

Leptospirosis posing new threat for canine hepatic, renal disease

Diagnostic testing can often be confusing, use reliable resources for accurate diagnosis

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Leptospirosis is a zoonotic disease caused by infection with any of the more than 250 serovars of a corkscrew-shaped bacteria called *Leptospira* (see Photo 2, p. 33). Leptospirosis in dogs was described in 1899 and has recently received new attention as a cause of hepatic and renal disease. In the United States, leptospiral serovars canicola and icterohaemorrhagiae were traditionally associated with canine leptospirosis. However, infections with serovars grippityphosa, pomona, and bratislava are now the most common causes of leptospirosis in dogs. The number of cases of canine leptospirosis has risen dramatically in the last several years and this increase is likely due to a true increase in the occurrence of the disease and increased awareness concerning this disease. The purpose of this update is to briefly review the current situation regarding the occurrence, diagnosis, treatment and control of leptospirosis in dogs.



The nonspecific nature of the clinical signs and laboratory values make a diagnosis of leptospirosis on clinical parameters difficult.

■ Epidemiology

Leptospiral serovars prevalent in a region are associated with one or more maintenance host(s), which serve as reservoirs

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of infection (see Table 1). Maintenance hosts are often wildlife species and, sometimes, domestic animals. Maintenance hosts shed leptospires in their urine for long periods of time (months to years) after infection. Direct or indirect contact with urine from maintenance hosts is the source of infection for other animals. Other animal species that become infected are called incidental hosts and while these animals become quite ill, they only shed the organisms in urine for a brief period (days to a few weeks) and therefore, are not important reservoir hosts. Based on these established maintenance host relationships (Table 1), the likely source of exposure for dogs with leptospirosis can be predicted. For example, dogs are the maintenance host for serovar canicola and therefore, a dog infected with this serovar is most likely to have been infected via contact with another infected dog. In contrast, a dog infected with serovar grippityphosa is likely to have become infected by contact with urine from a raccoon, skunk, or opossum—not from another dog.

Reliable data on the prevalence of canine leptospirosis is not available. Case reports indicate that on the East Coast, serovars grippityphosa and pomona predominate; in the Midwest, grippityphosa and bratislava are more common than pomona, and a study in California indicated that pomona and bratislava were the most common. Certain types of dogs are thought to be at an increased risk of leptospirosis, however, more data is needed to determine if these dogs are really more susceptible to infection or at more risk of exposure. Leptospirosis occurs in rural

and urban dogs, outside dogs and primarily inside dogs, hunting breeds and toy breeds, etc.

■ The disease

Leptospires can live outside the host for several months if the conditions are damp, protected from sunlight and temperate. Dogs become infected when leptospires invade the body after being deposited on mucous membranes or damaged skin. After a variable incubation period (three to 20 days), leptospires circulate in the blood. During this period, leptospires enter and replicate in many tissues, including the liver, spleen, kidneys, reproductive tract, eyes and central nervous system. Agglutinating antibodies can be detected in serum soon after the leptospires are in the bloodstream. Appearance of circulating antibodies coincides with the clearance of leptospires from blood and most organs. However, leptospires can remain in the kidney and may be shed in the urine for periods of a few days to many months after infection depending on the serovar.

Clinical signs associated with leptospirosis vary, are usually associated with

acute leptospirosis, and may include fever, inappetence, vomiting, abdominal pain, diarrhea, polyuria/polydipsia, myalgia, jaundice, epistaxis and hematuria. Vomiting and diarrhea are the most frequent presenting signs. Almost all dogs will have some degree of renal impairment during their disease—other signs are more variable. Leptospirosis is the most common infectious cause of acute renal failure in dogs and some clinicians estimate that from 30 to 50 percent of cases of acute renal failure in dogs in some parts of the United States are caused by leptospirosis. A significant proportion of infected dogs will not have recognizable clinical signs that warrant consultation with a veterinarian.

