations who share our values and commitment to the people we serve."

—Laura Robbins, DSW, Senior Vice President, Education & Academic Affairs

- Children's Aid Society
- Chinese American Planning Council
- Community Health Network
- Golden Eagle Adult Day Center
- Isabella Geriatric Center
- Lenox Hill Neighborhood House
- LaGuardia Senior Citizens Center
- Lupus Foundation of America
- Medicare Rights Center
- Mott Street Senior Center
- The Myositis Association
- National Osteoporosis Foundation
- New York Chinese American Association
- New York Chinatown Senior Citizen Center
- New York Foundation for Senior Citizens
- New York Road Runners Club (NYRRC)
- Prime Care Home Health Agency
- Project Sunshine
- Selfhelp Innovative Senior Center
- Senior Health Partners
- Service Program for Older People
- S.L.E. Lupus Foundation
- Stanley M. Isaacs Neighborhood Center
- YM & YWHA – Washington Heights/Inwood

HSS BY THE NUMBERS

More than **400** community-based exercise classes & educational forums offered in 2012

GOVERNMENT/ PUBLIC PARTNERS

- New York City Department for the Aging
- New York City Department of Health and Mental Hygiene
- New York City Public Schools
- New York Public Libraries
- New York State Department of Health
- Office of Women's Health, Department of Health and Human Services

LAUNCH OF NEW COMMUNITY BENEFIT & SERVICES COMMITTEE

HSS is proud to announce the formation of a new committee of the Board of Trustees. The Community Benefit & Services Committee, chaired by Board of Trustees member **Anne Ehrenkranz** (pictured at right), will provide oversight and advice on community program initiatives consistent with the HSS mission and strategic plan. It is an important step in ensuring the needs of our community members are met, especially those from culturally and economically diverse areas, through effective and innovative programs.

COMMUNITY INVESTMENT BY THE NUMBERS

What is Community Benefit?

Community benefit includes programs or activities that respond to an identified community health need. These programs must seek to achieve one of the following objectives:

- Improve access to health services
- Enhance public health
- Advance medical or health knowledge
- Relieve or reduce burden on government or other community efforts

HSS 2012 Community Benefit Spending by Category

Financial Assistance
HSS assists patients who are unable to pay for their hospital services and those with limited or no insurance coverage.

Medicaid Subsidy
Costs associated with services provided by HSS to patients who are covered under Medicaid insurance that exceed the reimbursement provided by the Medicaid program.

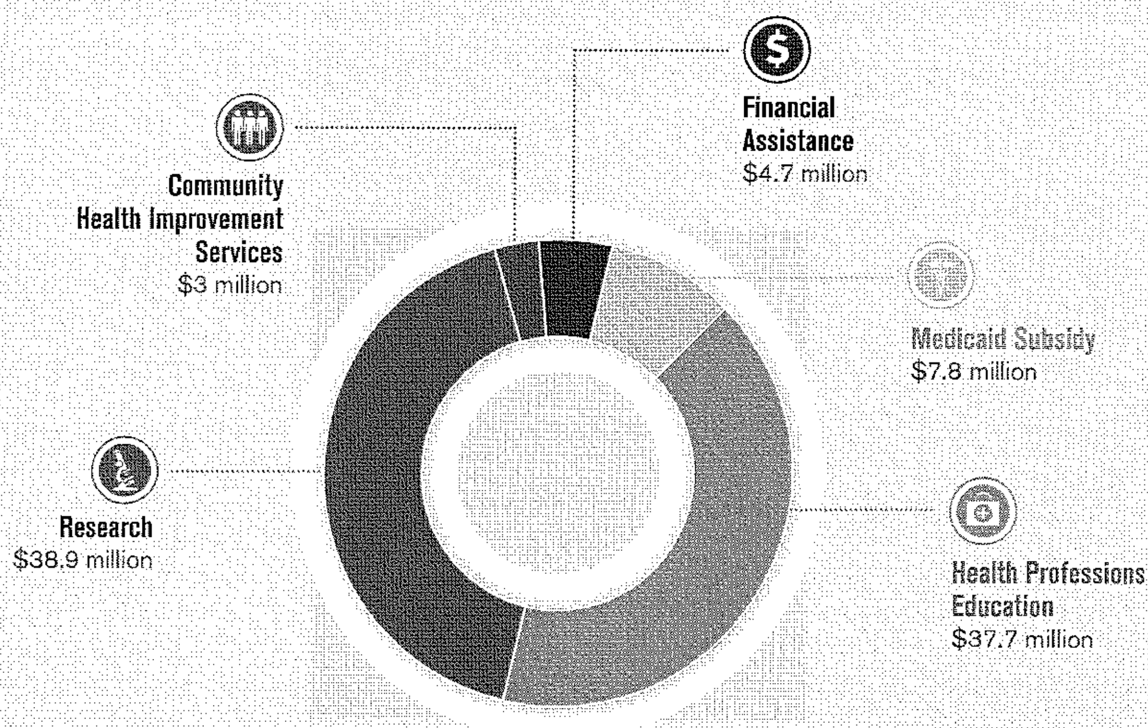
Health Professions Education
Supports the cost of training residents and fellows.

Research
Net expense of supporting research programs that work to improve patient outcomes and quality of life.

Community Health Improvement Services
Supports costs associated with various community-based initiatives.

$92.1 million

of spending on community benefits and services in 2012*



* As reported in the Hospital's 2012 IRS Form 990 filing.

FOR MORE INFORMATION

For more information about Hospital for Special Surgery's community education, support, and outreach programs, please call **(212) 606-1057** or visit us on the web at **www.hss.edu.**

You can also find us on **Facebook, Twitter, YouTube** and **LinkedIn** by searching for "HSpecialSurgery."

Managing editors: Sandra Goldsmith, MA, MS, RD, Director, Public & Patient Education; Robert Horton, LCSW, ACSW, Director, Social Work Programs; Marc Gould, Vice President, Finance; Marcello Guarneri, Assistant Vice President, Finance

Design: Christina Fisher, MFA, Senior Designer, Education Publications & Communications

Photography: Brad Hess; Huijuan (Jane) Huang, MPA; Don Pollard; Paggie Yu

HOSPITAL FOR SPECIAL SURGERY

535 East 70th Street, New York, NY 10021
212-606-1000 | www.hss.edu
www.hss.edu/backinthegame

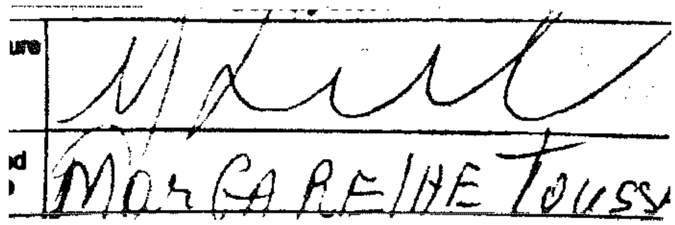
UNITED STATES POSTAL SERVICE

Date: April 1, 2014

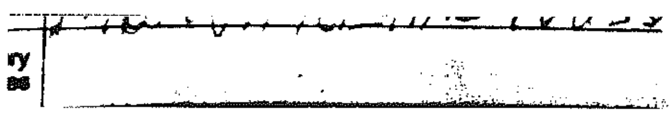
janice wojick:

The following is in response to your April 1, 2014 request for delivery information on your Certified Mail™ item number 9171999991703227063093. The delivery record shows that this item was delivered on March 21, 2014 at 4:57 pm in STAMFORD, CT 06902. The scanned image of the recipient information is provided below.

Signature of Recipient :



Address of Recipient :



Thank you for selecting the Postal Service for your mailing needs.

If you require additional assistance, please contact your local Post Office or postal representative.

Sincerely,
United States Postal Service

Huber, Jack

From: Martone, Kim
Sent: Tuesday, April 01, 2014 9:35 AM
To: Roberts, Karen; Huber, Jack
Cc: Greer, Leslie
Subject: FW: Read the 2013 Community Benefit Report

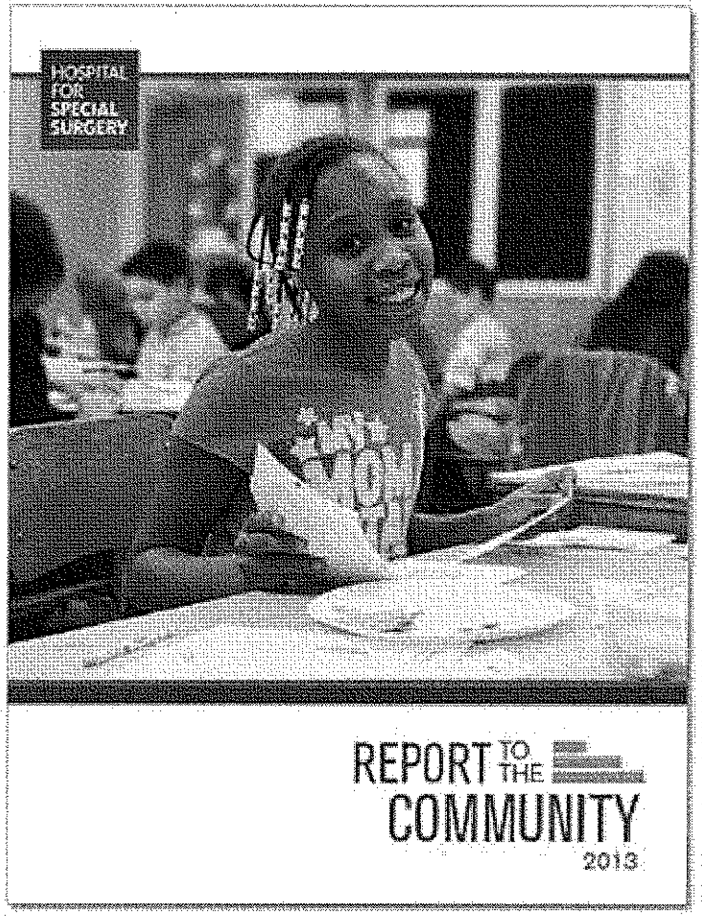
From: Buscemi, Peter [mailto:BuscemiP@HSS.EDU]
Sent: Monday, March 31, 2014 5:30 PM
To: Martone, Kim
Subject: FW: Read the 2013 Community Benefit Report

Good Afternoon Kim. Below is a link to HSS's 2013 Community Benefit Report. When we met in November, we discussed some of what HSS does to benefit the communities it serves. This report gives a more complete picture of our community benefit activities. Please feel free to share this with your colleagues and let me know if there are any questions or problems. I can also give your contact information to our Education & Academic Affairs department so you can receive this report and other like it in the future. Please let me know if this is ok and if there is anyone else you think should be added to the mailing list.

