

Ekbom Syndrome: The Challenge of “Invisible Bug” Infestations

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Abstract

Ekbom Syndrome is synonymous with delusory parasitosis, a belief that one's body is infested by invisible bugs. Persons suffering from this syndrome often claim to feel dermal sensations and to visualize the bugs, although no one else can see them. Ekbom Syndrome is a delusional condition; it is intractable and cannot be corrected by argument or evidence. Ekbom Syndrome sufferers exhibit a range of predictable behaviors in their attempts to eliminate their infestations, including seeking identifications and treatment from physicians and entomologists. Frequently they also experience comorbid psychological conditions. Because this is a delusional affliction, successful treatment typically requires neuroleptic medications, necessitating intervention by medical professionals.

ES: Ekbom Syndrome

DP: delusory parasitosis

INTRODUCTION

Ekbom Syndrome (ES) is the clinical term for the condition variously called delusory parasitosis (DP), delusions of parasitosis, delusion of infestation, psychogenic parasitosis, or dermatozoenwahn (dermatozoic delusion) (21, 30, 102, 106, 117). ES is characterized by the perception that one's body is infested by invisible mites or insects, despite evidence to the contrary (24, 120). These infestations are perceived as tactile sensations (e.g., stinging, burning, itching, or crawling) and visualized in a variety of forms. ES should not be confused with Wittmaack-Ekbom Syndrome, the medical term for restless legs syndrome; nor should it be confused with entomophobia, the fear of insects, or acarophobia, the fear of mites, although one of the earliest discussions of the condition was published in French as "Les acarophobes" by Thibierge (105).

A similar condition called Morgellons Syndrome is said to involve putative infestation of the skin by fibers (96). Because Morgellons does not involve insects, it is not synonymous with DP but likely is a variant within the same delusional complex (27, 58, 75, 95) (see sidebar, Morgellons).

MORGELLONS

Morgellons, also known as the fiber disease, is a condition in which individuals have an unshakable conviction that they have fibers emerging from their skin (84). The name derives from a 1674 description of children experiencing "harsh hairs on their backs," which the author termed Morgellons (96).

People who think they have Morgellons compare symptoms and discuss self-treatments on thousands of Web sites, and these individuals are now presenting to physicians with self-diagnoses of Morgellons (27, 58, 75, 84, 111). Along with the dermal symptoms, people exhibit disabling fatigue, life-altering cognitive decline (brain fog), arthralgia, and mood disorders (58, 96). Like ES, Morgellons is psychologically contagious, with families and work groups frequently sharing the condition (111). Although Morgellons has been widely covered in the popular press, this condition is not recognized by the medical community (84).

Those afflicted with ES often experience visual and tactile hallucinations perceived as bugs crawling in or on the skin (46, 119). These perceptual delusions may be monosymptomatic pathological elements, with individuals otherwise appearing unremarkable (19, 30, 57). Because this review deals with these individuals in nonmedical contexts, they are referred to as "sufferers," not "patients." References to "bugs" are used in the sense that Ekbom sufferers use the word, as a catchall term for the parasites, mites, insects, and larvae with which they label the organisms they perceive infesting them (43).

While ES has repeatedly been characterized as rare by the medical community (19, 65), it is a condition regularly encountered by pest control staff and entomologists (32, 38, 89). Trabert (106) estimated that at any given time there are over 25,000 ES sufferers in the United States (**Figure 1**). Because ES sufferers do not consider themselves ill, but rather infested with bugs, they are disinclined to accept psychiatric referrals (30, 41, 103, 106, 119). Ekbom himself (30) noted that "it is quite common for mentally ill people to believe they have creatures in (or on) the body."

CHARACTERIZATION OF SUFFERERS

Primary or autochthonous DP occurs independently of any medical condition. In contrast, secondary DP accompanies a physiological situation that produces paresthesia, pruritus, erythema, rash, or other symptoms that are then misinterpreted as invisible bugs in the skin (37). Although individuals may feel actual dermal sensations, the hallucination is a result of the brain attempting to identify the proximal cause, leading to their interpretations of skin debris as organisms producing the stings, prickling, bites, or crawling sensations (102). Pruritus is the most commonly reported sensation, typically found in over 80% of sufferers (121), with other feelings described as crawling, burrowing, and biting (6, 44).



Figure 1

Lesions produced by an Ekbom Syndrome sufferer attempting to remove bugs from under her skin.

Of course, there is a difference between feeling strange sensations in or on the skin and concluding that they are produced by invisible bugs. Similarly, while sufferers respond logically by attempting to view and collect the causative agent, their adamant assertions that scabs and hairs are indeed insects is indicative of delusion (27, 28).

