



Leptospirosis

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Definition

Leptospirosis describes a variety of clinical syndromes caused by infection with the Gram-negative spiral bacteria of the genus *Leptospira*. There are currently greater than 35 recognized species comprising more than 300 distinct serovars of *Leptospira*, many of which are capable of infecting both animals and humans. In horses, *Leptospira interrogans* serovar Pomona type kennewicki is responsible for most cases of clinical disease in North America, although *Leptospira kirschneri* serovar Grippytyphosa has also been reported. Frequently affected organs include the placenta and fetus, the kidneys, and the eyes. *Leptospira interrogans* serovar Bratislava is the most common infective serovar in North American horses (up to 50% seropositivity rate in some regions), however, this serovar is considered host-adapted and has not been reported to cause disease in infected horses in North America.

Clinical Signs

Leptospira Pomona type Kennewicki (and rarely *Leptospira kirschneri* serovar Grippytyphosa) cause three clinical syndromes in horses:

Acute Renal Failure: *Leptospira* colonization of the kidneys results in acute renal injury characterized by fever, anorexia, azotemia (elevated serum creatinine and BUN), and hemolytic anemia. Rarely, jaundice may be observed. Urinalysis reveals hematuria and pyuria (elevated leukocytes) without visible bacteria.

A syndrome of acute renal failure accompanied by fatal respiratory distress, pulmonary hemorrhage, thrombocytopenia and jaundice has been reported in 1–3-month-old foals in Europe, however, this syndrome has not been reported in North America.



In-utero Infection: Infection in pregnant mares may result in placentitis, abortion, neonatal illness or birth of an antibody-positive healthy foal. *Leptospira interrogans* serovar Pomona abortions may account for up to 15% of bacterial abortions in mares in endemic regions of North America. Most abortions occur after 8 months of gestation and without clinical signs of illness, however, some mares develop a fever prior to abortion. Sick neonatal foals born to infected mares display weakness, jaundice, and occasionally hemolytic anemia.

Equine Recurrent Uveitis (ERU): *Leptospira* associated ERU is an immune-mediated disorder resulting from cross reaction between *Leptospira* antigens and tissues of the lens, cornea, and retina. High concentrations of antibodies against *Leptospira*, and sometimes live *Leptospira* organisms can be found in the aqueous and vitreous fluid of many horses with *Leptospira* associated ERU. Unlike other Leptospirosis syndromes, *Leptospira* associated uveitis is a chronic condition, occurring months to years after initial *Leptospira* infection. Appaloosas and Warmbloods appear to be genetically predisposed to this condition.

Incubation Period

Bacteremia occurs 2-20 days following exposure. During this phase, horses may remain subclinical or develop fevers of several days' duration.

Risk Factors

- Horses residing in *Leptospira* endemic regions
- Access to stagnant water, especially following periods of high rainfall and flooding
- Close proximity to rodents and other wildlife hosts
- Contact with urine, reproductive fluids, and/or aborted fetal tissues from infected horses

Transmission

Leptospira infection occurs following direct contact with *Leptospira* contaminated urine or reproductive fluids from abortive mares. Environmental reservoirs such as *Leptospira* contaminated water and soil can also serve as sources of infection. Several wildlife species, including raccoons, skunks, opossums, and foxes, have been shown to carry *Leptospira* serovar Pomona and multiple strains of *Leptospira* Pomona Kennewicki. Rodents are also important hosts for several serovars including *L. Grippotyphosa*.

**Diagnostic
Sampling, Testing
and Handling**

- Diagnosis of Leptospirosis is made by a combination of antigen or antibody testing methods. **PCR** testing is preferred for evaluation of fluids, such as urine, ocular fluids, fetal fluid and blood.
- The **microscopic agglutination test (MAT)** is the gold standard for serologic detection of *Leptospira* antibodies. Marked increases in serum antibody titers support the diagnosis of *Leptospira* abortions or acute renal failure, but serum titers may be low in horses with ERU, presumably due to the chronic and localized nature of infection
- For horses with acute renal failure, collection of urine following furosemide administration may improve sensitivity of PCR, darkfield microscopy, or culture-based testing methods.
- Diagnosis of *Leptospira* abortion is best accomplished by PCR testing of aborted tissue or fluids or by fluorescent antibody testing (FAT) of the placenta, umbilical cord, fetal liver, or fetal kidney. The sensitivity and specificity of the PCR and FAT in these fluids or tissues are nearly 100%.
- Mares that abort their fetus will most commonly do so 2-4 weeks after infection and will have very high antibody titers at the time of abortion.
- For horses with *Leptospira* ERU, a combination of serum and aqueous serology (with ratio calculation), culture, and PCR testing of ocular fluid may be the only way to confirm *Leptospira* associated uveitis. A four-fold increase in ocular fluid MAT vs. serum MAT results is strongly supportive of an ERU diagnosis.

