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Canine Ehrlichiosis in Connecticut

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The first case of canine ehrlichiosis in Connecticut is reported. A female Brittany spaniel from Milford presented with lethargy, anorexia, fever, petechiae, splenomegaly, thrombocytopenia, anemia, elevated serum alkaline phosphatase, lymphopenia, and hypoalbuminemia. Serologic analysis revealed antibodies to *Ehrlichia canis* (titer, 1:2,560). This documents a more northern geographic distribution in the United States for this infectious agent than had previously been suspected.

Ehrlichia canis, the etiologic agent of canine ehrlichiosis, was first reported in the United States in 1963 and has subsequently been found in widely separated regions of this country (3–5, 8, 16). There is growing evidence that this rickettsial agent is globally distributed, is transmitted by ticks (9, 12), and may infect human beings (6, 10, 12, 15). We report here the first canine case in Connecticut and results of serologic analyses for dogs and persons living in tick-infested areas.

During May 1988, a 4-year-old, spayed female Brittany spaniel that lived in Milford, Conn., presented with anorexia, lethargy, and a stiff gait. The dog had not traveled outside of the state. The owner observed ticks on the dog, but specimens were not collected for identification. Upon physical examination by one of us (H.J.L.), lymphadenopathy, splenomegaly, hepatomegaly, and a temperature of 41°C were noted. The initial hematocrit (39.9%), erythrocyte count ($5.9 \times 10^6/mm^3$), and leukocyte count ($8.6 \times 10^6/mm^3$) were normal, but blood analyses revealed borderline low total protein (5.6 g/dl) and elevated serum alkaline phosphatase (181 U/liter). Vaccinations were current, and tests for *Dirofilaria immitis* (etiologic agent of dog heartworm) and antibodies to *Borrelia burgdorferi* (causative agent of Lyme borreliosis) were negative. Amoxicillin (300 mg) and dexamethasone (6 mg) were administered intramuscularly, and the dog was discharged on amoxicillin (200 mg twice a day).

On 2 June 1988, the dog continued to be ill and had a temperature of 40.7°C. She was brought to a local emergency hospital for examination and was subsequently discharged with cefadroxil (300 mg twice a day). Blood analyses revealed elevated amounts of serum alkaline phosphatase (307 U/liter), an erythrocyte count of $5.9 \times 10^6/mm^3$, a relatively low hematocrit (38.7%), and low amounts of total protein (5.0 g/dl) and albumin (2.0 g/dl). The platelet count was $37,000/mm^3$. Two days later the dog presented with an edematous muzzle, scleral injection, buccal and gingival petechiae, and a temperature of 40.7°C. Radiographs revealed hepatomegaly and splenomegaly. The complete blood cell analyses revealed a low number of lymphocytes (576/μl). There also was evidence of normocytic, normochromic anemia (hemoglobin, 11.8 g/dl; hematocrit, 32.4%). The erythrocyte count decreased ($4.9 \times 10^6/mm^3$), while the leukocyte count increased ($28.8 \times 10^3/mm^3$). The platelet count remained low ($41,000/mm^3$). The clotting profile was otherwise within normal limits. The direct Coombs and antinuclear antibody tests were negative, and there were no detectable antibodies to *Rickettsia rickettsii*, the etiologic agent of Rocky Mountain spotted fever. However, serologic analysis for antibodies to *E. canis* (14) was positive at a titer of 1:2,560. Results of a platelet factor 3 test were also positive. After the medication was changed to tetracycline (500 mg three times a day) and the dog was given one injection of dexamethasone (24 mg intramuscularly), there was marked improvement in the health of the dog within 1 week. Her temperature returned to normal in 24 h, scleral injection disappeared, and her gait returned to normal. On 9 June 1988, nearly all results of blood analyses were within the acceptable ranges for healthy dogs, including the substantial increase in platelets ($314,000/mm^3$). The hematocrit remained relatively low (37%). Tetracycline therapy was continued for 1 month, and follow-up examinations revealed no clinical abnormalities. Serologic analysis for antibodies to *E. canis* was negative for a serum specimen collected on 7 October 1988.

