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### Ticks and Tick-borne Diseases

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We all know that ticks can carry some nasty diseases and, in turn, transmit them to and infect our dogs. In this article we will help you to identify the enemy, avoid these problems where possible, and discuss treatment. Probably, the most widely known tick-borne disease is Lyme disease, but others are equally important. The table shows the most common tick borne diseases in North America.

genus	<i>Ehrlichia</i>	<i>Babesia</i>	<i>Rickettsia</i>	<i>Borrelia</i>
species known to infect dogs	<i>E. canis</i> <i>E. platys</i> <i>E. chaffeensis</i> <i>E. ewingii</i> <i>Anaplasma phagocytophila</i> (formerly <i>E. equi</i> )	<i>B. canis</i> <i>B. gibsoni</i> Theileria spp similar to <i>B. gibsoni</i> in California.	<i>R. rickettsii</i>	<i>B. burgdorferi</i>
causes this disease:	ehrlichiosis	babesiosis	Rocky Mountain Spotted Fever	Lyme Disease

In addition, *Hepatozoon americanum* a protozoal, illness transmitted by the Gulf coast tick is causing illness in dogs in the Southeastern U.S. The tick has to be swallowed by the dog to cause illness. Neorickettsial illness - salmon poisoning caused by *N. helminthoeca* or an ehrlichichia-like illness caused by *Neorickettsia risticii* (formerly *Ehrlichia risticii*) - is also contracted by ingesting the organism in raw fish containing infected flukes and infected snails, respectively.

Leishmaniasis is also a disease we may be hearing more about; it's carried by sandflies. Currently, infection has mostly been seen in foxhounds. Bartonella can also be transmitted to dogs by ticks, fleas and ear mites, but appears to cause serious disease only in cats only and not in dogs.

All of these organisms produce similar illness in dogs. All are intracellular -- they get into and survive inside the dog's blood cells. Most are bacterial, but several are protozoal. Dogs may be multiply-infected, and have more than one of these organisms simultaneously. A single tick bite may transmit multiple species. Infection does not confer lasting immunity; dogs



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can easily become re-infected. Dogs may test positive without showing signs of illness. Veterinarians have not reached a consensus as to whether positive dogs should be treated, although currently if the dog lives in an endemic region, treatment is advised.

These organisms have profound depressive effects on the host's immune system. This is manifested in a lack of antibodies and vulnerability of the infected animal to secondary infections. They can also cause the host to mount immune reactions against its own cells, resulting in the destruction of blood cells or blood cell progenitors in the bone marrow. Joints may become inflamed and swollen, and joint fluid shows all the characteristics of autoimmune polyarthritis. Lyme nephritis – a protein losing disease affecting the kidney and resembling the effects of systemic lupus erythematosus – is being widely reported. Affected dogs may also suffer from other autoimmune disorders such as inflammatory bowel syndrome, myositis, and uveitis. Many affected dogs are reported to suffer from skin "allergies", another indication of immune system dysfunction. At this time, there is no evidence that these autoimmune manifestations require genetic predisposition.

In the early, acute stages dogs are lethargic, off their food, have a fever and swollen lymph nodes. There may be a watery discharge from the nose, increased discharge from the eyes, increased light sensitivity, cough, lameness, joint swelling and pain, recurrent diarrhea, vomiting of bile, loss of weight and muscle mass, and increased thirst. A few dogs have seizures and increased irritability/aggression is also reported. Blood work will show low platelet counts (especially with ehrlichia), anemia (especially with Babesia) – although extremely high red cell, white cell and or platelet counts have also been reported – as well as elevated liver enzymes and low total blood protein in some cases. Low blood glucose can accompany Babesia and make prognosis worse. Most dogs will show one or more sign of infection; however, symptoms may be so mild they are not recognized.

Dogs may enter a sub-clinical stage, during which there are no symptoms and it appears healthy. This can last for weeks or years, especially if the dog's immune system is strong. Stress – physiological or psychological – can weaken the immune system and lead to chronic stage symptoms. At this time, the organisms enter the brain and nervous tissue or various internal organs – liver, spleen, kidneys, uterus, ovaries, testes and/or bone marrow. Because so many systems may be affected, it is usually more difficult to



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identify the cause. The resulting illnesses can be severe and life threatening. These include problems seen with the acute phase of disease, although usually in a more severe form. Facial paralysis (Bell's palsy) and thyroid suppression (including elevated thyroid antibodies) are more common in chronic illness. Infection can also cause a number of reproductive problems, including sterility, abnormal heat cycles, resorption and abortion of litters, as well as puppies born infected. There is some indication that rickettsial infections may have the potential to trigger the development of lymphosarcoma. *Ehrlichia canis* has been associated with meningitis and uveitis in dogs, and Leishmania has been associated with uveitis. Uveitis is inflammation of all or part of the uvea - the vascular layer of the eyeball that includes the iris. It is often the result of autoimmune disease.

