

Scientific Review Article

LYME DISEASE IN THE EQUINE

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ABBREVIATIONS

CBD – cannabinoids
CDC – Centers for Disease Control
EPM – equine protozoal myelitis
IL – Interleukin
LD – Lyme disease
NK cells – natural killer cells
PSSM – polysaccharide storage myopathy
Th1 – T-helper cell lymphocytes, type 1
Th2 – T-helper cell lymphocytes, type 2

Introduction

Lyme disease (LD) has been recognized for about 40–50 years. It is now the most commonly reported tick-borne illness in the US and Europe and is found in Asia and Australia (1, 2). The Centers for Disease Control and Prevention (CDC) showed more than 35,000 reported human cases in 2015 (1). Most cases are concentrated in about 15 states, mostly on the East Coast from Virginia northward. The CDC states it was the sixth most common nationally notifiable disease in 2015, in humans [<https://www.cdc.gov/nndss/>] (1). Many cases are not reported to the authorities, so the actual numbers are not known and likely higher; equine cases are not reported. Since LD can be found in so many locations, it should be considered as part of a rule-out list when a case diagnosis is not clear.

The organism

The Lyme spirochete (*Borrelia burgdorferi*) is a very mobile, corkscrew-shaped bacterium. The life cycle involves the *Ixodes ricinus* tick on the East coast, with other tick species involved in other parts of the US and world. Contrary to popular belief, deer are far from the only host for the infected tick as the different tick species prefer different hosts. Many small mammals are part of the host cycle, from the white-footed mouse (the main one in the northeast) to the chipmunk, hedgehog and rats, along with humans and dogs. Squirrels of

many species worldwide are capable of being carriers and are numerous (3). Fleas, spiders, mosquitoes, and mites are also possible parts of the life cycle, though the available research has not defined their exact role.

The nymph stage ticks are the source of most infections while the adult tick, which is a little larger and easier to see, may be less important but potentially infective.

Spirochete behavior within the body

Spirochetes possess separate plasmids (DNA strands) and have an inner and an outer protein coat, which is unusual in the bacterial world. The outside coat comes into contact with its host organisms and can be adapted to whichever host the spirochete encounters.

There are many different outer surface protein coats, called Osp, and different portions of them are upregulated while the tick is eating its blood meal, even before the spirochete enters the body. The compound decorin essentially hides the outer layer of the spirochete from the host immune system so that it can enter the body undetected. The spirochetes can then modify themselves in a variety of ways to avoid detection by the immune system. The spirochete cells also communicate in several complex ways, using quorum sensing,

plasmid transfer, and gene expression to evade antibiotics and immune detection, an event that also occurs with other resistant bacteria (4–8).

While in the body, the spirochetes continue to alter their structure from moment to moment. This probably contributes to the various symptoms that are part of the LD picture as well as the resistance to treatment.

Spirochetes are attracted to different kinds of cells in the hosts, particularly collagen. Joints, aqueous humor of the eye, meninges of the brain, skin collagen, and heart tissue (less so in the equine for an unknown reason) are all susceptible. Spirochetes travel faster in collagen than they do in the bloodstream. In Chinese medicine, the liver governs the collagen, sinews, tendons and ligaments, so one of the most important factors in Chinese treatment will be to support the liver meridian.

Infection with Lyme spirochetes as with many other chronic conditions cause or become an imbalance in the T helper cell (Th1 and Th2) immune complexes. The Th1 lymphocytes are characterized by the production of type I cytokines such as interleukin-2 (IL-2), tumor necrosis factor-beta, and interferon gamma. The host produces a major Th1 response to try to deal with the acute infection; the side effect of this response can be inflammation. Th2 lymphocytes produce the cytokines IL 4, 5, 6, 10, and 13 and essentially help downregulate the inflammation from the Th1 response. If either of these responses are out of balance, the spirochete can overcome the immune system (2, 9).

The spirochetes are clever opportunists responding to an assault from an antibiotic or the immune system by either changing their protective surfaces, entering a cell, and even forming a protective coating inside the cell. Other evasion tactics include creating a completely different form, usually referred to as a cyst; however, there are also blebs and spheroblastic L-forms. Blebs are partial pieces of material that are shed perhaps to confuse the immune system. Cysts or round bodies go dormant but can re-activate when conditions are conducive to their reproduction (5–9).

