Tick-Borne Diseases

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Tick-borne diseases are a significant concern in companion animal practices. The geographic range in which disease-carrying ticks were historically found has been expanding. While not diseases that can be transmitted between pets and people, most of these ticks are capable of infecting humans and a variety of other species. The tick transmits the disease-causing organisms when it bites dogs, humans, or other suitable hosts. *Francisella, Hepatozoon*, and a number of viruses can also be transmitted by tick vectors.

The most commonly encountered tick-borne diseases are:

- Anaplasmosis
- Babesiosis
- Ehrlichiosis
- Borreliosis
- Rocky Mountain Spotted Fever

Risk factors include frequent exposure to tick habitat, such as seen with hunting dogs. Cats are rarely infected due to the fastidious grooming habits of most cats. Most incidence of disease occurs during spring through fall seasons when the ticks are most active. Clinical signs of infection can be variable and non-specific and other organisms may also be transmitted that will influence clinical signs. A history of tick attachment along with fever and lethargy may prompt investigation into tick-borne illness. It is helpful to have the client bring or describe the tick as well as provide information regarding the length of time the tick was attached to the pet.

Anaplasmosis

The causative agents of canine anaplasmosis are *Anaplasma platys* (formerly referred to as *Ehrlichia platys*) and *Anaplasma phagocytophilum* (formerly referred to as *Ehrlichia equi*, *Ehrlichia phagocytophila* and the human granulocytic ehrlichiosis (HGE) agent). The organisms are gram-negative, non-motile, obligate intracellular rickettsiae that primarily infect granulocytes, particularly neutrophils. The organisms replicate inside the blood cell, forming the morula. Clinical signs include fever, anorexia, splenomegaly, hepatomegaly, and CNS signs. Thrombocytopenia is common.

Primary vectors are ticks of the genus *Ixodes A. marginale*, which causes hemolytic anemia in cattle, is primarily transmitted by ticks of the genus *Dermacentor* and *Rhipicephalus (Boophilus). Rhipicephalus sanguineus* has also been implicated in transmission of canine anaplasmosis. Reservoir hosts include mice, chipmunks, squirrels, deer and coyotes. Minimum feeding time for transmission of the organisms is 24 hours and the incubation period is one to two weeks.

Ehrlichiosis

The primary causative agent of canine ehrlichiosis is *Ehrlichia canis*. The gram-negative obligate intracellular rickettsial organism primarily infects monocytes, but may also be seen in granulocytes. Infections have rarely been seen in cats. The primary vectors are *Rhipicephalus sanguineus* ticks. Reservoir hosts include the coyote, fox, and domestic dogs. Granulocytes of dogs can also be infected with *E ewingii*, which are transmitted by the lone star tick, *Amblyomma americanum.(*Figure 1*)* White-tailed deer and dogs are reservoir hosts. Infections with E. canis are characterized by high fever, anorexia, lymphadenopathy, CNS signs. Thrombocytopenia, leukopenia, anemia, and proteinuria also occur.

Figure 1.
Dorsal view of a female "lone star tick", *Amblyomma americanum* CDC/ Dr. Amanda Loftis, Dr. William Nicholson, Dr. Will Reeves, Dr. Chris Paddock

Babesiosis

Canine babesiosis is caused by the protozoal organisms *Babesia canis* and *Babesia gibsoni*. The pear-shaped trophozoites of *B. canis* can be seen in canine red blood cells and are typically in pairs. Three sub-species of *B. canis* have been identified: *B. canis canis*, transmitted by *Dermacentor reticulatus*; *B. canis vogeli*, transmitted by *R. sanguineus*; and *B. canis rossi*, transmitted by *Haemaphysalis leachi*. The sub-species seen in North America are *B. canis canis* and *B. canis vogeli.* An attachment time of at least 24 hours is needed for transmission of the organisms to the host. Direct transmission via dog bites is also believed to occur. The incubation period is approximately 1 to 3 weeks.

Mild fever, thrombocytopenia, and petechiae usually occur. Clinical signs can also include depression, anemia, anorexia, lethargy, and splenomegaly. Diagnosis is generally dependent on identifying the organism within the red blood cells. IFA and PCR testing is

also available to confirm a diagnosis. Infection is characterized by depression, anemia, anorexia, lethargy, and splenomegaly. Treatment with imidocarb dipropionate or azithromycin is usually successful at clearing the parasite.

Babesia gibsoni is a smaller organism that generally occurs singly within the red blood cells. It can be transmitted by *R. sanguineus*, *Haemaphysalis bispinosa*, and *Haemaphysalis longicornis* ticks but bite wound infection is thought to be the most common mode of transmission. Clinical signs include fever, hemolytic regenerative anemia, thrombocytopenia, splenomegaly, lymphadenomegaly, anorexia, lethargy, and vomiting. *Babesia conradae* is another small form of *Babesia* is found in dogs and occurs in southern California.