DEMOGRAPHICS

Common attributes can typify ES sufferers but these individuals are not characterized by socioeconomic level, nationality, or any other demographic, including education (24, 26, 63, 94). Many ES sufferers appear to be quite normal except for their obsession about bugs in the skin differentiating them from other people (26, 61, 65, 74). Not infrequently, they are high-functioning, intelligent, productive individuals (36, 76, 109). Physicians and other medical professionals can suffer from ES (115), and in one survey the majority were professionals (65). Lyell (65) recounts the case of a middle-aged physician who suffered for a decade from

invisible bugs, traveling the world seeking a cure, unable to practice his profession. One of the best first-person accounts of the condition was published by Traver (108), a prominent zoologist who suffered from the condition for over 31 years (22, 88). Both a chemist and a biologist claimed to have acquired their infestation from yak wool sweaters and were unwilling to consider a psychopathological cause (98). Similarly, a psychologist given a diagnosis of ES refused to accept her physician's assessment (3). A scientist of some distinction claimed to have discovered a new insect from Central America that had infested him as he handled fruit from Guatemala; he presented detailed drawings of the insect and its copulation as observed under the microscope (117).

Although young people can experience ES (63), the majority of sufferers typically are older and female (11, 65, 81, 106), although this generalization does not capture the diversity of sufferers. There tends to be an equal distribution by sex under the age of 50, but above that age females predominate by a ratio of 2:1 (94).

The average age at clinical presentation is 72 years (81). The elderly may be disproportionately represented among ES sufferers due to senile pruritus (9, 109), increased incidence of diabetes mellitus-associated diabetic neuropathy (8), reduced visual acuity (30, 61, 109), and other medical conditions (26). Reduced blood flow due to arterial stenosis can also produce paresthesia (61). Additionally, advancing age brings with it loss of autonomy, leading to feelings of declining self-worth and depression, which have been linked with DP (42, 67). In addition, polypharmacy (simultaneous use of multiple medications) with concomitant side effects and potential drug interactions (7, 24, 38) may account for ES prevalence in the elderly. Older people frequently take over-the-counter drugs, supplements, and herbal remedies, which may interact with or potentiate other medications (16, 25, 31, 54). In at least one case, delusions of parasitosis were precipitated by prescription drugs and the condition resolved once the medication was withdrawn (93). Younger sufferers typically suffer from schizophrenia, are abusing drugs, or are involved in a shared delusion (26, 28, 36). However, there are documented cases of primary ES in adolescents (63).

MANAGEMENT STRATEGIES

Sufferers can develop fantastic and elaborate means of dealing with their infestations. One sufferer noted as his first option, “pour petrol over head and ignite” (74). He also listed three modes of committing suicide, which he eventually accomplished. Typically sufferers use a range of cleansing agents and other dubious remedies (11, 24). These individuals may pursue idiosyncratic methods for eliminating the pests from the home, automobile, and other aspects of the environment considered to be infested.

CASE REPORTS IN MEDICAL LITERATURE

The medical literature contains numerous accounts of ES cases, usually limited to single cases or small samples (6, 28, 91, 106), but

sharing many similarities. Because of the difficulty in recruiting patients, patient lack of compliance, and challenges of follow-up (6, 11, 50, 116), research studies are few. For instance, patients experiencing parasitic delusions due to illegal drug use are frequently incarcerated and unavailable for interview (28). This is a self-defined group and those willing to submit to neuroleptic agents may be more prone to successful treatment, thus biasing any investigation (24).

BEHAVIORS

Sufferers attempt to remove parasites by picking and digging into the skin, producing excoriation, scarification, lacerations, and other lesions (59, 65). Self-mutilation to remove the parasites is inflicted by fingernails or teeth (28), as well as mechanical implements such as needles (26), tweezers, knives (71), razor blades, and other sharp instruments (6, 46, 65). One woman had her sister scrape her body with a knife after each bath to remove the parasites, with the scrapings carefully disposed of by burning (117). Another lacerated her conjunctiva while attempting to extract a “worm” from her eye with tweezers (100). One man spent 25 years digging “worms” out of his scrotum with razor blades; he was periodically hospitalized and given blood transfusions to counteract the resultant anemia (46). This self-mutilation may result in severe blood loss, infections, and permanent scarring (28, 46, 116). Because they perceive the parasites as struggling to emerge from the skin, sufferers often cut openings to permit escape (57) (**Figure 1**).

The patient’s presentation may also include excoriations, bruising, traumatic hair loss, and contact dermatitis due to medications (6) or pesticides (56, 95). Typically the sufferer misinterprets these scabs, abrasions, or skin irritation as signs of infestation (68). Because these conditions often have existed for months or years, the individual’s body displays scarring from old extraction sites, appearing as lichenified (thickened and leathery), excoriated (abraded), ecthymatous (hardened, inflamed, and pustular) crusts and scabs (28, 46).

POTENTIAL CAUSATIONS OF DELUSORY PARASITOSIS SYMPTOMS

A diagnosis of primary DP can be made only after other underlying medical or psychiatric conditions have been excluded, because ES symptoms can be associated with numerous physical stimuli, illnesses, psychiatric disorders, or intoxications (62, 78, 89, 90, 91). Of course, the possibility of valid arthropod infestation must first be eliminated.

