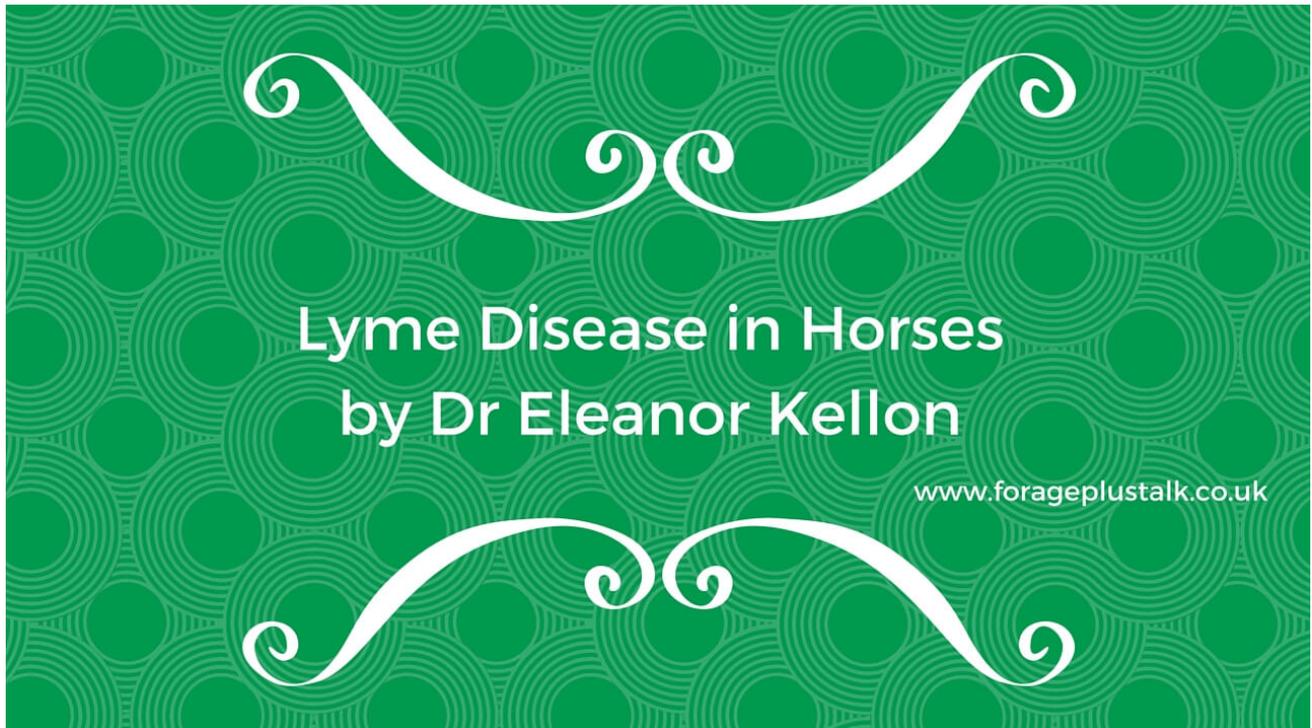


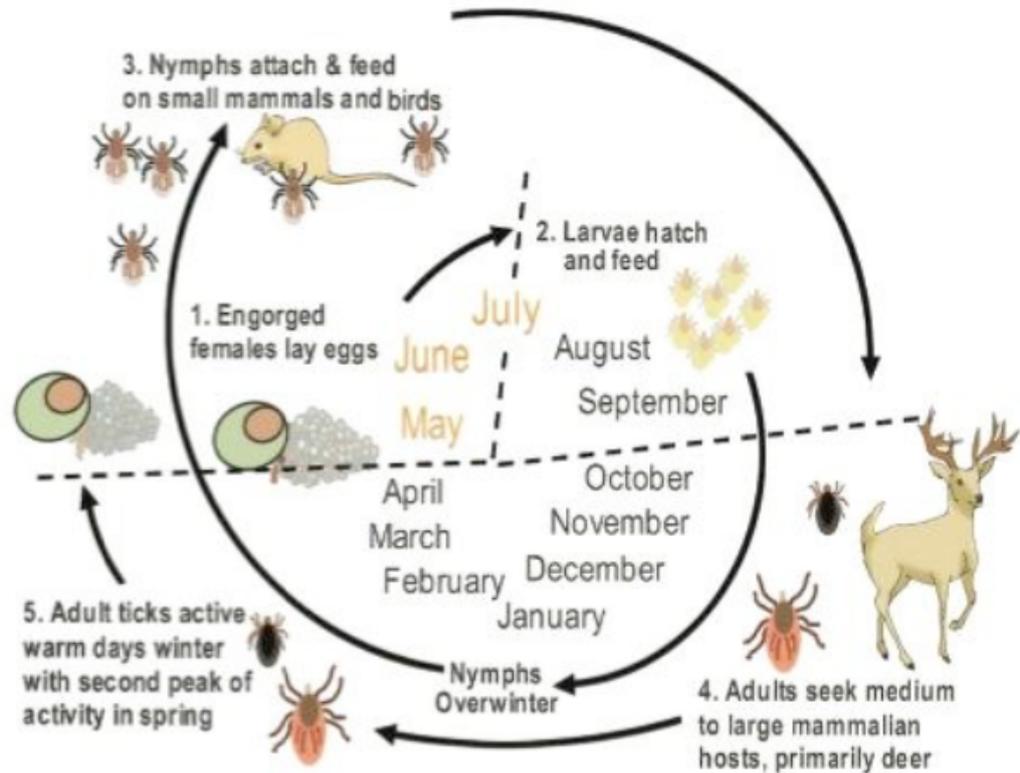
Lyme disease in horses can have many faces, this article seeks to inform you about what Lyme disease is and the many ways it can be manifested in your horse.



Lyme disease is caused by infection with a spirochete bacterium called *Borellia burgdorferi*. Horses become infected if fed on by a tick carrying the organism. Transmitting ticks are black-legged ticks called deer ticks in eastern USA but other types of ticks and biting insects could also spread Lyme.

Although the organism has undoubtedly been around a very long time, the disease was first recognised by Dr Alan Steere, who described a mysterious outbreak of arthritis in children in the town of Lyme, Connecticut. The actual causative organism was isolated 5 years later by microbiologist Willy Burgdorfer.

## Two-year Life Cycle for *Ixodes scapularis*



Tick larvae become infected when they feed. The natural reservoir of the organism is believed to be the white footed mouse but others are possible. Over the first winter of their life cycle, the larvae develop into nymphs which are tiny versions of the adults that commonly feed on small rodents.

Once infected, both nymphs and adults can transmit the disease. The longer an infected tick remains attached, the higher the risk of transmission, so check religiously for ticks, especially in the tail hair and the root of the mane. Remove by grasping the head firmly at skin level and pulling straight back. Disinfect the attachment site with alcohol.

As recently as 2008 and 2009, maps of states with Lyme disease showed only the east and west coasts and the great lakes region. Since then, locally acquired Lyme disease has been confirmed in 43 states. Cases are still very heavily clustered in the northeast and great lakes states, but Lyme must be considered a possibility almost anywhere.

## Lyme Disease in Horses – Stages of Infection

I. Early localized infection. This lasts 1 to 4 weeks and is characterized in humans by a bull's eye rash at the site of the tick bite which takes 3 to 30 days to appear.



Unfortunately, this would be virtually invisible on a horse so early stages of infection will invariably be missed. The trend in human medicine, and a wise one IMO, is to treat with doxycycline at the first report of a tick bite, regardless of any symptoms, when in an endemic area for Lyme (i.e. Lyme known to be high risk). Only a single dose is needed.

II. Early disseminated Lyme. This means the organism has spread beyond the general vicinity of the tick bite. This stage begins weeks to months after the initial tick bite.

