Tick-Borne Illness In Rhode Island – How Big a Problem Is It?

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ABSTRACT

Rhode Island is a state with a high incidence of tick-borne diseases, specifically Lyme disease. The *Ioxedes* tick which serves as vector for the three most common tick infections is endemic in both the New England and mid-Atlantic regions. However, differences in the density of infections exist within Rhode Island (RI), with the highest densities in the southern counties. Tick-borne diseases can have varying presentations, as well as varied response to appropriate treatment leading to many questions and confusion for patients, clinicians, and the public itself.

KEYWORDS: tick-borne illness, Lyme disease, TBDs, anaplasmosis, babesiosis

INTRODUCTION

In the United States, tick-borne diseases (TBDs), including borrelioses (Lyme), anaplasmosis, and babesiosis, are on the rise.[1] The three mentioned are significant causes of disease in the New England region including in RI. The reasons for this increase are multifactorial, including changes in the deer and mice population and the movements of humans into areas heavily populated by both host animals and the tick vectors.[2] All three of these TBDs are transmitted by the same vector in our region, the hard bodied *Ioxedes scapularis* tick, with infectivity concentrating in the summer months. Given the same vector for these infections, patients can be co-infected with more than one of these infections. Studies show an approximately 10% co-infection rate.[3,4] The clinical presentations of either of these diseases can vary among patients with many nonspecific acute symptoms such as fever, arthralgias, headache, and fatigue, to later presentations with arthritis, neurologic and other symptoms. Because of this, the diagnosis can be missed early on if TBDs are not considered. Of the three, Lyme disease is the most difficult to diagnose and treat appropriately given the different stages of presentation.

Early Lyme disease presents within the first 30 days from the tick bite and can be localized or disseminated. Localized presentation with the characteristic erythema migrans rash is the classic presentation. This is diagnosed clinically with supportive epidemiologic history as Lyme serology can be negative in this acute stage of infection. Early disseminated infection presents with objective findings of either arthritis, neurologic (e.g., cranial nerve palsy or meningitis), or carditis with heart block. These presentations are diagnosed by clinical findings, epidemiologic history and positive Lyme serology with two-tier testing of EIA and Western blot. Late Lyme disease most often presents with arthritis, or less common neurologic findings with encephalitis or neuropathy. This presentation occurs months to years after the tick bite. Diagnosis in this stage is most dependent on positive serology with both EIA and Western blot IgG. In terms of late neuroborreliosis, CSF analysis should be abnormal with a positive Lyme CSF index.[5] In addition to early and late Lyme stages, much debate has been around the post-Lyme disease syndrome or post-treatment Lyme disease syndrome (PTLDS). The clinical definition for post-Lyme disease syndrome is a clear objective history (i.e., positive serology) of prior Lyme infection and ongoing symptoms of joint pain, fatigue, or others after appropriate antibiotic treatment.[6] This can mimic many illnesses given its myriad of manifestations. Careful evaluation of the history of the illness, tick exposure, and consideration of concurrent disease is needed.

With the varying times and types of presentations for TBDs, diagnostic tests, specifically serology, are needed to aid in decision-making. However, the limitations of these tests can lead to varying interpretations of results by clinicians and to different treatment plans that, for the most part, are not strongly supported by evidence-based medicine. Research in the treatment of TBDs that do not fit the classic presentation is lacking, specifically in the late Lyme presentations. (**Table 1**) Without significant evidence-based

Table 1. Priorities for research on tick-borne disease

• Evaluation of current diagnostic tests
• Development of new diagnostic tests with better performance characteristics
• Evaluation of current treatment regimens for the different tick-borne diseases
• Characterization, diagnosis, and treatment of late Lyme disease
• Evaluation and treatment of post-treatment Lyme disease syndrome (PTLDS)
• Characterization of post-infectious inflammatory syndromes associated with Lyme disease
• Prevalence of novel or recently discovered tick-borne diseases (e.g. *borrelia miyamotoi)*

results, the guidelines for management of TBDs, particularly Lyme, are varied across different medical groups. This continues to add to the public's confusion of the management of Lyme disease and other TBDs and the frustration and suffering at the individual level of the patient. Adding to the many unknowns of TBDs and its higher prevalence in our region is the discovery of other infections being transmitted by these vectors. For example, in 2013 the first reported cases of *Borrelia miyamotoi* in the United States occurred in New England, including one case in RI, with presentation of relapsing fever and meningitis.[7,8]

Rhode Island and the Nation

Lyme disease (*Borrelia burgdorferi)* is the most common tick-borne infection reported in the US, with around 30,000 cases reported to the CDC annually. However, this is thought to be a significant underestimation of actual cases with the CDC reporting in August 2013 that the number of Lyme infection cases is approximately 300,000 nationwide.[9] This new estimation comes from the culmination of three ongoing studies that collects information from medical claims, clinical laboratories, and patient self-reporting, respectively. This ongoing effort to more accurately determine the burden of disease points to its importance among public health concerns.

