

SHORT REPORT: CONCURRENT ROCKY MOUNTAIN SPOTTED FEVER IN A DOG AND ITS OWNER

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Abstract. A sequential occurrence of Rocky Mountain spotted fever (RMSF) in a dog and its owner is described. Diagnosis of RMSF in the animal guided subsequent testing for and diagnosis of the same disease in the human patient. Previous reports of concurrent RMSF in dogs and their owners are reviewed, and the epidemiologic significance of this occurrence is discussed.

Rickettsia rickettsii, the etiologic agent of Rocky Mountain spotted fever (RMSF), causes potentially fatal disease in humans and various animal species, including dogs. Shepard and Topping¹ first reported simultaneous and sequential RMSF occurring in dogs and persons from the same or neighboring households in New York State in 1946. Subsequent descriptions of temporally associated RMSF in dogs and family members have been briefly noted from other locations in the United States, including Washington, D.C.; Maryland; Mississippi; Connecticut; and Ohio.^{2–6} Because RMSF occurs sporadically and can be a difficult diagnosis for veterinarians and doctors, cases in dogs and humans may be missed. In this report, we describe a case of fatal canine RMSF diagnosed at necropsy, resulting in testing for and diagnosis of the same disease in the dog's owner.

A 9-year-old male Labrador retriever was evaluated at a veterinary clinic in Rye, New York, on May 7, 1999, because of difficulty rising. The dog had been well until 2 days earlier, at which time it became progressively lethargic. At physical examination, the animal showed ataxia and spontaneous nystagmus. The dog was treated empirically with amoxicillin; however, its condition worsened during the next 4 days and it was transferred to an animal hospital. At admission, the dog was in profound stupor and had a temperature of 38.5°C (normal, 38.2°C). Other physical findings included scrotal erythema and ecchymoses, an absent menace reflex, extensor rigidity of the forelimbs, and opisthotonos. Computed tomography of the brain showed dilatation of the lateral ventricles and a poorly defined region of contrast enhancement in the brainstem. Cerebrospinal fluid obtained by cisternal puncture was grossly xanthochromic, contained 250 mg/dL protein (normal, < 25 mg/dL), and showed a nucleated cell count of 50×10^6 cells/L (normal, < 5×10^6 cells/L) with 50% neutrophils and 50% mononuclear cells, and rare erythrophagocytosis.

These findings were considered consistent with encephalitis or obstructive hydrocephalus secondary to a central nervous system tumor, and the animal was euthanized on May 12. At necropsy, there was marked erythema and edema of the scrotum and tunica vaginalis, with extensive hemorrhages in the epididymis and testes. There was focal subarachnoid hemorrhage over the ventral aspect of the brainstem. Histopathologic examination revealed diffuse, predominantly mononuclear inflammatory infiltrates involving capillaries and small- and medium-sized veins and arteries of multiple

organs and tissues. Vasculitic lesions were observed predominantly in the brain, eyes, testes, epididymis, and scrotum and were accompanied frequently by focal necrosis and hemorrhage. Because the pathologic findings were suggestive of RMSF, formalin-fixed, paraffin-embedded tissues were sent to the Centers for Disease Control and Prevention and tested by means of an immunohistochemical stain for spotted fever group rickettsiae.⁷

The dog's owner, a 69-year-old woman, presented to her physician on May 14, 1999, with a 3-day history of nausea, vomiting, fatigue, and fever. She reported that her dog had died 2 days earlier, presumably from "cancer," after a brief illness characterized by symptoms similar to her own. The patient was initially diagnosed with gastroenteritis and discharged. She returned the next day because of worsening fever and changes in mental status. Her temperature was 38.0°C, and she appeared confused and lethargic. Her physical examination was otherwise unremarkable and did not reveal focal neurologic abnormalities or a rash. Laboratory tests obtained the previous day showed a white blood cell count of 3.8×10^9 /L, a platelet count of 99×10^9 /L, a hemoglobin concentration of 12.7 g/dL, and a serum sodium of 133 mmol/L. The patient was hospitalized and treated with levofloxacin 500 mg intravenously. Her temperature returned to normal within 48 hr after receiving this antibiotic. Her nausea and vomiting dissipated, and her blood counts gradually returned to normal values. She was discharged on the third day with a diagnosis of fever of undetermined cause. Routine analysis of blood, urine, and stool cultures revealed no specific pathogens, and serological assays were negative for antibodies reactive with *Borrelia burgdorferi*, *Ehrlichia chaffeensis*, and the agent of human granulocytic ehrlichiosis.

Immunohistochemical staining of canine tissues obtained at necropsy demonstrated abundant spotted fever group rickettsial antigen and individual rickettsiae within and around small- and medium-sized vessels of multiple tissues, including brain and testes (Figure 1). This information was provided to the patient's doctor. When contacted by her doctor, the patient reported that her malaise and a mild headache had persisted after her discharge from the hospital, although these symptoms were much improved from the acute stage of her illness. She was treated with orally administered doxycycline, and these symptoms resolved completely within 1 week. Subsequent testing of early and late convalescent-

