First Pediatric Case of Tularemia after a Coyote Bite

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Bite-transmitted tularemia is a rare event in humans and most of the cases have been associated with cat bites. We report the first pediatric case of tularemia caused by a coyote (Canis latrans) bite. Coyotes can be healthy carriers of Francisella tularensis and transmit this infectious agent through a bite. Pediatricians should be aware of this risk after a carnivore bite and implement appropriate antibiotic therapy, as amoxicillin/clavulanate potassium (Augmentin) may have prolonged the typical two to three days’ incubation period commonly observed for tularemia after an animal bite and was not effective in preventing clinical signs in this child. Finally, it emphasizes again the importance of early and late serum samples for appropriate serodiagnostic.

1. Introduction

Tularemia is an acute infectious disease caused by Francisella tularensis, a Gram-negative bacillus, which has been reported in more than 250 animal species including mammals, birds, reptiles, fish, and invertebrates, although mammalian hosts are most commonly associated with risk of human infection, and man in North America [1]. Tularemia is principally a disease of wild lagomorphs (rabbits and hares) and rodents in the Northern Hemisphere. Tularemia is a zoonosis and humans are usually infected when handling infected animals, mainly lagomorphs or rodents [2]. Vector transmission (bites from blood sucking arthropods such as ticks, deerflies, and mosquitoes), ingestion of insufficiently cooked rabbit or hare meat, drinking contaminated water, inhalation of dust from contaminated soil, and inhalation of aerosolized bacteria are common modes of transmission [3]. Infrequently, infection is acquired following domestic or wild animal bites, mainly from domestic cats. More than 50 human cases of tularemia following cat bites have been reported between 1928 and 1993 [4]. A limited number of cases (Table 1) have been reported following bites from dogs [5], squirrels [2, 5, 6], monkeys [3, 7], a skunk [5, 8], an opossum [5], a raccoon [9], a coyote [10], a hamster [11], a prairie dog [12], and a hog or a wild boar [2, 5, 13].
2. Case Report

We report on a 3.5-year-old Caucasian boy who was bitten by a coyote when picnicking on a summer day at Windy Hill Open Space Preserve, San Mateo County, California. Shortly before dusk, the child was attacked and bitten first on the right hand and then on the right shoulder and scalp. When brought to the Lucile Salter Packard Children’s Hospital at Stanford, the head lacerations were cleaned and sutured, but the small puncture wounds on the right hand were not closed. The child was given rabies postexposure treatment, including rabies human immunoglobulins and subsequently the full series (1 mL of rabies HDCV vaccine at days 3, 7, 14, and 28). The child was followed daily by the plastic surgery department for wound care on his scalp and 50 mg 3 times a day (tid). The child was started on an antibiotic treatment (Augmentin) for 24 hours. Laboratory work included a serology (slide agglutination) test (Lot 93367LA, Difco Laboratories, Detroit, MI) revealed a *F. tularensis* titer (≥1:1,280) consistent with the diagnosis of tularemia. No cross-reaction was observed with *Brucella* antigen (B. abortus card test).

3. Discussion

The high antibody titer in the late serum sample confirmed the etiology of this child’s infection. It is the first documented pediatric case of coyote bite–transmitted tularemia and the second ever reported case following a coyote bite [10]. Coyotes can be healthy carriers of *F. tularensis* and as previously demonstrated [15], especially in adult coyotes compared to young coyotes [16]. *Francisella tularensis* was recovered from the salivary glands of two out of three experimentally infected coyote pups [10], suggesting the possibility of human disease acquired from the bite of an infected coyote. In the present case, at least two coyotes were trapped a few days after the child’s bite and they tested negative for *F. tularensis*. Unfortunately, because of the late suspicion of tularemia, no culture or PCR testing attempt was made from the pustule or the lymph node, given the fact that the boy had already been treated with antibiotics. The clinical symptoms seen in this child were very compatible with either tularemia or cat scratch disease. A serum sample collected approximately 2 months after the bite was negative for *Bartonella henselae* antibodies using an immunofluorescence test (IFA), but a tularemia slide agglutination test (Lot 93367LA, Difco Laboratories, Detroit, MI) revealed a *F. tularensis* titer (≥1:1,280) consistent with the diagnosis of tularemia. No cross-reaction was observed with *Brucella* antigen (B. abortus card test).