Anaplasma (*Anaplasma phagocytophilum)* formerly known as *Ehrlichia phagocytophilum* is the second most common TBD reported in the US since its discovery in the 1990s. Over 10 years (2000 to 2010), the incidence rose from 1.4 cases per million to 6.1 cases per million. In 2010, a total of 1761 cases were reported.[10] The same hard bodied tick (*Ioxedes scapularis)* serves as the vector for anaplasma which explains the similar geographic distribution of anaplasma to Lyme. Babesia is less common with only 911 cases reported in 2012. Only 22 states conduct surveillance on babesia with the majority in the upper Midwest and the Northeast.[11] However, the majority of infected individuals have a brief febrile illness or nonspecific symptoms for which they do not seek medical attention, thus the true incidence of disease is unknown.

Regional Impact

The majority of Lyme disease cases are limited to the northeast and east coast of the US. In 2013, cases from New England made up 39% of the reported cases while the Mid-Atlantic comprised 34%. Rhode Island and its neighboring states continue to carry a significant burden of Lyme disease in the country. (**Table 2**) Within New England, the states reporting the highest number of Lyme disease cases in 2013 included Massachusetts (1319), Connecticut (840) and New Hampshire (396).[12] The incidence of Lyme disease in RI for 2012 was 12.1 (per 100,000), with higher incidence rates in nearby states: MA 51.1, CT 46.0, ME 66.6, and NH 75.9. There are 34 states that have an incidence of less than 2.0 for Lyme disease, highlighting the burden faced by this region of the country.[13] Anaplasmosis and babesiosis contribute to a number of TBD cases in the New England area as well. Nationwide, there were 1761 cases of anaplasma and 911 cases of babesia in 2012. Of the anaplasma cases, 90% occurred in six states: New York, Connecticut, New Jersey, Rhode Island, Minnesota, and Wisconsin. Similarly, babesia affected mostly New England states. The 911 cases reported in 2012 occurred in 14 states; however 96% of them occurred in seven states: NY, CT, NJ, RI, MN, WI, and MA. Given that babesia only recently became a notifiable disease in 2011, the total number of cases may be underreported in the New England region as well as other parts of the country. Both historical and current data show that a large number of cases of Lyme disease, anaplasmosis, and babesiosis were reported in New England, especially in Rhode Island's neighboring states. As such, Rhode Island has the potential for higher disease burden given its geographical location in the New England region.

Table 2. Incidence of Lyme disease by state and county in 2012.

	Incidence (per 100,000)
Connecticut	46.0
Maine	66.6
Massachusetts	51.1
New Hampshire	75.9
Rhode Island	12.1
Bristol County	*14.0*
Kent County	*16.9*
Newport County	*25.3*
Providence County	*13.7*
Washington County	*59.1*

Within RI

There is a high variation among the different counties in RI. (**Table 2**) So though overall, the state reports a higher incidence of Lyme, as well as other TBDs, certain counties have a higher density of infection that drives the statewide incidence above the national averages. Lyme infections are the most often reported TBD in RI, with 217 cases reported in 2012. This is an incidence of 20 per 100,000 people. The demographics of those infected show two age peaks among the population: ages 5 – 9 and ages 50+. There is a seasonality effect of overwhelming majority occurring in June and July, correlating with the summer months and increased activity of both tick vectors and people. The raw total number of cases shows Providence County to be most affected with 86 cases in 2012, followed by 75 cases in Washington, and 28 and 21 cases in Kent and Newport counties. However the incidence rates show a significantly higher density of Lyme disease in Washington County: 59.1 (per 100,000) compared to Providence County: 13.7. Newport and Kent counties also had higher incidence rates of 25.3 and 16.9 respectively.[14]

The findings for both anaplasma (ehrlichia) and babesia are similar with higher density of infection in the southern counties of Washington and Kent. The statewide incidence of anaplasma is reported at 10.2 per 100,000 for 2012 with a raw total number of 107 cases. However, on the county level Washington has an incidence of 30.7 and Kent with a rate of 20.5, while Providence County had a much lower incidence at 4.6.[15] Reported babesia cases per county follow the same trend, with a statewide incidence of 5.3 per 100,000 in 2012, and Providence County with a lower rate of 1.4. Washington, Kent, and Newport counties have incidence rates of 23.6, 6.0 and 6.0, respectively.[16]

Review of the surveillance data available for the years 2010-2012 shows that overall there has been a rise in reported Lyme and anaplasma cases statewide, though much more heavily concentrated in the aforementioned counties. Contrary to this, reported cases of babesia have declined in this same time period. However, similar to the national CDC data, these are likely underestimations of true burden of disease given that it is only through passive surveillance that these numbers are collected. The trends that are seen in terms of increasing cases and higher density of infections in southern counties can help to inform the medical and lay community on the burden of TBDs here in RI, but the true weight of that burden is likely unknown at this time.

CONCLUSION

As described above, RI has a higher burden of tick-borne infections compared to the majority of the United States, though not as severe as its neighboring states. It is important to be aware of the magnitude of the burden of TBDs faced in this region which is compounded by the many questions unanswered with Lyme disease and other TBDs. The difficulty in diagnosis particularly in late-presentation cases, the varied response to appropriate treatment, as well as the ongoing symptoms in select patients despite treatment are just a few of the questions faced by clinicians and patients. TBDs are an important public health concern given the gaps in the knowledge of these diseases and their outcomes, and the high prevalence among our community.

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