Best regards,

Peter Buscemi
Assistant Vice President, Financial Planning
Tel: (646) 797-8228
Fax: (212) 774-7841
buscemip@hss.edu

From: Ennis, Marcia
Sent: Monday, March 31, 2014 1:53 PM
To: HSSALL
Subject: Read the 2013 Community Benefit Report



We are pleased to introduce the HSS 2013 Community Benefit Report, which describes the Hospital's extensive community programs and services, research activities and medical education efforts.

Download the Report

If you would like hard copies, please contact Sandie Goldsmith at
goldsmiths@hss.edu

We encourage you to forward this message to a friend or colleague

Learn more about:
HSS Community Outreach • Public & Patient Education Programs • Patient & Consumer Resources

Visit us on

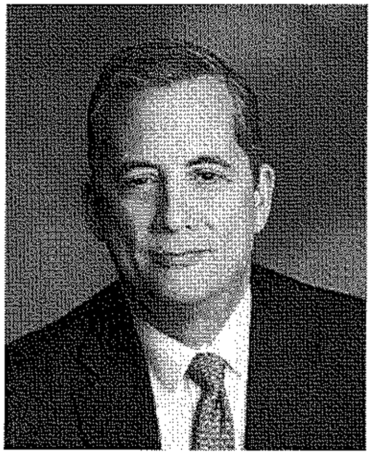
Education & Academic Affairs, 535 East 70th Street, New York, NY 10021 | 212.606.1057

HOSPITAL FOR SPECIAL SURGERY

REPORT TO THE COMMUNITY

2013

Dear friends,

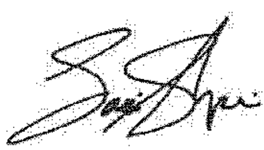


It gives me great pleasure to release this year's Community Benefit Report on behalf of Hospital for Special Surgery. Caring for our community is one of our Hospital's core values. We define our community broadly to include our staff, patients, Upper East Side neighbors, neighbors in all five boroughs of New York City, and everyone across the United States and around the world who would benefit from world-class prevention and care in our areas of specialty – orthopedics, rheumatology, and rehabilitation.

This report highlights the many educational, clinical, and research programs we have instituted to serve our local, national, and international communities. In every effort, HSS is committed to raising the bar for excellence, innovation, and compassion.

In today's complex and multicultural world, collaboration is essential to achieve extraordinary outcomes. HSS collaborates with local, national, and international partners to address key public health concerns and enhance wellness and care in underserved communities. As a world leader in musculoskeletal care, we are proud to offer our skills, expertise, and knowledge to enrich programs that make a real difference in people's lives. Our goal is to advance the field of musculoskeletal medicine while increasing access to care for patients around the world, so that more can benefit from medical and health systems advances.

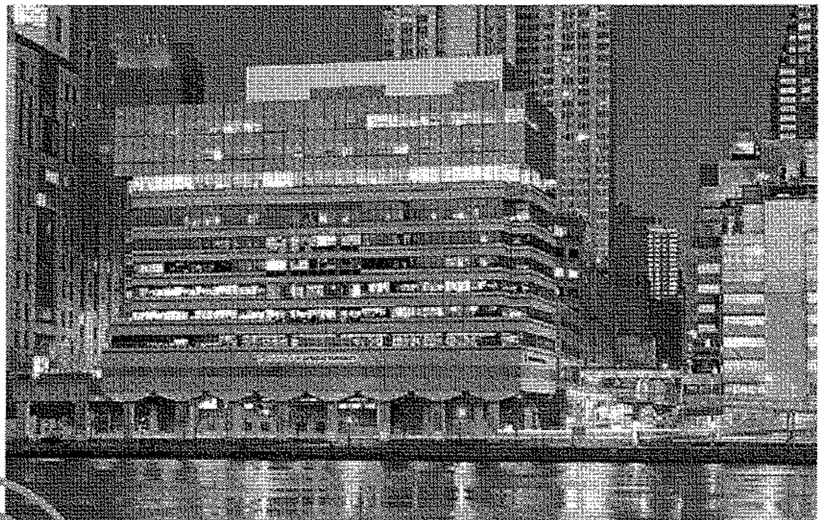
We are proud of what we have accomplished and look forward to continuing to lead efforts to elevate care and access to care for patients in our local community and around the world.



LOUIS A. SHAPIRO
President and CEO

TABLE OF CONTENTS

ON THE COVER: A student participates in the SNEAKER® program at PS 140 Nathan Straus on the Lower East Side of Manhattan. Read more about SNEAKER® and other HSS community programs on page 8.



1 About Hospital for Special Surgery

Hospital for Special Surgery (HSS) celebrated our 150th anniversary in 2013. Founded in 1863, at the height of the Civil War, HSS – the country's oldest orthopedic hospital – has grown to become a world leader in orthopedics, rheumatology, and rehabilitation. The Hospital has achieved continued success by maintaining our culture of excellence, innovation, and caring in a rapidly changing external environment.

Today HSS maintains our dedication to delivering exceptional care to people from all backgrounds. Through a variety of programs, the Hospital strengthens public health efforts by disseminating information, providing comprehensive services, and partnering with organizations which share our passion for nurturing good health for the diverse communities we serve. Our enthusiastic staff understands that their skills and talents are not just valued within our walls, but beyond them as well.

All great medical advances have been achieved through research. HSS maintains a robust Research Division which supports a vigorous program of basic science and clinical investigation. Throughout our long and distinguished history, the innovation and expertise of HSS investigators have enhanced our understanding of musculoskeletal and rheumatologic disorders and led to the development of technologies that have greatly improved patients' quality of life.

HSS is also committed to training the leaders of the future through our residency and fellowship programs. Many of the leaders in orthopedics today across the country and around the world honed their skills through the Hospital's educational programs.

SERVING OUR DIVERSE COMMUNITY

HSS reaches many communities in New York City, the Tri-State area and around the world. The Hospi-

ACHIEVING EXCELLENCE

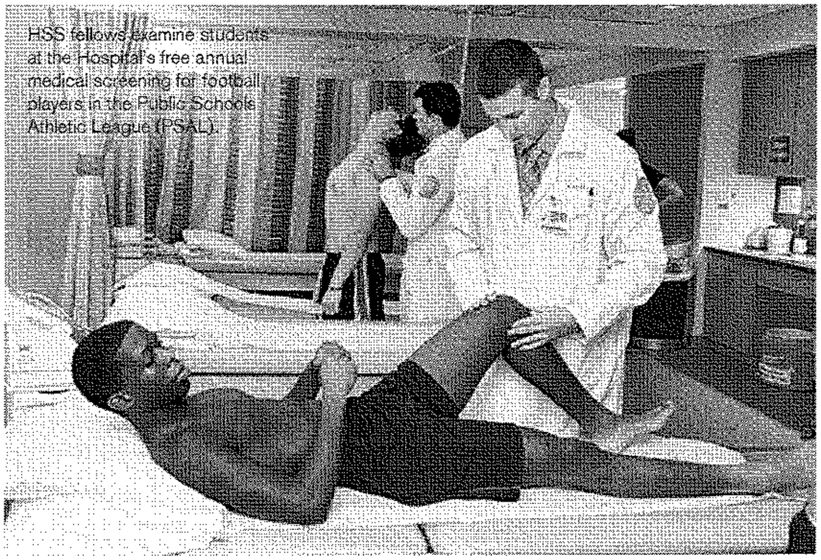
The commitment of every member of the HSS family to raise the bar in patient care through research, innovation, education, and compassion is stronger than ever, and has resulted in external recognition and, most importantly, positive feedback from patients.

HSS is nationally ranked No. 1 in Orthopedics, No. 4 in Rheumatology, and No. 5 in Geriatrics by *U.S.News & World Report* ("Best Hospitals" 2013-2014), and was the first hospital in New York State to receive Magnet Recognition® for Excellence in Nursing Service from the American Nurses Credentialing Center three consecutive times.

HSS has been cited as having one of the lowest infection rates in the country. From 2007 to 2012, we were also a recipient of the HealthGrades Joint Replacement Excellence Award.

HSS has been named a 2013 Guardian of Excellence Award winner by Press Ganey Associates, Inc., which recognizes top-performing facilities for patient satisfaction, employee engagement, physician engagement, and clinical quality performance. We won the award for our extraordinary results in the Patient Satisfaction category.

Pictured above: Hospital for Special Surgery is located on the Upper East Side of Manhattan.



HSS fellows examine students at the Hospital's free annual medical screening for football players in the Public Schools Athletic League (PSAL).

tal's primary service area consists of the five boroughs of New York City. Our immediate community lies within the boundaries of New York City's Community Board 8, which extends north from 59th Street to 96th Street and east from Fifth Avenue to the East River. The suburban counties surrounding New York City are our secondary service areas, including New Jersey, Connecticut, Westchester County, and Long Island.

