American Association of Zoo Veterinarians Infectious Disease Manual

LEPTOSPIROSIS

Animal Group(s) Affected	Transmission	Clinical Signs	Fatal Disease	Treatment	Prevention and Control	Zoonotic
Mammals	Contact with urine of shedding host-adapted/ carrier animal or urine-contaminated water; organism can penetrate macerated or wounded skin and intact mucous membranes; potential, but limited, transmission transplacental, transmammary	None or modest in host-adapted/ carrier animals; inapparent to severe in acute infections in non-host adapted animals. Renal signs most typical and include acute renal failure; up to 20% of cases present concurrent hepatitis.	Fatal disease can occur in non-host adapted species.	Antibiotics – usually doxycycline.	Personal hygiene, especially handwashing, and prevention of contact with host-adapted/ carrier animal urine; control of free-ranging wildlife and pests which are often these host-adapted carriers.	Yes

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Fact Sheet Reviewed by: Kenneth Harkin; June Olds

Susceptible animal groups: Mammals; recent literature assessment published that 10-20% prevalence had been reported in most mammalian families, although *Muridae*, *Canidae*, and *Bovidae* were over-represented; *Felidae* appear more resilient, but recent assessments are that domestic felids are detected more often with sub-clinical disease than recognized previously, and personal author experience with clinical disease in two large exotic felids; reservoir situations, increasing contact with humans through urbanization and conversion to a omnivorous diet is associated with increased prevalence for some taxa, such as *Phalangeridae* (brush-tail possum). Additional reservoirs, including birds and reptiles, have been identified.

Causative organism: *Leptospira* spp. (250± serovars) are spirochaete bacteria which share a common lipopolysaccharide antigen but differ by surface agglutinating antibodies that allows classification. Currently, some of the most common pathogenic leptospiral serovars for U.S. mammals are identified as (*L. kirshneri*) Grippotyphosa, and (*L. interrogans*) Pomona, Bratislava, Hardjo, Icterohemorrhagicae, and Autumnalis.

Zoonotic potential: Infectious to people from animals; though generally comes from a common point source (i.e., rodents, contaminated water) when both animal and human are involved.

Distribution: Worldwide distribution with moist environments most conducive, especially prevalent in tropical countries; occupational and leisure activity risk factors; autumn seasonality observed.

Incubation period: 7-14 days, up to 21 days

Clinical signs: Common reservoir species can have high prevalence of infection – up to 50%. Generally, these individuals do not develop disease or clinical signs, except perhaps mild signs at initial infection. Fatality would not be expected. These animals may shed the organism for a few weeks or intermittently for several years due to chronic infection of the renal tissue. Each serovar tends to have certain host associations as potential natural reservoirs; wildlife and rodents are often implicated in this role during outbreaks.

Acute infections can occur in susceptible species and include most captive zoological species and humans; following infection with the organism, they become ill, moderately to severely. Fatality can occur, especially in untreated individuals. These animals generally do not become carriers. Once the infection has been resolved, especially if these animals are treated, prolonged shedding likely does not occur, although chronic renal damage may be incurred in survivors. Essentially any serovar could infect these individuals and produce disease.

LEPTOSPIROSIS

Endothelial damage is primary source of clinical signs. These signs are non-specific, and many infected animals do not become clinically, or severely, ill. The first signs in humans appear as mild to moderate flu-like with fever, anorexia, malaise and fatigue. Rash may be present but is inconsistent. Other clinical signs are much more severe and related to systemic infection with signs of acute renal disease, including the non-specific, but consistent, clinical signs of infection in the kidneys. Concurrent clinical pathology changes of elevated BUN and creatine, and hyperphosphatemia are present and may be accompanied by hemoglobinuria due to vasculitis. Some infected animals (10-20%) progress to concurrent hepatic disease (Weil's disease) with icterus and increasing hepatocellular enzymes. Pregnant animals may abort. The initial signs may wane with the more serious signs appearing in a biphasic time frame.
As specific taxon focus, equids tend to present with recurrent uveitis rather than renal or hepatic disease; however, reports of acute pulmonary distress as a result of leptospirosis has been reported in foals. Recent studies have also detected leptospiral DNA in vaginal swabs of mares, suggesting potential venereal transmission. Although original association of this organism with black rhinoceros (*Diceros bicornis*) and hemolytic anemia was considered, it has not been proven. Free-ranging California sea lions (*Zalophus californianus*) have a marked predisposition to infection with serovar Pomona with severe renal disease; limited other serovars have been identified in other pinnipeds, but not in cetaceans.