Physical Causations

Physical causes of pruritus include actual arthropods and other factors as discussed by Blum (12), especially environmental particulate matter (99). Some DP cases may be precipitated by actual physical causes such as insulation causing dermal irritation or static electricity attracting fibers or fragments that feel like stings (12, 65, 86, 99, 101, 113). Various allergens and environmental materials such as formaldehyde can produce dermatitis (15). Numerous components of sick building syndrome have been associated with symptoms of invisible bugs (83, 89, 101). Conditions produced by actual physical causes are referred to as illusions of parasitosis; these individuals acknowledged the true cause of their discomfort once it is explained.

Physiological Causations

Several dozen health conditions produce symptoms that imitate ES, illustrating the need for a thorough medical exam for underlying conditions that might be responsible (52). For instance, a brain tumor produced paresthesia in a patient who complained that ants were crawling on and biting her (77) and another suffered ES ancillary to pellagra (90). Poorly managed diabetes mellitus can result in diabetic neuropathy, leading to paresthesia, which may be misinterpreted as bites or stings (8, 103). Other endocrine and metabolic disorders can produce pruritus as well (7). Most of Ekblom's (30) patients displayed hypertension, but he failed to associate this underlying illness with the

symptomatology observed. Wilson & Miller (117) observed that after a patient's hypertension had been successfully treated, the pruritus abated and the patient's concern about parasites resolved. Similarly, cerebral infarctions can produce brain lesions that result in neurological sensations perceived as insect activity, or the pruritus accompanying chronic renal failure may provoke ES (103, 119). Organic brain disease should always be considered in delusion cases (10, 29, 77, 79). Bhatia et al. (11) had five cases of leprosy present as ES.

In addition, pruritus and paresthesia are common side effects of both over-the-counter and prescription medications and are mentioned as potential side effects on most package inserts (16, 24, 35, 51). For instance, the antidepressant phenelzine produced both widespread pruritus and the perception of being infested with parasites (1).

Similarly, formication (the sensation of insects in or on the skin) afflicts users of opioids, amphetamines, and other illicit drugs (28, 39, 59). Formication has been reported by 13 to 32% of cocaine abusers (28). Ekblom (30) recognized that certain drugs, in particular cocaine (33), could mimic many of the skin sensations of which his patients complained, so he noted that substance abuse was not present in any of these cases. The delusion of parasitism is so ingrained in the medical history of cocaine use that the term Magnan's sign is used to denote "cocaine bugs," evidenced by skin lesions produced as sufferers attempt to dig out the parasites (21, 23, 66). Because amphetamines are neuropharmacologically similar to cocaine, methamphetamine users experience similar sensations and respond with the same skin picking behavior in response to what is deemed "meth mites" (21, 29, 39, 70).

Psychological Causations

Depression, anxiety, stress, and other psychological conditions are known to initiate the itch-scratch cycle (59) and to manifest as dermal conditions (14, 49). Lepping et al. (62) categorized and provided examples of

Formication:

sensation of insects (especially ants) crawling on the skin

Comorbid: occurring simultaneously with another medical condition

PCO: pest control operator

psychoses comorbid (occurring simultaneously with another medical condition) to secondary delusional parasitosis. The most common underlying psychopathologies include schizophrenia, paranoid states, bipolar disorders, depression, anxiety disorders, and obsessive-compulsive conditions (6, 11, 28, 59, 61, 67, 116). To resolve the delusion, the underlying psychological illness must be addressed psychopharmacologically (50, 62, 64, 91). Some antidepressants combine antipruritic and antihistamine effects as well and so are particularly well suited for use in ES cases (59, 61).

These individuals may also exhibit paranoid persecution attitudes (20, 61). Not infrequently the origin of the organism is attributed to a conspiracy (20). Threats may be made if the customer is not satisfied by pest control results (47). Similarly, because the physician typically does not provide satisfaction, sufferers can retaliate against their doctors, even threatening their lives (13, 117).

MANAGEMENT

Entomological/Pest Control

Pest control professionals are on the front lines of dealing with home “infestations,” so they are more likely to encounter these situations than are members of the medical community (32). Practically every pest control operator (PCO) who has been in the business for more than a few months has encountered a case of invisible bugs (32, 45, 83, 115). Those involved in pest control perceive ES as much more common than do people in other fields (45, 81, 83, 113).

The role of entomologists in Ekbohm Syndrome situations is to examine proffered specimens, to determine if an arthropod is involved, and, if so, to make recommendations for suppression (83). It should be emphasized that merely finding an arthropod does not indicate an infestation or that the species is associated with the condition (42). Ethical pest control companies decline to make insecticidal applications until they identify a target pest (65, 83, 86, 89). Because most ES sufferers have their homes repeatedly treated with insecticides, either by

pest control companies or by themselves, there is risk of pesticide overload (19, 60, 86, 112).