Antibiotic treatments are capable of triggering a morphological change in the spirochetes to abnormal motile forms, which can be a cyst, round body, or spheroblastic L-form, or enable the organism to be resistant to antibiotic treatment by forming bio-films. Viable organisms were detected in 70–85% of the biofilm-like colonies after antibiotic treatment (4). Other changes in environmental conditions such as those involving temperature, pH, starvation, and most importantly antibiotic exposure can

cause a phenotypic change in the spirochete. This change involving surface proteins is hypothesized to be the way in which the spirochete evades the host immune system (4).

LD appears to suppress the body's natural killer (NK) cells. The borrelia's proteins are encoded by plasmid and chromosomal genes. These genes are regulated and change their expression from different environmental factors in ticks as well as the host during infection. This antigenic diversity further enables the spirochete to escape host defense mechanisms and maintain infection (5).

Studies have shown that after antibiotic treatment with various drugs, the DNA of the *B. burgdorferi* changes, leading to antibiotic resistance, or more likely, a tolerance (5–9). It continues to reproduce slowly in this new form for as long as 12 months after treatment has finished. These *B. burgdorferi* were unable to be cultured, so the standard tests would be unable to determine activity. Recent evidence of persistent *B. burgdorferi* present in tissues of treated hosts during chronic infection prompted the author to state that it is “plausible to speculate that there is preexisting (natural) variation in antimicrobial susceptibility among bacterial strains, which could be an alternative phenotype that offers an appreciable survival advantage within the pathogen's original population” (7).

Clinically, many horses seen with later stages of LD seem to mount a poor immune response. This frequently is observed as low white blood cell counts on a traditional CBC. Poor immune responsiveness may be the reason behind the commonly seen low to equivocal Lyme antibody titers (10, 11).

The longer the spirochetes are in the body prior to treatment, the more adjusted they become to the specific immune situation in that host. For example, the spirochetes may stay in the synovial *lining* of a joint then evade the immune system or the antibiotic therapy by entering the synovial *cells*. Once the antibiotics are out of the system or the immune system is weakened, the spirochetes reenter the joint.

Symptoms

The characteristic bull's-eye skin lesion is generally missing in the equine and dog, most likely due to the presence of their hair coat. One of the most common signs is lameness that is difficult to specifically identify. In humans, cognitive problems, irritability, fatigue, headaches, disorganization, nerve pain, deficits in memory and retrieval of information, reduced perceptual motor skills, and problem solving are all serious issues. All of these symptoms likely exist in the horse, with the most frequently seen signs being irritability,

fatigue, lack of interest in work, perhaps stubbornness, or perceived stubbornness, or dullness, all of which are difficult to diagnose (10, 11).

Arthritis attacks may be periodic, and may wax and wane, apparently being worse during a full moon, and due to variations in the ability of the immune system to respond. Studies have shown that the primary factor leading to arthritic inflammation is the health of the immune system. Spirochete levels have been found to be irrelevant to the severity of the disease (9).

Cardiac issues do not seem to be a significant problem with the equine; however, some horses with cardiac issues could have Lyme exposure in their background (11). Perhaps testing for LD should be performed in equine cardiac cases, including in sudden death equine cases when a fresh blood sample is available.

Clinically, about 10–15% of the horses in the author's practice area become dangerously spooky when infected with the Lyme spirochete. The exact reason for this is unknown; however, there are at least 16 strains of *B. burgdorferi* (8), and likely more in the US alone, and as many as 300 that are known worldwide (1, 2). This diversity is thought to contribute to the antigenic variability of the spirochete and its ability to evade the immune system and antibiotic therapy, leading to chronic infection (9). A possible explanation for the behavior problems may be due to different strains since some of the cases were clustered in small areas of the county (1, 10).

Co-infections?

The issue of co-infections with other organisms is a serious problem and complicating factor with humans (1). True co-infections have not been identified in the equine, however the concept cannot be ruled out. In this author's experience, cases of equine protozoal myelitis (EPM) occur along with LD, particularly in older horses.

Bartonella is one of the common human co-infections (9). It has been identified in the equine and potentially implicated in several diseases (10). It is difficult to culture and therefore currently not able to be reliably diagnosed or treated with conventional means.

