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Tick borne illness—Lyme disease

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ABSTRACT

Lyme disease is the most commonly reported tick-borneillness in the United States. Thecausative spirochete, *Borrelia burgdorferi* is transmitted by 4 species of Ixodes tick species. Over 90% of US cases occur in northeasternstates from Maine to Virginia, and in Wisconsin, Minnesota, and Michigan. Infection also takes place in northern California and Oregon. Lyme borreliosis is also diagnosed in parts of Europe, China, and Japan. The white-footed mouse is the primary animal reservoir for B. burgdorferi in the U.S. and the preferred host for nymphal and larval forms of the deer tick. Deer are hosts for the adult ticks but do not carry the spirochete. Signs and symptomsof infection occur in 3 stages; early localized, typified by erythema migrans; early disseminated with a flu-like syndrome, neurologic, and cardiac manifestations; and late, characteristically with arthritis. Although, the term 'Chronic Lyme Disease' has been assigned to many patients with a variety of unexplained symptoms, experts in the field question the validity of this diagnosis and warn against prolonged unproven antimicrobial therapies. Diagnosis relies upon clinical evaluation and is supported by serologic testing using a 2-step process which requires careful interpretation. Treatmentvaries with stage of disease, but normally includes doxycycline, amoxicillin,and ceftriaxone. Currently, no preventative vaccine is available. In some geographic areas, patients may be confected with Babesia, Ehrlichia, and

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Anaplasma since the same Ixodes ticks transmit these pathogens.

Introduction

Lyme disease, also referred to as *Lyme borreliosis*, was first clinically described in 1977 by Dr. Allen Steere, a rheumatologist who led an investigation of an outbreak of arthritis, initially believed to be juvenile rheumatoid arthritis, in 39 children and 12 adults clustered in the small town of Lyme, Connecticut.[1] First called "*Lyme Arthritis*", he suspected this condition was caused by an arthropod-born infection, as most patients suffered from asymmetric swelling of large joints, many of whom also presented with an erythematous annular rash similar to that described decades earlier in Europe associated with the bite of the *Ixodes ricinus* tick.[2] Although the causative agent was unknown, the etiology was believed to be a bacterial pathogen in that the rash seemed to respond to treatment with penicillin. During this time, the entity was given several names including erythema chronicum migrans, Bannwarth's syndrome, and acrodermatitis chronica atrophicans.[3]

It was not until 1982 that Dr. Willy Burgdorfer, a microbiologist studying the microbiology of the hindgut of ticks, successfully isolated the pathogen, named in his honor *Borrelia burgdorferfi*, from *I. damimini* (*I. scapularis*) ticks found on Shelter Island, New York.[4,5] Subsequently, this causative spirochete bacterium has been isolated from the typical skin lesions, as well as blood and cerebrospinal fluid of infected individuals. Since its early discovery, Lyme disease has geographically spread to an extent that this zoonotic infection is currently the most prevalent vector-borne disease in both North America and Europe.

Epidemiology

In the United States, Lyme disease did not become a reportable disease until 1991. In 2008, the case definition of Lyme disease was revised such to now include probable, as well as confirmed cases. Since the reporting of nearly 10,000 confirmed cases in 1992, the Centers for Disease Control and Prevention (CDC) is annually informed of more than 30,000 proven and probable cases, though the actual yearly number is believed to be about ten times that amount. Interestingly, the disease has likely been present and occurring in North America for centuries, but alteration of the natural wooded landscape for agricultural reasons, along with the diminution of the deer population through hunting that occurred following the arrival of the settlers from Europe, led to less than favorable ecologic conditions necessary for tick survival and proliferation of reservoir and definitive hosts. In the 1900s, a reversal of these events took place allowing once again environmental alterations that favored the necessary components for the adaptation and proliferation of *B. burgdorferi*. The recognition and rising incidence of human infection directly correlates with the influx of populations into desirable wooded areas, where the deer are not preyed upon and people engage in more outdoor activities risking greater tick exposure.

The majority of Lyme disease occurs in temperate regions of North America, Europe, and Asia. In the United States, the preponderance of reported cases come from distinct geographic pockets. In endemic areas, the yearly incidence of Lyme disease generally is between 10 and 100 cases per 100,000 persons. On an almost yearly basis, approximately 95% or more of proven cases are diagnosed in people living in states located in the Northeastern, Mid-Atlantic, and North Central United States (Maine to North Carolina, Michigan, Wisconsin, and Minnesota) (Fig. 1). Historically, Connecticut has the greatest amount of reported cases. In the Northwest, Oregon, Washington, and parts of coastal California are the other states accounting for most of the remaining Lyme disease cases in the United States. However, in these locations, as well as in some Canadian territories that are adjacent to the United States that report a small number of Lyme disease cases each year, a