Tick-borne infections are commonly misdiagnosed. Symptoms may be very similar to fungal diseases - blastomycosis and Valley Fever. Tick-borne infections may be misdiagnosed as lupus (especially as many result in a positive ANA test), autoimmune hemolytic anemia, idiopathic thrombocytopenia, inflammatory bowel disease, polyarthritis, rheumatoid arthritis – or general "autoimmune disease," lymphosarcoma, leukemia, encephalitis, epilepsy, myositis or even brucellosis.

So, how do we know if our dog is infected and, by what? These diseases show a definite regional distribution, but with our increasingly mobile society they have spread to all of the lower 48 states. If your dog could have been exposed to a tick bite, the possibility of infection is there. A good first attempt at determining if your dog has been infected is the "Snap 3Dx Test" that can be done right at your Vet's office. While its main use is to test for Heartworm infection, it also checks for Lyme and *Ehrlichia canis*. It's a good idea to have this test run routinely at least once a year. If it is negative, you can probably rule out infection with Lyme disease and *E. canis*, unless there are other symptoms; but, dogs that have been vaccinated for Lyme disease will usually test positive and, as we have seen, there are many other tick borne and related diseases, so if your dog does test positive or is showing signs of tick borne disease and tests negative, more extensive testing is definitely called for. The quantitative C 6 assay will distinguish vaccinated from infected dogs. Most tests look for the presence of antibodies to the organism. While high levels indicate infection, low levels may mean the dog has mounted a successful response to the disease or that his suppressed immune system was unable to respond appropriately. Given that the tick borne illnesses cause profound immunosuppression, negative antibody tests



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cannot rule out disease, especially in symptomatic dogs. These tests are also very specific and you may not be testing for the right disease.

Blood smears may pick up organisms causing ehrlichia or Babesia; but, even when the diseases are most active, the number of organisms in the blood is usually low and they are easily missed. Polymerase chain reaction (PCR) testing can be used to look for evidence of organisms in tissues other than blood, e.g. testes, bone marrow; however, it is usually only available at research labs, is highly specific to a particular strain of each disease organism and cannot distinguish live from dead organisms.

What if your dog has shown no symptoms of disease but comes up positive on the Snap test for either Lyme or Erlichiosis? It is probably best to assume your dog is infected if it tests positive and proceed with treatment. Many dogs will display a notably higher energy level once treatment has been started and improved state of health indicating that they were in fact affected. Unless your dog shows symptoms of tick borne disease, it probably is not cost effective to test for each of these diseases routinely. Your vet will know what diseases are most likely in your area; but, be sure to let him know if your dog has been traveling to other areas with you.

The initial treatment for tick borne diseases is usually doxycycline, which appears to be far more effective than amoxicillin. Doses should be high (5mg/pound body weight twice a day) and continued for a minimum of two months. Make sure to give the antibiotic with meals, and adding probiotics (eg PB-8) to replace the normal gastrointestinal flora killed by the antibiotics, may reduce gastrointestinal upset. If your dog shows neurological signs, other drugs, such as minocycline or ceftriaxone (Rocephin), cross the blood brain barrier, while doxycycline does not. Doxycycline is also unable to clear Babesia infections, and the drug of choice is usually imidocarb following pretreatment with atropine. A newer treatment is atovaquone with azithromycin. There is some indication that if treatment is not initiated within a month of infection these diseases may be suppressed but never cleared from the body. It is impossible to tell a flare up from a previous infection from a new infection, and previous infection does not confer any immunity to the dog for future exposure to the infective organism, or to other tick borne diseases.

There is much debate as to whether prednisone and other steroids should be used concurrently with antibiotics in treating tick borne diseases. Steroids



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suppress the immune system, reducing its ability to work with antibiotics to kill the offending bacteria. This may be especially true when treating with doxycycline, which requires that the dog's immune system play an active role in killing the targeted bacteria. Also, many tick-borne infections are quite immunosuppressive. However, many tick-borne diseases trigger a wide array of autoimmune problems in infected dogs. Once triggered, these autoimmune processes may persist after the infecting organism is cleared. Each case must be reviewed to determine the most appropriate treatment. Some dogs may need transfusions. All dogs will benefit from a diet with good quality, easily digestible animal protein.