Diagnosis

A combination of a thorough history along with a complete physical exam and blood work are required. The history often becomes the most important part of the diagnosis. Many, if not most, of the horses show behavioral changes of various sorts, the most common being lethargy, irritability, or lack of

interest in their surroundings. In some cases, as mentioned above, the behavioral changes trend more towards the hyperactive or spooky side. The key is a significant mental change (11).

The physical part of the history can include shifting leg lameness, stiffness, joint swelling, poor performance, reluctance to turn, and poor jumping performance, etc. In many cases, horses have been worked up for subtle lamenesses and have had traditional treatments such as joint injections and various anti-inflammatory medications but have not responded well. Diagnostic imaging may be inconclusive or may point to joint inflammation, yet treatment of that inflammation yields poor results.

Other signs that have been attributed to Lyme borreliosis are anterior uveitis, neurologic signs, low grade fever, sensitivity to touch, lameness, weight loss, tremors, neck pain, lethargy, laminitis, and pseudolymphoma (10, 11). These signs can be caused by other diseases that are also commonly seen. Those include anaplasmosis, EPM, "tying up," equine polysaccharide storage myopathy, and many more.

Older horses, especially those with severe neurologic signs, may be infected with both EPM and Lyme spirochetes, either at the same time, or one after the other. Clinically, in this author's practice, horses affected with LD may be more susceptible to showing significant clinical signs of EPM.

Laboratory diagnosis

Laboratory diagnosis of LD can be very difficult, even with humans where testing is significantly more sophisticated. This is in part due to the cleverness and changeability of the spirochete, and partly because the tests are not good enough yet. With the equine, the main test is performed by the Cornell University College of Veterinary Medicine Animal Health Diagnostic Laboratory Center and is called the Lyme Disease Multiplex Testing for Horses (12). This quantitative test measures the 3 different antigen proteins on the outer surface of the spirochete, the Osp A, C, F (12). OspA is for vaccination responses; however, this author has seen it be positive in known unvaccinated horses. OspC is for the early infection and F for the chronic cases. However, it may be that the horse has both an acute and a chronic infection, so the test is still not absolute. Horses with long-term chronic infections also may have a poor immune response, so the test numbers may not correlate with the severity of the infection in this author's experience.

The other test used is a commercial ELISA-type of test (a), which has the advantage that it can be performed at

the horse's side. This reads surface antigens that mark viable spirochetes. The C6 antibody declines rapidly after treatment (since the spirochete can go inside the cells). Snap 4Dx testing yields some false positive and false negative results, and does not give a quantitative result. It is useful for screening purposes, but should be followed up with the quantitative test to obtain a better understanding of the response of the immune system and to be able to compare results from pre- and post-treatment.

Holistic diagnosis

Since LD has many manifestations, there is not one clear-cut pattern observed from a holistic perspective. The practitioner's training and experience will guide the tools to be used diagnostically and for treatment.

From a homeopathic perspective one needs to take a complete history and prescribe a constitutional medicine based on the animal's presentation. A good follow-up is important since these cases can be complex. The client also needs to understand that a single homeopathic medicine may not be enough.

From a Chinese perspective, the liver meridian is the most often affected, directly and indirectly by the spirochete. Many horses will exhibit signs of liver dysfunction; however, there is seldom one pattern for all horses. Wind invasion is common, and many symptoms are related to that, with shifting signs. There may be Liver Qi Stagnation, Liver Heat rising, Liver Yin deficiency, Liver Blood deficiency, and so on. Frequently a generalized Qi deficiency will be an important part of the diagnosis. These may be combined with other patterns, often made more complex by long-term drug use.

The key is to approach each case as an individual, from the practitioner's perspective and experience, and treat that horse's specific presentation. It may change from month-to-month as well as from year-to-year.

Vaccination

There are no LD vaccines approved for the horse, so canine vaccines are being used. It is my experience that the vaccine can be detrimental to the horse's immune system since many horses relapse post-vaccination. Some horses appear to handle the canine Lyme vaccine, however, in this practice, horses usually respond poorly to the vaccine once they have been infected.