■ Diagnosis

Results of clinical pathological testing are variable in canine leptospirosis. The non-

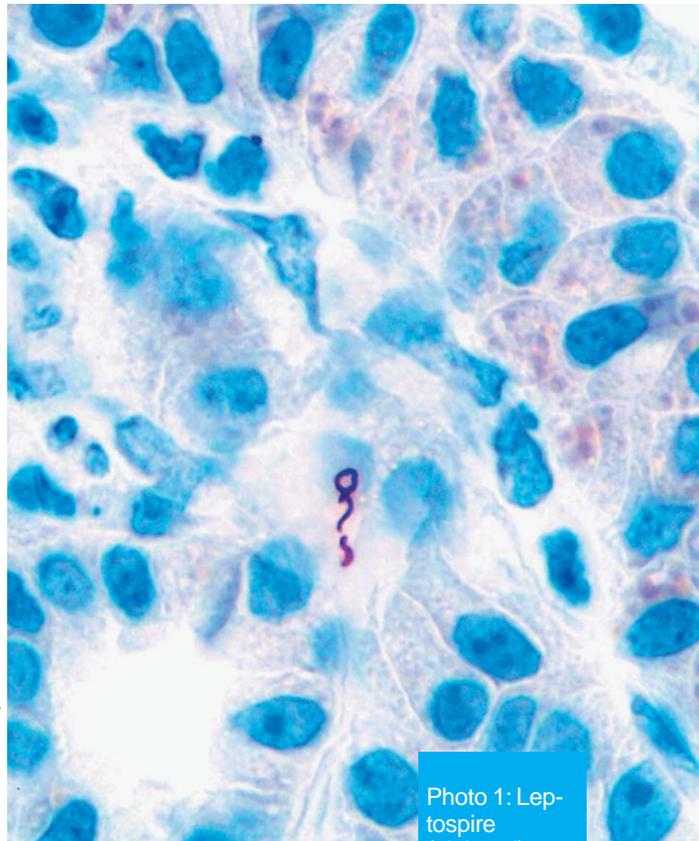


Photo: Dr Matt Kuipfel

Photo 1: Leptospire (pink-red) identified in kidney tissue from an infected dog by immunohistochemistry.

Table 1: Serovars and maintenance hosts of pathogenic leptospires common in the United States

Genus and Species	Serovar	Maintenance Host(s)
<i>L. interrogans</i>	canicola	dogs
<i>L. interrogans</i>	icterohaemorrhagiae	rats
<i>L. interrogans</i>	pomona	pigs, cattle, skunks, opossums
<i>L. kirschneri</i>	grippityphosa	raccoons, skunks, opossums
<i>L. borgpetersenii</i>	hardjo	cattle
<i>L. interrogans</i>	bratislava	pigs, horses (?)

specific nature of the clinical signs and laboratory values make a diagnosis of leptospirosis on clinical parameters difficult. Leptospirosis should be considered in the differential diagnosis of fever of unknown origin, acute and subacute renal disease and liver disease. Specialized diagnostic tests for leptospirosis consist of assays to detect serum antibodies and to detect the organism in tissues or body fluids.

Serum antibodies against various leptospiral serovars are detected using the microscopic agglutination (MA) test. In the United States, serum samples are usually tested for antibodies against leptospiral serovars *canicola*, *icterohaemorrhagiae*, *grippotyphosa*, *pomona*, *hardjo* and *bratislava*. The test result is reported as an antibody titer against each of the serovars.

Interpretation of leptospiral serologic results can be confusing. A dog infected with a single serovar is likely to have anti-bodies against more than one serovar in an MA test. However, in general, the infecting serovar is assumed to be the serovar to which the animal develops the highest titer. Use of leptospiral vaccines also complicates interpretation of serologic results. In general, dogs develop relatively low agglutinating antibody titers (1:100 to 1:400) in response to vaccination and these antibody titers persist at their peak for one to three months after vaccination; an occasional dog will develop titers as high as 1:1,600 after vaccination.

Are you confused yet? Here are my real-life recommendations regarding interpretation of leptospiral serology. First, send your sera to a lab that routinely provides help in titer interpretation as part of its service. A simple report with num-

bers or “positive” and “negative” is not sufficient. Second, be sure to know when, and with what type of leptospiral vaccine the dog has been vaccinated. Third, begin to pay attention to titers at the level of 1:400 to 1:800. Unless, vaccination has been very recent, these titers are more likely to be associated with infection (cur-

rent or past) than they are with vaccination. A titer in this range, particularly if associated with clinical signs, should be repeated in seven to 10 days to see if the titer is increasing.

