

Lyme Disease and Rocky Mountain Spotted Fever: Diagnosis, Prevention, and Management

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ABSTRACT

Most reported cases of Lyme disease and RMSF occur in the spring and summer months when tick infestations reach their peak. The primary care physician can play an important role during peak periods by remaining vigilant to early signs of both Lyme disease and RMSF. Although both Lyme disease and RMSF are treatable, clinicians should be aware of early signs of both diseases to help reduce long-term complications. Patients should also be encouraged to adopt personal protective measures to minimize exposure to ticks and, thus, either of these diseases. The following is a comprehensive overview in which pertinent diagnostic aspects of each disease are highlighted with a particular emphasis placed upon the role of the primary care physician in treating and minimizing the risks of Lyme disease and RMSF.

Key Words: Lyme Disease, Rocky Mountain Spotted Fever, *Rickettsia rickettsii*, American dog tick, *Dermacentor variabilis*, Ixodes tick, *Borrelia burgdorferi*, spirochete, tick-borne disease

Rocky Mountain Spotted Fever (RMSF)

Incidence

3.8 cases per 1 million persons in 2002.^{1,2} Over 90% of patients with Rocky Mountain spotted fever are infected during summer months (Table 1).¹ Is most common in the Southeastern United States.¹

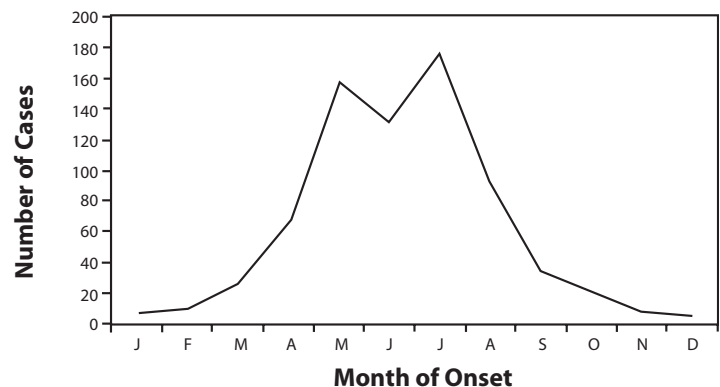
Mortality

The overall mortality rate is currently 1.4%²; however, the case-fatality rate can be as high as 4.8% in children under the age of 5.²

Discussion

Rocky Mountain spotted fever (RMSF), the most severe of the rickettsioses, is a serious tick-borne disease that is endemic in the United States.³ It is caused by *R. rickettsii* and is transmitted

Table 1: Monthly Case Distribution of RMSF in 2002¹



by *Dermacentor andersoni* (wood tick) or *Dermacentor variabilis* (dog tick).⁴ Although it is most commonly known as a cause of fever and rash, it can have systemic manifestations.³ The initial presentation of RMSF is often nonspecific and may resemble many other infectious and non-infectious diseases and can represent a diagnostic challenge.⁴ The classic triad for the disease is rash, fever, and history of being bitten by a tick. Unfortunately, these findings are present in less than half of cases and only in the early clinical presentation.^{2,4} Most patients will complain of fever (98%), rash (97%), nausea and/or vomiting (73%), and headache (61%), but can also present with no sign other than the rash (>50%).⁵ Furthermore, although the dog tick is responsible for most cases of RMSF, less than half of those infected report antecedent tick bites.⁵

The rash seen in RMSF is characteristically macular, spotted (petechial), and begins on the ankles and wrists and then generalizes throughout the body.⁶ This, perhaps, is due to the fact that the clinical picture changes according to how long prior to admission the tick bite occurred.^{6,7,8} For example, in patients presenting within the first two weeks after the tick bite, typical symptoms would be very elevated fever (often greater than 101), headaches, and constitutional symptoms such as myalgias, anorexia, diar-

rhea, or vomiting.^{6,7} As a result of the nonspecific nature of such symptoms, patients living in endemic areas, who present with high fever and a history of tick bite, should be considered for the disease.⁸ Between 60-80% of patients presenting two weeks or longer after the tick bite will have the characteristic rash along with the aforementioned nonspecific symptoms.^{1,8}

Diagnosis

Laboratory confirmation of the diagnosis can be attained via immunofluorescence assay (IFA), complement fixation, latex agglutination, or immunodetection to detect bacterial antigens in a skin biopsy specimen.^{2,8} Unfortunately, no rapid diagnostic test currently exists for RMSF and serologic confirmation of the disorder often requires serum obtained at least two weeks after onset of symptoms.² Furthermore, culture of *Rickettsia* can only be done via specialized laboratories and often requires two weeks for confirmatory results.^{2,9} However, the rapid progression of the disease and the associated mortality make empiric therapy a standard of therapy even in the absence of serologic confirmation.^{8,9} Delays in diagnosis and initiation of appropriate therapy are unacceptably common in RMSF, and, as a result, patient outcomes are often suboptimal.^{2,5} This is particularly troubling since up to 14% of infected individuals will develop neurologic deficits.⁵

