Immunology Bulletin

Canine Lyme disease

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Continuing questions and disparity of opinion led the American College of Veterinary Internal Medicine to develop a consensus statement in 2006 to address the diagnosis, treatment, and prevention of canine Lyme borreliosis, or Lyme disease.[1] While a consensus was not reached on all issues, the importance of canine Lyme disease in the United States today warrants a review of current literature.

Lyme disease: How real is the threat?

About 10 years ago, opinions on canine Lyme disease prompted suggestions that there was no such disease or, if infection did occur, disease did not. Clearly, we're beyond that today. Clinical illness associated with Lyme disease is well documented, and the role of the outer surface protein A (OspA) antibody in protecting dogs and people against infection is scientific fact. Yet questions regarding the incidence of infection continue to prompt concern about the need for testing and vaccination.

In dogs and people, Lyme disease is of regional importance and is focally endemic in North America, Europe, and Asia. In 2000, data from the Centers for Disease Control and Prevention indicated the highest annual incidence of infection in people occurred in the Northeast and upper Midwest. A dog's risk of exposure to Lyme disease is directly related to the presence of infected ticks. Several studies suggest that, at least in parts of the Northeast, seroprevalence in dogs correlates with that in people. Not surprisingly, in 1988 canine infections were reported to exceed that in people.[2]

Although seroprevalence studies provide insight on the exposure risk that dogs and people might experience within a specific region, they don't address the risk of infection faced by individual dogs seen in practice. The fact that dogs travel into and from endemic regions supports clinical observations that infections—and clinical illness—could appear in any part of the country.

Clinical signs

Clinical illness associated with canine Lyme disease is well characterized. Acute lameness with joint swelling that rapidly responds to doxycycline (10 mg/kg orally once daily) is the most common clinical sign. Although synovial fluid cytology reveals neutrophilic inflammation, there is no evidence that Lyme arthropathy leads to degenerative joint disease. Limited case reports cite dogs with cardiac, neurologic or dermatologic signs; however, these findings have not been reproduced experimentally. Laboratory findings in seropositive dogs are not consistently helpful in establishing a diagnosis.

Considerable attention has been directed to Lyme nephropathy, a protein-losing nephropathy that frequently leads to death despite aggressive treatment. Affected dogs typically present during the summer or fall with physical and laboratory signs characteristic of acute or chronic renal failure. It is not known why some dogs seem predisposed to Lyme nephropathy, although an immune-mediated mechanism is suggested.[1]

Despite a 70% to 90% seroprevalence for Lyme disease in endemic regions of the United States, clinical illness is relatively uncommon. The long-term consequences of *Borrelia burgdorferi* infection in dogs have not been studied.

Cats can become infected with *B. burgdorferi* and seroconvert, but they do not have a predilection for developing clinical signs.

Testing: Diagnostic dilemmas

A positive test result for antibody to *B. burgdorferi* is neither diagnostic of active infection nor predictive of impending clinical disease. So how does one establish a diagnosis of canine Lyme disease? Authors cite several variables that clinicians must consider, such as evidence of exposure to vector ticks (*Ixodes scapularis* and *I. pacificus*), clinical signs, seropositivity, response to treatment with doxycycline, and a decline in C_6 antibody concentration. Dogs with clinical signs and a positive antibody test may or may not have Lyme disease. Several diseases, including infection with other tick-borne diseases (*e.g.*, ehrlichiosis or anaplasmosis) may mimic signs characteristic of canine Lyme disease. A clinical algorithm has been published to facilitate the assessment of dogs presenting for lameness with or without fever.[1]

In clinical practice, testing is generally limited to antibody detection rather than the complex process required to isolate spirochetes. Several commercial antibody tests are available. The

in-clinic, rapid-assay SNAP® 4Dx® Test (IDEXX Laboratories) is a sensitive and specific test for C_6 antibody detection subsequent to *B. burgdorferi* exposure. No Lyme disease vaccine available today causes a false-positive C_6 antibody test.

Clinicians should know what method is used by outside laboratories. Prior vaccination is known to interfere with ELISA and IFA tests. Western blot analysis was initially reported to distinguish between infected and vaccinated dogs. However, because the OspA antibody can be expressed in some chronically infected dogs, false-positive test results may still occur.