The commitment of HSS to caring for the public can be traced back to our roots. James Knight, MD, our founder and first Surgeon-in-Chief, established The New York Society for the Relief of the Ruptured and Crippled (the forerunner of HSS) in 1863 as a 28-bed facility in his own home on Second Avenue at 6th Street. Dr. Knight felt a need to provide healthcare to the poor and the crippled on the streets of New York.

Today HSS continues to provide care to medically underserved populations through our outpatient clinics, maintaining our commitment to caring for those patients most in need. They often come to us seeking relief of pain due to arthritis and other rheumatologic conditions or traumatic injury, hoping to be helped by an intervention that would restore their mobility and ability to complete the activities of daily living.

HSS BY THE NUMBERS
More than
25,000
HSS outpatient clinic visits

Many of them have disorders that are complex and/or chronic, such as scoliosis, lupus, rheumatoid arthritis, and cerebral palsy – disorders that are best treated at an institution with the level of expertise and resources found at HSS.

FINANCIAL ASSISTANCE

The Hospital's Financial Assistance Program ensures the provision of quality healthcare to patients of all backgrounds across the United States. We carefully take into account the ability of each patient to pay. The Hospital extended our program beyond the state-mandated level of 300 percent of the federal poverty level to include patients whose income is at or below 500 percent of the federal poverty level.

We have also extended our policy to consider a patient's insurance co-pay, deductible, and co-insurance when considering eligibility for a discount.

In addition, in 2013, HSS increased the number of Medicaid managed care plans in which we participate from two to four.

HSS OUTPATIENT CLINICS: ENSURING ACCESS TO CARE

HSS has more than **20 specialty clinics** serving the medically underserved, including those focusing on the Hip/Knee, Sports and Shoulder, Spine, Metabolic Bone, Physiatry, Pain Management, Foot, Hand, Neurology, Rheumatology, Pediatric Neurology, Dermatology, Adult Limb Lengthening, Skeletal Dysplasia, Pre-surgical Screening, and the Comprehensive Arthritis Program. The Pediatric Orthopedic Clinic addresses all orthopedic concerns of children. Specialized clinics are geared toward the needs of children with scoliosis, cerebral palsy, lupus, juvenile rheumatoid arthritis, pediatric limb lengthening, spina bifida, child foot, child hand, and clubfoot.

2 Commitment to Community

HSS continues its commitment to helping our diverse community started by our founder James Knight, MD, in 1863 by offering many vital services and resources to vulnerable populations. The number of beds we have may be higher, the number of patients we serve may be greater, and the technology we use is far more advanced than it was in Civil War times. But one thing has not changed: our desire to help those who need it most.

IDENTIFYING THE COMMUNITY'S NEEDS

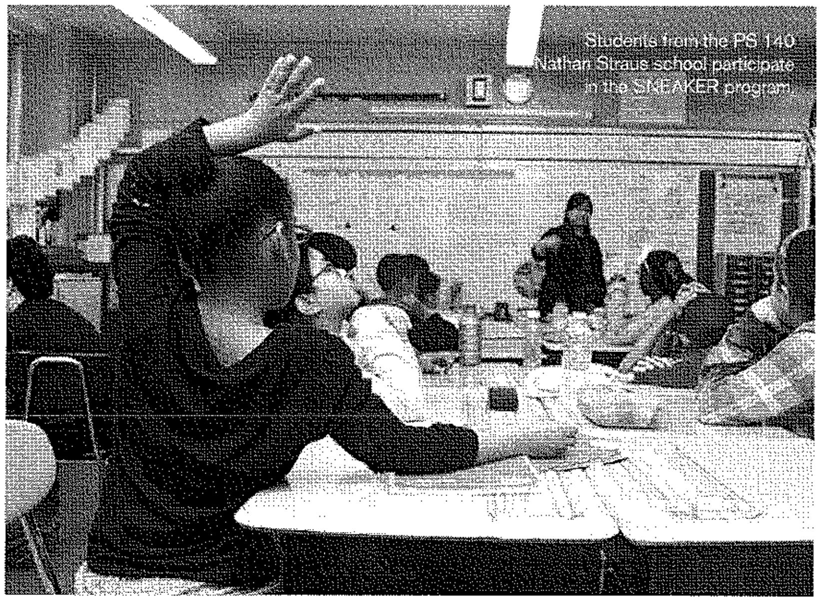
HSS gathers feedback from local organizations, city and state agencies, colleges and universities, public schools, the private sector, our patients, and the broader community to identify the community's needs, ascertain healthcare gaps, and inform new directions for efforts to improve public health.

These continuous interactions are vital to ensuring that we remain aware of the community's changing needs and use this information to adapt our programs accordingly.

In 2013, the Hospital performed a formal community health needs assessment (CHNA) to evaluate musculoskeletal and rheumatologic health conditions and management; quality of life; use of and access to healthcare; and socio-demographic characteristics (including health literacy).

The public and community partners helped design the CHNA by providing input about survey gaps, length, and construction; health literacy; and cultural relevance.

Nearly 1,100 people responded to the survey, which was given in English, Spanish, and Chinese. The responses provided a useful look at the makeup of the HSS community, which can be seen on page 6.



Students from the PS 140 Nathan Straus school participate in the SNEAKER program.

MEETING THE NEEDS OF THE COMMUNITY

Community Service Plan

Using the results of the CHNA and other needs assessments, input from key partners, and public health data, the Hospital designs and coordinates programs to meet the community's needs. HSS details these programs in a comprehensive three-year Community Service Plan (CSP), which is required by the New York State Department of Health (NYSDOH). The CSP outlines how the Hospital will address the needs of our community while aligning with the NYSDOH public health improvement plan.

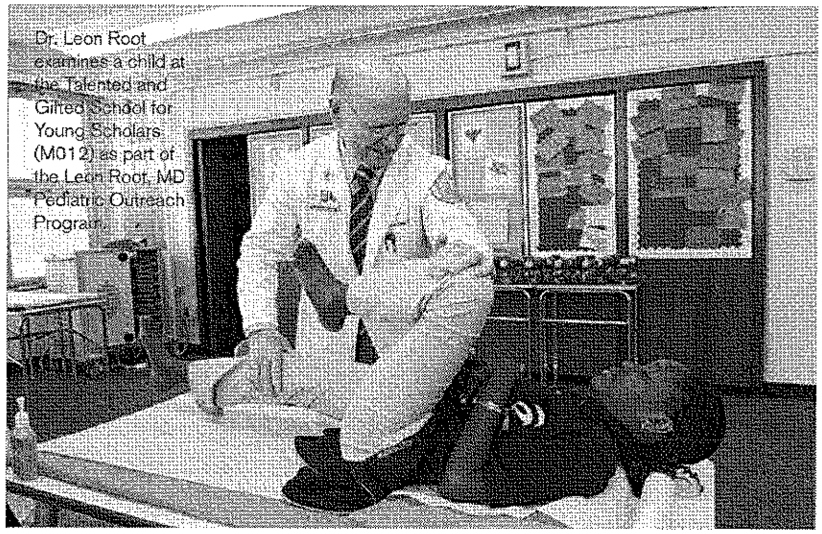
The focus of the HSS CSP is on preventing chronic disease, with the Hospital concentrating on musculoskeletal and rheumatologic conditions. The 10 programs outlined in the CSP will contribute to the NYSDOH priorities to reduce obesity in children and adults and increase access to high-quality chronic disease preventive care and management in clinical and community settings.

HSS Community Service Plan programs include:

1. **SNEAKER© (Super Nutrition Education for All Kids to Eat Right)** provides culturally-sensitive nutrition education to New York City's children and their families.
2. **HSS Asian Community Bone Health Initiative** addresses musculoskeletal issues in

the Asian community through culturally relevant education and exercise programs.

3. **The Leon Root, MD Pediatric Outreach Program (POP)** screens children for musculoskeletal issues in New York City schools and daycare centers located in medically underserved neighborhoods.
4. **The Osteoarthritis Wellness Initiative** provides educational and exercise programs to the public to raise awareness of, provide education about, and reduce the impact of osteoarthritis.
5. **The Osteoporosis Wellness Initiative** helps those living with osteoporosis better manage their condition through education and exercise programs.
6. **The Geriatric Resident Training Program** provides third-year orthopedic surgery residents with enhanced communication skills to improve provider-patient communication, while also empowering older patients to be better advocates and partners in their own healthcare.
7. **VOICES 60+ Senior Advocacy Program** helps older adults navigate and access the support, education, and communication resources needed to manage their rheumatologic and musculoskeletal disorders and enhance their quality of life.
8. **Charla de Lupus/Lupus Chat®** is a national program offering underserved communities with lupus (including African Americans and Spanish speakers)


Dr. Leon Root examines a child at the Talented and Gifted School for Young Scholars (M012) as part of the Leon Root, MD Pediatric Outreach Program.

SNAPSHOT OF CHNA RESULTS

Nearly 1,100 people responded to the **Community Health Needs Assessment** (CHNA) survey. Here's a look at our respondents and their reported needs.

Gender

82% female — **18%** male

Age

- **11%** under 40
- **25%** age 40–59
- **47%** age 60–79
- **17%** age 80 and older

Ethnicity

- **60%** white
- **16%** black
- **14%** Hispanic/Latino
- **10%** Asian

Education

- **10%** less than high school
- **12%** completed high school
- **21%** more than high school
- **22%** completed college
- **35%** post-college

Leading health conditions

- Osteoarthritis
- Rheumatoid Arthritis
- Osteoporosis

60% needed help understanding their healthcare coverage

17% could not access a healthcare provider when needed

Top barriers to accessing healthcare

- Service not covered
- Affordability issues

34% reported **having fallen** in the last year

15% reported a **fracture** sustained from the fall

40% **did not report the fall** to a healthcare provider and their families peer health support and education.

9. **LANtern® (Lupus Asian Network)** is a national support and education program designed specifically for Asian Americans with lupus and their loved ones.