One potential reason for the difficulty with the Lyme vaccine is that vaccines generally are not to be given in the face of an infection. Since LD is difficult to detect and may be asymptomatic or unrecognized for a long period of

time, horses that get vaccinated may already be harboring the spirochete. Most people desiring to vaccinate are in endemic areas, and consequently the horses are likely to be infected. Lyme titer testing can be done before vaccinating to determine exposure; however, since the test cannot be considered 100% accurate, positive horses will still be missed.

Of note is that many, but not all, of these horses have detrimental responses to other vaccines, such as rabies, West Nile Virus, and others once they have had LD.

Treatment

There is no magic bullet in treating chronic LD cases. The best approach is a multi-systemic one, using a combination of conventional, complementary, and alternative medicine. Most of the good experienced human LD practitioners use antibiotics along with immune system supplements. Successful treatment of LD includes support for the immune system, not just during the immediate treatment period but over the long term. Due to the Lyme spirochete's ability to "recur," the immune system must be prepared to respond at a moment's notice.

Since the spirochete selectively adapts to the individual's body, what works well in one horse may or may not work as well in another. Some horses have a naturally strong immune system and a healthy lifestyle, while other horses are weaker or may have a stressful lifestyle.

Antibiotics

In the acute stages and generally upon initial diagnosis, antibiotics are used by this author. Doxycycline is administered orally, and consequently it is usually the starting point of therapy. Intravenous tetracycline may work better than doxycycline, though clinically many horses seem to respond quite well to the oral drug. The management of long term intravenous therapy can be difficult in many situations. With the equine caregiver's permission, it can be beneficial to start directly with intravenous treatment. There are fewer choices of antibiotics for equine LD treatment than there are for humans.

If doxycycline is used, the dose is approximately 10 mg/kg BID. The idea behind antibiotic use is to have the greatest effect at one time, as lower doses allow the spirochete to adapt and become resistant/tolerant. If the horse responds well before 30 days, then doxycycline is the only drug needed. After 30 days, if the response is mediocre, this author's preference is to go straight to the intravenous tetracycline treatment, if possible. There are many specific protocols, and likely there is not one that is significantly better than any other.

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The use of antibiotics does suppress the immune system in the gut particularly, and from a Chinese perspective it damages the Spleen and Stomach due to the cold energy (13, 14). Therefore, the support during this stage is designed to counteract the side effects.

Horses presented to this author's clinic in the later stages or those that have recurrences despite antibiotic usage are preferentially treated with herbal medicine, immune support, and homeopathics (15).

Probiotics

The microbiome is the DNA of the microbes living in the gut. The microbiota is the community of commensal, symbiotic, and pathogenic microorganisms that are present in the gut of a healthy horse. Research in the equine microbiome and microbiota are just beginning, but what has been done shows clearly that a healthy microbiota is important for good health (16).

Probiotics are an absolute necessity in the treatment protocol. There is controversy about the timing of the probiotics. The ideal situation is to give the probiotics away from the meal with the antibiotics, but most horse management situations do not allow that to happen. Many practitioners feel probiotics should not be given until after the antibiotics are finished. However, the only bacteria that needs killing is the spirochete. Most other bacterial species are valuable assets. The antibiotics probably kill some of the probiotics, but that is why probiotics should continue to be fed for several to many months after antibiotic therapy is finished. The purpose of the long term feeding of probiotics is to restore the health of the microbiome (16).

Immune system support

Immune system supporting compounds are generally used. Many compounds that affect the immune system positively are expensive, so consideration needs to be given to the clients' financial concerns. If finances are limited, the most targeted compounds should be selected. Generally Chinese herbs, Western herbs and homeopathic medicines are the most curative in this author's hands. Many nutritional compounds are supportive rather than curative, but can be critical to the overall success.

Fortunately, a few compounds are relatively inexpensive and can be quite helpful. Vitamin C is one such compound. It is readily available in bulk form and palatable with the dose of 4 to 6 gm divided twice a day. Vitamin C is well known for its action in collagen which is one of the

tissues particularly damaged by the spirochete. Camu camu (*Myrciaria dubia*) fruit is an excellent source of natural vitamin C. Vitamin C mixed with bioflavonoids and quercetin is also a good source (b). The data on using Vitamin C in treating LD is mostly anecdotal, although physicians and naturopaths treating humans routinely include it as part of their LD protocol.