Clinical

The psychological community is not in agreement regarding the proper classification of DP, and no specific course of psychotherapy has been determined (21, 62). It may be considered either as a sensory misinterpretation that transforms into a tactile hallucination and eventually becomes delusional, or as a hallucination that evolves into a somatic delusion (68). It has been termed a monosymptomatic hypochondriacal psychosis (61), an isolated thought disorder in which the psyche is otherwise intact, or a somatoform delusional disorder (103). According to the American Psychiatric Association (4), it is categorized as a delusional disorder, somatic type, incorporating tactile and visual hallucinations of parasites, accompanied by a fixed belief of infestation (28, 78). Generally, the phenomenon is grouped into two categories, one secondary to a medical or psychiatric condition and the other called primary (or autochthonous) delusional parasitosis because it develops spontaneously and is not precipitated by an underlying health problem (28, 79). In cases of secondary DP, the underlying disorder must be resolved in order to eliminate the delusory component (11, 50, 38). Illusions of parasitosis refers to the situation in which sensations produced by actual environmental stimuli are misinterpreted and attributed to insects. Illusions are not fixed or intractable, however, and affected individuals will accept evidence and explanation of the true cause of their skin irritation.

There is a 50% chance of remission if psychotherapy is administered soon after onset of symptoms (107), but the delusion almost never resolves spontaneously (11, 109). Delusional infestation is usually progressive, with worsening trauma and psychopathology as the condition goes untreated, and the condition becomes more refractory to therapy (24, 56, 118). If left untreated, it may become entrenched and more difficult to treat (29, 117, 120). Research

continues into both typical and atypical neuroleptic medications for ES treatment (6, 40, 71, 81, 116). Second-generation antipsychotics show greater efficacy and reduced risk of side effects (29, 37, 64).

COMMONALITIES IN EKBOM SYNDROME

The similarities of sufferers' accounts are quite remarkable (6, 102, 121, 116), suggesting that there is some atavistic drive underlying this condition (68). Although not all cases involve all features, almost all sufferers exhibit several of the characteristics described by Hinkle (51), sharing the commonalities mentioned by Ekblom (30). Listed below are several of those commonalities with illustrative examples.

The insects or mites are facultative parasites able to survive on inanimate objects (furnishings, vehicles) and then switch to infesting human bodies (36, 56, 73, 98). The creatures possess other attributes that are biologically impossible (24, 56, 76, 98), such as the ability to chew through rubber and steel (80). The pests are said to make sounds (117), sometimes loud enough to wake people (80, 87), and even to make intelligible threats (117). Pesticides are said to "make the pests mad" (117), causing them to retaliate (119). The intricate, elaborate, and dramatic descriptions of behaviors and appearance that sufferers attribute to their bugs fail to correlate with any actual organisms (24, 59).

The bugs are everywhere—there are millions of them, but the sufferer is unable to catch a single specimen (30, 65). Sufferers invest considerable time and effort in collecting, preparing, and labeling their samples (26, 30, 116). Historically, these samples have been called the matchbox sign because specimens typically were presented in matchboxes (13, 56, 116). More recently, samples are contained in pill bottles or sandwich bags (59, 102, 114, 115, 118). Sometimes tape samples are affixed to sheets of paper and meticulously labeled with descriptions of the specific body region from which the material was obtained (115, 121).

Some individuals mount their specimens on microscope slides (65). These samples tend to include only lint, skin, scabs, other dermal effluvia, paper splinters, dirt, or normal household debris (28, 29, 30, 45, 116). Negative findings invariably lead to more intense sample collecting, and despite no insects being found, sufferers return time and again with additional samples, certain that they have captured a specimen (112).

In their determination to prove that insects are causing the problem (50, 116), sufferers may dust off their windowsills and include this material in their samples. Environmental samples often include incidental insects of the type that would be found in any windowsill or light fixture (12, 45, 65, 112). One sufferer, viewing his sample under the entomologist's microscope, insisted that someone must have replaced the bugs with debris during the night (43). Even when shown their samples under the microscope and forced to admit that there is nothing there, one sufferer responded with, "ah, but you should look under the *electron* microscope" (65).

Sufferers frequently photograph their lesions and present these images as documentation and proof of their infestation (65, 118). Sufferers insist that their wounds are evidence of actual bites, and not self-induced (50, 103). A striking observation is that lesions are restricted to skin accessible to the person's reach, with wound concentrations contralateral to the dominant hand (61, 65).

The bugs are invisible, yet the sufferer can describe their appearance (59, 65, 102). Generally, only the sufferer is aware of the organisms; physicians and others are unable to see them, even with magnification (46, 119).

Descriptions of the creatures often involve their changing appearance and colors (61, 65). Initially, they are invisible, but change to black and white, and often to colorful granular, fibrous, flat, or oval shapes (30, 61, 74, 76, 112, 117). Dust motes are mistaken for clouds of flying creatures (119). Sufferers often sketch pictures of the organisms (28, 46, 76) and provide diagrams of the life cycle (57, 74).

The sufferer frequently has an elaborate description of the creatures' life cycle (28, 42, 65, 74, 116), including their laying eggs under the skin (56), entering or emerging through body orifices (43, 116, 117), and crawling under the skin (6, 59, 65, 104). These descriptions liberally mix complete and incomplete metamorphosis, as well as other features not found in arthropods (73).

The creatures exhibit a variety of locomotory abilities including jumping, crawling, swimming, flying, and burrowing (59, 65, 74, 112). Ekblom (30) documented one woman who washed her hair comb in water and then claimed to see the insects swimming around in the basin.