10. **HSS Nursing Community Education Outreach** works with local senior centers and community-based organizations to provide self-management education to older adults.

Over the next three years, HSS expects to reach nearly 14,000 participants/contacts through its education, support, and exercise programming. The HSS CSP can be viewed at www.hss.edu/community.

KEEPING THE COMMUNITY IN MOTION

Partnering with several local and national groups, the Hospital's community initiatives promote health education, support and outreach services, and communication, enhancing the mobility and quality of life of our community. While the CSP outlines many of the efforts of HSS to improve public health, there are many other programs not highlighted in this document. A comprehensive list follows here.

Educating to Improve Public and Patient Health

HealthConnection: Hospital for Special Surgery's Good Health Newsletter informs the community about the latest information and research in musculoskeletal health. *HealthConnection* has expanded its reach through publication on the HSS website.

HealthConnection Fast Facts is our online health education newsletter designed to provide the public with fast, current, and accurate information about musculoskeletal and general health, and is available on the HSS website.

Integrative Care Center (ICC): The Hospital offers public education programs, private classes, and alternative care services under the supervision of HSS physicians, physical therapists, and complementary care providers.

HSS BY THE NUMBERS

HSS expects to reach nearly **14,000** participants/contacts through its education, support, and exercise programs over the next **3** years.

Nursing Community Education Outreach: HSS nurses provide educational workshops to older adults at local senior centers to help them develop self-care knowledge and provide self-management support strategies on issues important to seniors.

Public & Patient Education: HSS offers a wide variety of programming and practical information on musculoskeletal conditions and other health and wellness topics for patients and the general public through community education programs, lectures, workshops, support groups, publications, and a patient education library.

Focusing on Musculoskeletal Health

Musculoskeletal Wellness Initiatives: Osteoarthritis and Osteoporosis Wellness Initiatives were developed to raise awareness

SPOTLIGHT: Nursing Community Education & Outreach Initiative

"Magnet nurses are committed to the public health needs of the communities we serve. The Nursing Community Education & Outreach Initiative affords nurses the opportunity to connect with the community through teaching and help them to lead healthy lives – an important and satisfying part of our scope of practice."
—Trish Quinlan, PhD, MPA, RN, CPHQ

The HSS Nursing Community Education & Outreach initiative aims to develop self-care knowledge and provide self-management support strategies for issues that are important to seniors.

Launched in August 2012, the program has grown from a small circle of nurse volunteers to a robust, structured program that addresses the public health needs of New York City's older adult population. Select HSS nursing staff work with local senior centers to assess the educational needs of this population and develop evidence-based content to provide workshops and seminars.

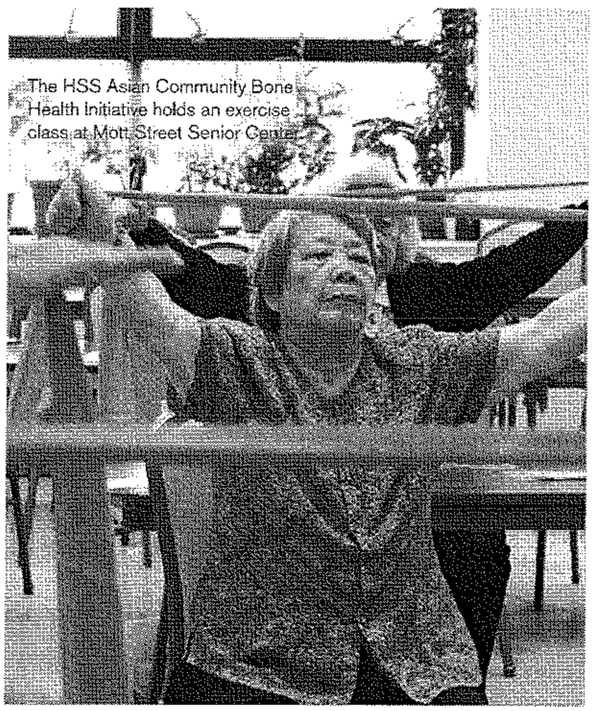
Falls prevention, nutrition, and medication safety are just a few of the topics that have been addressed to date.

of, provide education about, and reduce the impact of these diseases in older adults. Free or low-cost education and exercise programs aim to improve fitness, increase mobility, decrease pain, and enhance quality of life.

Encouraging Safe Exercise

Exercise Wellness Program: For people who have completed their formal physical therapy regimen and choose to continue under the guidance of therapists at the HSS Joint and Mobility Center.

Osteofitness, a group exercise mat class, was developed especially for patients with osteoporosis or osteopenia. The classes follow the HSS Rehabilitation Department's 5-Point Program, focusing on posture, flexibility, strengthening, weight-bearing, and balance.


The HSS Asian Community Bone Health Initiative holds an exercise class at Mott Street Senior Center.

Pre-Season Football Medical Screening: HSS teamed up with the Public School Athletic League to offer public high school students screenings that include, but are not limited to, orthopedic screening, flexibility testing, and body fat percentage assessment – all provided at no cost.

HSS BY THE NUMBERS

More than **29,000** community contacts were made through **9** Department of Social Work Programs

Support for People with Chronic Musculoskeletal Conditions

Living with RA is a monthly support and education program for HSS patients with severe rheumatoid arthritis (RA). The group features RA-related lectures, and is followed by a support group facilitated by a social work manager and nurse manager in rheumatology.

The Early RA Support and Education Program focuses on early intervention for people with newly diagnosed RA by providing essential RA-related group support and education. The group meets monthly and is co-led by a licensed social worker and nurse manager.

The Myositis Support and Education Group meets monthly to help patients cope with the disease, reduce isolation, and increase understanding of inflammatory myopathies. A monthly newsletter is sent to all group members.

The Scleroderma, Vasculitis, and Myositis Center Education and Support Forum features disease-specific talks by expert healthcare professionals, followed by a social work-facilitated support and discussion hour. It is open to community members and to HSS patients.

Caring for Children and Families

The Leon Root, MD Pediatric Outreach Program is a community-based musculoskeletal screening program, conducted in New York City schools, and is designed to prevent long-term musculoskeletal disorders and severe joint disability in children living in medically underserved communities.

SNEAKER© (Super Nutrition Education for All Kids to Eat Right) provides culturally sensitive nutrition education to New York City children and their families residing in underserved communities.

Improving Health Among Older Adults

HSS Speaker's Bureau matches professionals to organizations around New York City to present educational programs on various topics, such as elder abuse, diabetes, heat safety, osteoporosis, and arthritis.

Greenberg Academy for Successful Aging develops and implements health education and exercise programs aimed at the interests and needs of people age 65 and over.

VOICES 60+ Senior Advocacy Program assists ethnically diverse HSS patients, age 60 and older, with arthritis and related orthopedic conditions. The program's goal is to enhance the medical care experience and improve quality of life by helping older adults navigate and access the care, community resources, and education they need.

Helping People with Lupus

Charla de Lupus/Lupus Chat® is a national program offering underserved communities with lupus (including African Americans and Spanish speakers) and their families peer health support and education.

LANtern® (Lupus Asian Network) is the only national support and education program designed specifically to serve Asian Americans with lupus and their loved ones through its national SupportLine and many other related services. The initiative has also published "LANtern e-News – Building Community Partnerships."

LupusLine® is the only national telephone peer support program offering one-to-one emotional support and information to people with lupus across the country and internationally. The program links people who need the service with trained volunteers who have lupus or are family members of someone with lupus.

The SLE Workshop is one of the country's longest-standing support and education groups for people with lupus. The program offers free monthly meetings at HSS for individuals with lupus, their families, and their friends.

Reaching the Asian-American Community

HSS Asian Community Bone Health Initiative aims to improve the quality of life of at-risk older adult members of the New York City Asian community by helping them stay active and better manage chronic bone and joint diseases through exercise classes and educational workshops.

Assisting with Access to Care

VOICES Medicaid Managed Care Education Program provides bilingual (English/Spanish) education, support, and advocacy to help patients and the community understand and navigate insurance options under Medicaid managed care.

