

# Lyme Disease



Garapata de venado en las etapas de larva, ninfa y adulta (no es el tamaño real)

Hinchazón o erupción roja inflamada característica de la enfermedad de Lyme y conocida como eritema migratorio

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**Tick species that transmit Lyme Disease:** Black-legged tick (Deer tick), western black-legged tick

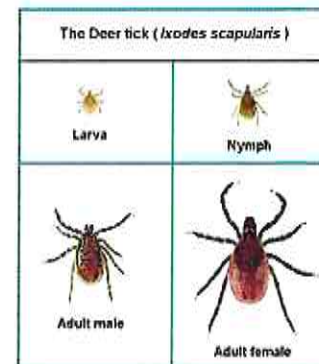
## What is Lyme Disease?

Lyme disease (LD) is an infection caused by *Borrelia burgdorferi*, a type of bacterium called a spirochete (pronounced spy-ro-keet) that is carried by deer ticks. An infected tick can transmit the spirochete to the humans and animals it bites. Untreated, the bacterium travels through the bloodstream, establishes itself in various body tissues, and can cause a number of symptoms, some of which are severe.

LD manifests itself as a multisystem inflammatory disease that affects the skin in its early, localized stage, and spreads to the joints, nervous system and, to a lesser extent, other organ systems in its later, disseminated stages. If

diagnosed and treated early with antibiotics, LD is almost always readily cured. Generally, LD in its later stages can also be treated effectively, but because the rate of disease progression and individual response to treatment varies from one patient to the next, some patients may have symptoms that linger for months or even years following treatment. In rare instances, LD causes permanent damage.

Although LD is now the most common arthropod-borne illness in the U.S. (more than 150,000 cases have been reported to the Centers for Disease Control and Prevention [CDC] since 1982), its diagnosis and treatment can

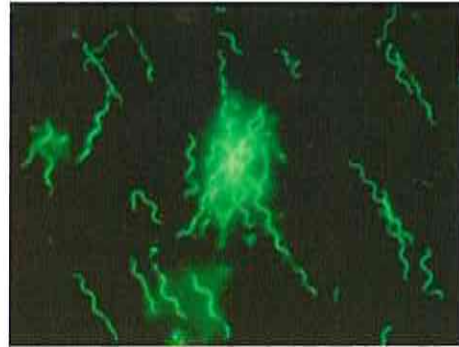


[Click here for pictures of deer ticks](#)

be challenging for clinicians due to its diverse manifestations and the limitations of currently available serological (blood) tests.

The prevalence of LD in the northeast and upper mid-west is due to the presence of large numbers of the deer tick's preferred hosts - white-footed mice and deer - and their proximity to humans. White-footed mice serve as the principal "reservoirs of infection" on which many larval and nymphal (juvenile) ticks feed and become infected with the LD spirochete. An infected tick can then transmit infection the next time it feeds on another host (e.g., an unsuspecting human).

The LD spirochete, *Borrelia burgdorferi*, infects other species of ticks but is known to be transmitted to humans and other animals only by the deer tick (also known as the black-legged tick) and the related Western black-legged tick. Studies have shown that an infected tick normally cannot begin transmitting the spirochete until it has been attached to its host about 36-48 hours; the best line of defense against LD, therefore, is to examine yourself at least once daily and remove any ticks before they become engorged (swollen) with blood.



*Borrelia burgdorferi*

Generally, if you discover a deer tick attached to your skin that has not yet become engorged, it has not been there long enough to transmit the LD spirochete. Nevertheless, it is advisable to be alert in case any symptoms do appear; a red rash (especially surrounding the tick bite), flu-like symptoms, or joint pains in the first month following any deer tick bite could signal the onset of LD.

Manifestations of what we now call Lyme disease were first reported in medical literature in Europe in 1883. Over the years, various clinical signs of this illness have been noted as separate medical conditions: acrodermatitis, chronica atrophicans (ACA), lymphadenosis benigna cutis (LABC), erythema migrans (EM), and lymphocytic meningoradiculitis (Bannwarth's syndrome). However, these diverse manifestations were not recognized as indicators of a single infectious illness until 1975, when LD was described following an outbreak of apparent juvenile arthritis, preceded by a rash, among residents of Lyme, Connecticut.

### **Where is Lyme Disease Prevalent?**

LD is spreading slowly along and inland from the upper east coast, as well as in the upper midwest. The mode of spread is not entirely clear and is probably due to a number of factors such as bird migration, mobility of deer and other large mammals, and infected ticks dropping off of pets as people travel around the country. It is also prevalent in northern California and Oregon coast, but there is little evidence of spread.