The sufferer frequently is quite certain of the source of the infestation (57, 97). It may be, for example, a former lover, a slovenly neighbor, or a resented employer (65, 69, 100). Frequently, there is some conflict, such as the condominium owner who was being sued by the condo association, or workers in dispute with management (12, 113, 115). One woman was convinced her infestation originated from her husband (102), and another displaced her anger at her husband onto bugs, using the infestation as an excuse to move out (97). One man stated that his infestation had begun two years prior when he ate an unwashed pear (116), and another claimed the mites came out of the faucet (83).

The infestation frequently is assumed to have come from an animal, for example, the neighbor's dog, mice in the pantry, or squirrels in the attic (24, 102, 117, 121). Many pet owners have killed or abandoned their animals (36, 42, 100) or had pets euthanized, believing that the infestation was coming from the animal (24, 76, 80, 102). Based on assumptions that the infestation originated from an animal, a veterinary entomologist or someone knowledgeable about animal parasites may be contacted to identify specimens and recommend treatment (68). Complaints include "worms from her dog" (116), "lice from the dog" (1), "fleas from a pet" (121), and "mites from her cat" (116) or from house mice (65). Owners repeatedly present pets to veterinarians for treatment of nonexistent infestations (29, 80, 100, 102).

Sufferers can pinpoint precisely when the infestation was acquired because it is associated with a major life event (50, 115). In about half of ES cases, a precipitating life event can be identified (5, 60, 69, 91). Both acute stress and chronic psychoemotional stress can trigger or enhance pruritus and other delusional parasitosis symptoms (82, 91, 98). Often, onset is temporally linked with divorce (47), death of a friend or loved one (43, 61, 80, 116), job loss (42), a move (121), or other disruptive incident (45). Home renovation was identified as the cause of one infestation (121), and onset of symptoms coincided with retirement in another sufferer (42). One man's delusory infestation was precipitated by the shock of an accident in which his sister lost her vision as the result of his negligence (117).

Duration of infestation ranges from months to decades, with sufferers averaging three years between symptom onset and clinical diagnosis (106). One man had a 12-year history of insects infesting his scalp (74). An 84-year-old woman had complained of lice infestation for 20 years (69); another woman had a 20-year history of worms crawling in her body (61). Two women sufferers had struggled with insects crawling on and beneath their skin for 24 years (6, 13). One man reported a 25-year infestation of his scrotum (46). In another case, the symptoms lasted for 31 years from onset until the patient's death (22). Over 20% of individuals in one study had suffered for more than five years (94). Valid arthropod infestations do not persist for years or exhibit the periodicity described by some sufferers, nor do the reported characteristics and behaviors reflect insect or mite biology (24, 80, 88).

The sufferer's adamant certitude and inability to accept conclusions proffered by entomologists and the pertinacity with which they cling to their convictions (97) are considered almost pathognomic, in themselves diagnostic for the condition (45). Sufferers are confident that they know what is causing their problem (28). They have done some investigation and determined it is bugs, mites, parasites, larvae, worms, nematodes, or some other specific organism (28,

76). Not uncommonly it is something “new to science” (30, 117), particularly resulting from a “government conspiracy,” such as genetically engineered organisms or an organism that “escaped from the lab,” reflecting their paranoid inclinations (76).

Sufferers go to extreme measures to eradicate the organisms from their bodies (116), and the more extreme the control recommendation, the more likely it is accepted. One woman would extinguish a match and use the hot tip to burn the bugs in her skin (30). Another sufferer spent most of the day rubbing her body with bread crumbs “to bring out the insects” (117). Sufferers bathe frequently and obsessively, using harsh detergents or disinfectants (42, 61, 65). Excessive bathing can be particularly detrimental to older skin, exacerbating xeroderma and senile pruritus (11). Sometimes they engage in specific purification or cleansing rituals, using particular products in a specified sequence (6, 11, 28, 109). They may treat themselves with a wide range of harsh chemicals such as alcohol, bleach, kerosene, gasoline, pesticides, and other potentially dangerous materials (74, 112, 116, 117). One woman scrubbed her skin with undiluted ammonia (30). Another regularly bathed in dyes (65), and Traver (108) used the purple dye gentian violet to treat her scalp. They self-medicate with home remedies, folk cures, and self-prescribed therapies such as veterinary medicaments or nostrums from online Web sites (6, 24, 26, 54, 62, 76, 104).

Sufferers use pesticides on their bodies (6, 29, 56, 113). One woman confessed to squirting 1% lindane lotion (Kwell) into her ears (43), while another daily sprayed himself with permethrin (109). The resultant dermal damage exacerbates skin irritation, perpetuating the “treatment” cycle (36).

Although the infestation may be generalized, frequently it is localized to specific body regions, and most often this includes the scalp (11, 30, 65, 112). Sufferers often pull out their hair or shave the scalp in efforts to eliminate the infestation (11, 56, 65, 74, 116). One woman shaved only her eyebrows, perceiving them as the site of infestation (100). Some sufferers go

so far as to shave all the hair from their bodies (80).