Noni (*Morinda citrifolia*) contains many antibacterial, antifungal, and anti-inflammatory compounds. Studies have shown it is effective for many forms of arthritis and is also a good immune regulator (17). In the fruit leather form, it is relatively inexpensive and concentrated, while the juice form can be quite expensive, more dilute, and contains a significant amount of sugar.

Omega-3 fatty acids are anti-inflammatory as well as supportive to the immune system. They can be obtained through feeding whole flaxseed (inexpensive), naturally stabilized ground flax, hemp seeds, or Chia seeds (a very stable omega-3 source) (c). Flax or hemp oils can be given; however, they must be refrigerated during warm or hot weather. Three to 6 ounces BID is the usual dose for seeds; less volume is used with the oils. Oils sold that do not require refrigeration are usually preserved with chemicals that can be detrimental to the immune system. Fish oils are absorbed, but are not a natural source of food for horses so are less desirable. Blue-green algae contain significant amounts of omega-3 fatty acids, are palatable, and readily available.

Medicinal mushrooms have excellent research showing their positive effects on the immune system with polysaccharides, glycoproteins, and anti-inflammatory compounds (18). There is also evidence they are beneficial in various arthritic conditions. They tend to be more expensive to use, but their immune modulating properties make them a beneficial addition. They are safe and can be used over a long term in a tincture or powder. A mixture of equal proportions of Cordyceps (*Cordyceps sinensis*), Reishi (*Ganoderma lucidum*), Maitake (*Grifola frondosa*), Shiitake (*Lentinula edodes*), and Turkey Tail (*Trametes versicolor*) is a useful combination (18).

Glutathione is a powerful antioxidant present in every cell. It is particularly important in the liver and has some direct anti-inflammatory effects in arthritis. Intravenous glutathione is available; and if clients are comfortable, it can be given 2-3 times a week. It is safe and may be able to be used in higher doses; however, a dose of approximately 2,000 mg in an adult horse seems to be effective.

Precursors such as alpha lipoic acid or N-acetyl cysteine can also be used (19). Doses of alpha lipoic acid that have been used in horses range from 2,000–5,000 mg per day. Oral glutathione products are on the market for humans and should be considered, although the absorption and/or bioavailability has not been tested in the equine.

Supplements to support joint health are important for any horse that has shown signs of joint-related discomfort. These include glucosamine-based supplements, hyaluronic acid, glycosaminoglycans, and green-lipped mussel. Western herbal anti-inflammatories can also be used. Chinese herbal arthritis formulas based on the imbalances shown can also be useful, particularly alternating with some of the active herbs as discussed below. If an herbal formula is being used as a primary LD treatment, general joint support is better accomplished through nutritional supplementation to avoid an overload of herbs.

Hemp, Cannabis and CBD

The use of cannabinoids (CBD) for LD in horses has not yet been researched, but early clinical experimentation is showing good results. In humans, CBDs are being used clinically with useful results (20). The effects of cannabinoids on the immune system, arthritis, pain relief, and as an anti-inflammatory make them particularly promising for LD therapy.

Primary Treatments

Homeopaths should be prescribed constitutionally based on the presenting signs. There are several medicines that fit many of the LD symptoms quite well. *Ledum palustre* is one of the major homeopaths for LD; its symptoms include effects from toxic puncture wounds as well as insects. A tick bite is both of those. *Rhododendron* and *Kalmia latifolia* along with other medicines in the *Ericaceae* family are worth considering. Based on the constitution, other medicines have helped the treatment, including, but not limited to *Sulphur*, *Arsenicum album*, and *Rhus toxicodendron*.

Western herbal protocols also have been used successfully (21). The formulas alternate every 2 weeks with: Houttuynia (*Houttuynia cordata*) leaf, Sichuan Teasel (*Dipsacus asper*) root, Boneset (*Eupatorium perfoliatum*) leaf, Isatis (*Isatis tinctoria* L) rhizome, and *Lomatium* (*Lomatium dissectum*) root in one, and Sarsaparilla (*Smilax ornata*) rhizome, Guaiacum (*Guaiacum officinale*) bark, Andrographis (*Andrographis paniculata*) leaf, Prickly Ash (*Zanthoxylum americanum*) bark, and Stillingia (*Stillingia sylvatica*) root in the second one (d). Another Western herbal formula designed for the equine is based on a rotation of 2

formulas alternating a spirochete killing formula and a tonic formula for recovery.

