

## **LYME DISEASE**

(Lyme Arthritis, borreliosis)

### **REPORTING INFORMATION**

- **Class B:** Report by the end of the next business day in which the case or suspected case presents and/or a positive laboratory result to the local public health department where the patient resides. If patient residence is unknown, report to the local public health department in which the reporting health care provider or laboratory is located.
- Reporting Form(s) and/or Mechanism:
  - The Ohio Disease Reporting System (ODRS) should be used to report laboratory findings to the Ohio Department of Health (ODH). For healthcare providers without access to ODRS, you may use the [Ohio Confidential Reportable Disease Form](#) (HEA 3334).
  - The Centers for Disease Control and Prevention (CDC) [Lyme Disease Case Report form](#) (CDC 52.60, rev. 2/09) is available for use to assist in local health department disease investigation. Information collected on the form should be entered into ODRS and the form should be uploaded under the Administration module in ODRS.
- Key fields for ODRS reporting include: Clinical Information module, including date of illness onset, fields under Symptoms and Signs of Current Episode, fields in the Epidemiology Information module and fields in the Travel History module.

### **AGENT**

*Borrelia burgdorferi*, a spirochete-type bacterium.

### **CASE DEFINITION**

#### **Clinical Description**

A systemic, tick-borne disease with protean manifestations, including dermatologic, rheumatologic, neurologic and cardiac abnormalities. The most common marker for the disease is erythema migrans (EM), the initial skin lesion that occurs in 60-80% of patients.

For purposes of surveillance, EM is defined as a skin lesion that typically begins as a red macule or papule and expands over a period of days to weeks to form a large round lesion, often with partial central clearing. A single primary lesion must reach greater than or equal to 5 cm in size across its largest diameter. Secondary lesions also may occur. Annular erythematous lesions occurring within several hours of a tick bite represent hypersensitivity reactions and do not qualify as EM. For most patients, the expanding EM lesion is accompanied by other acute symptoms, particularly fatigue, fever, headache, mildly stiff neck, arthralgia, or myalgia. These symptoms are typically intermittent. The diagnosis of EM must be made by a physician. Laboratory confirmation is recommended for persons with no known exposure.

For purposes of surveillance, late manifestations include any of the following when an alternate explanation is not found:

- *Musculoskeletal system.* Recurrent, brief attacks (weeks or months) of objective joint swelling in one or a few joints, sometimes followed by chronic arthritis in one or a few joints. Manifestations not considered as criteria for diagnosis include chronic progressive arthritis not preceded by brief attacks and chronic symmetrical polyarthritis. Additionally, arthralgia, myalgia, or fibromyalgia syndromes alone are not criteria for musculoskeletal involvement.

- *Nervous system.* Any of the following signs that cannot be explained by any other etiology, alone or in combination: lymphocytic meningitis; cranial neuritis, particularly facial palsy (may be bilateral); radiculoneuropathy; or, rarely, encephalomyelitis. Headache, fatigue, paresthesia, or mildly stiff neck alone, are not criteria for neurologic involvement.
- *Cardiovascular system.* Acute onset of high-grade (2nd-degree or 3rd-degree) atrioventricular conduction defects that resolve in days to weeks and are sometimes associated with myocarditis. Palpitations, bradycardia, bundle branch block, or myocarditis alone are not criteria for cardiovascular involvement.

### Laboratory Criteria for Diagnosis

For the purpose of surveillance, laboratory evidence includes:

- A positive culture for *B. burgdorferi*; **OR**
- Two-tier testing interpreted using established criteria below ([see testing flow chart at CDC Lyme disease website](#)):
  - Positive IgM is sufficient only when < 30 days from symptom onset
  - Positive IgG is sufficient at any point during illness
  - Demonstration of diagnostic IgM or IgG antibodies to *B. burgdorferi* in serum or cerebrospinal fluid (CSF). A two-test approach using a sensitive enzyme immunoassay (EIA) or immunofluorescence antibody (IFA) followed by Western blot / immunoblot is recommended. **Note:** Patients with syphilis, infectious mononucleosis, systemic lupus erythematosus (SLE), and other diseases may have false-positive IFA or ELISA for Lyme disease.
  - All specimens positive or equivocal by a sensitive EIA or IFA should be tested by a standardized Western immunoblot. Specimens negative by a sensitive EIA or IFA need not be tested further. When Western immunoblot is used during the first 4 weeks of disease onset (early LD), both immunoglobulin M (IgM) and immunoglobulin G (IgG) procedures should be performed. A positive IgM test result alone is not recommended for use in determining active disease in persons with illness greater than 1 month's duration because the likelihood of a false-positive test result for a current infection is high for these persons. If a patient with suspected early LD has a negative serology, serologic evidence of infection is best obtained by testing of paired acute- and convalescent-phase serum samples. Serum samples from persons with disseminated or late-stage LD almost always have a strong IgG response to *Borrelia burgdorferi* antigens. It is recommended that an IgM immunoblot be considered positive if *two* of the following three bands are present: 24 kDa (OspC)\*, 39 kDa (BmpA), and 41 kDa (Fla). It was further recommended that an IgG immunoblot be considered positive if *five* of the following 10 bands are present: 18 kDa, 24 kDa (OspC)\*, 28 kDa, 30 kDa, 39 kDa (BmpA), 41 kDa (Fla), 45 kDa, 58 kDa (not GroEL), 66 kDa, and 93 kDa; **OR**
- A positive single-tier IgG Western blot test for Lyme disease. **Note:** While a single IgG Western blot is adequate for surveillance purposes, a two-tier test is still recommended for patient diagnosis.