To determine whether *E. canis* infected other dogs or human beings in tick-infested areas of Connecticut, a retrospective serological study using an indirect fluorescent-antibody technique (14) was conducted at the Connecticut Agricultural Experiment Station. Serum samples, obtained as a part of routine screening for evidence of *D. immitis* infections, represented 146 clinically healthy dogs living in six counties. Specimens were collected from 1982 to 1986 and had been frozen at −60°C. Study groups for human beings consisted of 15 healthy persons, 21 individuals who had febrile illnesses of unknown cause but no antibodies to *B. burgdorferi*, 46 patients who had *B. burgdorferi* infections (as defined by erythema migrans) and antibodies (enzyme-linked immunosorbent-assay titers, >1:1,280) to this bacterium, 22 persons who had no expanding skin lesions but had antibodies (enzyme-linked immunosorbent-assay titers, >1:1,280) to *B. burgdorferi*, and 43 individuals who had erythema migrans but lacked antibodies to *B. burgdorferi*. All these people lived in southern Connecticut. Dog and human serum specimens were serially titrated in 0.15 M phosphate-buffered saline solution (pH 7.2) and were tested at dilutions of 1:20 and 1:80, respectively. Fluorescein isothiocyanate-labeled rabbit anti-dog immunoglobulins (GIBCO, Grand Island, N.Y.) and fluorescein-conjugated

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goat anti-human immunoglobulins (GIBCO) were diluted in phosphate-buffered saline solution to 1:50 and 1:90, respectively. The source of the *E. canis* antigen and the positive and negative serum controls used in analyses was the Department of Veterinary Pathobiology, University of Illinois, Urbana. Results of 146 canine and 147 human serum samples were negative.

Lethargy, anorexia, fever, petechia, splenomegaly, thrombocytopenia, anemia, elevated serum alkaline phosphatase, lymphopenia, and hypoalbuminemia indicate canine ehrlichiosis (8, 16). Although atypical, platelet factor 3 test results can be positive in dogs with ehrlichiosis. An immune-mediated mechanism is suspected (1, 3). Tetracycline is an effective drug for treatment of *E. canis* infections (2, 5, 8, 13), and remission of clinical and hematologic signs in the present case was probably due to tetracycline and dexamethasone treatment. The observed decline in antibody titer to *E. canis* following antibiotic therapy also is consistent with earlier observations (2, 8). On the basis of clinical information and a convincing serologic confirmation of antibodies, we suspect that this dog had an infection caused by *E. canis* or a closely related agent. Since the owner indicated that the dog had not traveled to areas outside of Connecticut, we conclude that this rickettsial agent is present there. This is the first report of canine ehrlichiosis in Connecticut, and our finding demonstrates that there is in the United States a more northern geographic distribution for this infectious agent than had previously been suspected.

E. canis infections in dogs have been reported, and they are strongly suspected to occur in human beings in widely separated regions of the United States (4, 6–8, 10–12, 15, 16). Although most cases occur in southern states, recent reports indicate a distribution extending into the northeastern portion of the United States, including New Jersey and Pennsylvania (12, 16). In our serologic study, we had no further evidence of *E. canis* infection in Connecticut. Relatively low antibody titers in humans (12) and brief durations of antibody presence may have biased the serologic test results. Also, there was no cross-reactivity with antibodies to *B. burgdorferi*. Although *E. canis* and *R. rickettsii* appear to be rare in northeastern states, further surveillance for clinical disease in dogs and human beings is warranted.

The brown dog tick, *Rhipicephalus sanguineus*, has been shown to efficiently transmit *E. canis* experimentally (16). However, this tick rarely bites human beings and therefore may not be the sole vector of this infectious agent. In New Jersey, unidentified tiny ticks were clearly associated with ehrlichial infections in humans (12). Studies are needed to determine if other tick species, particularly *Ixodes dammini* and *Amblyomma americanum*, can transmit *E. canis* to dogs or human beings.

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