In order to assess LD risk you should know whether infected deer ticks are active in your area or in places you may visit. The population density and percentage of infected ticks that may transmit LD vary markedly from



one region of the country to another. There is even great variation from county to county within a state and from area to area within a county. For example, less than 5% of adult ticks south of Maryland are infected with *B. burgdorferi*, while up to 50% are infected in hyperendemic areas (areas with a high tick infection rate) of the northeast. The tick infection rate in Pacific coastal states is between 2% and 4%.

## U.S. Range Maps and Statistics

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To view U.S. Range Maps and Statistics for Lyme disease, click [here](#).

## Symptoms

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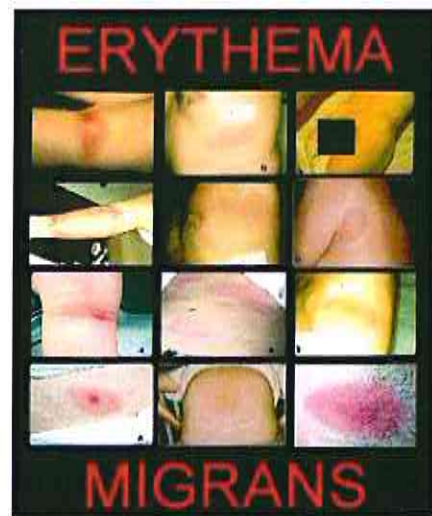
The spirochetal agent of Lyme disease, *Borrelia burgdorferi*, is transmitted to humans through a bite of a nymphal stage deer tick *Ixodes scapularis* (or *Ixodes pacificus* on the West Coast). The duration of tick attachment and feeding is a key factor in transmission. Proper identification of tick species and feeding duration aids in determining the probability of infection and the risk of developing Lyme disease.

[Spirochete transmission poster: how long has that tick been feeding on you?](#)

The early symptoms of LD can be mild and easily overlooked. People who are aware of the risk of LD in their communities and who do not ignore the sometimes subtle early symptoms are most likely to seek medical attention and treatment early enough to be assured of a full recovery.

The first symptom is usually **an expanding rash** (called erythema migrans, or EM, in medical terms) which is thought to occur in 80% to 90% of all LD cases. An EM rash generally has the following characteristics:

- Usually (but not always) radiates from the site of the tickbite
- Appears either as a solid red expanding rash or blotch, OR a central spot surrounded by clear skin that is in turn ringed by an expanding red rash (looks like a bull's-eye)
- Appears an average of 1 to 2 weeks (range = 3 to 30 days) after disease transmission
- Has an average diameter of 5 to 6 inches (range = 2 inches to 2 feet)
- Persists for about 3 to 5 weeks
- May or may not be warm to the touch
- Is usually not painful or itchy



[Click here for pictures of EM's](#)

EM rashes appearing on brown-skinned or sun-tanned patients may be more difficult to identify because of decreased contrast between normal skin tones and the red rash. A dark, bruise-like appearance is more common on dark-skinned patients.

Ticks will attach anywhere on the body, but prefer body creases such as the armpit, groin, back of the knee, and nape of the neck; rashes will therefore often appear in (but are not restricted to) these areas. Please note that multiple rashes may, in some cases, appear elsewhere on the body some time after the initial rash, or, in a few cases, in the absence of an initial rash.

Around the time the rash appears, other symptoms such as **joint pains, chills, fever, and fatigue** are common, but they may not seem serious enough to require medical attention. These symptoms may be brief, only to recur as a broader spectrum of symptoms as the disease progresses.

As the LD spirochete continues spreading through the body, a number of other symptoms including **severe fatigue, a stiff, aching neck**, and peripheral nervous system (PNS) involvement such as **tingling or numbness in the extremities or facial palsy (paralysis)** can occur.

The more severe, potentially debilitating symptoms of later-stage LD may occur weeks, months, or, in a few cases, years after a tick bite. These can include **severe headaches, painful arthritis and swelling of joints, cardiac abnormalities**, and central nervous system (CNS) involvement leading to **cognitive (mental) disorders**.