**VACCINATION:** The first thing to remember is that the only tick borne infection for which vaccines exist is Lyme disease, so the dog will still be at risk for other diseases often transmitted by the same tick. The vaccines are only good for one year **maximum**. The vaccines available all induce antibodies to a protein expressed by the bacteria while the tick is feeding. Once in the dog's body, this antigen is no longer expressed. Some vaccines attempt to induce antibodies to other antigens expressed once the bacterium is in the dog. These change rapidly – one of the reasons the body has difficulty responding to infection unaided. If you decide to vaccinate, I would recommend using the Recombitek Lyme vaccine, which is only effective against bacteria in the tick. Unlike other vaccines, it is not heavily adjuvanted, and as most now know, adjuvants are probably more likely to cause adverse vaccine reactions than the vaccine itself. Vaccinosis reactions and immune-mediated problems can result from these vaccines. If you live in a highly endemic area, you may feel vaccination is advisable. However, other steps must be taken to protect your dog from ticks and the other diseases they carry.

### Prevention of Tick Borne Diseases

While different species of ticks carry these diseases, depending upon the region and disease, prevention is similar for all tick borne diseases. One common misconception is that ticks are mostly in wooded areas. In fact they are found primarily on the ground or the first few inches of vegetation and do not fall from trees.

**TICK REMOVAL:** It is generally believed that disease cannot be transmitted from the tick to an animal for 24 to 48 hours after initial attachment; although, this may not always be the case. No matter what other



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preventative steps you take, you should go over your dog every day and remove attached ticks. To remove the tick, use tweezers or a tick remover. Grip the tick as close to the skin as possible and gently, but firmly, pull the tick straight out. A little alcohol dropped on the head of the tick may cause it to loosen its attachment and make removal easier. Dispose of the tick in alcohol. Disinfect the attachment point. If you've been walking in the woods with your dog, you can often find the ticks crawling on your dog before they attach within the next half hour or so. Just drop them into alcohol.

There are numerous products that can be used for tick control. Be advised that no product is 100% foolproof. Always be sure to apply the product as directed and dispose of containers appropriately. Topicals will come off in the environment and when you pet your dog. As a personal note, I use Frontline Plus and have found attached and live feeding ticks on my dog. The following are products that deter and can kill ticks:

**K9 ADVANTIX:** This is a topical treatment which contains imidacloprid and permethrin. It repels mosquitoes, as well as repelling and killing fleas and ticks. It also kills flea larvae. Studies have shown 100% efficacy in preventing Lyme infection after 25 days under lab conditions. However, in the real world efficacy may be reduced by bathing or frequent immersion in water, and the product may need to be applied more frequently than the label suggests.

**FRONTLINE & FRONTLINE PLUS:** These are topical gels or sprays containing fipronil, the Plus also contains *-(S)- methoprene*, which is a growth regulator and prevents fleas laying fertile eggs. The Frontline products kill fleas and ticks and are good for about 30 days. It was slightly less effective in protecting against Lyme infection in lab tests (about 80%) than K9 Advantix.

Using either of these products should not preclude your checking your dog for ticks. While quite effective, ticks are able to attach and survive to feed, especially on the dog's head. They also control fleas. You should not bathe your dog within 2 days before or after application to ensure the product's effectiveness.

**PREVENTIC TICK COLLAR:** This is a collar which kills and detaches ticks within hours and prevents new ticks from attaching for up to three months. Amitraz (the active ingredient in the tick collar) interferes with the





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tick's metabolism, causing the tick to detach and die. Over a three month period, Amitraz is supposed to be released at the correct, consistent level. Preventic uses the normal oils of your dog's skin and hair as a vehicle to spread the Amitraz over the dog, from head to tail.

REVOLUTION: This product is only effective against the American dog tick and not the other ticks that carry tick-borne diseases. It is a topical containing selamectin, which also controls fleas, heartworm, ear-mite infestation and the intestinal, round and hook worms. Once applied, Revolution enters the bloodstream through the skin. Concentrations of Revolution in the blood and intestinal tract prevent heartworm disease and treat gastrointestinal parasites, respectively. Revolution selectively redistributes from blood to sebaceous glands, which are found below the skin's surface. Revolution's presence in the sebaceous glands and in the skin is the reservoir of drug that provides protection against fleas, flea eggs, ticks and mites.

Tick borne diseases are transmissible via fresh blood. Obviously any animal being used to give blood transfusions should be checked for these diseases, at least to the extent to which they are prevalent in the area in which it lives. It should also be remembered that these diseases are transmissible to humans; an accidental needle stick can cause infection as well as the bite from an infected tick. In general, though, dogs are not carriers for these diseases; they do not have enough of the organism in their blood to infect ticks dining on them, so that they can then infect a person or another dog.

Tick borne diseases are becoming epidemic in parts of the country. In New England about 60% of dogs have been testing positive for Lyme disease since the Snap 3 Dx test came into widespread use. We need to be aware of these diseases and do everything we can to protect our dogs – and ourselves – from infection.