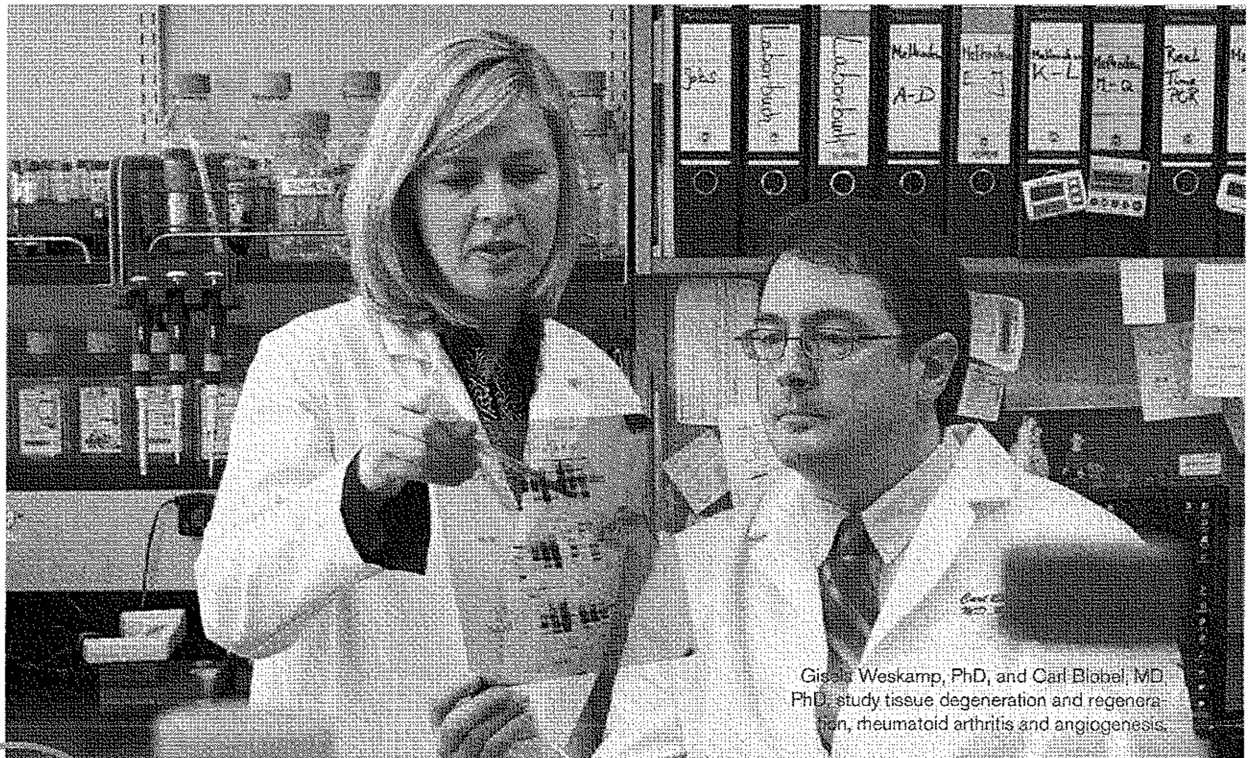
Reaching the International Community

Foundation of Orthopedics and Complex Spine (FOCOS) is a non-profit organization that was established by the Chief of the Scoliosis Service at HSS. The organization's mission is to provide comprehensive, affordable orthopedic and spine care to people in medically underserved areas – primarily in Ghana, West Africa – through an international network of volunteer nurses, surgeons, and other medical providers.

HSS supports this humanitarian work by offering employees 40 hours per year of paid time off for humanitarian service projects.

HEALING THROUGH ART AND WORDS

HSS has created a new online narrative journal, **Rheum to Heal**, where people affected by rheumatic diseases can share their experiences, thoughts, and feelings through poetry, prose, artwork, and photography. Rheum to Heal, available through a free subscription, accepts submissions from patients with arthritis, autoimmune diseases, pain disorders affecting joints, and osteoporosis, as well as the healthcare professionals who care for them. In sponsoring Rheum to Heal, HSS hopes to build a sense of community among people with similar health struggles and reduce the sense of isolation that often accompanies chronic illness. For more information, **visit www.hss.edu/rheumtoheal**.



Gisela Weskamp, PhD, and Carl Blobel, MD, PhD, study tissue degeneration and regeneration, rheumatoid arthritis and angiogenesis.

3 Enhancing Care through Research

New knowledge of how diseases work has led to more effective treatments that allow people around the world to live healthier, more active lives. Many of these advances originated at HSS, where physicians and scientists continue to conduct cutting-edge research in orthopedics and rheumatology.

Our research projects are strongly supported by a history of basic scientific investigation, a high volume of patients with musculoskeletal disorders, and an interdisciplinary alliance between scientists, physicians, and surgeons who share a passion for rapidly translating research findings into better ways to improve our patients' lives.

In 2013, we conducted $34.2 million in research projects at HSS. Examples of research projects in 2013 include:

- **The Value of Partnership:** A study, presented at the Annual Meeting of the American College of Rheumatology (ACR) in October, showed that joining forces with the community-based S.L.E. Lupus Foundation to publicize a Facebook chat sponsored by the HSS Lupus Center of Excellence tripled the number of participants compared with previous HSS-sponsored chats. The collaboration attracted 123 participants to the chat from 28 U.S. states and six countries.
- **The Risks of Social Isolation:** A survey reported that people who lacked strong social ties – such as having several close friends or relatives or associations with community or religious groups – are more likely to experience serious, ongoing pain after total hip replacement two or more years

HSS BY THE NUMBERS

$34.2 million spent on research in 2013, supporting more than **300** research projects

"Lupus patients are hungry for information, and with social media, we can address their specific concerns in real time."

— *Jane E. Salmon, MD, Director, Lupus Center of Excellence*

after the procedure. There was a strong link between lack of social interaction and increased pain.

- **Using MRI to Pinpoint Early Arthritis**
  HSS received funding from the Arthritis Foundation to evaluate MRI and biomarker studies to identify which patients who suffer from an anterior cruciate ligament (ACL) tear in the knee are most likely to develop osteoarthritis – information that could be used to start testing new treatments sooner.

A BOOST FOR GENOMICS

HSS received a $5.6 million grant from The Tow Foundation to establish the HSS David Z. Rosensweig Genomics Research Center, which will seek to further understand the genes associated with rheumatoid arthritis and lupus.

The Center will collaborate with scientists at the New York Genome Center in lower Manhattan, known for its genome-sequencing machines and other state-of-the-art resources. The goal is to develop more effective treatments with fewer side effects.

SPOTLIGHT: Honoring Lupus Heroes

"We are deeply grateful that they have allowed us to learn from their journey and grow as caregivers."
–Peggy Crow, MD, HSS Physician-in-Chief

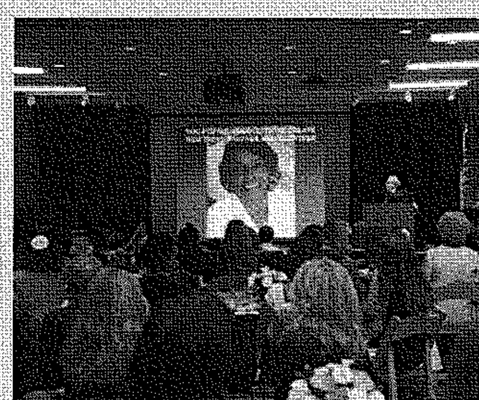
As part of HSS's 150th Anniversary celebration, the Division of Rheumatology honored the thousands of lupus patients, past and present, who have inspired each member of the healthcare team and helped advance research through participation in clinical research studies. "Honoring Lupus Heroes," held in September 2013, celebrated patients' wisdom, generosity, and invaluable contributions to lupus care and research.

Lupus is an autoimmune disease that can impact the joints, skin, kidneys, heart, and other organs and affects more than 600,000 people in the United States.

At the event, a historical timeline of lupus and HSS was presented, including important milestones representing significant breakthroughs in research and treatment. Several lupus patients and their family members reflected on their experiences at HSS and how they were inspired to make a difference in the lives of other patients.

"Our goal is to bring hope and provide enlightenment concerning this complex illness," said Karen Ng, HSS patient and Lupus Hero. Ms. Ng helped launch the HSS LANtern® Lupus Asian Network (read more about the program on page 9).

HSS team members – including physicians, nurses, social workers, and others – also paid tribute to specific "Lupus Heroes" for their involvement in helping to advance research, care, and the initiation of support programs.



Right: Patients and HSS staff gathered to honor Lupus Heroes. Above: Karen Ng presents at the event.

4 Educating Tomorrow's Leaders

The commitment of HSS to train doctors to become musculoskeletal specialists dates back to 1887, when Virgil P. Gibney, MD — the second Surgeon-in-Chief of HSS — established the nation's first program to educate orthopedic surgeons. The program quickly set the standard for orthopedics education. Nearly 1,000 orthopedic surgeons have since come through the doors of HSS, finishing well-prepared to take their talents and expertise to top academic medical centers and hospitals all over the country.

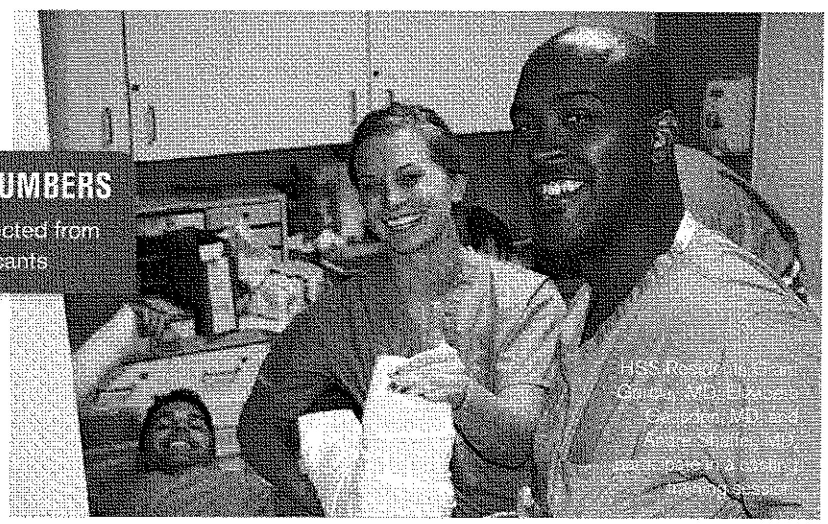
In 2013, some 660 applicants vied for just nine coveted spots in the Accreditation Council for Graduate Medical Education (ACGME)-accredited Orthopedic Surgery Residency program at HSS, which offers five years of education, during which our residents also rotate to other hospitals like New York Hospital Queens and the Bronx VA. This enables them to gain different experiences caring for patients. Surgeons who wish to further specialize can pursue fellowships in joint replacement, sports medicine, and rare specialties such as limb lengthening and metabolic bone disorders.

Technical expertise is a must in orthopedics, but so is the ability to communicate compassionately and effectively with patients. Toward that goal, through a collaboration with the Greenberg Academy for Successful Aging, third-year residents make presentations to groups of our older patients. Similarly, the Leon Root, MD Pediatric Outreach Program helps residents hone their cultural sensitivity skills and improve their ability to communicate with patients from different cultures and those who may speak a language other than English – factors which may impede the ability or desire of these patients to seek healthcare.

Many people from our community come to us for knee and shoulder surgeries. HSS has implemented an ACGME-mandated simulation-based training program for orthopedic surgery residents. As part of this curriculum, the residents practice on anatomical models or cadavers. HSS also has an arthroscopy simulator which enables them to practice arthroscopy on "virtual" knees and shoulders. Once the simulator's computer scores their performance, they can repeat the procedure over and over – something they can't do on a human being – to improve their skills and achieve a higher score.