Lyme borreliosis

The causative agents of Lyme Borreliosis are a group of related spirochetes. Borrelia burgdorferi sensu stricto is the primary one found in the United States. Vectors are the hard-shelled ticks, Ixodes scapularis (Figure 2) and Ixodes pacificus. Attachment time of at least 24 hours is thought to be needed for the organism to be transmitted. The disease may be asymptomatic or may manifest as acute arthritis with lameness. Fever, anorexia,lymphadenopathy, and depression may occur. If untreated, the disease may progress to fatal renal failure. Patients respond well (within 3-4 days) to antimicrobial therapy. Lyme borreliosis is the most commonly diagnosed vector-borne disease in people. Diagnosis is often based on history, clinical signs, and response to antibiotic therapy.

Figure 2.
These "black-legged ticks", *Ixodes scapularis*, are found on a wide range of hosts. CDC/ Michael L. Levin, Ph. D.

Rocky mountain spotted fever

The causative agent of Rocky Mountain Spotted Fever is the rickettsial agent, *Rickettsia rickettsia*. Vectors include *Dermacentor variabilis*, *Dermacentor andersoni* (Figure 3), *Rhipicephalus sanguineus*,(Figure 4) and *Amblyomma cajennense*. Reservoir hosts include wild rodents and canines. Infection with *R. rickettsia* causes a severe and sometimes fatal illness. The organisms can be transmitted in after as little as 5 hours of tick attachment and the incubation period varies from a few days to two weeks. The organisms infect the epithelial cells of small blood vessels. The subsequent blood vessel damage leads to petechial and ecchymotic hemorrhage of the skin and other organs. Thrombocytopenia is common. Other clinical signs include anorexia, lymphadenopathy, polyarthritis, coughing or dyspnea, abdominal pain, vomiting and diarrhea. Diagnosis requires IFA testing. Fatality rates can be as high as 10% in dogs. Human infections exhibit fatality rates as high as 20%.

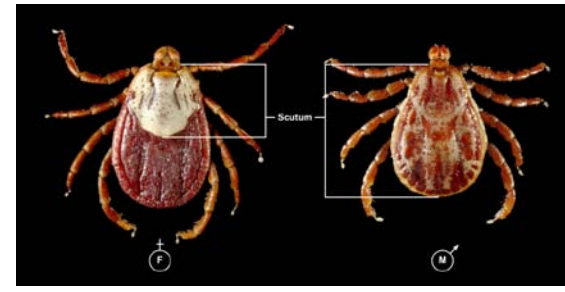

Figure 3
Dorsal view of male and female *Dermacentor andersoni***.** CDC/ Dr. Christopher Paddock

Figure 4
Festoons along the posterior abdominal margin of this North American hard tick of the genus *Rhipicephalus*. CDC

Diagnosis

Diagnosis of tick-borne diseases generally involves visualization of the organisms on a peripheral blood smear in combination with laboratory testing and clinical signs. An ELISA test is commercially available that will demonstrate presence of antibodies to a number of organisms that cause tick-borne diseases. Indirect fluorescent antibody (IFA) assays and polymerase chain reaction (PCR) tests are also available to referral laboratories to confirm a diagnosis.

Tick identification

Ticks are usually identified by the shape and length of the capitulum (mouthparts), the shape and color of the body, and the shape and markings on the scutum. Male and unengorged female ticks are easier to identify than engorged female ticks. Identifying the species

of larval or nymphal ticks is extremely difficult. The common species can be identified by their size, shape, color, body markings, host, and location on the host.

Treatment

A variety of antimicrobials are used for treatment of infections with tick-borne diseases, including Doxycycline, Imidocarb, Clindamycin, and Enrofloxacin. Response to therapy varies depending on the presence of concurrent related infections and overall patient physical status. Many dogs will show improvement within 48 hours of the start of antimicrobial therapy. Therapy may not completely eliminate the organisms and infected animals may develop recurrence of clinical signs.

Control of infection requires focus on avoiding exposure to the tick vectors. Attached ticks should be promptly removed and saved for later identification or photographed. Tick collars and topical tick control medications are recommended for those dogs at highest risk of exposure to ticks (i.e. hunting dogs and other outdoor dogs in tick-infested areas).

Summary

A large number of viral, bacterial, and protozoal agents can be transmitted to both pets and people. Many of these can cause severe disease. Diagnosis is complicated by the fact that the tick vectors can transmit more than one type of infectious organisms simultaneously. This may account for the wide variation in severity of disease.

References available from the author.