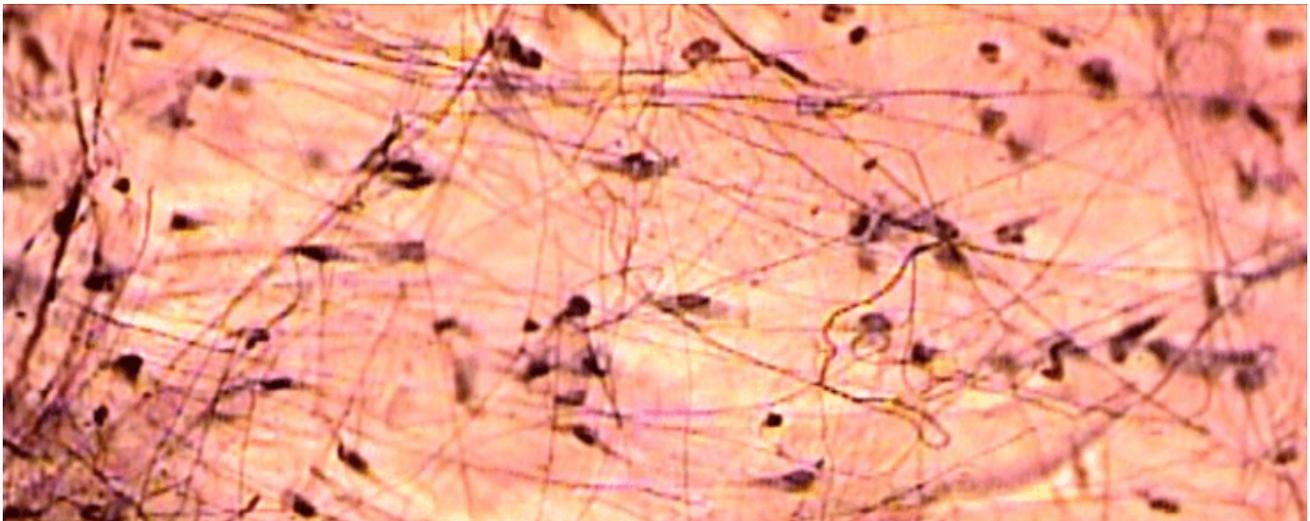
III. Late disseminated Lyme. The disease enters this stage weeks, months or even years after the tick bite. It is associated with the most severe signs, in a variety of organ systems.

Recognizing that Lyme occurs in stages is important because it has been well established in humans that the longer the interval between infection and treatment, the more difficult to impossible it becomes to really cure the infection.

The only symptoms present in the early localized disease, other than the rash (which is not always present) are very nondescript such as easily missed mild fever, aching, fatigue, transient swollen lymph nodes. The chances of detecting these in your horse are minimal. Even if the horse does seem “off” at some time, it is so nonspecific you’re not likely to think Lyme.

## Symptoms of Lyme Disease in Horses

In addition to the nonspecific infection symptoms of fever, fatigue, aches and pains, the symptoms of Lyme disease can be virtually anything. Lyme has been called “the great imitator” because it can easily be mistaken for a variety of disorders. The reason for this is that the organism settles into the connective tissue. Connective tissue is found everywhere in the body. All cells in all organs are anchored in a connective tissue network.



The Lyme organism prefers a fairly low level of oxygen so it's not going to be happy in the lungs or blood. Connective tissue fits the bill. In addition to the background connective tissue where cells are anchored, connective tissue includes tendons, ligaments, joint cartilage, joint capsules, encasing membranes of the brain and spinal cord, sheaths surrounding all the organs and muscle groups and tissue planes between and surrounding all body structures.

The table below from a study (1) gives an extensive list of tissues found to be infected with *Borellia burgdorferi* after an experimental infection by tick exposure in ponies:

**Table 1.** Experimental design of equine Lyme infection model.

Pony No.	Age*	Sex	Exposure to Infected or Uninfected Ticks†	Day of Necropsy	<i>Borrelia burgdorferi</i> Isolation‡	
					Skin§	Tissues
139	48	M	+	259	+ (3, 6)	+
142	46	F	+	266	+ (2, 3, 5, 6)	+
144	45	M	+	262	+ (1, 2, 4, 5)	+
172	21	F	+	303	+ (1, 2, 3, 4)	+
177	17	M	+	301	+ (1, 2, 3, 4)	+
179	14	F	+	289	+ (1, 3, 5)	+
180	13	F	+	275	+ (1, 2, 3, 4)	+
178	17	M	+	287	–	–
<b>Controls</b>						
132	50	F	–	252	–	–
133	49	F	–	266	–	–
141	46	F	–	271	–	–
159	33	F	–	278	–	–

\*Age in months at start of experiment.

† Ponies were exposed to either *B. burgdorferi*-infected ticks (+) or uninfected control ticks (–) on days 0 and 59 of the experiment. Pony No. 178 was also exposed to 20 uninfected nymphs on day 0 and to *B. burgdorferi*-infected ticks on day 59 of the experiment.

‡ Blood and urine from each pony were cultured monthly and all were negative for *B. burgdorferi*.