Obsessive laundering and housecleaning are common (61). Many sufferers claim they spend every waking hour cleaning the house to eliminate the infestation (103, 117). In addition to washing their bed linens daily, they frequently report boiling clothes, drying them, and then sealing the garments in plastic bags until they are ready to wear them (57, 117). Some get up several times during the night to change the bed linens (38).

ES sufferers dispose of household goods because they typically believe that the infestation has spread to their environment from which they are reinfested (38, 102). Common household items such as toothpaste and cosmetics may be infested by the bugs (112). Any furnishings suspected to be infested, including upholstered furniture, mattresses, and carpets, are thrown out or burned (42, 65, 87, 117, 119). Typically, these decisions are based more on the sufferer’s perceptions than on any objective evidence of pests (47). One sufferer piled all his furniture in the backyard and burned it, commenting, “The house is next if this doesn’t get ’em” (45).

Two accounts of ES sufferers mention attempts to eradicate the creatures with a blowtorch (65, 119). One individual was convinced that he contaminated every toilet he sat on, so he purified his own with a blowtorch, which eventually destroyed it (65).

Moving out of the home (26, 30, 80) is another effort undertaken to elude the pests, with sufferers fleeing to a motel (56) or friend’s house (53). Generally, the infestation accompanies them (19, 43, 61, 112, 119). In one case, a mother and daughter moved 11 times in four years (65). Eventually, sufferers may end up living out of their vehicle. Some sufferers have tried to eliminate an infestation by starting a fire in the apartment or flooding it (53).

Sufferers practice doctor-shopping (26, 30, 44, 56), frequently visiting several doctors to find one who concurs with their assessment and will prescribe the cure (6, 19, 29, 74, 121). One woman had been treated by at least

Medicament: an agent intended to promote recovery from injury or ailment; medicine

20 physicians (98), and another had seen more than 10 dermatologists, all of whom she described as “completely incompetent” (100). In addition to their personal physician, sufferers contact dermatologists, parasitologists, infectious disease and other specialists, public health departments, and various government agencies (43, 68, 112). Unfortunately, physicians often make a cursory examination, pronounce the lesions as insect bites, and tell the patient to contact an exterminator (112).

Large amounts of money are spent on pesticides (24, 26, 29, 53, 56, 119), special remedies, and replacing belongings that were discarded or destroyed (24, 43, 65, 117). Sufferers abuse and overuse pesticides, sometimes making daily environmental applications, including treating the bed linens (6, 30). Sufferers bring in a succession of pest control services (38, 45, 62). One apartment was fumigated eight times in seven years (53). When one company refuses further applications, they hire another (86).

Sufferers quit their jobs, explaining that the infestation is so distracting that they cannot focus on work tasks (109) or that the shame of being infested is so great that they resign (19). Another explanation is that they want to avoid transferring their infestation to coworkers, which may be tied to isolating themselves from human contact (65). Some choose to be self-employed, which allows them to further limit contact with others (65). One man claimed to have changed jobs 14 times in 12 years (74).

Sufferers experience social isolation (26, 61), either intentionally or because friends withdraw (74). The sufferer retreats from friends and family to avoid contaminating them (94, 98). Sufferers often misinterpret scratching behavior in others as confirming their infestation (21) and as evidence that others are acquiring their infestation (38, 65, 102, 117). The family's frustration and inability to deal with the sufferer may also result in estrangement (6, 65). Because so much of the individual's time is devoted to cleaning, treating, and other activities associated with their infestation, they have no time for social activities and their lives eventually center exclusively on their delusion (30, 50,

56). In one case, all four members of a family withdrew from social interaction, believing that they were infested as a result of their neighbors' persecutory activities (20). Considerable time is also spent online investigating their infestation (36, 76).

Frequently, this psychotic disorder is shared. The most common shared delusion is between husband and wife (5, 65). Even in cases in which the spouse is not afflicted, the experience is frequently so vivid that he or she truly believes in the other's infestation (24, 30, 65, 112, 116). By comparison, one couple actually occupied separate apartments because the wife felt bugs crawling on her when around the husband but did not consider herself infested (109).

Sometimes the pair consists of a parent and child, as in a case in which a mother and adult son contracted their delusion almost simultaneously. Even after the index case (the “inducer”) was hospitalized, the son continued to experience the infestation (56). In a similar case, even after his wife (the inducer) was hospitalized, treated, and recovered from her delusion, the husband continued in his conviction of mite infestation, living in an insecticide-soaked home with the windows taped shut and furniture covered in plastic (68).

Three members of one family developed DP within a few months of the index case's retirement (42), demonstrating the power of suggestion in the pathogenesis of these shared delusions (65, 82, 101). A case affecting all four members of a family was precipitated by the mother's persecution complex and persisted for over six years before any family member sought medical help (20). A case involving five members of a family who claimed to be infested is noteworthy because two of the sufferers lived in different cities and never came in contact with the presumed source of infestation (yak wool sweaters) (98). In fact, the fifth victim had contact only with her grandmother, who was presumed to have been infested by a visit from her son.