Post mortem findings: These findings are specific to the body system infected and presenting clinical signs at time of illness. Usually, it is evidence of acute renal failure. Acute hepatitis is observed in those animals which had icterus. Scarring ("white spots") in affected organs in chronic cases observed macroscopically in the kidneys of pigs and dogs.

Diagnosis: Diagnosis is challenging and treatment must begin before diagnosis is conclusive. In the literature since the last review, increasing effort to find faster or more point-of-care options was noted. Although direct observation with (silver or fluorescent antibodies (FA)) or without (darkfield microscopy) stain enhancement has been reported as useful, leptospires must be present in sufficient numbers in the sample evaluated, usually urine. The defined gold standard of testing is serologic evaluation by microscopic agglutination testing (MAT) but this testing modality is specific and requires maintenance of the organism with its markedly fastidious culture needs, and it cannot differentiate between vaccine and natural antibody production. However, MAT testing is readily available. A positive status is assigned to a test result >1:100 in an unvaccinated animal, but this low seroconversion requires a four-fold rise in titer over 2-4 weeks for diagnostic support. In a clinically ill animal, a single serologic status of 1:800 is strongly suggestive of leptospirosis. Cross-reactivity is quite common so a panel of likely serovars are assessed, assigning the serovar with the highest titer as the most likely causative agent. Polymerase chain reaction (PCR) of urine is now available which detects specific gene unique to pathogenic serovars. New canine specific tests include indirect ELISA and a commercial lateral flow assay.

Material required for laboratory analysis: Serum is submitted for most testing, but urine can be submitted for PCR. Whole blood and serum can be submitted for PCR or whole blood for culture. Post-mortem tissues – ideally kidney - can be submitted for histology using special silver stains, culture, PCR, or FA. Due to the fastidious nature of leptospira, cultures are often unrewarding, and additional diagnostic methodologies are recommended for confirmatory diagnosis.

Relevant diagnostic laboratories: Leptospire MAT is offered by many commercial and state diagnostic laboratories; Michigan State University Diagnostic Laboratory has an excellent serology panel and consultation services available. PCR testing now is offered routinely by many laboratories, the LipL32 based and 23s rRNA-based PCR have been shown to have false positives from free-catch urine samples.

Treatment: These organisms are generally quite sensitive to most antibiotics, except notably chloramphenicol. First generation cephalosporins (specifically cephalothin) historically were considered less successful for treatment but recently these (specifically cefazolin and cephalexin) have been suggested as effective. Best success occurs when the treatment is initiated promptly and as early in the disease course as possible. Doxycycline for 14 days is most commonly used successfully to treat clinical signs. Supportive care for systemic signs may be needed in more severe cases.

LEPTOSPIROSIS

Prevention and control in zoos: Although vaccines as killed whole cell bacterins are available for pigs, cattle, and dogs, it would be necessary to specifically target the serovar of concern in the particular area. It may therefore be preferred to leave this option to consideration in outbreak control or in areas with higher risk or increased urban wildlife or domestic stray interactions. Serologic testing can be monitored in these situations and during transfers between facilities. More importantly, pest control and exclusion of other carriers from contact with collection animals would be important.
Once an animal is confirmed infected, prompt treatment will minimize or may eliminate shedding. In the treatment interval, appropriate staff protection and personal hygiene is to be utilized to prevent spread within the facility or to staff. Consideration of drainage of the area should be made in this control measure. If the situation were to occur in a contact program area, it is recommended to exclude guests until the situation is treated, and leptospiruria is confirmed resolved.

Suggested disinfectant for housing facilities: Any standard disinfectant technique would be appropriate for cleaning of this organism.

Notification: In the US, Hawaii is the only state currently maintaining this disease as reportable in animals. Centers for Disease Control and local health authorities should be alerted for human cases, especially clusters. USDA apprises WHO of leptospirosis issues in certain production species.

Measures required under the Animal Disease Surveillance Plan: None

Measures required for introducing animals to infected animal: Infected animals should be maintained as isolated as possible from other mammals until treatment interval is completed. PCR testing on urine would be helpful to confirm that the infected animal was no longer shedding. Serologic monitoring of animals in adjacent areas would be considered prudent.

Conditions for restoring disease-free status after an outbreak: Serologic monitoring of adjacent areas would be considered prudent following return of infected animal to collection to assess for exposure.

Experts who may be consulted:

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