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Update on Tick-Borne Diseases (Lyme Disease)

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Exposure to ticks parasitizing both animals and humans is becoming an increasingly prevalent issue worldwide. Several factors may be involved including populations living in closer proximity to wildlife, changing wildlife populations and more temperate winter months. Tick involvement in the transmission of zoonotic diseases from animal reservoirs is well known as both clients and practitioners are increasingly well informed due in large part to the internet. It is also critical to understand and recognize tick-borne diseases as horses continue to travel internationally to countries in which these diseases may be endemic including *Theileria equi* (*Babesia equi*).

Equine Lyme Disease

Lyme disease, caused by the spirochete *Borrelia burgdoferi* *sensu lato* and transmitted by ticks of the genus *Ixodes*, is the most commonly reported tick-borne disease in humans in the Northern Hemisphere. In Europe and Asia, Lyme disease is also caused by the spirochetes *B. garinii* and *B. afzelii*. In horses, Lyme disease is the most controversial and frequently diagnosed tick-borne disease in certain areas of the United States. Recent European studies evaluating the seroprevalence of *B. burgdorferi* revealed a prevalence of 47% seropositive horses in Slovakia, 25% in Poland, 16% in Sweden and 16% in Germany [Hansen et al 2010]. *Borrelia* is maintained in a complex life cycle of small wild mammals and immature stages (nymphs) of the black legged tick, *Ixodes scapularis*, *Ixodes pacificus* and in Europe, *Ixodes ricinus*. Larval and nymphal stages of the tick acquire the organism when they feed on infected mice. Lyme disease develops when the infected nymphs feed and transmit infection via the skin to humans and animals such as horses, particularly during the summer and fall months. Female ticks are the main vector and infection in horses (and other mammals) is the result of tick attachment and prolonged feeding (24-48 hrs) of the infected adult tick. After infection, the organism typically resides in the skin near the tick bite. *Borrelia* may also survive in the host by residing in connective tissue and callogen, thus having no requirement for iron. The organism’s ability to survive with a very limited blood supply may significantly impair the efficacy of antibiotics used for treatment of Lyme disease.

Clinical Signs

Clinical signs attributed to *Borrelia* are often vague and non-specific. Signs may include fever, stiffness, muscle pain, swollen joints, sporadic lameness, chronically poor performance and diverse orthopedic issues. Neurologic signs such as depression, ataxia, dysphagia and head tilt have been reported along with behavioral changes and extreme skin hypersensitivity. It should be noted that multiple and diverse clinical signs have been attributed to *Borrelia* infection in horses [Divers 2013]. This is due to the high incidence of seropositive horses for *Borrelia* and the failure of a reliable experimental model to confirm and validate both infection and clinical signs.
Diagnosis

The diagnosis of Lyme disease in horses is currently based on a combination of history, clinical signs, response to antibiotic therapy, risk of probable exposure, and blood tests. It should be emphasized, however, that the results of blood tests do not always correlate with disease status. The following questions should be posed; 1. Does the horse live (or was in) an endemic area? 2. Are the clinical signs compatible with Lyme disease? 3. Have other causes of disease been ruled out? 4. Has the horse tested positive of *Borrelia* antibodies? The most commonly utilized screening tests for antibodies (indicating exposure only) are the immunofluorescent antibody (IFA) and enzyme-linked immunosorbent assay (ELISA) tests. The recommended ‘ideal’ diagnostic testing procedure is usually to perform the ELISA followed by the Western blot assay. The stall-side screening C6 -SNAP test (Idexx Labs, Westbrook, Maine) is based on detection of antibody to an immunodominant conserved region (C6) and has demonstrated good correlation with the equine ELISA test. While all of these tests may suggest exposure, determination of active infection is relatively challenging. Recently, a multiplex antibody bead test assay has been developed at Cornell University [http://ahdc.vet.cornell.edu/sects/Serol/]. It is a quantitative test based on 3 recombinant outer surface proteins (Osp) of *Borrelia* including OspA, OspC and OspF [Wagner 2011]. This test has several advantages including; fully quantitative with improved sensitivity, less non-specific binding and the ability to determine response to treatment. For example, 2-4 weeks post infection OspC is positive and OspF is negative, 5 weeks to 5 months post infection OspC+ and OspF+ and > 5 months post infection OspC- and OspF+. Basically, the antibody pattern is able to distinguish between early and late infection and also indicate success of therapy.

Therapy

Many horses are treated presumptively each year for Lyme disease. Treatment is often prolonged, expensive and carries some chance of toxicity. The drugs most frequently used for treatment of Lyme disease in horses includes intravenous (IV) tetracycline and per os doxycycline. The highest tissue concentrations are obtained with IV tetracycline and this is the preferred drug to initiate therapy. Doxycycline per os has a very low bioavailability (+/-5%) and due to the ease of administration it is preferred by clients. Recently, reports have suggested that minocycline hydrochloride has superior bioavailability in horses than doxycycline and achieves higher tissue concentrations [Schnabel 2012]. While other classes of antibiotics have been used to treat Lyme disease in humans (cephalosporins, ampicillin, penicillin) these have not proven successful in horses. The precise dose, interval and duration of tetracycline for treatment of Lyme disease in horses are unknown. However, a suggested treatment option is IV tetracycline (6.6mg/kg Q 12 hours) for 1 to 2 weeks followed by either PO doxycycline (10mg/kg Q 12 hours) for 1-2 months OR minocycline PO (4mg/kg Q 12 hours) for 3-4 weeks. Currently, licensed vaccines for horses are not available. There are reports of canine vaccines for Lyme disease being used in horses but it is unknown how well these vaccines will protect horses from *Borrelia* infection.
References