It is possible for many individuals to experience the delusion together. Groups of office workers complained of being infested with

paper mites (113) or cable mites (99, 101). Lyell (65) describes eight cases of what he calls “mass hysteria,” in which workers in various settings share delusions. It is possible that up to one in five patients gives rise to a secondary case or cases (21, 106, 121).

The infestation shared by others is taken as evidence of person-to-person transmission (117), but it is undoubtedly due to the power of suggestion (12, 56, 101). Just as medical students routinely experience symptoms of each pathology they study, people hearing about symptoms of invisible bugs readily experience similar phenomena (65, 92). Scratching is known to be a highly suggestible and contagious activity, subliminally conveyed among individuals (21, 82), so it is not surprising that family members or coworkers frequently experience similar responses (28, 60, 113) and may actually reinforce each other’s condition (47, 106).

A newly recognized phenomenon is shared psychotic disorder at a distance, with groups forming via the Internet (29). Increased communication accessibility allows strangers to compare symptoms, diagnose conditions, and recommend therapy via online groups (29, 36). Technology facilitates dissemination of misinformation on a wide scale (110), playing a major role in both ES and Morgellons (29, 111).

Sufferers frequently express intense desperation and hopelessness, using such terms as “I’m desperate” (24, 102, 116), “I’m at the end of my rope” (116), “you’re my last hope” (76), “you have to help me,” “they’re driving me insane,” “I can’t take this anymore,” and “I’m not delusional” (30, 74, 84, 116). Despite their frequent remarks such as, “This itching and crawling is about to drive me crazy,” sufferers adamantly state words to the effect of “I am not crazy” (84).

Sufferers express thoughts of suicide (28, 38, 50); some make suicide attempts (6, 116) and some are successful (74). Lyell (65) cites five cases of suicide but emphasizes that they may have resulted from underlying psychological problems other than the Ekblom delusion. Even for those for whom ES is not life-threatening, it can be “life-ruining” (59).

Sufferers express frustration and scorn over the expert’s inability to identify the pest (29, 41, 45, 47, 65, 116), complaining that doctors and entomologists are callous, incompetent, and ignorant of parasitic infestations (36, 76, 100). They display paranoia because “no one believes me” (38, 61, 65, 116) and feel misunderstood (50, 64). Sometimes the patient becomes hostile and belligerent (57), delivering a diatribe against uncaring and ignorant physicians who are indifferent to patient suffering (24).

INTERVENTION

ES conditions are distressing to family and friends who want to help the sufferer but do not know how (29, 79). Typically, such efforts are rebuffed because they contradict the sufferer’s conviction of infestation. Family members become concerned when sufferers withdraw, refuse contact, and exhibit other odd behaviors (73).

Some sufferers may exhibit paranoia and a persecution complex, believing that everyone is against them because no one else will concur with their story (28, 43, 93). Although initially the sufferer may be able to compartmentalize the affliction, eventually it may take over his life and become truly debilitating (50, 61, 76).

Several neuropharmacologic drugs have been advocated for treatment of this condition (37, 71). If diagnosed and treated early in its development, psychiatric intervention can prevent the delusion from becoming irrevocably fixed (29, 120). Although many sufferers refuse to believe that their condition is psychological, they sometimes can be persuaded to consult a psychiatrist and accept therapy to help them manage the emotional hardships created by their affliction (65). Because the delusion can recur upon cessation of medication, long-term maintenance with low dosages may be required (11, 59, 71, 116). Even if the conviction of infestation persists after treatment, symptoms may be reduced to the point of not interfering with the individual’s daily life (6, 120). Sufferers may experience relief from symptoms and consider themselves “cured of the infestation,” but they

almost always believe that they were indeed infested prior to the treatment (30).

DETERMINE IF ARTHROPODS ARE INVOLVED

Before assuming that an individual suffers from ES, it is essential to ascertain that no infestation exists (12, 41, 45, 48). There are few arthropods that can cause the physical symptoms and that possess the attributes with which they are described (88, 101). The differential diagnoses will include lice (head, body, and pubic), mites (e.g., *Sarcoptes*, *Cheyletiella*, *Pyemotes*, and bird and rodent mites), bed bugs, thrips, fleas, and springtails (6, 12, 17, 34, 48, 72, 83, 89). Altschuler et al. (2) purported to show Collembola in skin samples taken from individuals diagnosed with DP, but the work has not received widespread acceptance and awaits additional research to confirm or refute these findings. In one study (60), 13% of the inspected premises had actual arthropods accounting for the discomfort.