\*Depending upon the assay, OspC could be indicated by a band of 21, 22, 23, 24 or 25 kDa.

### Case Classification

Suspected: a) a case of EM where there is no known exposure (as defined below) and no laboratory evidence of infection (as defined above); **OR** b) a case with laboratory evidence of infection but no clinical information available

**Probable:** any other case of physician-diagnosed Lyme disease that has laboratory evidence of infection (as defined above).

**Confirmed:** a) a case of EM with exposure in a high incidence state (as defined below); **OR** b) a case of EM with laboratory evidence of infection and a known exposure in a low incidence state; **OR** c) a case with at least one late manifestation that has laboratory evidence of infection.

Lyme disease reports will not be considered cases if the medical provider specifically states this is not a case of Lyme disease, or the only symptom listed is "tick bite" or "insect bite."

### **Comments**

The surveillance case definition was developed for national reporting of Lyme disease; it is not intended to be used in clinical diagnosis. Definitions of terms used in the clinical description and case definition sections are listed below.

### **Exposure**

Exposure is defined as having been (less than or equal to 30 days before onset of EM) in wooded, brushy, or grassy areas (i.e., potential tick habitats) of Lyme disease vectors. Since infected ticks are not uniformly distributed, a detailed travel history to verify whether exposure occurred in a high or low incidence state is needed. An exposure in a high-incidence state is defined as exposure in a state with an average Lyme disease incidence of at least 10 confirmed cases/ 100,000 for the previous three reporting years. A low-incidence state is defined as a state with a disease incidence of <10 confirmed cases/ 100,000. Lyme disease incidence rates by state can be found on the [CDC Lyme disease data tables website](#). A history of tick bite is not required.

## **SIGNS AND SYMPTOMS**

Untreated Lyme disease can produce a wide range of symptoms, depending on the stage of infection. These include fever, rash, facial paralysis, and arthritis. Medical attention should be sought if any of the above mentioned symptoms are observed and there is a history of a tick bite, live in an area known for Lyme disease, or have recently traveled to an area where Lyme disease occurs. Information on distribution and incidence of Lyme disease in the U.S. can be found on the [CDC Lyme disease data and statistics website](#).

### Early signs and symptoms (3 to 30 days post-tick bite)

The first sign of infection is often a circular rash called erythema migrans or EM. This rash occurs in approximately 70-80% of infected persons and begins at the site of a tick bite after a delay of 3-30 days (average is 7 days). A distinctive feature of the rash is that it gradually expands over a period of several days, reaching up to 12 inches (30 cm) across. It may be warm but is not usually painful. Patients also experience symptoms of fatigue, chills, fever, headache, and muscle and joint aches, and swollen lymph nodes. In some cases, these may be the only symptoms of infection. Some people get a small bump or redness at the site of the tick bite that goes away in 1-2 days. This is not a sign of Lyme disease.

### Later signs and symptoms (days to months post tick-bite)

Untreated, the infection may spread from the site of the bite to other parts of the body within a few days to weeks, producing an array of discrete symptoms that may come and go including loss of muscle tone on one or both sides of the face (Bell's palsy), severe headaches and neck stiffness due to meningitis, additional EM rashes on other areas of the body, intermittent pain in tendons, muscles, joints, and bones, shooting pains that may interfere with sleep, heart palpitations and dizziness due to changes in heartbeat, nerve

pain, and pain and swelling in large joints. Large joints are most often affected, particularly the knees. In addition, up to 5% of untreated patients may develop chronic neurological complaints months to years after infection. These include shooting pains, numbness or tingling in the hands or feet, and problems with concentration and short term memory.

