



Leptospirosis in Horses

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In the USA and Canada, *Leptospira interrogans* serovar Pomona type kennewicki and serovar Grippotyphosa are the most common causes of equine leptospirosis. The prevalence of leptospirosis in horses is unknown, but serologic evidence indicates a higher incidence than is apparent clinically. Antibodies to serovar Bratislava are reported frequently in horses in the USA and in Europe; horses are thought to be a maintenance host for this organism, and clinical disease has not been confirmed with Bratislava infections. Acute Pomona infections also commonly cause cross-reacting antibodies for Bratislava and Icterohaemorrhagiae on the MAT, which may explain some of the commonly observed high titers to Bratislava. Clinical leptospirosis in horses is most commonly associated with abortions, acute renal failure, rarely pulmonary or systemic illness in foals, and most importantly recurrent uveitis.

Leptospira interrogans serovar Pomona abortions may account for ~13% of bacterial abortions in mares in endemic regions, although incidence varies considerably between years. The reason for the yearly variation in incidence of abortions is not clear. Serovar Pomona type kennewicki is responsible for most of the leptospiral abortions in North America, but serovars Grippotyphosa and Hardjo have also been reported. Skunks, raccoons, and red foxes are known to harbor Pomona type kennewicki. Most abortions occur after 9 mo of gestation, and rarely a live foal may be born ill from leptospirosis. Macroscopic lesions are edema, areas of necrosis in the chorion, and placentitis that does not involve the cervical star. Microscopic lesions include necrosis and calcification of the placenta. Placental disease may result in the mare developing hydroallantois. Macroscopically, the fetal liver may have yellow discoloration. Liver disease in the fetus is a multifocal necrosis and giant cell hepatopathy. Tubulonephrosis and interstitial nephritis may be detected in the kidneys of the aborted fetus. Inflammation of the umbilical cord (funisitis) may be recognized by diffuse yellowish discoloration. Aborting mares typically have very high leptospiral antibody titers at the time of abortion and, although quite variable, the time of urine shedding of leptospire after an abortion is often 2–3 mo.

Occasionally, *Leptospira interrogans* serovar Pomona causes fever and acute renal failure in horses. The kidneys become swollen as a result of tubulointerstitial nephritis, and urinalysis may reveal hematuria and pyuria without visible bacteria. On rare occasions, multiple weanling or yearling horses may be affected with fever and acute renal failure after infection.

The most important clinical disease associated with *L interrogans* serovar Pomona infection in adult horses in North America and *L kirschneri* serovar Grippotyphosa in Europe is equine recurrent uveitis (ERU). ERU is believed to be an immune-mediated disease sometimes involving antibody against certain *Leptospira* antigens, specifically the LruC outer membrane protein, which cross-reacts with tissues of the lens, cornea, and possibly retina. Live *Leptospira* organisms can be found in the aqueous or vitreous fluid of horses with ERU. High concentration of antibody against *L interrogans* serovar Pomona in the aqueous humor, compared with serum titers, also suggests persistent local antigenic stimulation. Survival of the organism in the face of high ocular antibody indicates an absence of cells or molecules (eg, complement) involved in bacterial clearance, suggesting an ocular immune privilege similar to that of the CNS. Recurrent episodes of the disease may be related to a Th17 response of autoreactivity following mimicry and inter- or intramolecular epitope spreading, or both.

Genetic factors are likely involved in the disease process, helping to explain why only some horses infected with *Leptospira* develop uveitis. Appaloosas are thought to be genetically predisposed, and specific MHC markers on ECA1, ELA class 1, and an ELA class II microsatellite are strongly associated with the disease. The prevalence of ERU is unknown, but reports suggest that ≥1% of horses will develop the disease during their lifetime. It is probable that some cases of ERU are not associated with *Leptospira* infection, and this may vary by geographic region. In some regions, more than 50% of ERU cases are associated with persistent ocular infections with *Leptospira*. *Leptospira*-associated uveitis may cause corneal, anterior chamber, and posterior chamber disease. Therefore, clinical findings may vary from corneal edema, clinically quiet retinal lesions observed on funduscopic examination, and most dramatically recurrent and progressive painful uveitis. The chronic disease of the globe may cause cataracts, retinal degeneration, or even glaucoma.

Diagnosis of *Leptospira* abortion is best accomplished by fluorescent antibody testing (FAT) or immunohistochemical evaluation of the placenta, umbilical cord, fetal liver, or fetal kidney. The sensitivity and specificity of the FAT in these tissues (but not urine) are nearly 100%. Examination of silver-stained kidney samples in horses with renal disease does not yield high accuracy, because there may be false-negative and false-positive findings, likely a result of nonpathogenic serovars. PCR testing is preferred for evaluation of fluids, such as urine, ocular fluids, and blood. Marked increases in serum antibody titers often accompany *Leptospira* abortions or acute renal failure, but serum titers may be low in horses with recurrent uveitis because of the chronic and localized nature of infection. Acute *L interrogans* serovar Pomona infections often cause marked increases in antibody titers to several serovars (especially

Icterohemorrhagiae and Bratislava, but the noninfecting serovar titers usually decline much more quickly over several weeks than the titers to the actual infecting serovar. Collection of a voided urine sample after furosemide administration may improve sensitivity of PCR, darkfield staining, or culture testing. A combination of serology, culture, and PCR testing of aqueous fluid may be the only way to confirm *Leptospira*-associated uveitis. In ERU, the organism is most commonly found in the vitreous rather than aqueous fluid, which limits the practical application of ocular fluid PCR testing.

In acute disease, systemic antibiotics such as enrofloxacin, penicillin, tetracyclines, or aminoglycosides are useful, but this has not been proved to be the case with recurrent uveitis. There are no leptospiral vaccines approved for horses, although many veterinarians have used vaccines approved for cattle on horse farms that have endemic *Leptospira* abortions or uveitis.



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