Chinese medicine offers one of the best modalities to treat LD in this author's experience. Acupuncture is excellent for pain control, immune stimulation, relieving blood stagnation or pain, and moving or tonifying Qi. Among many acupuncture points that are useful (though one should always treat the pattern the animal presents) are:

LIV 3 – free flow of Qi, Source point, relieves Liver Qi stagnation, nourishes Blood

LIV 8 – tonification point for Liver

ST 36 – strong Qi tonification, immune stimulation, tonifies Spleen Qi to build Blood

KI 3 – pain, inflammation in joints, tonifies Kidney, source point for Kidney

LI 4 – clears heat toxin, moves Qi to clear stagnation, immune support

LI 11 – moves Qi, resolves stagnation, cools Blood, benefits joints and sinews

LI 10 – tonify Qi, supports Spleen

BL 18 – Liver back Shu point, soothes Liver Qi

BL 23 – resolve stagnation, Shu point for Kidney, tonifies Yin

BL 24 – tonifies Qi, Sea of Qi

SI 3 – moves stagnation, tonification point, master point Governing Vessel

GB 34 – benefits the Liver, moves Qi, dispels Damp Heat from the Liver, influential point for tendons and ligaments

Qi Hai Shu and Pi Shu – classical point to strengthen Spleen Qi

Chinese herbal medicines are effective in both the early and late stage LD cases depending on the pattern presented. Many herbs that have direct action against the spirochete are also Chinese herbs that clear toxins, move Blood, expel Wind and Damp, and strengthen Qi. Since the spirochete has such an ability to change and adapt to treatment, current thinking is to change formulas on a regular basis (21, 22). This author seldom uses an herbal formula for more than 2 months at a time before rotating to another formula.

One way to approach the Chinese treatment is to use a formula geared towards clearing spirochetes for 2 to 4 weeks (f), and alternate with a formula that fits the main pattern the horse exhibits. For example, one horse may have SP Qi deficiency signs with lethargy and loose stool, in which case one could use a Lyme clearing formula and alternate with or *Ba Zhen Tang* (Eight Treasures) (h) and add a different spirochete-clearing herbs such as Cat's claw (*Uncaria tomentosa*) for 2 to 4 weeks.

Alternately, a horse showing signs of Liver Qi and Blood stagnation could receive *Chai Hu Shu Gan San* and Cat's Claw

for those 2 to 4 weeks. Horses with body pain, Blood and Qi stagnation, or Blood Stasis can receive a formula such as *Shen Tong Zhu Yu Tang* (g, h). A horse with a Qi and Blood deficiency could alternate with *Wei Qi Booster* (h) or *Qi Performance* (h).

Individual Herbs

Astragalus root (*Astragalus membranaceus*) is a key immune system supporting herb that tonifies Qi, strengthens the defensive Qi and the exterior. It also expels toxins and is a key LD herb in many Western formulas. There may be some benefit to giving Astragalus long term to prevent LD. Once the disease is present or active, it is better to use it in a balanced formula or not at all. In humans, some people become worse with its use, though clinically in horses, this author has seen benefit, especially when used as part of a formula.

Andrographis is another herb that can be useful as part of a formula or alone. It is known to cause some GI disturbance in some humans, though horses seem to tolerate it well. This herb has some effects on breaking the encysted forms (2).

Many herbs can be used singly or in combination based on the clinical signs and the goal of the treatment. A discussion of all the possible herbs to use is beyond the scope of this paper.

Other treatment suggestions

Other compounds can be helpful depending on the signs the horse is exhibiting. Magnesium is frequently deficient in human LD patients, and it is easy to supplement horses with magnesium citrate (1–3 g per day). Topical preparations of magnesium are beneficial if oral formulations cause intestinal upset; however, the actual dose absorbed is difficult to calculate.

Hyperbaric oxygen therapy, if it is available, has been shown to be helpful in humans. Heat therapy is used in humans with saunas, but is difficult or impossible with horses. Horses that live outside in the sunshine may have increased body temperatures for a portion of the day; however, it is unknown if that has a positive effect.