The following is a checklist of common symptoms seen in various stages of LD:

#### **Localized Early (Acute) Stage:**

- Solid red or bull's-eye rash, usually at site of bite
- Swelling of lymph glands near tick bite
- Generalized achiness
- Headache

#### **Early Disseminated Stage:**

- Two or more rashes not at site of bite
- Migrating pains in joints/tendons
- Headache
- Stiff, aching neck
- Facial palsy (facial paralysis similar to Bell's palsy)
- Tingling or numbness in extremities
- Multiple enlarged lymph glands
- Abnormal pulse
- Sore throat
- Changes in vision
- Fever of 100 to 102 F

- Severe fatigue

#### **Late Stage:**

- Arthritis (pain/swelling) of one or two large joints
- Disabling neurological disorders (disorientation; confusion; dizziness; short-term memory loss; inability to concentrate, finish sentences or follow conversations; mental "fog")
- Numbness in arms/hands or legs/feet

#### **Diagnosis**

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If you think you have LD symptoms you should see your physician immediately. The EM rash, which may occur in up to 90% of the reported cases, is a specific feature of LD, and treatment should begin immediately.

Even in the absence of an EM rash, diagnosis of **early** LD should be made on the basis of symptoms and evidence of a tick bite, not blood tests, which can often give false results if performed in the **first month after initial infection** (later on, the tests are more reliable). If you live in an endemic area, have symptoms consistent with early LD and suspect recent exposure to a tick, present your suspicion to your doctor so that he or she may make a more informed diagnosis.

If early symptoms are undetected or ignored, you may develop more severe symptoms weeks, months or perhaps years after you were infected. In this case, the CDC recommends using the ELISA and Western-blot blood tests to determine whether you are infected. These tests, as noted above, are considered more reliable and accurate when performed at least a month after initial infection, although no test is 100% accurate.

If you have neurological symptoms or swollen joints your doctor may, in addition, recommend a PCR (Polymerase Chain Reaction) test via a spinal tap or withdrawal of synovial fluid from an affected joint. This test amplifies the DNA of the spirochete and will usually indicate its presence.

#### **Treatment**

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Recommended courses and duration of treatment for both early and late Lyme symptoms are shown in our [Table of Recommended Antibiotics and Dosages](#) (see also table footnotes).

Early treatment of LD (within the first few weeks after initial infection) is straightforward and almost always results in a full cure. Treatment begun after the first three weeks will also likely provide a cure, but the cure rate decreases the longer treatment is delayed.

**Doxycycline, amoxicillin and ceftin** are the three oral antibiotics most highly recommended for treatment of all but a few symptoms of LD. A recent study of Lyme arthritis in the New England Journal of Medicine indicates that a four-week course of oral doxycycline is just as effective in treating late LD, and much less expensive, than a similar course of intravenous Ceftriaxone (Rocephin) unless neurological or severe cardiac

abnormalities are present. **If these symptoms are present**, the study recommends immediate intravenous (IV) treatment.

Treatment of late-Lyme patients can be more complicated. Usually LD in its later stages can be treated effectively, but individual variation in the rate of disease progression and response to treatment may, in some cases, render standard antibiotic treatment regimens ineffective. In a small percentage of late-Lyme patients, the disease may persist for many months or even years. These patients will experience slow improvement and resolution of their persisting symptoms following oral or IV treatment that eliminated the infection.

Although treatment approaches for patients with late-stage LD have become a matter of considerable debate, many physicians and the Infectious Disease Society of America recognize that, in some cases, several courses of either oral or IV (depending on the symptoms presented) antibiotic treatment may be indicated. However, long-term IV treatment courses (longer than the recommended 4-6 weeks) are not usually advised due to adverse side effects. While there is some speculation that long-term courses may be more effective than the recommended 4-6 weeks, there is currently no scientific evidence to support this assertion. Click [here](#) for an article from the New England Journal of Medicine which presents clinical recommendations in the treatment and prevention of early Lyme disease.

## **Prevention & Control**

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Larval and nymphal deer ticks often hide in shady, moist ground litter, but adults can often be found above the ground clinging to tall grass, brush, and shrubs. They also inhabit lawns and gardens, especially at the edges of woodlands and around old stone walls where deer and white-footed mice, the ticks' preferred hosts, thrive. Within the endemic range of *B. burgdorferi* (the spirochete that infects the deer tick and causes LD), no natural, vegetated area can be considered completely free of infected ticks.

Deer ticks cannot jump or fly, and do not drop from above onto a passing animal. Potential hosts (which include all wild birds and mammals, domestic animals, and humans) acquire ticks only by direct contact with them. Once a tick latches onto human skin it generally climbs upward until it reaches a protected or creased area, often the back of the knee, groin, navel, armpit, ears, or nape of the neck. It then begins the process of inserting its mouthparts into the skin until it reaches the blood supply.