Such technology makes it possible for surgical residents to gain more experience than ever before early in their careers, enabling them to be exceptionally well-prepared when their mentors deem them ready to operate on patients.

HSS BY THE NUMBERS
9 residents selected from
660 applicants



HSS Residents [illegible], MD, Elizabeth Gausden, MD, and Andre Shaffer, MD [illegible] training session.

"People describe running, dancing, and walking among their interests and passions. These physical activities add immense pleasure and quality to people's lives. To be able to restore their movement and relieve pain is a profound privilege for me."

—Andre Shaffer, MD, second-year Orthopedic Resident

5 Investing in the Community through Effective Partnerships

As strong as HSS is in the world of orthopedics and rheumatology, we cannot accomplish our community-focused initiatives alone. Key to the success of our efforts are strong, effective partnerships with stakeholder groups, with whom we have formed lasting and effective collaborations. Active partnerships include:

CLINICAL/ACADEMIC PARTNERSHIPS

- Asian American/Asian Research Institute, City University of New York
- Burke Rehabilitation Center
- Charles B. Wang Community Health Center
- Chinese Community Partnership for Health, NewYork-Presbyterian/Lower Manhattan Hospital
- Clinical Translational Science Center, Community Engagement Core, Weill Cornell Medical College
- Gouverneur Healthcare Services, New York City Health and Hospitals Corporation
- HSS China Orthopedic Education Exchange
- Mt. Sinai Medical Center, Adolescent Health Center
- NewYork-Presbyterian Morgan Stanley Children's Hospital, Pediatric Rheumatology Service, Columbia University Medical Center
- NewYork-Presbyterian Hospital/Weill Cornell Medical College – Health Outreach® Program
- NewYork-Presbyterian Hospital
- Silberman School of Social Work at Hunter College
- SUNY Downstate Medical Center's Asian Pacific-American Medical Students Association
- Translational Research Institute for Pain in Later Life (TRIPLL)
- University of Delaware
- Weill Cornell Medical College, Department of Psychiatry

COMMUNITY-BASED ORGANIZATION PARTNERS

- All Community Adult Day Centers
- Arthritis Foundation – NY Chapter
- Asian Health and Social Service Council
- Brown Gardens Assisted Living Facility
- CenterLight Healthcare

SPOTLIGHT: HSS Asian Community Bone Health Initiative

"Strong partnerships are essential to the success of this program." *—Huijuan Huang, MPA, Program Coordinator*

The HSS Asian Community Bone Health Initiative was launched in response to the health needs of the growing number of older Asian adults living in New York City. Its goal is to help Asian seniors better manage chronic musculoskeletal disorders, while also increasing access to care in this medically underserved community through culturally relevant educational workshops, self-management education, yoga, and low-impact chair exercise programs. The program funded by HSS and The Fan Fox & Leslie R. Samuels Foundation, has produced positive results, with participants reporting decreased pain, stiffness, and fatigue, and improvement in various aspects of quality of life.

HSS has partnered with many different organizations – including the New York City Department for the Aging, local senior centers, the New York Public Library and the HSS-China Orthopedic Education Exchange – in an effort to bring vital programming to this population.

"This program provides useful, accurate information about the treatment and prevention of common musculoskeletal conditions in the participants' native language. The program was very beneficial to the Asian older adult community," say Drs. Li Feng, Hu Li and Tiezheng Sun (HSS-China Orthopedic Educational Exchange Program).

"We can only accomplish our mission of meeting the needs of our community through partnerships and collaboration with organizations who share our values and commitment to the people we serve."

—Laura Robbins, DSW, Senior Vice President, Education & Academic Affairs

- Children's Aid Society
- Chinese American Planning Council
- Community Health Network
- Golden Eagle Adult Day Center
- Isabella Geriatric Center
- Lenox Hill Neighborhood House
- LaGuardia Senior Citizens Center
- Lupus Foundation of America
- Medicare Rights Center
- Mott Street Senior Center
- The Myositis Association
- National Osteoporosis Foundation
- New York Chinese American Association
- New York Chinatown Senior Citizen Center
- New York Foundation for Senior Citizens
- New York Road Runners Club (NYRRC)
- Prime Care Home Health Agency
- Project Sunshine
- Selfhelp Innovative Senior Center
- Senior Health Partners
- Service Program for Older People
- S.L.E. Lupus Foundation
- Stanley M. Isaacs Neighborhood Center
- YM & YWHA – Washington Heights/Inwood

HSS BY THE NUMBERS

More than **400** community-based exercise classes & educational forums offered in 2012

GOVERNMENT/ PUBLIC PARTNERS

- New York City Department for the Aging
- New York City Department of Health and Mental Hygiene
- New York City Public Schools
- New York Public Libraries
- New York State Department of Health
- Office of Women's Health, Department of Health and Human Services

LAUNCH OF NEW COMMUNITY BENEFIT & SERVICES COMMITTEE

HSS is proud to announce the formation of a new committee of the Board of Trustees. The Community Benefit & Services Committee, chaired by Board of Trustees member **Anne Ehrenkranz** (pictured at right), will provide oversight and advice on community program initiatives consistent with the HSS mission and strategic plan. It is an important step in ensuring the needs of our community members are met, especially those from culturally and economically diverse areas, through effective and innovative programs.

COMMUNITY INVESTMENT BY THE NUMBERS

What is Community Benefit?

Community benefit includes programs or activities that respond to an identified community health need. These programs must seek to achieve one of the following objectives:

- Improve access to health services
- Enhance public health
- Advance medical or health knowledge
- Relieve or reduce burden on government or other community efforts

HSS 2012 Community Benefit Spending by Category

Financial Assistance
HSS assists patients who are unable to pay for their hospital services and those with limited or no insurance coverage.

Medicaid Subsidy
Costs associated with services provided by HSS to patients who are covered under Medicaid insurance that exceed the reimbursement provided by the Medicaid program.

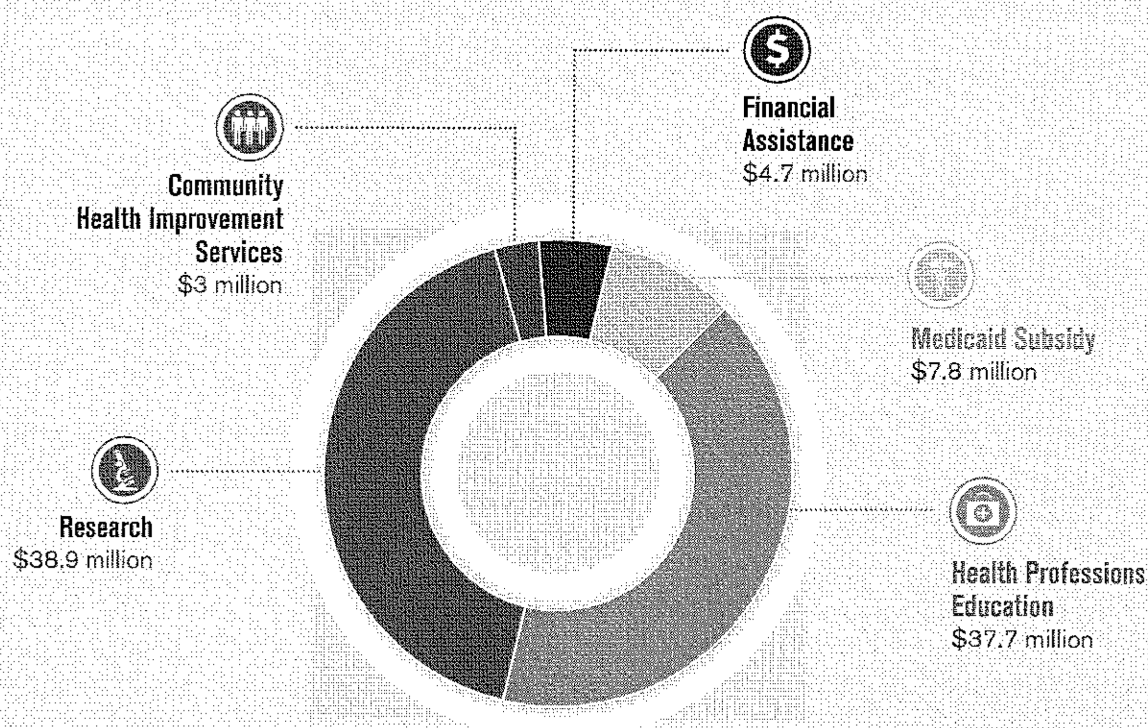
Health Professions Education
Supports the cost of training residents and fellows.

Research
Net expense of supporting research programs that work to improve patient outcomes and quality of life.

Community Health Improvement Services
Supports costs associated with various community-based initiatives.

$92.1 million

of spending on community benefits and services in 2012*



* *As reported in the Hospital's 2012 IRS Form 990 filing.*

FOR MORE INFORMATION

For more information about Hospital for Special Surgery's community education, support, and outreach programs, please call **(212) 606-1057** or visit us on the web at **www.hss.edu.**

You can also find us on **Facebook, Twitter, YouTube** and **LinkedIn** by searching for "HSpecialSurgery."