Herbs to support general gut health can be beneficial, especially after prolonged courses of antibiotics. Slippery elm bark (*Ulmus rubra*), marshmallow leaf (*Althaea officinalis*), and meadowsweet aerial parts (*Filipendula ulmaria*) are examples. Turmeric root (*Curcuma longa*) is an herb that shows excellent anti-inflammatory effects on joints and supportive properties to the liver. Garlic (*Allium sativum*) bulb may be beneficial; it may also help keep some ticks away and is a good tonic herb. Coenzyme Q-10 is a fat-soluble antioxidant that may be

beneficial. Resveratrol is another antioxidant that can be used in LD cases.

Exercise at the level the horse is comfortable with is an important part of adjunctive care. It is good for the immune system, and is helpful for the horse mentally. Exercise is needed to avoid Liver Qi stagnation. There is no benefit to pushing the horse beyond what is comfortable, so if the horse is having a bad day, a short walk will suffice.

Stress is an important factor in the recovery from LD. Herbs also can be used to help counteract stress. It is beneficial to maintain horses under stress on adaptogenic, stress relieving herbs such as Siberian ginseng root (*Eleutherococcus senticosus*) once they have recovered and gone back to competition (23). It is also important to observe the amount of rest the horse gets at a barn. It has been shown that at many busy barns, horses actually get very little rest and sleep. This adds to stress, which suppresses the immune system.

Prevention

Prevention is difficult if you live in a LD endemic area. Topical antiparasitics are toxic to the animals and the environment (if they are washed off in the rain and get into the waterways). In some cases, it is easier to support the horse's system to deal with the drugs than to treat chronic LD. In other cases, it is beneficial to use a more natural approach. For example, Guinea hens are effective at removing ticks from the environment, though they are noisy and may not fit with the farm environment. Keeping the grass mowed in the pasture is also helpful.

Topical essential oils and various insect repellent sprays can be helpful but need to be applied frequently. Japanese knotweed root (*Fallopia japonica* or *Polygonum cuspidatum*) appears to be helpful in endemic areas, but cannot be said to guarantee protection. It is non-toxic and therefore safe to add to a prevention program.

Conclusion

The treatment of LD is complex and requires the willingness to keep reevaluating the progress and make changes based on the presenting signs. To prevent relapses and maintain optimal health, attention needs to be directed at managing stress, supporting the immune system, and becoming aware of minor changes in behavior that indicate a horse is not feeling perfect. Tick and insect control is always a challenge and needs to be an integral part of managing the disease. Most horses can be returned to full performance even with chronic LD, but many will require ongoing maintenance. 🌿

Footnotes

- (a) SNAP and SNAP 4Dx; Idexx Laboratories, Westbrook, ME.
(b) Equilite; Arenus, Ft. Collins, CO. <http://arenus.com/supplements/for-your-horse/equilite-herbals/>
(c) US Chia, Louisville, KY; www.uschia.com
(d) Spirolyd Support and Spirolyd Compound, Herbalist and Alchemist; <http://www.herbalist-chemist.com>
(e) Hilton Herbs; Somerset, England; <http://hiltonherbsusa.com>
(f) Clear Spiro, (NP) Or Lyme Formula; (JT)
(g) NP; Natural Path Herbs, Edmonton Canada. US Website <http://www.atimetohealherbs.com>
(h) JT; Jing Tang, Reddick, FL; www.tcvmherbal.com

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Supplement websites

- Noni fruit leather: <http://www.nonifruitleather.net/index.htm>
Medicinal mushrooms: <http://www.fungiperfecti.com/>
Cat's Claw powder:
<http://www.rain-tree.com/products/cats-claw-powder.htm>
Many ethically harvested bulk herbs: <http://www.mountainroseherbs.com/>
Intravenous glutathione: <http://mcguff.com/>
APF, Adaptogen: <http://auburnlabs.com/>
David Winston, Western herbal Lyme formulas:
<http://www.herbalist-chemist.com/>
Vitamin C supplement: <http://www.equilite.com>
JT: Jing Tang; www.tcvmherbal.com
NP: Natural Path herbs available in USA at
<http://www.atimetohealherbs.com>
Hilton Herbs: <http://hiltonherbsusa.com>

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