



Lyme Disease

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Introduction

Lyme disease is a zoonosis caused by a spirochete bacterium of the genus *Borrelia*. It is transmitted to humans by ticks. Of the 11 different species of the genus *Borrelia*, *B. burgdorferi* is the most common cause of human disease in North America. In Europe and Asia *B. afzelii*, *B. garinii*, and *B. burgdorferi* are the causative agents.

Ticks of the *Ixodes* species are responsible for transmitting Lyme disease; *I. scapularis* and *I. pacificus* are seen in North America and *I. ricinus* and *I. persulcatus* in Europe and Asia. Mice, other rodents and small mammals are the bacterial reservoirs; birds may also be a reservoir. Deer are an important host for adult ticks in the complex transmission cycle of Lyme bacteria.

The disease occurs in temperate regions of North America, Europe and Asia and is the most common tick borne infection in the United States (US) It gained its name from the first descriptions of clinical Lyme disease in Lyme, Connecticut, US in the mid 1970's.

Epidemiology

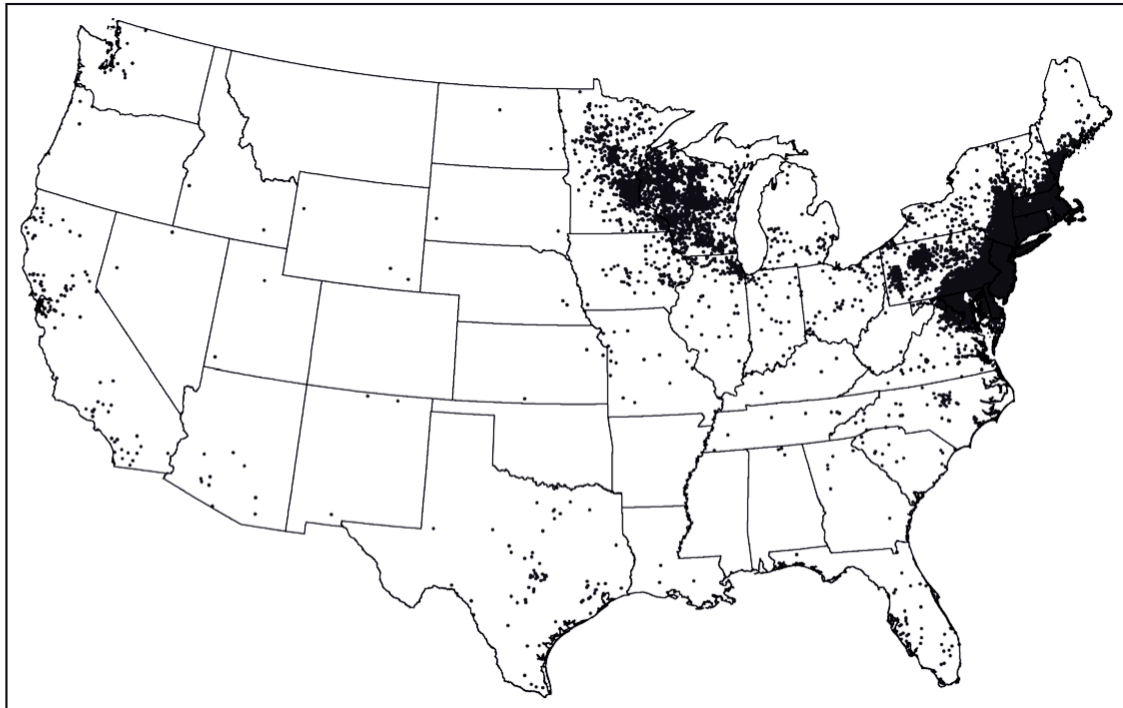
Global Epidemiology

Lyme disease is not a notifiable disease in the European Union, but has been in the US since 1991. The highest reported incidence of Lyme borreliosis is found in central Europe, with an estimated incidence of 206 cases per 100,000 population in Slovenia and 135 per 100,000 population in Austria [1]. In southern Europe, incidence appears to be much lower, at less than 1 per 100,000 (fewer than 30 cases per year) in Portugal and Italy. However focal areas of higher incidence can occur in countries where the incidence is generally low.

In the US from 2003-2005, 64,382 cases were reported from 46 states with a national incidence rate of 7 cases per 100,000 population and a per state range of <1 to 77 cases per 100,000 [2]. The highest risk regions of the US are the northeastern, mid-Atlantic and north-central regions of the country (Figure 1) [2].

Figure 1

Number of Lyme disease cases by county: United States, 2005. ([2] with permission).



Lyme Disease in UK Travellers

From 2002 through 2006 there were 371 cases reported in travellers, mainly returning from the United States, France, Germany, Scandinavia and other northern and central European countries [3,4]. Imported infections account for about 17% of the total number of UK reported cases.