Managing editors: Sandra Goldsmith, MA, MS, RD, Director, Public & Patient Education; Robert Horton, LCSW, ACSW, Director, Social Work Programs; Marc Gould, Vice President, Finance; Marcello Guarneri, Assistant Vice President, Finance

Design: Christina Fisher, MFA, Senior Designer, Education Publications & Communications

Photography: Brad Hess; Huijuan (Jane) Huang, MPA; Don Pollard; Paggie Yu

HOSPITAL FOR SPECIAL SURGERY

535 East 70th Street, New York, NY 10021
212-606-1000 | www.hss.edu
www.hss.edu/backinthegame

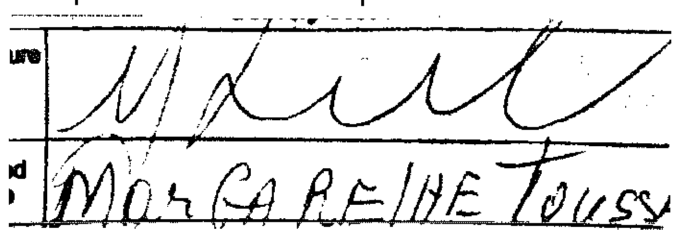
UNITED STATES POSTAL SERVICE

Date: April 1, 2014

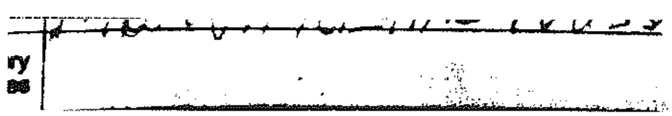
janice wojick:

The following is in response to your April 1, 2014 request for delivery information on your Certified Mail™ item number 9171999991703227063093. The delivery record shows that this item was delivered on March 21, 2014 at 4:57 pm in STAMFORD, CT 06902. The scanned image of the recipient information is provided below.

Signature of Recipient :



Address of Recipient :



Thank you for selecting the Postal Service for your mailing needs.

If you require additional assistance, please contact your local Post Office or postal representative.

Sincerely,
United States Postal Service

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

May 21, 2015 FACSIMILE TRANSMISSION ONLY

Mr. Louis A. Shapiro
President and Chief Executive Officer
Hospital for Special Surgery
535 East 70th Street
New York, NY 10021

Re: Compliance with Agreed-Upon Conditions set forth in Docket Number: 12-31780-CON
Hospital for Special Surgery's Acquisition of a MRI Scanner for its Planned Outpatient Center in Stamford, Connecticut
Request for Required Reporting and Project Update

Dear Mr. Shapiro:

On December 26, 2013, New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery, hereinafter referred to as "HSS", entered into an Agreed Settlement with the Department of Public Health, Office of Health Care Access ("OHCA") under Docket Number ("DN"): 12-31780-CON. The settlement granted HSS the acquisition of a 1.5 telsa-strength magnetic resonance imaging ("MRI") scanner for its planned outpatient center in Stamford, Connecticut (the "Stamford Center"). A copy of the agreed settlement is enclosed as Attachment 1 of this letter for reference proposes.

OHCA has received the following filings from HSS regarding the agreed-upon conditions set forth in DN: 12-31780-CON:

- On March 3, 2014, HSS filed its plan to achieve payer mix goals in support of Condition #13;
- On April 1, 2014, HSS filed a copy of its 2013 Community Benefit Report.
- On February 11, 2015, HSS reported that the Stamford Center became operational on February 2, 2015 in response to Condition #17.
- On April 20, 2015, HSS provided documentation evidencing Stamford Center's acceptance in the Connecticut Medicaid Program in response to Condition #18.

As of this date, OHCA has not received any correspondence regarding agreed-upon Condition #19. Additionally, a recent inquiry from a Stamford-area orthopedist has given cause for OHCA to seek additional information about the Stamford Center's operation. Lastly, HSS's plan to achieve payer mix goals as required by the agreed-upon Condition #13 was found to be lacking specific information as to how the goals are to be achieved. As such, OHCA requests that the HSS provide the following:

An Equal Opportunity Provider
(If you require aid/accommodation to participate fully and fairly, contact us either by phone, fax or email)
410 Capitol Ave., MS#13HCA, P.O.Box 340308, Hartford, CT 06134-0308
Telephone: (860) 418-7001 Fax: (860) 418-7053 Email: OHCA@ct.gov

1. With respect to Condition #19, provide OHCA with documentation evidencing that HSS has provided notice to providers of its participation in the Connecticut Medicaid Program in accordance with Condition #7. The reporting of this documentation was to have occurred within thirty (30) days of having received approval from the Connecticut Department of Social Services to HSS's application for the Stamford Center's enrollment as a Connecticut Medicaid Provider.

2. In mid-May of this year OHCA was informed by a Stamford-area orthopedist of his difficulty in referring a patient enrolled in the HUSKY Program to the Hospital for Special Surgery's Stamford Center. During the course of attempting the referral, the orthopedist was informed that the Stamford Center doesn't have clinic sessions in Stamford and that clinic sessions are only offered at HSS's New York City campus. With respect to the above circumstance and in conjunction with agreed-upon Conditions #9 and #10, please provide the following:

   a. An explanation of where in the development process the Stamford Center is in establishing its clinic sessions, which are being created to provide additional physician services for Medicaid recipients and the uninsured. Specifically address how the clinic sessions will be phased into the programs offered at the Stamford Center as well as how the individual subsections Condition #9 a. through #9 d. will be met.

   b. An explanation as to how the aforementioned clinic sessions have been or will be communicated to area health care providers.

   c. An explanation as to how the Stamford Center will handle referrals for musculoskeletal MRI services and other specialized musculoskeletal services from local health care providers, community-based health centers or other sources, as needed.

3. On March 3, 2014, HSS filed with OHCA its plan to achieve payer mix goals in support of Condition #13. OHCA finds that the four point plan is simply a recapitulation of the required actions that HSS needs to fulfill in remaining compliant with the agreed-upon conditions in the settlement's order and is lacking sufficient information as to how HSS is attempting to reach the prescribed payer mix goals. With respect to the above circumstance and in conjunction with agreed upon Condition #13, provide a revised plan which describes specific steps detailing how the payer mix goals of the Stamford Center will be achieved.

4. With respect to Condition #14, provide a description of the steps that have been taken to date in establishing the following:

   a. Educational and community outreach programs in the communities served by the Stamford Center;
   b. A Community Service Committee; and

c. Community Needs Health Assessment in the catchment area of the Stamford Center.

Kindly have a response to this letter prepared and sent to OHCA by the close of business on Friday, June 12, 2015. If there is another HSS associate that you prefer to be the recipient of future compliance correspondences from OHCA, please send me the name, title and contact information of that individual. Should you or an associate have any questions regarding the above, please feel to contact me at (860) 418-7069. I may also be reached at Jack.Huber@ct.gov.

Sincerely,

Jack A. Huber

Jack A. Huber
Health Care Analyst

Attachment

Cc: Kimberly R. Martone, Director of Operations, DPH, OHCA (Cover Letter)
Karen Roberts, Principal Health Care Analyst, DPH, OHCA (Cover Letter)

Attachment 1

IN RE: New York Society for the Relief of the Ruptured and Crippled, Maintaining the Hospital for Special Surgery

DOCKET NUMBER: 12-31780-CON

AGREED SETTLEMENT

On or about August 13, 2012, New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery ("HSS or the "Applicant") submitted a certificate of need ("CON") application to the Office of Health Care Access ("OHCA") seeking approval to acquire a 1.5 Tesla Magnetic Resonance Imaging ("MRI") unit to be located in Stamford, Connecticut with an associated capital expenditure of $3,245, 583.

The application was filed under Docket No. 12-31780-CON. On September 20, 2013, OHCA issued its Final Decision denying the Applicant's CON application. On or about October 15, 2013, HSS filed an administrative appeal in the Superior Court for the Judicial District of Stamford-Norwalk at Stamford bearing Docket No. FST-CV-13-6020149-S. By order of the Superior Court, this appeal was transferred to the Tax and Administrative Appeals Session of the Superior Court for the Judicial District of New Britain bearing Docket No. HHB-CV-13-6022722-S (hereinafter the administrative appeal is referred to as, "Docket No. HHB-CV-13-6022722-S").

Wherefore, HSS and OHCA sought to resolve the issues raised under Docket No. HHB-CV-13-6022722-S and entered into good-faith settlement discussions in order to avoid the continued expense of litigation;

Wherefore, HSS's original proposal sought to acquire an MRI scanner to serve its own patients who are commercially insured or who privately pay for services received; HSS now proposes to acquire an MRI scanner to serve all Connecticut residents, including Medicaid recipients and the uninsured;

ORDER

NOW, THEREFORE, OHCA and the Applicant, HHS, hereby stipulate and agree to the terms of settlement with respect to the Applicant's request to acquire a 1.5 Tesla MRI unit to be located in Stamford, Connecticut with an associated capital expenditure of $3,245, 583:

1. HHS's request to acquire a 1.5 Tesla MRI unit to be located in Stamford, Connecticut with an associated capital expenditure of $3,245, 583 is **approved.**

2. HSS shall ensure that there is equal access to the MRI service located in Stamford to all patients, including Medicaid recipients and the uninsured;

7. HSS shall apply to the Connecticut Medicaid program and make all efforts to comply with the requirements of participation;

8. HSS shall institute the same Financial Assistance Program at its Connecticut site that is in place at its main campus in New York. Currently under this program, uninsured patients with income levels below 500% of the U.S. Health and Human Services Poverty Guidelines will be eligible for a discounted patient bill. In addition, insured patients may be eligible for discounts toward their copayments, deductibles and other fees depending on income and reasonably available assets;

9. HSS shall establish clinic sessions to provide additional physician services at its Connecticut site for Medicaid recipients and the uninsured to improve the accessibility of services for this patient population;
   a. Clinic sessions shall run two days per month.
   b. Clinic sessions shall be staffed by fully credentialed Medical Doctors employed by HSS.
   c. All services available during private sessions shall be available during clinic sessions and shall be subject to the same quality standards applicable at all HSS locations.
   d. Clinic patients shall have access to all HSS services.

10. Availability of the aforementioned services to Medicaid and uninsured patients at HSS's Connecticut site shall be communicated to area health care providers, including community based health centers. HSS shall accept referrals for:
    a. Musculoskeletal MRI services at its Connecticut site from local health care providers as needed; and
    b. Other specialized musculoskeletal services available during clinic sessions from local health care providers, community based health centers or other sources as needed.

