Tickborne Infections

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KEYWORDS

• Tickborne infections • Lyme disease • Ehrlichia • Anaplasma • Babesiosis
• Rocky Mountain spotted fever

KEY POINTS

- Tickborne infections are increasing throughout the United States, and diagnosis can be missed if appropriate history and physical examination are not done.
- Appropriate testing is essential for diagnosis of most tickborne infections.
- Empiric therapy with appropriate antibiotics should not be delayed if patient is ill and suspicion for tickborne infection is high.
- Patients do not always remember a tick bite. This should not influence testing and treatment if history is concerning for tickborne infection.

INTRODUCTION

Tickborne diseases are found throughout the United States and the world, and can be caused by bacteria, viruses, or parasites. Many tickborne illnesses, including Lyme disease, *Ehrlichia*, and anaplasmosis, are increasing owing to improved diagnostic methods, increasing human population, and the sprawl of habitation into previously rural areas. Tickborne diseases are serious health problems affecting hundreds of thousands of people in the United States each year.[1] From 2013 to 2016, the Centers for Disease Control and Prevention has increased the number of reported Lyme cases in the United States from 30,000 to 300,000; a 10-fold increase.[1]

Diagnosing a tickborne illness can be challenging, because symptoms are often vague, like headache, fever, and malaise, which can mimic other illnesses. Many patients do not remember a tick bite or rash, and travel history is not always obtained by the clinician, leading to a delay in treatment and increase in morbidity and mortality.

This article concentrates on the most common tickborne diseases affecting the United States today—Lyme disease, *ehrlichiosis and anaplasmosis*, babesiosis, and Rocky Mountain spotted fever (RMSF). New tickborne diseases, such as Powassan disease, heartland virus, and southern tick-associated rash illness are emerging and research is ongoing. Previous well-circumscribed boundaries for endemic tick areas are changing as our population grows and our environment changes. Clinicians face

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the challenge of diagnosing and treating regional tickborne illnesses, but also keeping current with updates and emerging infections.

LYME DISEASE

Lyme disease is a bacterial infection, caused by the spirochete *Borrelia burgdorferi*, and transmitted by the black legged or deer tick (*Ixodes scapularis*). It is the most common tickborne infection in the United States, with about 300,000 cases diagnosed annually.[1,2] Lyme disease is most commonly reported in New England, mid-Atlantic states, and north central United States. Less commonly, it is found in the western United States, where it is transmitted by the western blacklegged tick, *Ixodes pacificus*. Of interest, although Lyme disease has been reported in 48 states, data suggest that cases are concentrated in 13 states (Connecticut, Delaware, Maine, Maryland, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Vermont, Virginia and Wisconsin), with the highest incidence annually in Pennsylvania.[1]

Lyme disease occurs throughout Europe, where it is caused by *Borrelia afzelii* and *Borrelia garinii*, and transmitted by the sheep tick *Ixodes ricinus*.[3] The *I scapularis* tick may also transmit *Anaplasma phagocytophilum*, which causes human granulocytic anaplasmosis (previously called ehrlichia) and/or *Babesia microti*, which causes babesiosis.[4] A bite from an infected tick may lead to any of these infections or, less frequently, coinfection. The most common reservoirs for *B burgdorferi* are white-tailed deer, mice, chipmunks, birds, and other small mammals. Mosquitoes are not vectors for Lyme disease.

Etiology

Most cases of early Lyme disease occur during spring and summer when ticks are feeding, but tick bites can occur throughout the year. Most often, disease is transmitted by ticks in the nymphal stage, although female adult ticks can transmit bacteria as well. Although the nymphal I. scapularis tick is more likely to be infected with B burgdorferi, adult ticks are larger and are likely to be noticed and removed more quickly (**Fig. 1**). It takes at least 2 hours for ticks to attach to the skin, and the most common attachment sites are legs, back, groin, axilla, and waist.[3] In children, the head, scalp, and neck are frequent sites of tick bites. *B burgdorferi* bacteria lives in the midgut of ticks, and must replicate and migrate to the salivary glands to be transmitted with the tick bite.[3] For this reason, it takes 36 to 48 hours after the tick attaches to be infected with *B burgdorferi*. Lyme disease cannot be transmitted from person to person.[1] Dogs and cats can become infected from a tick bite, but there is no evidence that they transmit Lyme disease to humans, although if a tick is present it can move to a human host.

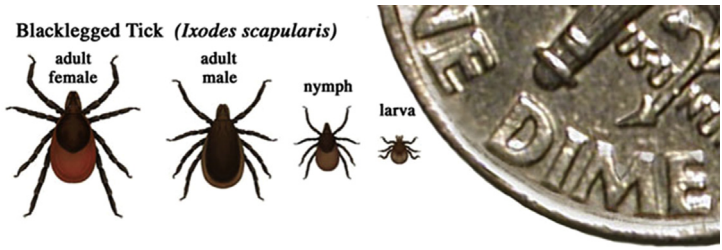

Fig. 1. Blacklegged tick life stages. (*Courtesy of* the Centers for Disease Control and Prevention.)