

## 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 these regions. It gained its name from the first descriptions of clinical Lyme disease in Lyme, Connecticut, USA in the mid 1970's.

### Epidemiology

(Data from the [Travel Health Surveillance Section](#) of the Health Protection Agency Communicable Disease Surveillance Centre)

### Global Epidemiology

### Lyme Disease Risk in UK Travellers

## Risk for Travellers

Lyme disease is not a notifiable disease in the European Union, but has been in the United States since 1991. In the U.S. in 2002 nearly 24,000 cases were reported from 48 states with a national incidence rate of 8 cases per 100,000 population.<sup>1</sup> The highest risk regions of the US are the Northeast, mid-Atlantic and north Central regions of the country ([Figure 1](#)).

Travellers acquire Lyme disease when they come into contact with *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.

## Transmission

The disease is transmitted by *Ixodes* spp. ticks through salivation during feeding. There are three stages of ticks (larvae, nymphs and adults) that feed only once during each stage. The development cycle of the ticks can take years. Larvae and nymphs take up the spirochete from reservoir hosts (usually small mammals such as mice) and transmit infection to humans when they come in contact with them. The nymph is primarily responsible for transmitting infection. Larger mammals, such as deer, that are not hosts for the spirochete, are necessary to maintain the adult population of ticks.

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 tick bites.

## 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 the classic cutaneous lesion termed erythema migrans. This is seen in 60% to 90% of persons who are infected with *B. burgdorferi*. 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 recollect a tick bite.

A cutaneous manifestation that is seen in Europe is acrodermatitis chronica atrophicans. 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.

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. There can be 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, patients will experience chronic neurologic symptoms of headache, encephalitis and cognitive disorders.

## 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.

Antibiotic therapy is of benefit in all stages of Lyme disease, but is most effective during the early stages. Antibiotics are usually administered orally. If there are systemic complications of serious neurologic or cardiac disease, parenteral antibiotics may be required.

Doxycycline is the drug of choice for oral treatment and ceftriaxone is the most effective parenteral drug. Amoxicillin is an alternative oral agent.

## Prevention

Currently 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.

Ticks require several hours of feeding (24 to 72 hours) before transmitting *Borrelia* to the humans. 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. Pets should be checked for ticks before being allowed into living areas.

A single prophylactic dose of doxycycline (200 mg) following the removal of an *Ixodes* tick has been shown to decrease the incidence of *B. burgdorferi* infection in the U.S. <sup>2</sup> 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

1. Centers for Disease Control and Prevention. Lyme disease--United States, 2001-2002. MMWR 2004;53:365-369.
2. Nadelman RB, Nowakowski J, Fish D, et al. Prophylaxis with single-dose doxycycline for the prevention of Lyme disease after an *Ixodes scapularis* tick bite. N Engl J Med 2001;345:79-84.

## Reading List:

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Nadelman RB, Wormser GP. Lyme borreliosis. Lancet 1998;352:557-565  
Steere AC. Lyme disease. N Engl J Med 2001;345:115-125  
Stanek G, Strle F. Lyme borreliosis. Lancet 2003;362:1639-1647

## Links:

European Union Concerted Action on Lyme Borreliosis:  
<http://vie.dis.strath.ac.uk/vie/LymeEU/>

Figure 1

Incidence of Lyme disease per 100,000 population, by county of residence – United States, 2002. (from reference 1, with permission).