In the majority of cases, Lyme disease is successfully treated with oral antibiotics. Physicians sometimes describe patients who have non-specific symptoms (like fatigue, pain, and joint and muscle aches) after the treatment of Lyme disease as having post-treatment Lyme disease syndrome (PTLDS) or post Lyme disease syndrome (PLDS). The cause of PTLDS is not known.

The term "chronic Lyme disease" (CLD) has been used to describe people with different illnesses. While the term is sometimes used to describe illness in patients with Lyme disease, in many occasions it has been used to describe symptoms in people who have no evidence of a current or past infection with *B. burgdorferi* (*Infect Dis Clin N Am* 22:341-60, 2008). Because of the confusion in how the term CLD in this field is employed, experts do not support its use (*New Engl J Med* 357:1422-30, 2008). For more information, visit the [National Institutes of Health Chronic Lyme Disease](#) site.

## **DIAGNOSIS**

The IFA and ELISA serum antibody screening tests are available through many commercial laboratories. A two-test approach on an appropriate specimen is recommended, using an approved EIA or IFA assay followed by a Western blot. A positive culture for *B. burgdorferi* is also diagnostic. The following are important points to remember:

- A Western blot should not be run without first performing an EIA or IFA.
- The Western blot should not be run if the EIA or IFA tests are negative.
- A positive IgM western blot is only meaningful during the first 4 weeks of illness.
- If the person has been ill for longer than 4-6 weeks and the IgG Western blot test is negative, it is unlikely the person has Lyme disease, even if the IgM Western blot is positive.

## **EPIDEMIOLOGY**

### **Source**

The Lyme disease bacterium, *Borrelia burgdorferi*, normally lives in mice, squirrels and other small animals. It is transmitted among these animals – and to humans – through the bites of certain species of ticks. The white-footed mouse is the primary vertebrate reservoir.

### **Occurrence**

Onset of EM is generally in the late spring or summer (peak in June or July); late manifestations may occur at any time of the year.

### **Mode of Transmission**

The spirochete is transmitted through the bite of a tick: *Ixodes scapularis*, in the eastern and midwestern and *I. pacificus* in the western United States. Other species of ticks are not known to transmit Lyme disease in the U.S.

### **Period of Communicability**

Although the spirochete has been isolated from the EM lesion, blood and CSF, human-to-human transmission is not known to occur. Transplacental transmission (mother to fetus) may occur. Humans are not considered to be a source of the spirochete for ticks.

### **Incubation Period**

For EM, 3 to 32 days after tick bite (mean 7 to 10 days); early stages of the illness may be unapparent and the patient may present with later manifestations.

## **PUBLIC HEALTH MANAGEMENT**

### **Case**

#### Investigation

A complete history of travel and tick contact for the 30 days prior to onset should be obtained.

#### Treatment

Antibiotic therapy is recommended during the acute phase to reduce the incidence and severity of arthritic, neurologic and cardiac manifestations. Antibiotics commonly used for oral treatment include doxycycline, amoxicillin, or cefuroxime axetil. Patients with certain neurological or cardiac forms of illness may require intravenous treatment with drugs such as ceftriaxone or penicillin. A few patients, particularly those diagnosed with later stages of disease, may have persistent or recurrent symptoms. Longer courses of antibiotic treatment have not been shown to be beneficial and have been linked to serious complications, including death.

#### Isolation and Follow-up Specimens

Isolation is not indicated. Follow-up specimens are usually not indicated.

### **Contacts**

Prophylaxis of contacts is not indicated.

### **Prevention and Control**

A Lyme disease vaccine is no longer available. The vaccine manufacturer discontinued production in 2002, citing insufficient consumer demand. Protection provided by this vaccine diminishes over time. Those vaccinated before 2002 are probably no longer protected against Lyme disease. Tick avoidance in endemic areas is probably the best preventive measure at present. Tuck pants cuffs into sock tops, spray insect repellent on pants and socks and wear light-colored clothing to facilitate frequent checks for crawling ticks. Inspect every hour or two for attached and crawling ticks. Remove ticks promptly. Inspect pets for ticks every day. Keep grass and weeds mowed short. Reduce mouse populations by habitat reduction and exclusion from and to buildings.

#### Vector Investigation

For advice on vector assessment, contact the ODH Zoonotic Disease Program (ZDP) at (614) 752-1029, option 1.

#### Tick Bite Avoidance

The best way to prevent Lyme disease infection is to avoid tick bites. Prevention tips are similar to those for other diseases transmitted by ticks, such as anaplasmosis or Rocky Mountain spotted fever:

- Avoid direct contact with ticks by avoiding woody or brushy areas with high grass and leaf litter and walking in the center of trails.
- Use insect repellent [registered with the U.S. Environmental Protection Agency \(EPA\)](#) on exposed skin. Always follow the directions on the package. When using both sunscreen and insect repellent, apply the sunscreen first then the repellent.
- Wear long sleeves, pants and socks if feasible.
- Wear permethrin-treated clothing to repel and kill ticks.
- Bathe or shower as soon as possible after coming indoors (preferably within two hours) to wash off and more easily find ticks that are crawling on you.