Risk for Travellers

Travellers acquire Lyme disease when they are bitten by *Ixodes* spp. ticks in forested, grassy, or woodland areas of endemic regions. Activities that might put a traveller at risk include camping, walking or working in these areas. Lyme disease has a seasonal transmission with highest risk periods during the spring, summer and autumn months [5, 6].

Transmission

The disease is transmitted by *Ixodes* spp. ticks through salivation during feeding [6]. *Ixodes* ticks are also the vectors for tick borne encephalitis and babesiosis. There are three stages of ticks (larvae, nymphs and adults) that feed only once during each stage. The development cycle of the ticks extends over two to three years. Larvae and nymphs take up the spirochete from reservoir hosts (usually small mammals such as mice) and transmit infection to humans when they are bitten. The nymph stage is usually responsible for transmitting infection. Larger mammals, such as deer, are not hosts for the spirochete but are necessary to maintain the adult population of ticks [6].



Ticks reside on ground level vegetation from where they can be brushed onto clothing or drop onto passing humans. They climb up the clothing until they find exposed skin to feed upon. The legs, groin, and axilla are common sites for ticks to attach.

Signs and Symptoms

Lyme disease is a multi-system infection that can occur in acute and chronic stages with remissions and exacerbations of clinical symptoms. The disease has also been known in Europe as erythema migrans, acrodermatitis chronica atrophicans, and Bannwarth's syndrome.

The initial stage is characterised by a classic cutaneous lesion termed erythema migrans. This is seen in 70% to 80% of persons who are infected with *B. burgdorferi* [5, 6]. The lesion usually occurs at the site of the bite, developing 3 to 30 days (usually 7 to 10 days) following exposure. There may be an initial red macule or papule that expands over days to reach an average diameter of 15 cm. It typically has a bright red outer border with partial central clearing; however, the central clearing may be absent. The thigh, groin and axilla are common sites. The lesion is warm to touch but frequently painless and may go unnoticed by the patient if it is not in an easily seen area. Multiple, secondary lesions may develop when the organism disseminates to other sites of the body. Many patients will not remember a tick bite [5, 6].

A cutaneous manifestation that is seen in Europe is acrodermatitis chronica atrophicans [5]. This is a long-standing lesion with slow evolution from an initial red or bluish-red discolouration to atrophic skin changes that usually occur on the extensor surfaces of the hands.

The initial phase of erythema migrans may be accompanied by mild systemic symptoms of myalgias, fever, headache, and regional lymphadenopathy. These symptoms are more likely with Lyme disease acquired in North America compared with disease acquired in Europe [6].

With dissemination of the spirochete there may be extracutaneous symptoms that can include meningitis, cranial nerve palsies (usually the facial nerve), and carditis manifesting as heart block.

Late symptoms can occur 3 to 4 months after an infection that has not been treated. Patients can experience arthritis of one or more joints (usually knee, elbow, or ankle) with swelling often without prominent pain, and that can persist for weeks, resolve, and then recur. Rarely, chronic neurologic symptoms of headache, encephalitis, and cognitive disorders will occur.

Treatment

The diagnosis of Lyme disease is made on clinical grounds and is supported by serologic testing. Although culture and PCR would provide documentation of the presence of the organism, these are not usually performed because of the low yield from culture and the limited availability of PCR [6, 7].

Antibiotic therapy is of benefit in all stages of Lyme disease, but is most effective during the early stages. Treatment recommendations for early stages including erythema migrans and cranial nerve palsies include: doxycycline, amoxicillin, or cefuroxime taken orally for 14 days [7]. Parenteral antibiotics are usually required for neurologic complications, cardiac involvement and late manifestations such as recurrent arthritis.

Prevention

There is no vaccine against Lyme disease. A vaccine against *B. burgdorferi* was released in the US in 1999, but withdrawn from the market in 2002.



Travellers to endemic areas should be advised to practice [insect bite avoidance measures](#). In particular clothing should be treated with an insecticide, and travellers should be encouraged to tuck their trousers into their socks to prevent ticks from crawling up the legs [5, 6]. Persons should also apply repellents to exposed skin.

Ticks require several hours of feeding (24 to 72 hours) before transmitting *Borrelia* to the humans [7]. Therefore, travellers should check themselves frequently for ticks and remove them promptly using tweezers placed as close as possible to the skin followed by a slow pulling motion [8]. Pets should be checked for ticks before being allowed into living areas.

A single dose of doxycycline (200mg) may be offered to adult patients and to children 12 years and older, following the removal of an *Ixodes* tick that has been attached for more than 36 hours but less than 72 hours, and acquired in a Lyme endemic area. In a US study this has been shown to decrease the incidence of *B. burgdorferi* infection [9]. Because of the possibility of different vector and organism dynamics in Europe and Asia, it is not known if this approach would be effective in these regions.

References

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Reading List:

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Links:

European Union Concerted Action on Lyme Borreliosis:

<http://meduni09.edis.at/eucalb/cms/index.php?lang=en>