§ Skin biopsy was performed monthly and positive culture results are indicated by month after tick challenge.

|| Postmortem tissue positive for isolation of *B. burgdorferi* (see Table 2).

What's interesting, and this has been seen in other experimental infections, is that none of the ponies showed any obvious symptoms over a 9 month period. It may well be that if they were stressed by showing, shipping, etc. it would be a different story. However, it is also known in humans and lab animals that exposure/infection can occur without symptoms in some individuals.

## Laboratory Diagnosis of Lyme Disease in Horses

Although it can be done, the Lyme organism is difficult to culture so this is a different situation from a wound or respiratory problem where your vet would want to do a culture swab. Instead, other blood tests are used. ELISA. This is an antibody test that is usually the first thing done. However, there can be false positives so the next step is Western Blot. Western Blot. This is a specialized antibody test that looks for several different Lyme protein associated antibodies. It is considered the most accurate and specific test. SNAP. This is a rapid, on farm, test that looks for one specific antibody to a protein called C6. It is highly specific for the Lyme organism, but may miss some cases. The SNAP will be positive earlier than ELISA. PCR (polymerase chain reaction). This is a very sensitive test that detects even tiny traces of the organism's genetic material (DNA/RNA). It can be used as a substitute for culturing

Because the early stages of Lyme in horses can easily be missed, or mistaken for something else, once the disease is diagnosed it is likely to be in the early or late disseminated stage.

Common symptoms include:

unexplained lameness that may move from leg to leg, with or without joint swelling and reluctance to work  
skin sensitivity to touch  
depressed attitude/irritability  
laminitis (may be very severe)

Pain may also involve tendon, muscle, bursae or bone. The eyes, liver or spleen may be involved. In the later two stages, neurological involvement becomes possible. (2)

Neurological signs can vary from inflammation of isolated nerves to encephalopathy or inflammation of the spinal cord. Neuroborreliosis (neurological Lyme disease) has recently been confirmed in horses (3).



from neuropathology-web

The brain with meningitis above shows engorged arteries and veins as well as spots of hemorrhage.

## Lyme Disease in Horses - Seasonal Effects

Horses with Lyme disease often become symptomatic in the fall. This may simply reflect infections that were acquired in the spring entering a symptomatic phase. However, horses also experience a rise in the hormone ACTH in the fall. This in turn causes release of cortisol which can have the effect of suppressing the immune system.

The two drugs used to treat Lyme in horses are intravenous oxytetracycline or oral doxycycline. The standard course of treatment in humans is 4 weeks. Veterinarians commonly recommend 3 to 4 weeks of antibiotics. A study (4) found that only tetracycline was actually able to reliably cure the infection.

Actually curing Lyme in horses is also complicated by the fact the disease is in an advanced stage by the time it is diagnosed. The prohibitive cost of four weeks of intravenous antibiotics coupled with advanced stage means most horses treated with oral doxycycline will not be cured. Longer courses of treatment may be needed to eliminate symptoms of an episode and the horse may become ill again in the future

## Tick Proofing to Avoid Lyme Disease in Horses

Regular mowing and clearing brush/weeds/dead vegetation from your fields and around all buildings make the premises less appealing to both ticks and the rodents on which they feed. When riding cross-country, saturate the lower legs down to skin level with Permethrin, which will both repel and kill ticks. These ticks get on the animal close to ground level then climb. Also saturate the mane and tail base, common areas where ticks will hide and attach. Nothing is proven to work better than Permethrin. Do daily grooming along with tick checks and removals. Dispose of ticks in a jar of rubbing alcohol. Ticks can survive even attempts to burn them and jump back on.

## Summary

Fortunately, only about 10% of horses with antibody evidence of Lyme exposure will actually develop the disease. For those that do, it can be devastating. Be vigilant about insecticide use and removing ticks. Make your grounds less tick friendly. If your horse develops an unexplained laminitis, ill-defined lameness or attitude change, with or without fever, suspect Lyme and contact your veterinarian.

### Useful References:

- (1) Experimental Infection of Ponies with *Borrelia burgdorferi* by Exposure to Ixodid Ticks
- (2) Meningitis, cranial neuritis, and radiculoneuritis associated with *Borrelia burgdorferi* infection in a horse.
- (3) Lyme neuroborreliosis in 2 horses
- (4) Antibiotic treatment of experimentally *Borrelia burgdorferi*-infected ponies

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