- Conduct a full-body tick check using a hand-held or full-length mirror to view all parts of your body upon return from tick-infested areas.
- Examine gear and pets. Ticks can ride into the home on clothing and pets, then attach to a person later, so carefully examine pets, coats and day packs.
- Tumble clothes in a dryer on high heat for an hour to kill remaining ticks. (Some research suggests that shorter drying times may also be effective, particularly if the clothing is not wet.)

**Susceptibility**

All persons are probably susceptible. Re-infection has occurred in those treated with antibiotics for early-stage disease.

**What is Lyme disease?**

Lyme disease is caused by a cork-screw shaped bacterium called *Borrelia burgdorferi*. It is transmitted by a tick called the blacklegged tick (formerly known as the deer tick). The bacteria are normally found in mice, squirrels, and other small mammals without causing illness. Lyme disease affects both humans and dogs.

**Who is most at risk for getting Lyme disease?**

People who spend time outdoors in tick-infested environments are at an increased risk of exposure. Most cases have reported an exposure to ticks or woodland/brush habitats during the months of May through August, but cases have been reported in every month of the year. Dogs or other pets frequenting tick infested areas may carry ticks home to their owners.

**How is Lyme disease spread?**

Lyme disease is acquired by the bite of an infected tick. Most cases are caused by immature ticks called nymphs, which are very small and may go unnoticed even when biting. Ticks must be attached for 24 hours or more before the Lyme disease bacteria are passed. No direct transmission occurs from person to person or from dog to person.

**How is Lyme disease diagnosed?**

Lyme disease is diagnosed by a physician based on clinical symptoms, exposure history and blood test results.

**What are the symptoms of Lyme disease?**

The illness usually occurs during the summer months and often starts as a roughly circular reddish rash around or near the site of the tick bite. The rash expands over several days to several weeks, becoming several inches across. The rash appears in 70-80% of the cases. Approximately 15% of people will develop multiple skin lesions. Other, general flu-like symptoms also occur: fever, headache, fatigue, stiff neck, joint and muscle pain. These may last for several weeks. If left untreated complications such as meningitis (inflammation of the lining of the spinal cord), facial paralysis or heart abnormalities may develop. Swelling and pain in the major joints, especially the knees, can recur over several months or years.

**How soon do symptoms occur?**

The early symptoms usually occur 3-30 days after the tick bite.

**Does past infection with Lyme disease make a person immune?**

Current information suggests that a person can be infected more than once.

**What is the treatment for Lyme disease?**

The disease is usually treated with antibiotics in the tetracycline group, administered either orally or by injection.

**What can be done to prevent Lyme disease?**

If you are in areas where ticks might be present, the following precautions can reduce the risk of acquiring Lyme disease or other tick-borne diseases:

- Wear light-colored, long pants, tuck pant cuffs into sock tops and spray pant legs and socks with insect repellent. Repellents containing 0.5% permethrin or 20-30% DEET are effective in repelling ticks. Follow application directions carefully.
- When possible, avoid walking in tall grass and weeds.

- Conduct visual “tick checks” on yourself and children every hour or two.
- Check pets for ticks before allowing them into the home.
- Carefully remove attached ticks as soon as possible.
- Keep yard and play areas well mowed to discourage ticks.

### **How should a tick be removed?**

Although disease transmission occurs 24 to 48 hours or more after attachment, it is important to remove ticks as soon as possible after discovery.

To remove an attached tick, grasp it with tweezers as close as possible to the skin and pull with firm, steady pressure straight out. Do not twist or jerk the tick, as the mouthparts may break off. If tweezers are not available, protect fingers with rubber gloves or tissue paper.

- Do not handle ticks with bare hands.
- Do not squeeze, crush or puncture the body of the tick as it may contain infected fluids.
- After removing the tick, thoroughly disinfect the bite site and wash your hands.
- See or call your doctor if there is a concern about incomplete tick removal.

For more information, contact your local health department or the Zoonotic Disease Program at ODH by calling 614-752-1029.

### **For more information please visit the following websites:**

CDC Learn about Lyme disease - <http://www.cdc.gov/lyme/>

CDC Public Information Guide - <http://www.cdc.gov/lyme/resources/brochure/lymediseasebrochure.pdf>

ODH Zoonotic Disease Program Tick-borne Diseases (statistics and educational materials) - <http://www.odh.ohio.gov/ticks>