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Outfoxing a Rash: Clinical Example of Human-Wildlife Interaction

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Abstract: Increasing human–wildlife contact can manifest in a variety of clinical conditions that may be overlooked by both human health and veterinary professionals. We report on an outbreak of scabies infection in a community, affecting both animals and humans, and representing the effects of an emerging infectious disease in a wildlife population. These cases underscore the potential importance of ''animal sentinel'' events for human, animal, and ecosystem health. The treatment given to the human cases of infection ranged from aggressive therapy to watchful waiting, with similar outcomes. There is a need for further collaborative, evidence-based research by human and veterinary health professionals into the optimal treatment and prevention of infections resulting from cross-species transmission.

Key words: animal sentinel, scabies, zoonoses, wild animals, occupational diseases, host–parasite relations

Background

Recent outbreaks of infectious disease, including severe acute respiratory syndrome (SARS) and monkeypox, have underscored the consequences to human health of increasing human–wildlife interaction. Yet these widely publicized episodes may give the impression that emerging zoonotic diseases tend to manifest in dramatic and distinctive ways. In fact, common medical problems presenting in a primary care setting may be a reflection of ecosystem level changes. Greater recognition of the underlying processes at work could lead to more effective surveillance and prevention for human public health. There have been calls for better communication between animal health and human health professionals regarding unusual events in animal populations that could be ''sentinel events'' for a human biological or chemical terrorist threat or other environmental health hazards (van der Schalie et al., 1999; Logan-Henfrey, 2000), yet as this case demonstrates, a number of barriers to recognition of animals as sentinels of human environmental health hazards must be overcome.

Case Details

A 36-year-old woman presented to a dermatologist's office complaining of a papular pruritic rash on her neck area and chest that had developed over the past 1 1/2 weeks. She had no previous history of skin problems or allergies. She denied any history of contact with any persons experiencing rashes but reported handling a wild fox that had ''mites.''

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The dermatologist treated the woman with a course of topical Lindane solution over the entire body from the neck down, as well as oral steroids and antihistamines. With this treatment, the rash improved over the next 2 weeks.

The woman worked as a wildlife rehabilitator, caring for injured and sick wild animals. One week before her rash developed, she had received a wild red fox (*Vulpes vulpes*). The fox had been sighted on a local golf course, and was easily captured due to its emaciated condition (Fig. 1). Upon capture, the fox had been noted to have a diffuse crusting rash, skin thickening, and extensive hair loss. The wildlife rehabilitator took the fox to a local veterinarian who performed skin scrapings (Fig. 2) that confirmed the diagnosis of "sarcoptic mange" due to diffuse infection with the scabies mite, presumably the vulpine strain (*Sarcoptes scabiei var vulpes*). The veterinarian began treating the fox with a regimen of subcutaneous ivermectin (0.3 mg/kg sc) days given at 10-day intervals, but the fox escaped from captivity before completing the full course of therapy; it was last sighted in a wooded area near a road leading to an adjoining community.

Over the previous 2 months, the veterinarian recalled treating five cases of sarcoptic mange among dogs living near the golf course where the fox had been captured. These cases were confirmed with skin scrapings, and showed a rapid response to ivermectin injections. Shortly after handling and treating the fox, the veterinarian also developed a pruritic, papular rash on her abdomen and chest. She elected not to seek medical care for the lesions, since she believed that the vulpine strain of scabies would be unlikely to persist in a human host. Her rash resolved spontaneously over several weeks.

Figure 1. Wild red fox with "sarcoptic mange" due to diffuse infection with *Sarcoptes scabiei*.

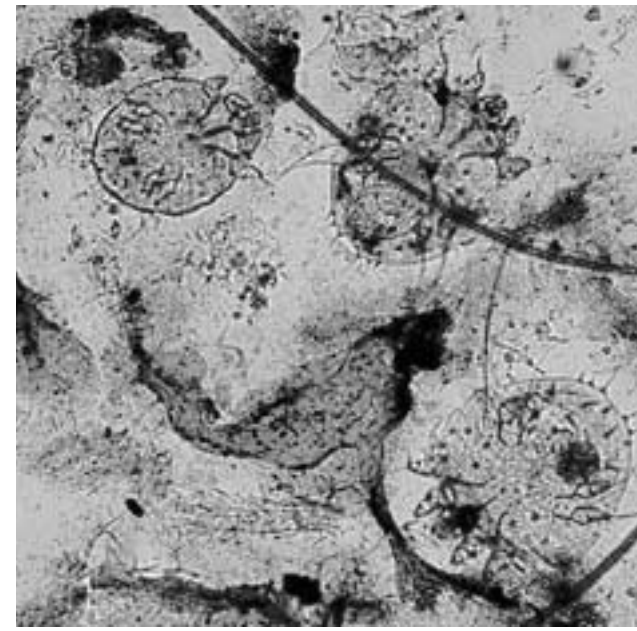

Figure 2. *Sarcoptes scabiei* in a skin scraping from a wild red fox.

Discussion

Sarcoptic mange is the term used for diffuse scabies infection in an animal, bearing resemblance to the widespread lesions of crusted or "Norwegian" scabies seen in immunocompromised human patients (Schlesinger et al., 1994). Sarcoptic mange has caused epidemic mortality among a number of wild animal populations including canids (Little et al., 1998; Bates, 2003), cats, boars, wombats, apes, and bovids (Pence and Ueckermann, 2002), and is one of a growing number of "emerging infectious diseases of wildlife" (Daszak et al., 2000). Such diseases may "spill over" into wildlife populations from a domestic animal or human reservoir, and then "spill back" from wildlife to domestic animals and humans. A number of strains of *Sarcoptes scabiei* exist, adapted to different host species. Treatment is often successful with the use of ivermectin or similar agents (Jacobson et al., 1999).