Treatment

Doxycycline (10 mg/kg orally once daily for 30 days) is the preferred antibiotic administered to dogs with clinical signs of Lyme disease. Although people with Lyme disease are treated with doxycycline for only 10 days, 30 days is recommended for dogs because of the risk of co-infection (*e.g.*, Rocky Mountain spotted fever, anaplasmosis, or ehrlichiosis). Administration of glucocorticoids (oral prednisone at 2.2 mg/kg daily) to dogs manifesting lameness has been suggested.[1] Extended doxycycline treatment may be indicated for dogs with nephropathy. Supplemental treatment can include intravenous fluid therapy, antihypertensive drugs (*e.g.*, enalapril), omega-3 fatty acids, gastrointestinal protectants, oral phosphate binders (*e.g.*, aluminum hydroxide), and a modified-protein and restricted-phosphorus diet.[3]

A favorable clinical response to doxycycline, particularly when associated with a decline in the C_6 antibody concentration levels supports a Lyme disease diagnosis. However, a positive response to treatment does not necessarily mean the patient has been effectively cleared of *B. burgdorferi.* Several authors have suggested that doxycycline is effective in lowering the concentration of spirochetes in the tissue of infected dogs but may not effectively kill all of the organisms.[1] Recrudescence of clinical signs is possible in the weeks to months after treatment ceases, and it may be difficult or impossible to distinguish between recrudescence of infection and re-exposure.

Treatment of healthy (*i.e.*, absence of physical signs) dogs with a positive test for the C_6 antibody is not indicated, although routine diagnostics to detect proteinuria are recommended.[3]

What's OspA?

OspA, a lipoprotein found on the surface of *B. burgdorferi*, is the antigen in all vaccines that stimulates the production of protective antibodies and thereby prevents transmission of *B. burgdorferi* to dogs, horses, and people. OspA antibodies produced by vaccination are protective—not in the blood of the vaccinated dog but in the midgut of the tick as it feeds—thereby blocking transmission of spirochetes from the tick to the dog.[4,5]

Vaccination

Two types of canine Lyme disease vaccines are available in the United States: whole-cell, killed spirochete (bacterin) vaccines and recombinant (subunit) vaccines.

Killed *B. burgdorferi* vaccines, more accurately described as bacterins, contain OspA and numerous nonessential, additional proteins. The concern about these additional proteins resides mainly with their impact on potential safety. The precise role of these extraneous proteins in causing postvaccine adverse reactions is not known, but their potential consequence has been highlighted in several articles.[6-8] One study showed that adverse vaccine reactions (within three days post-vaccination) were significantly higher among dogs that received a killed bacterin.[8]

On the other hand, the manufacturing process for recombinant Lyme disease vaccine entails production of pure OspA expressed from bacterial DNA plasmids. Recombinant vaccines contain no spirochetes, are noninfectious, and are free of extraneous proteins. In addition, one commercially available recombinant vaccine does not contain adjuvant.

Risk management

Vaccination alone cannot provide complete protection to all dogs. Where tick exposure is known to occur, regular administration of a topical flea and tick preventive is strongly recommended, as is annual surveillance testing.

Recommend that your clients avoid tick-infested areas and carefully examine themselves and their pets after entering grassy or wooded areas. Clients can also reduce tick populations in their yards by regularly clipping their lawn; trimming bushes; and promptly removing lawn clippings, mulch, and leaves.

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References

1. Littman MP, Goldstein RE, Labato MA, et al. ACVIM small animal consensus statement on Lyme disease in dogs: diagnosis, treatment, and prevention. *J Vet Intern Med* 2006; 20:422-434.

2. Guerra MA, Walker ED, Kitron U. Canine surveillance system for Lyme borreliosis in Wisconsin and Northern Illinois: geographic distribution and risk factor analysis. *Am J Trop Med Hyg* 2001;65:546-55.

3. Littman, MP. Lyme disease in dogs. *Standards of Care: Emerg and Crit Care Med* 2004;6:1-6.

4. Greene CE, Straubinger RK. Borreliosis. In: Greene CE, ed. *Infectious diseases of the dog and cat.* 3rd ed. St. Louis, Mo: Saunders-Elsevier, 2006;417-435.

5. Rice Conlon JA, Mather TN, Tanner P, et al. Efficacy of a nonadjuvanted, outer surface protein A, recombinant vaccine in dogs after challenge by ticks naturally infected with *Borrelia burgdorferi. Vet Ther* 2000;1:96-107.

6. Appel MJG, Jacobson RH. CVT update: Canine Lyme disease. In: Bonagura JD and Kirk R, eds. *Kirk's Current Veterinary Therapy XII*. Philadelphia, Pa: WB Saunders Co, 1995;303-309.

7. Wormser GP. Prospects for a vaccine to prevent Lyme disease in humans. *Clin Infect Dis* 1995;21:1267-74.

8. Moore GE, Guptill LF, Ward MP, et al. Adverse events diagnosed within three days of vaccine administration in dogs. *J Am Vet Med Assoc* 2005;227:1102-1108.

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