11. HSS shall allocate or block not less than one-third of its Connecticut MRI appointment slots to Connecticut residents;

12. Appointments for MRI services at the Connecticut site shall be scheduled on a "first come, first served" basis, regardless of referral source or payer. If wait times consistently exceed one week, strategies for expanding capacity (e.g. extending hours of operation) shall be considered;

13. HSS shall take all practical steps to achieve a payer mix that includes 10% Connecticut Medicaid and 2% uninsured patients for its Connecticut MRI service within the first year of operation, including but not limited to outreach efforts described in 9 and 10 above. HSS shall provide a plan detailing the foregoing steps to be taken within sixty (60) days of the execution of this settlement. HSS shall report such payer mix to OHCA at the end of its first year of operation and if this threshold is not met, HSS shall work with OHCA

to re-evaluate its outreach initiatives and develop strategies to increase utilization by Connecticut Medicaid and uninsured patients;

14. HSS shall implement educational and community outreach programs in the communities served by its Connecticut site. Implementation efforts shall include the following:
    a. Establishing a Community Service Committee, led by HSS with representation from local Connecticut communities as well as partnering organizations, i.e. Stamford Hospital, community based health centers, local school systems, consumers, etc.;
    b. Conducting a community needs health assessment in the catchment area around the Connecticut site within the first six months of operation and providing the results of the needs assessment to OHCA within thirty (30) days of completion;
    c. Identifying community partners that work with the underserved;
    d. Developing select programs to be offered to address the needs identified in the community needs health assessment, i.e., wellness classes, lectures, etc., either independently or in partnership with local providers (e.g. Stamford Hospital) based upon the results of the community needs health assessment;
    e. Distributing publications via regular mail and/or electronically to the community, i.e., Health Connection newsletter; Health Connection Fast Facts;
    f. Considering extension of existing HSS community outreach programs to the Connecticut service areas, as needed, based on the community needs health assessment. Programs may include, but are not limited to:
        i. The Leon M. Root, MD Pediatric Outreach Program (POP).
        ii. SNEAKER© (Super Nutrition Education for All Kids to Eat Right).
    g. HSS community outreach programs shall include free health screening programs, including free musculoskeletal screening and education sessions to be offered at least quarterly; and
    h. Include the Connecticut communities served by the Connecticut site within the HSS eAcademy consumer/patient programs, i.e., live streaming, webinars, etc.

15. HSS shall provide continuing professional/medical education on musculoskeletal magnetic resonance imaging to providers in the Connecticut service areas as follows:
    a. HSS shall provide educational conferences on musculoskeletal magnetic resonance imaging targeted to at least the two following groups:
        i. Program for Radiologists
        ii. Program for Technologists
    b. Conferences shall include education on musculoskeletal magnetic resonance imaging software, applications and best practices developed by HSS in collaboration with GE Healthcare.
    c. Conferences shall be provided to meet demand but occur no less frequently than annually.

d. HSS shall communicate the availability of its fellowship programs to Connecticut Radiology Residency programs and encourage application to these fellowship programs.

16. HSS shall seek to fill any additional non-medical doctor positions created as a result of the relocation and expansion of its Old Greenwich office to Stamford (approximately 25 positions) with qualified Connecticut residents;

17. Reporting to OHCA shall be required for a period of five (5) years following the opening of the Connecticut site. HSS shall immediately report to OHCA the date that the project has become fully implemented and the MRI service operational at the Connecticut location. This date shall be considered the implementation date for reporting purposes;

18. HSS shall provide documentation to OHCA evidencing acceptance within the Connecticut Medicaid Program in accordance with Condition 7. Such documentation shall be filed within thirty (30) days of approval as a Connecticut Medicaid provider;

19. HSS shall provide documentation to OHCA evidencing that HSS has provided notice to providers of its participation in the Connecticut Medicaid Program, in accordance with Condition 7 above. Such documentation shall be filed within thirty (30) days of approval as a Connecticut Medicaid provider;

20. The following shall be filed with OHCA within sixty (60) days subsequent to the one year anniversary of the implementation date for a period of five (5) years:

    a. A report of the quality data on patient outcomes regarding HSS MRI Service Integration during the past operating year, including:
        i. Report on the use of contrast for non MRI Angiography and report on comparison of the repeat studies where the base study from the outside institution used contrast ,
        ii. Report on the number of repeat studies where it was determined that the outside study was not adequate for diagnosis,
        iii. Summary of research findings from clinical practice studies (findings will also be incorporated into community based education for local radiologists where appropriate), and
        iv. Hospital wide publicly reported measures enabled by HSS integrated care which includes MRI (readmission rates, surgical site infection rates, etc.);
    b. The number of Connecticut Medicaid recipients and uninsured utilizing the clinic sessions during the past operating year, in accordance with Condition 9 above;

c. Quantification of the discounts provided through the Financial Assistance Program for the approved site during the past operating year in accordance with Condition 8 above. The information shall be provided as both a dollar amount and a volume figure (i.e., the number of scans for which a discount was provided);

d. A description of, as well as the frequency of, the free health screening programs during the past operating year and the area providers involved, in accordance with Condition 9 above;

e. A description of, as well as the frequency of; educational sessions held during the past operating year and the topics discussed, in accordance with Conditions 14 and 15 above;

f. A summarization of the collaborative efforts and the discussions with area hospitals and providers during the past operating year, in accordance with Condition 14 and 15 above;

g. A summary of communication to Connecticut Residency programs regarding HSS's Fellowship programs, in accordance with Condition 15 above;

h. The names of the radiologists from or licensed in Connecticut who participated in and completed the magnetic resonance imaging fellowship during the past operating year, in accordance with Condition 15 above.

i. A listing of the positions, both employed or under contract, at the Connecticut site for the past operating year and the State in which the individuals that hold the listed positions, reside;

j. A listing of the community needs identified and the community benefit activities undertaken during the past operating year, in accordance with Condition 14 above;

k. A copy of the Community Service Plan Report, including a summary of Community Service Committee activities and a summary of completed and planned health screening and education activities during the past operating year, in accordance with Condition 14 above;

l. Annual magnetic resonance utilization data based on number of scans shall be provided by zip code and by payer type. This data shall be filed in the following table format in Excel:

Zip Code	Medicare	CT Medicaid	Other States' Medicaid	Other Government (CHAMPUS & Tricare)	Commer-cially Insured	Uninsured	Workers Compensation	Total for Zip Code
06001	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
06002	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
#####	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans

#####	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
#####	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
Total for CT zip codes	# and %	# and %	N/A	# and %	# and %	# and %	# and %	N/A
Total for other states zip codes	# and %		# and %	# and %	# and %	# and %	# and %	N/A
Total all zip codes	# and %	# and %	# and %	# and %	# and %	# and %	# and %	N/A

m. Annual MR utilization data based on number of scans shall be provided by zip code and by diagnostic category. This data shall be filed in the following table format in Excel:

Zip Code	Diagnostic Category	Diagnostic Category	Diagnostic Category	Diagnostic Category	Diagnostic Category	Diagnostic Category	Diagnostic Category	Diagnostic Category
06001	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
06002	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
#####	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
#####	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans
#####	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans	# of scans

n. Other reporting as reasonably required by OHCA.

21. OHCA and HSS agree that this settlement represents a final agreement between the OHCA and HSS with respect to Docket No. 12-31780-CON. The execution of this settlement resolves all objections, claims and disputes, which may have been raised by HSS with regard to Docket Number 12-31780-CON;

22. HSS hereby agrees to withdraw its administrative appeal filed under Docket No. HHB-CV-13-6022722-S within two (2) business days of the execution of this settlement and provide evidence thereof to OHCA.

23. OHCA may enforce this settlement under the provisions of Conn. Gen. Stat. §§ 19a-642 and 19a-653 with all fees and costs of such enforcement being the responsibility of HSS; and

24. This settlement shall be binding upon HSS and its successors and assigns.

Signed by Louis Shapiro, President & CEO
(Print name) (Title)

12/23/13
Date

[signature]
Duly Authorized Agent for
New York Society for the Relief of the Ruptured and Crippled, maintaining the Hospital for Special Surgery

The above Agreed Settlement is hereby accepted and so ordered by the Department of Public Health Office of Health Care Access on December 26, 2013.

[signature]
Lisa A. Davis, MBA, BSN, RN
OHCA Commissioner

* * * COMMUNICATION RESULT REPORT (MAY. 21. 2015 3:23PM) * * *

FAX HEADER:

TRANSMITTED/STORED : MAY. 21. 2015 3:21PM

FILE	MODE	OPTION	ADDRESS	RESULT	PAGE
077	MEMORY TX		912126061628	OK	11/11

REASON FOR ERROR
E-1) HANG UP OR LINE FAIL
E-2) BUSY
E-3) NO ANSWER
E-4) NO FACSIMILE CONNECTION

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: **MR. LOUIS A. SHAPIRO**

FAX: **(212) 606-1628**

AGENCY: **HOSPITAL FOR SPECIAL SURGERY**

FROM: **JACK HUBER**

DATE: **5/21/2015** **Time:** **~3:30 p.m.**

NUMBER OF PAGES: **11**
(including transmittal sheet)

Transmitted: Compliance Letter seeking required reporting information and project updates regarding:

The Hospital for Special Surgery's Acquisition of a MRI Scanner for its Outpatient Center in Stamford, Connecticut

PLEASE PHONE Jack A. Huber at (860) 418-7069
IF THERE ARE ANY TRANSMISSION PROBLEMS.

Phone: (860) 418-7001 ***Fax: (860) 418-7053***

410 Capitol Ave., MS#13HCA
P.O. Box 340308
Hartford, CT 06134