<table>
<thead>
<tr>
<th>Animal species</th>
<th>Name</th>
<th>Location, date</th>
<th>Reference(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coyote</td>
<td>Canis latrans</td>
<td>Montana, 1925; California, 1996</td>
<td>[10]</td>
</tr>
<tr>
<td>Skunk</td>
<td>Mephitis mephitis</td>
<td>Greenboro, N. Carolina 1930 (reported by Francis)</td>
<td>[5, 8]</td>
</tr>
<tr>
<td>Opossum</td>
<td>Didelphis virginiana</td>
<td>N.A.</td>
<td>[5]</td>
</tr>
<tr>
<td>Prairie dog</td>
<td>Cynomys sp.</td>
<td>Spain, 2003</td>
<td>[12]</td>
</tr>
<tr>
<td>Ground squirrel</td>
<td>Citellus richardsoni</td>
<td>Montana (N.A.)</td>
<td>[2]</td>
</tr>
<tr>
<td>Tree squirrel</td>
<td>Sciurus carolinensis</td>
<td>Arkansas, 1988</td>
<td>[6]</td>
</tr>
<tr>
<td>Squirrel monkey</td>
<td>Saimiri sciurus</td>
<td>California, 1970</td>
<td>[7]</td>
</tr>
<tr>
<td>Hog</td>
<td>Sus scrofa domestica</td>
<td>Iowa (N.A.)</td>
<td>[2, 5]</td>
</tr>
<tr>
<td>Wild boar</td>
<td>Sus scrofa</td>
<td>France, 1947</td>
<td>[13]</td>
</tr>
</tbody>
</table>

N.A.: not available.

Table 1: Reported cases of tularemia in humans following an animal bite (excluding cats and dogs).
negative for antibodies against tularemia, plague, brucellosis, and toxoplasmosis, but positive for leptospirosis. Both coyotes also tested negative for rabies by IFA on brain tissues. Unfortunately, no attempt was made to detect Francisella in the oral cavity of the coyotes, because of the initial rule-out of tularemia in the boy. Because of the initial negative tularemia serology test on that child, cat scratch disease was considered. When tested serologically, both coyotes were reported to be positive for Bartonella spp. [17]. Further investigation revealed that coyotes are infected with a Bartonella species found in canids, Bartonella vinsonii subsp. berkholffii [17, 18]. Despite the fact that one of the two coyotes tested was likely to be the one which had bitten the child, none of them were seropositive for F. tularensis, therefore being healthy carriers of this bacterium. It has also been reported that tularemia is quite endemic in this part of California, where outbreaks have occurred in nonhuman primates colonies [19, 20].

Despite being uncommon, tularemia should be systematically suspected after a coyote bite, especially when the bitten person develops fever and adenopathy. This case also emphasizes the importance of early and late (>15 days) serum collection to establish an appropriate diagnosis. At the time of the first serological test, performed on a serum sample collected 10 days after the bite incident, the child had not yet mounted an elevated IgG antibody response. Furthermore, the immediate administration of antibiotics may have delayed the development of an immune response and led to a prolonged incubation period to a week instead of a 2-3 days after a bite in most documented case reports [3, 6, 10]. The treatment with Augmentin did not prevent the boy’s infection but may have reduced the severity of the clinical signs by comparison with the two other documented human cases of contamination by coyotes where suppuration of lymph nodes or persistent ulceration at the bite site or infection site occurred [10, 14].

All efforts should be taken to detect or to isolate F. tularensis from such patients in a specialized laboratory. Serology can confirm infection retrospectively. Methods can include agglutination, ELISA, or western blotting [1]

F. tularensis is generally susceptible to a range of antibiotics, including fluoroquinolones, streptomycin, kanamycin, amikacin, and gentamycin and promptly treated patients have a generally favorable prognosis [1]. Tetracycline, doxycycline, and chloramphenicol may be used but are bacteriostatic and treatment must be provided for at least 14 days to prevent a relapse.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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References