Post-mortem

Leptospira may be found in the kidneys, liver, eyes, placenta, umbilical cord, kidney, and liver. Affected kidneys display histologic evidence of tubulonephrosis and interstitial nephritis.

Aborted fetuses infected with *Leptospira* display hepatitis, tubulonephrosis and interstitial nephritis, meningitis, myocarditis, and pulmonary hemorrhage. The fetal liver may appear swollen with yellow discoloration and macroscopic nodules. Histologic hepatic lesions include multifocal necrosis with lymphoplasmacytic inflammation.



	<p>Inflammation of the umbilical cord (funisitis), may be recognized by diffuse yellowish discoloration of the umbilical structures.</p>
<p>Treatment</p>	<p>Antimicrobial therapy is often used to reduce <i>Leptospira</i> shedding in infected horses or to prophylactically protect exposed pregnant mares, but documentation of efficacy is lacking. Horses with <i>Leptospira</i>-associated acute renal failure can be successfully treated with appropriate antimicrobials (penicillins, cephalosporins, enrofloxacin, doxycycline) and supportive care (intravenous fluid therapy +/- diuretics). In cases of <i>Leptospira</i> recurrent uveitis, antimicrobial therapy has not been effective in eliminating the organism and associated inflammatory response from affected eyes. A single dose (4 mg) of intravitreal preservative-free gentamicin has been shown to reduce the frequency and severity of ERU flare ups in a high percentage of affected horses.</p>
<p>Prognosis</p>	<p>Most horses with <i>Leptospira</i> renal injury will recover fully if treated promptly with appropriate antimicrobials and supportive care. The long-term prognosis for vision with <i>Leptospira</i> ERU is guarded, as horses may repeatedly suffer from episodes of ocular pain and inflammation, ultimately leading to permanent loss of vision in affected eyes.</p>
<p>Vaccination</p>	<p>An inactivated <i>Leptospira interrogans</i> serovar Pomona type Kennewicki vaccine is available and approved for use in horses. It is labeled for vaccination of healthy horses 6 months of age or older as an aid in the prevention of leptospirosis caused by <i>Leptospira interrogans</i> serovar Pomona. The vaccine has demonstrated safety in foals as young as 3 months of age and in pregnant mares during all stages of pregnancy. Although controlled published studies are unavailable, leptospira abortion data from the U. of Kentucky supports efficacy of the vaccine.</p>
<p>Shedding of Organism Following Resolution of Clinical Signs</p>	<p>Aborting mares and other recently infected horses may shed <i>L. interrogans</i> serovar Pomona in urine for up to 3 months.</p>
<p>Environmental Persistence</p>	<p><i>Leptospira</i> has been shown to remain viable in contaminated water sources for up to 10 months and may survive longer in optimal temperature conditions.</p>



<p>Biosecurity Recommendations</p>	<p>Leptospirosis is a transmissible disease in horses, and suspect cases should be promptly isolated and tested. <i>Leptospira</i> serovars are also capable of causing disease in humans. Veterinarians and personnel handling infected horses and/or aborted fetal tissues should wear proper PPE (goggles, face shields, coveralls, gloves, gowns, and boot covers) and implement biosecurity practices that prevent contact with urine and fetal tissues.</p>
<p>Release of Animals from Isolation</p>	<p>Acutely infected horses and mares aborting from <i>Leptospira</i> infection should be isolated for 3-4 weeks, and their urine should be confirmed to be negative by PCR prior to release from isolation.</p>
<p>Disinfection</p>	<p><i>Leptospira</i> are easily killed by both common disinfectants and drying.</p>
<p>Zoonotic Potential</p>	<p>Several <i>Leptospira</i> serovars are capable of causing disease in humans. Direct transmission of <i>Leptospira</i> from an infected equid to human followed by clinical disease has, to our knowledge, not been documented in North America.</p>
<p>Additional Reading</p>	<p>Divers, TJ; Chang YF; Irby NL; <i>et al.</i> Leptospirosis: An important infectious disease in North American Horses. <i>Equine Vet J.</i> 2019 May;51(3):287-292. doi: 10.1111/evj.13069.</p>

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