Despite reliable diagnostics, scabies is routinely overdiagnosed (34, 85, 115). Unfortunately, once the diagnosis of a scabies or lice infestation becomes entrenched after the physician (authority figure) confirms it, the patient persists in believing that these creatures are living on the skin (20, 28, 40). If the patient's complaint is pruritus and the clinical presentation is consistent with scabies, "the diagnosis is scabies until proven otherwise" (55). Even pruritic lesions not found in scabies predilection sites are assumed to be scabies and treated accordingly (18, 40, 55). If treatment is begun with scabicides and the patient's condition improves, the scabies diagnosis is assumed to be confirmed (34, 61, 115). However, there is a strong placebo effect in these cases, so any treatment typically produces temporary remission, which is then followed by rebound conditions of greater severity (20, 87, 118), prompting the patient to insist that the physician provide "something stronger" because the first prescription was not adequate (11, 40, 46, 50, 65). Often the

patient attributes treatment failure to the eggs being resistant to the chemical or the ability of the creatures to burrow in the skin and escape (57, 65).

Similarly, a pesticide application is frequently perceived as succeeding (12, 87), but shortly thereafter the problem returns, convincing the sufferer that the pesticide was only marginally effective. The PCO is obligated to respond to the callback and thus begins the cycle of treatment and customer dissatisfaction (12, 87). For this reason, PCOs should always conduct a thorough inspection and identify the pest to control before an insecticide is employed (32). In some cases, especially if ES is suspected, the company may choose to decline the account (87, 89).

IF NO ARTHROPOD IS INVOLVED

If, following a thorough investigation, PCOs and entomologists fail to identify an arthropod that is producing the condition, the ES sufferer should be referred to a dermatologist to ensure they receive appropriate medical care, either in that practice or by psychological/psychiatric associates (26, 32, 45, 121). The physician must rule out all medical conditions marked by symptoms of pruritus, paresthesia, urticaria, or other skin sensation (28). Recreational drug use must also be considered (52, 78), especially in younger patients (70). Because ES symptoms can be indicative of life-threatening medical conditions, they should be accorded due concern (28, 29, 36).

MULTIDISCIPLINARY MANAGEMENT

Physicians should avail themselves of the skills and expertise of entomologists and PCOs to survey the living environment for potential causations (45, 48, 72, 86, 115). Delusional conditions are particularly challenging for entomologists because of their background training in facts, logic, evidence, and other aspects of science (121). The entomologist can play a role by

determining whether an arthropod is involved, but cannot diagnose or treat the condition, limited to encouraging the sufferer to seek medical assistance and to persist in doing so until suitable care is received (50).

Benign deception has been proposed as a method of handling ES cases. For instance, a physician may prescribe a placebo (e.g., pill or cream) with assurance that this will cure the infestation (50). However, Wilson & Miller (117) recognized that such attempts serve to deepen the patient's conviction of infestation and fix the delusion, impeding any subsequent therapy (57).

Similarly, a PCO could treat the house with water or other inert material, assuring the homeowner that it will eliminate the bugs (41, 73, 83). It is likely that these activities would result in a temporary remission of the condition, due either to enhanced humidity reducing static electricity (101) or the placebo effect (83, 86). However, it is almost inevitable that the sensations will resume (113), causing loss of confidence in the PCO (83). At the same time, it locks the PCO into an ongoing cycle of treating for a nonexistent pest (83, 86). In these situations, treating serves to validate for the sufferer that there is a pest present, because the authority figure has confirmed it (28, 38, 41, 102, 118). In the long term, providing treatment is almost certain to do more harm than good. More basic than these practical considerations is the ethical question of deception. Whereas the physician has such latitude, pest control firms cannot

legally or ethically treat for nonexistent pests (41, 65, 83, 86, 101).

CONCLUSIONS

The entomologist's imperative is to determine whether an arthropod is involved (41). Obvious candidates such as mosquitoes, fleas, bed bugs, or scabies mites must be excluded, as well as more transient causative agents such as thrips and clover mites (12, 17, 48, 83). If no arthropod can be implicated, then Ekbohm Syndrome becomes the likely diagnosis. The only role entomologists and pest control companies can play in these cases is to provide referral to a medical professional (32, 45, 83, 86, 92, 121).

As Schrut & Waldron (97) concluded, "The entomologist is ineradicably and often uncomfortably involved with the person who is troubled with delusions of parasitosis." If the psychological community has been unable to reach a consensus on the cause and categorization of Ekbohm Syndrome, it is not surprising that entomologists and the pest control industry are bewildered by the condition, perhaps even more so than when Waldron (112) made the observation that further research was needed "to define the problem clearly and to determine the proper role of public health entomologists and other lay workers who may on occasion be asked to provide consultation." Although Ekbohm Syndrome is not an entomological problem, it will likely continue to be Entomology's problem (45, 57).

SUMMARY POINTS

1. Ekbohm Syndrome, or delusory parasitosis, is a true delusion, incapable of being changed by argument or evidence.
2. Frequently, ES is shared among family and coworkers.
3. Entomologists can assist ES sufferers by identifying material presented as specimens, but they cannot provide medical diagnoses.
4. ES sufferers require medical treatment in order to recover.

FUTURE ISSUES

1. With easier communication via the Internet, cases of ES are likely to increase; sharing symptoms and treatments tends to fix a sufferer's conviction of infestation.
2. Erroneous information (such as bird mites infesting humans) is disseminated by Web sites.
3. More effective treatments must be found for ES sufferers.
4. The relationship of Morgellons to ES needs to be elucidated.

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Errata

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