The lack of knowledge of RMSF among clinicians can be responsible for the diagnostic shortcomings. For instance, a recent study demonstrated that only 21% of family practice physicians and 25% of emergency medicine physicians surveyed were able to correctly identify the drug of choice for treating RMSF.⁸ Continuing efforts to educate first responders and primary care physicians on the intricacies of the disorder should focus on appropriate selection of antibiotics and prompt initiation of empiric prior to the onset of rash in suspected patients.^{8,9}

Treatment

The current treatment of choice for RMSF is 200 mg of doxycycline b.i.d until three days after resolution of fever.^{2,10} Given the high mortality associated with the condition, it is recommended that doxycycline be prescribed empirically in all suspected cases.⁹ The only exception is pregnant women for whom doxycycline should be avoided.¹¹ Oral chloramphenicol therapy remains the only effective alternative in treating pregnant women with RMSF.^{2,8,11} All individuals suspected of the condition should receive prompt antimicrobial therapy to avoid potentially fatal complications.^{9,11}

Lyme Disease

Incidence

There are 29.2 cases per 100,000 population with 93% of those cases occurring among residents in ten states, mostly in the northeastern United States.¹²

Mortality

Lyme disease is rarely fatal.

Discussion

Lyme disease is a multisystem inflammatory condition caused by the organism *Borellia burgdorferi*, which is transmitted to humans by the bite of infected Ixodes ticks.¹² The disease exists in three distinct clinical stages, but clinical features and symptoms of stages may overlap.¹³ Stage I describes early localized Lyme disease, whose common features include flu-like symptoms, chills, headaches along with erythema migrans (EM) or a circular red rash that tends to generalize from the site of the tick bite.^{12,13} Although EM characteristically exists as a solitary lesion, in up to one-fourth of patients, multiple annular lesions may also develop. Stage II or early disseminated Lyme disease describes the clinical features of the disorder several weeks to months after being infected.¹⁴ Characteristic clinical features of Stage II include intermittent pain and swelling in the joints, especially the knees, weakness in the extremities as a result of neurologic deficits, and arrhythmias.¹⁵⁻¹⁷ Stage III or late persistent Lyme disease is often accompanied by chronic arthritis, numbness and weakness in the limbs, and pericarditis.¹⁵⁻¹⁸ Increased risk of chronic neurologic and cardiac complications accompanies the onset of Stage III of the disease.¹⁷⁻¹⁸

Diagnosis

Recognition of salient clinical signs and accompanying history of exposure are important to accurately diagnose the condition. The current diagnostic paradigm recommended is utilization of immunosorbent assay (ELISA) or immunoblotting, two techniques considered essential for diagnosis.^{16,19} Although it can be confirmatory, culturing *B. burgdorferi* from patient serum or skin specimens has proven largely ineffective.^{20,21} Assessing serum for specific antibodies against *B. burgdorferi* can be an effective adjunctive diagnostic test, especially four to six weeks after onset of symptoms when such antibodies peak in number.^{20,21}

Treatment

Since the preponderance of patients with early Lyme disease can be cured with the appropriate therapy, the major goal of therapy in the disease is to eliminate the causative organism.²² Lyme disease tends to be most responsive to therapy, particularly when treatment is initiated early in the course of the disease. The treatment of choice for the disorder consists of oral doxycycline 100 mg b.i.d for 21 days or oral amoxicillin 500 mg t.i.d for 21 days.^{15,22} Treating patients in later stages of Lyme can pose a challenge. However, treatment of Lyme-induced meningitis with intravenous penicillin G has demonstrated promising results.^{15,16} Further, Lyme-induced arthritis has been successfully treated with oral antibiotics in the past.^{16,23}

Prevention

Contrary to popular belief, both Lyme disease and RMSF can occur throughout the country. As with any tick-borne disease, all patients, especially those living in endemic areas, should be encouraged to adopt the following protective measures:²⁴⁻²⁸

- 1) Avoid sandals or open-toe shoes;
- 2) Wear light-colored garments for easier identification of ticks;
- 3) Spray tick repellent on exposed skin and over clothing;
- 4) Wear long-sleeve shirts and long pants whenever possible;
- 5) Tuck shirt into pants and pants into socks to prevent ticks from reaching exposed skin;
- 6) Wear a hat;
- 7) Check body for ticks at least once a day (especially in inguinal regions, on the scalp, and behind the neck);
- 8) Avoid tick-infested areas, especially during peak months (spring/summer);
- 9) Wash and dry clothing in high temperature in order to destroy lingering ticks;
- 10) Clear vines, leaves, or woodpiles around the home, as they can provide shelter for ticks.

Conclusions

Although both RMSF and Lyme disease tend to be most common to specific geographic locales, both diseases can occur throughout the United States. Since the spring and summer months coincide with peak infestation of the ticks responsible for the two diseases, clinical awareness coupled with clinical preparedness can be instrumental in early recognition of these two diseases. Early diagnosis of both RMSF and Lyme disease is critical, since untreated infection may cause irreversible damage to the central nervous and cardiovascular systems.

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