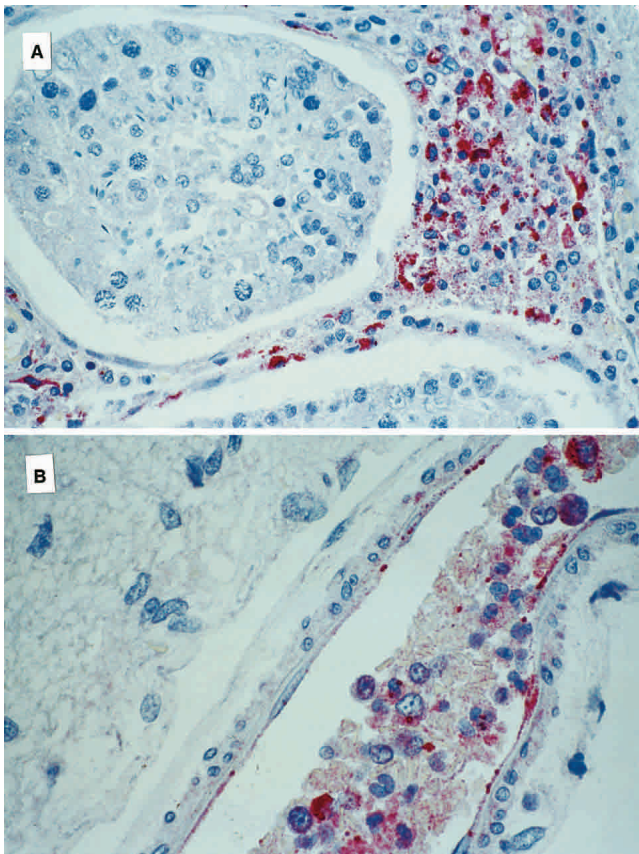


FIGURE 1. Immunohistochemical localization of spotted fever group rickettsial antigen in tissues of a dog with fatal Rocky Mountain spotted fever. Immunoalkaline phosphatase stain with naphthol phosphate-fast red substrate and hematoxylin counterstain.⁷ (A) Rickettsial antigen (red) staining in a focus of mononuclear inflammation in interstitium of testis (original magnification, $\times 158$). (B) Intracellular rickettsiae and rickettsial antigen within endothelium and intraluminal mononuclear cells in a vessel of the leptomeninges (original magnification, $\times 158$).

phase serum samples of the patient by an indirect immunofluorescence assay for antibodies reactive with *R. rickettsii* confirmed the diagnosis of RMSF. Titers of immunoglobulin (Ig) M and IgG antibodies were 1,024 and 512, respectively, on Day 17, and had declined to 256 and 256, respectively, on Day 89 after the onset of illness. The patient did not recall any recent tick bites or exposures to tick-infested habitats and had not seen or removed ticks from her dog in the weeks preceding her illness; however, the dog had run freely in a wooded area in New Jersey shortly before its illness.

Temporal and spatial associations between canine and human cases of RMSF have been briefly described from several regions of the United States where the disease is endemic. The first report of concurrent cases of disease was based on the detection of antibodies reactive with *R. rickettsii* in serum samples of 6 dogs residing in households or neighborhoods of 7 patients with a recent history of RMSF on Long Island, New York. In 3 instances, the dog and the owner were ill with presumed RMSF within 2 weeks of each other.¹ Reports from other states have documented cases of temporally associated human and canine disease occurring within a period of 14–21 days.^{2,4,8} In a hyperendemic focus

of RMSF in Clermont County, Ohio, concurrent illnesses were reported in 4 (25%) of 16 dogs owned by families in which 14 confirmed cases of RMSF had occurred. The prevalence of antibodies reactive with *R. rickettsii* was significantly higher among dogs from case households: 12 (75%) animals associated with human cases had positive antibody titers when tested by immunofluorescence assay, compared with only 1 (0.7%) of 137 stray dogs sampled at animal shelters in another Ohio county where RMSF was endemic.⁶

Dogs may serve as sentinels for RMSF in human populations, and infections in canines have been associated repeatedly with an increased risk of the disease in owners. In this context, dog-directed serologic surveys may alert owners that the pathogen is endemic to their immediate environment, and as in this report, provide doctors with a presumptive diagnosis for dog owners presenting with unexplained febrile illnesses.

The specific exposure or event responsible for RMSF in the patient described in this report was not determined; however, several possible mechanisms may contribute to concurrent canine and human infections with *R. rickettsii*. Dogs and their owners may be infected simultaneously by common exposures to tick-infested areas; the probability of such exposures may be enhanced by the focal distribution of rickettsia-infected ticks in the environment.^{9,10} Dogs may also serve as important transport hosts, carrying infected ticks in proximity to owners. Ticks carried by dogs may establish a focus of infection at or near the residence, or they may initiate infection in owners when the owners remove ticks manually from the animals.^{3,6,11} When ticks infected with *R. rickettsii* are damaged at the time of removal or crushed by hand, infective tissues or fluids may be introduced into the eyes or abraded skin. In several reports of human RMSF, manual deticking of dogs was the only known risk factor associated with the development of disease.^{1,12} Price³ described 20 human cases of RMSF in Maryland associated with household dogs, and 8 (40%) of these patients had removed ticks from their pets 5–14 days before developing disease. In addition, RMSF has been produced in guinea pigs by suspensions of *R. rickettsii*-infected tick tissues applied to conjunctivae or to shaved or epilated skin.¹¹

The apparent favorable clinical response to levofloxacin in this patient deserves mention. Although levofloxacin demonstrates strong bacteriostatic activity against *R. rickettsii* *in vitro*,¹³ and related fluoroquinolones show therapeutic efficacy in treating RMSF in dogs,¹⁴ we are not aware of published reports describing treatment of RMSF in humans with this antibiotic. This anecdotal report should be interpreted cautiously because tetracyclines remain the drugs of choice for treating RMSF; however, this observation suggests that the use of levofloxacin as alternate therapy for RMSF merits further investigation.

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