In acute leptospirosis, the titers may be low on the first test, however, with a compatible clinical presentation, a titer of as low as 1:100 to 1:200 may be indicative of infection—particularly if the dog has not been vaccinated; a titer recheck is likely to reveal high titers. Diagnosis on a single titer is often possible. If the

dog has been infected for two to three weeks, titers may be diagnostic in the first sample; a titer of $\geq 1:1,600$ is diagnostic for serovars *grippotyphosa*, *pomona* or *bratislava*. If you have questions, ask the lab for help—if lab personnel are not willing or able to help with titer interpretation, find a new lab.

The other techniques available for the diagnosis of leptospirosis involve detection of leptospires or their DNA in tissues or body fluids. Three of these tests are routinely useful: fluorescent antibody (FA) or PCR testing on tissues or urine and histopathology/immunohistochemistry on biopsy samples. In general, leptospires can be found in the urine as early as three or four days after the onset of illness and for one to two weeks after. Urine or blood for FA or PCR testing should be collected prior to the admin-

istration of antibiotics.

PCR and FA tests (in experienced hands) are of equivalent sensitivity for the detection of leptospires in the urine of dogs. The availability of these tests is increasing, and the tests have good sensitivity, provided the urine sample has been collected prior to the administration of antibiotics. The use of special stains in histopathology can be effective for identification of leptospires in biopsy or post-mortem samples. Application of immunohistochemical stains to tissue sections allows detection of leptospires (see Photo 1, p. 32).

■ Treatment

Treatment of leptospirosis involves supportive care and appropriate antimicrobial therapy. Controlled studies on the treatment of dogs with leptospirosis are not available. The recommended therapy is empirically derived. Parenteral administration of beta-lactam antibiotics at the recommended doses are the treatment of choice during the acute phase of leptospirosis. These drugs eliminate leptospires from the blood stream and most organs, but they are not particularly effective in stopping urinary shedding. Doxycycline is used for this purpose. Doxycycline can also be used alone to treat dogs that are not acutely ill when the diagnosis is made. The

Photo 2: Electron micrograph of a leptospire showing the characteristic corkscrew shape.



recommended regimen in an acutely ill dog is beta-lactam antibiotic for seven to 10 days followed by three weeks of oral doxycycline.

■ Control

The cornerstone of prevention of canine

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Leptospires can live outside the host for several months if the conditions are damp, protected from sunlight and temperate.



Leptospirosis is the most common infectious cause of acute renal failure in dogs.

leptospirosis is vaccination. Traditional canine vaccines contain serovars canicola and icterohaemorrhagiae; a new vaccine contains serovars grippityphosa and pomona in addition. However, despite the availability of these new vaccine options, the controversy regarding vaccination for canine leptospirosis continues unabated.

My recommendation for leptospiral vaccination is that puppies get two doses of the four-way vaccine (but not more than that!) followed by an annual booster. The duration of immunity for most leptospiral vaccines has not been rigorously demonstrated. It is reasonable to assume that leptospiral vaccines will provide good protection from disease associated with the serovars in the vaccine for approxi-

mately a year. Hypersensitivity reactions as a result of use of leptospiral vaccines are usually mild but are disturbing to the owner. Some veterinarians premedicate dogs with antihistamines prior to vaccination; others do not vaccinate certain breeds of dogs or small dogs. I am not aware of data to validate these approaches.

■ Human health considerations

Humans are susceptible to infection with leptospires and the route of infection is by direct or indirect exposure to urine from an infected animal. Therefore, care should be taken in handling fluids and tissues from infected animals. Unfortunately, a diagnosis of leptospirosis is often not established until several days after a sick dog is seen and asymptomatic shedding occurs. I recommend using Universal Precautions to prevent mucous membrane contact with urine and tissues from animals. Wearing gloves whenever urine, soiled bedding or tissues are handled will significantly decrease the potential of human infection. Leptospires are very susceptible to disinfectants and contaminated areas can be easily cleaned. I recommend that the zoonotic implications of leptospirosis be discussed with clients and that they be advised to use disposable gloves and household disinfectants to clean up urine accidents in the home. Dogs that are receiving appropriate antibiotic therapy present a small risk of shedding infectious organisms.

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Photo: Wendy Reyes

Suggested reading

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Dr. Bolin received her veterinary degree from Purdue University and her Ph.D. from Iowa State University in veterinary pathology. She worked for the U.S. Department of Agriculture at the National Animal Disease Center as the Research Leader of the Zoonotic Diseases Research Unit and conducted research on leptospirosis for 18 years. She is currently a professor and section chief of bacteriology in the College of Veterinary Medicine at Michigan State University.