While strains of mites from different species are host-specific, cross-species transmission can occur. The risk of animal strains infecting humans increases with the degree of human–animal contact (Walton et al., 1999). In a population of aborigines with extensive contact with domestic dogs, approximately 25% of adults displayed positive antibodies to the canine strain (*Sarcoptes scabiei*

var canis) (Normaznah et al., 1996). The aborigines appeared to have a low rate of clinical manifestations of scabies, suggesting that continuous exposure to the dog mite provided protective immunity against human scabies. Humans have been reported to be infected with Sarcoptes strains from other mammals, including cows (Mumcuoglu and Rufli, 1979), dogs and cats (Warner, 1984), wombats (Skerratt and Beveridge, 1999), and pigs. The association with occupational contact with animals has led to names such as ''cavalryman's itch'' and pig-handler's itch'' for the condition (Burgess, 1994).

When an animal strain of *Sarcoptes scabiei* infects a human, the mite penetrates the skin and rapidly causes a pruritic rash, but is unable to successfully reproduce and persist (Burgess, 1994). Skin scrapings are usually negative, and one must rely on a history of exposure to infected animals to correctly diagnose the rash. After a period of weeks, the rash tends to resolve spontaneously (Burroughs and Elston, 2003), in contrast to infection with the human strain, which may last for a year or more if untreated. A case series of 22 treated and untreated cases of canine scabies in humans found that treatment shortened the duration of symptoms (Smith and Claypoole, 1967), but this has not been tested in a randomized clinical trial.

The human strain of the mite (*Sarcoptes scabiei var humanis*) has the potential to infect animals as well. A study of mountain gorillas found evidence of severe scabies infection in apes being habituated to humans in an effort to promote ecotourism, suggesting that the human strain was responsible (Graczyk et al., 2001).

In this case, a dermatologist treating a wildlife rehabilitator and a veterinarian self-diagnosing her rash were both encountering a type of ''sentinel event.'' The dermatologist correctly determined that the wildlife rehabilitator's rash was an occupational infection. Occupational diseases often present in a ''sentinel'' manner, where illness in one worker indicates that many more may be at risk (Rutstein et al., 1983). In the state where the dermatologist saw this patient, there is a statewide reporting system for any occupational disease, allowing the public health department to potentially recognize clusters of ''sentinel events'' and initiate preventive efforts for other workers at risk. However, occupational disease events continue to be underrecognized and reported in medical practice (Harber et al., 2001; Morse et al., 2004). If the dermatologist had reported this case, other wildlife rehabilitators and veterinarians could have been alerted to the risk of scabies infection.

For the veterinarian, two types of animal ''sentinel events'' were occurring. The first was the sick fox, possibly representing the ''tip of the iceberg'' in terms of infection in the wild red fox population. The occurrence of sarcoptic mange may represent a decreased immune response in the affected animal (Skerratt, 2003). Could the fox have been immune-suppressed due to starvation or underlying disease? Or, was the fox, living near a golf course, a ''sentinel'' for chemical contamination in the environment (Dip et al., 2003) due to pesticides or other lawn chemicals (Porter et al., 1999)?

The second ''animal sentinel'' event was the cluster of recent cases of scabies in dogs living near the golf course where the fox was caught and presenting to the veterinarian's practice. It is not known whether other veterinarians were encountering similar cases. If the veterinarian had known earlier about the common exposure (to the fox), she might have prevented some of the cases, by encouraging dog owners to limit dog wandering and to make their dog yards less attractive to foxes by removing food sources. Such efforts could also have reduced the risk of canine scabies in local dog owners.

There are a number of possible reasons why sentinel events do not receive the attention they deserve in actual practice. The dermatologist, busy in a practice geared toward treating individuals, may not have been aware of the statewide occupational disease reporting network, nor have seen an incentive to report through it. While this physician elicited a history of contact with a red fox, the information was used strictly to make a presumptive diagnosis of animal scabies in the patient. Any other issues related to the possible value of the fox as a ''sentinel'' of human health hazards in the environment, if considered at all, were probably seen as falling outside current medical practice. It would also have been highly unusual for a physician in community practice to consult with a veterinarian either locally or in a public health department to further investigate such an episode.

The veterinarian treating the fox and the dogs had a chance to talk with both the wildlife rehabilitator as well as the dog owners. In this way, she was able to see a pattern of disease spreading in the community. Yet there is currently no surveillance or reporting system for an animal disease event like sarcoptic mange. The diseases reportable to the state animal health officer are primarily large animal diseases of agricultural importance, although recent emphasis on homeland security issues has led to efforts encouraging veterinarians to report possible cases due to bioterrorism

agents such as tularemia as well. In the absence of organized systems, there are few informal contacts between veterinary and human health professionals in a community. For this reason, the information that the veterinarian had was not accessible to local medical practitioners or the public health department. There was also no channel for communication to wildlife health officers who could have initiated an investigation into the causes and extent of sarcoptic mange in the fox population. One might argue that such measures are not needed for a disease with relatively low human morbidity, yet without developing the habit of greater communication between veterinary and human health professionals, it will be more difficult to mount a rapid response to a major animal sentinel event.

In addition to lost opportunities for public health intervention on both a human and animal population level, this case illustrates a differing worldview between the physician and veterinarian with regard to the treatment of cross-species infections. Did the wildlife rehabilitator's rash represent a self-limited process that would have resolved without aggressive treatment and risk of drug side effects (Solomon et al., 1995)? Would the veterinarian's rash have resolved more quickly if she had treated it? These questions further illustrate the need for evidence-based research involving collaboration across disciplines to determine the optimal treatment and prevention of diseases related to human and animal contact.

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