In tick-infested areas, the best precaution against LD is to avoid contact with soil, leaf litter and vegetation as much as possible. However, if you garden, hike, camp, hunt, work outdoors or otherwise spend time in woods, brush or overgrown fields, you should use a **combination of precautions** to dramatically reduce your chances of getting Lyme disease:

**First**, using color and size as indicators, learn how to distinguish between:





Deer tick larva (top), nymph (right) and adult (left).

- deer tick\* nymphs and adults
- deer ticks and two other common tick species - dog ticks and Lone Star ticks (neither of which is known to transmit Lyme disease)

\*Deer ticks are found east of the Rockies; their look-alike close relatives, the western black-legged ticks, are found and can transmit Lyme disease west of the Rockies.



Dog tick.



Lone star tick.

**Then**, when spending time outdoors, make these easy precautions part of your routine:

- **Wear enclosed shoes and light-colored clothing** with a tight weave to spot ticks easily
- **Scan clothes and any exposed skin frequently** for ticks while outdoors
- **Stay on cleared, well-traveled trails**
- **Use insect repellent containing DEET (Diethyl-meta-toluamide)** on skin or clothes if you intend to go off-trail or into overgrown areas
- **Avoid sitting directly on the ground or on stone walls** (havens for ticks and their hosts)
- **Keep long hair tied back**, especially when gardening
- **Do a final, full-body tick-check at the end of the day** (also check children and pets)

When taking the above precautions, consider these important facts:

- If you tuck long pants into socks and shirts into pants, be aware that ticks that contact your clothes will climb upward in search of exposed skin. This means they may climb to hidden areas of the head and neck if not intercepted first; spot-check clothes frequently.
- Clothes can be sprayed with either DEET or Permethrin. Only DEET can be used on exposed skin, but never in high concentrations; follow the manufacturer's directions.
- Upon returning home, clothes can be spun in the dryer for 20 minutes to kill any unseen ticks

- A shower and shampoo may help to remove crawling ticks, but will not remove attached ticks. Inspect yourself and your children carefully after a shower. Keep in mind that nymphal deer ticks are the size of poppy seeds; adult deer ticks are the size of apple seeds.

Any contact with vegetation, even playing in the yard, can result in exposure to ticks, so careful daily self-inspection is necessary whenever you engage in outdoor activities and the temperature exceeds 45° F (the temperature above which deer ticks are active). Frequent tick checks should be followed by a systematic, whole-body examination each night before going to bed. Performed consistently, this ritual is perhaps the single most effective current method for prevention of Lyme disease.

**If you DO find a tick** attached to your skin, there is *no need to panic*. Not all ticks are infected, and studies of infected deer ticks have shown that they begin transmitting Lyme disease an average of 36 to 48 hours after attachment. Therefore, your chances of contracting LD are greatly reduced if you remove a tick within the first 48 hours. Remember, too, that nearly all of early diagnosed Lyme disease cases are easily treated and cured.



[Video of Proper Tick Removal](#)

To remove a tick, follow these steps:

1. Using a pair of pointed precision\* tweezers, grasp the tick by the head or mouthparts right where they enter the skin. **DO NOT** grasp the tick by the body.
2. Without jerking, pull firmly and steadily directly outward. **DO NOT** twist the tick out or apply petroleum jelly, a hot match, alcohol or any other irritant to the tick in an attempt to get it to back out.
3. Place the tick in a vial or jar of alcohol to kill it.
4. Clean the bite wound with disinfectant.

\*Keep in mind that certain types of fine-pointed tweezers, especially those that are etched, or rasped, at the tips, may not be effective in removing nymphal deer ticks. Choose unrasped fine-pointed tweezers whose tips align tightly when pressed firmly together.

**Then, monitor the site of the bite** for the appearance of a rash beginning 3 to 30 days after the bite. At the same time, learn about the other early symptoms of Lyme disease and watch to see if they appear in about the same timeframe. If a rash or other early symptoms develop, see a physician immediately.

Finally, prevention is not limited to personal precautions. Those who enjoy spending time in their yards can reduce the tick population around the home by:

- keeping lawns mowed and edges trimmed
- clearing brush, leaf litter and tall grass around houses and at the edges of gardens and open stone walls
- stacking woodpiles neatly in a dry location and preferably off the ground
- clearing all leaf litter (including the remains of perennials) out of the garden in the fall



- having a licensed professional spray the residential environment (only the areas frequented by humans) with an insecticide in late May (to control nymphs) and optionally in September (to control adults).