

Recognition of and Prompt Treatment for Tick-Borne Infections in Children



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KEYWORDS

- Tick-borne infections • Rocky Mountain spotted fever • Ehrlichiosis • Anaplasmosis
- Lyme disease • Tularemia • Babesiosis • Doxycycline

KEY POINTS

- Tick-borne infections occur more often than is generally recognized, and they frequently present with nonspecific clinical findings.
- In cases of suspected tick-borne rickettsial infections, specific antimicrobial therapy should be initiated promptly, without depending on results of confirmatory laboratory tests.
- Doxycycline is the drug of choice for treatment of tick-borne rickettsial infections, even in young children.
- Prevention of tick-borne infections depends on decreasing the likelihood of tick attachments and promptly removing attached ticks.

INTRODUCTION

A variety of tick-borne infections are endemic in North America. This review focuses on widely prevalent diseases for which specific antimicrobial treatment is available—namely, Rocky Mountain spotted fever (RMSF), ehrlichiosis, anaplasmosis, Lyme disease, tularemia, and babesiosis. Other regionally important tick-associated illnesses on this and other continents are not emphasized. Our aim is not to provide exhaustive reviews of these diseases, but rather to highlight concepts that apply broadly to the care of patients with suspected tick-borne illnesses. Although children are the focus of this review, the principles underscored are largely applicable to adults as well.

Dr S. Mukkada and Dr S.C. Buckingham have nothing to disclose.

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ETIOLOGIC AGENTS AND VECTORS

Etiologic agents of North American tick-borne diseases include rickettsiae (intracellular gram-negative coccobacilli, including *Rickettsia*, *Ehrlichia*, and *Anaplasma* spp.), spirochetes (*Borrelia* spp.), other bacteria (eg, *Francisella tularensis*), protozoa (*Babesia* spp.) and viruses. The causative organisms, vectors, geography, and prominent clinical findings of the diseases emphasized in this review are summarized in **Table 1**.¹⁻⁴ Similar data are provided for selected additional North American tick-borne infections in **Table 2**.

Tick-borne diseases occur across vast areas of North America, although not all diseases occur in all regions. Although it was first described in the northern Rocky Mountains, RMSF cases are most heavily concentrated in the southeastern, south-central, and mid-Atlantic regions of the United States (**Fig. 1**). RMSF has been reported in all US states except Alaska and Hawaii, as well as in Mexico and throughout Central and South America (where it is also known as Brazilian spotted fever). Ehrlichiosis cases are also most frequent in the southern and mid-Atlantic regions. Unlike RMSF, however, ehrlichiosis only occurs within the geographic range of the Lone Star tick, which runs eastward from the Great Plains (**Fig. 2**).^{1,2}

By contrast, Lyme disease occurs most frequently in northeastern and upper Midwestern states, with scattered endemic cases in the Pacific Northwest (**Fig. 3**). Reports of Lyme disease from nonendemic regions generally represent either acquired illnesses in travelers returning from Lyme-endemic areas or false-positive serologic results in patients inappropriately tested for Lyme disease. In the southern United States, a disease has emerged—named, fittingly enough, the Southern tick-associated rash illness (STARI)—that mimics the early localized rash of Lyme disease (see **Table 2**). Anaplasmosis and babesiosis follow geographic distributions similar to Lyme disease.^{2,3}

Unlike the aforementioned diseases, tularemia is associated not only with multiple tick vectors, but also with numerous other arthropods and mammals (most notoriously, rabbits). Tularemia is widely distributed across North America, although cases are relatively concentrated in the south-central United States (**Fig. 4**).^{2,5}

EPIDEMIOLOGY

Tick-borne infections occur more frequently than is generally recognized. For example, data from the southeast and south-central United States indicate that more than 10% of children have serologic evidence of prior rickettsial infections.^{6,7} The gap between seroprevalence and reported cases may be related to missed diagnoses as well as cross-reactions to other rickettsiae of uncertain pathogenicity.

Seasonality

Most tick-borne infections occur between April and October, when both tick and outdoor human activity are at their peaks; however, these infections do occur all year, even in regions with cold winters. Ixodid ticks live for 2 years, and although they are less active during winter months, they are not necessarily killed by cold weather.⁸ Underscoring this point, 4% of RMSF cases, 3% of ehrlichiosis cases, and 3% of anaplasmosis cases reported to US Centers for Disease Control and Prevention (CDC) from 2000 to 2007 occurred during the months of December, January, or February.^{9,10} Indeed, 9% of all RMSF cases from New York, New Jersey, and Pennsylvania were reported during these months.⁹

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