LYME DISEASE SURVEILLANCE PROTOCOL

Public Health Action

1. Educate the public about Lyme disease, especially regarding the mode of tick transmission and use of personal protection. Cases of Lyme disease usually occur between April and November in West Virginia; increased public education should be targeted for this time frame.

2. Educate providers and laboratories to report cases of Lyme disease to the local health department in the patient's county of residence within one week of diagnosis.

3. Educate providers about appropriate diagnosis of, and testing for Lyme disease:
    a. Laboratory confirmation of Lyme disease requires:
        i. Demonstration of diagnostic immunoglobulin M (IgM) or immunoglobulin G (IgG) antibodies to *Borrelia burgdorferi* in serum or cerebrospinal fluid (CSF) using a sensitive enzyme immunoassay (EIA) or immunofluorescence antibody (IFA) assay, with
        ii. Western immunoblot confirmation.

4. Conduct an appropriate investigation as follows:
    a. If case presented with EM, interview patient to determine where the patient was during the month prior to onset of EM to identify the location of the likely exposure. If no EM is present identify and document any late manifestations of Lyme disease that the patient is experiencing.
    b. Complete a yellow card, a CDC Lyme Disease Case Report Form (may be filled out by diagnosing physicians office) and attach copies of all appropriate laboratory reports (diagnostic total antibody with confirmatory western immunoblot) and send to IDEP.
    c. Educate the person about personal protection and potential for re-infection in those treated with antibiotics for early disease (i.e.; persons who do not mount an antibody response).

Disease Control Objectives

Prevent cases of Lyme disease by educating public about prevention measures that can be effective in reducing exposure to infected ticks.

Disease Prevention Objectives

1. Reduce disease risk through public education by encouraging use of personal protective measures.

2. Increase number of patients successfully treated with antibiotics in the early stages of Lyme disease to reduce number of patients with disseminated and late disease.

Surveillance Objectives

1. To understand the demographic characteristics of persons with Lyme disease.

2. To identify Lyme endemic areas and the tick species involved in transmission.

3. To identify risk factors for infection with Lyme disease.

Public Health Significance

Lyme disease is transmitted to humans by the bite of infected deer ticks and cause more than 16,000 infections in USA each year.

In the USA, endemic foci of Lyme disease exist along the Atlantic coast and are concentrated between Massachusetts and Maryland; in the upper midwest, an expanding focus is currently concentrated in Wisconsin and Minnesota; and in some areas of California and Oregon. Lyme disease continues to increase nationally as well as in West Virginia.

Initial infection occurs primarily during summer, with peak in June and July, but may occur throughout the year, depending on the seasonal abundance of the tick in different geographic areas. The distribution of the majority of cases coincides with the distribution of *Ixodes scapularis* (formerly called *I. dammini*) ticks in the eastern and midwestern USA. The explosive repopulation of white-tailed deer in the eastern USA has been linked to the spread of Lyme disease in this region.

Lyme disease spirochetes disseminate from the site of the tick bite by cutaneous lymphatic and blood-borne routes. If left untreated a secondary EM lesion may present as well as neurological, muscluoskeletal and cardiac manifestations that may last for years.

Clinical Description

This tickborne, spirochetal, zoonotic disease is characterized by a distinctive skin lesion, systemic symptoms and neurologic, rheumatologic and cardiac involvement that occur in varying combinations over a period of months to years. The early symptoms are intermittent and changing. The illness typically begins in the summer, and the first manifestation in about 90% of patients appears as a red macule or papule that expands slowly in an annular manner, often with central clearing. This distinctive skin lesion is called “erythema migrans”. EM may be single or multiple. To be considered significant for case surveillance purposes, the EM lesion must be physician diagnosed and measure at least 5 cm in diameter. With or without EM, early systemic manifestations of Lyme disease may include malaise, fatigue, fever, headache, stiff neck, myalgia, migratory, arthralgias and/or lymphadenopathy, all of which may last several weeks or more in untreated patients. **Patients with acute Lyme disease almost always have objective signs of infection (e.g., EM, facial nerve palsy, arthritis). Nonspecific**

symptoms commonly accompany these specific signs but are almost never the only evidence of Lyme disease.

Within weeks to months after onset of the EM lesion, neurologic abnormalities such as aseptic meningitis and cranial neuritis–including facial palsy, cerebellar ataxia, motor or sensory radiculoneuritis, myelitis and encephalitis–may develop; symptoms fluctuate, may last for months and may become chronic. Cardiac abnormalities (including atrio-ventricular block and rarely, acute myopericarditis or cardiomegaly) may occur within a few weeks after onset of EM. Weeks to years after onset (mean, 6 months), intermittent episodes of swelling and pain in large joints, especially the knees, may develop and recur for several years; chronic arthritis may occasionally result. Similarly, sometimes following long periods of latent infection, chronic neurologic manifestations may develop and include encephalopathy, polyneuropathy or leukoencephalitis; the CSF often shows lymphocytic pleocytosis and elavated protein levels, while the electromyogram is usually abnormal.

Etiologic Agent

The causative spirochete of North American Lyme disease, *Borrelia burgdorferi,* was identified in 1982.

Reservoir

Certain ixodid ticks through transstadial transmission. Wild rodents, especially *Peromyscus* spp. in the northeastern and midwestern USA and *Neotoma* spp. in the western USA maintain the enzootic transmission cycle. Deer serve as important maintenance mammalian hosts for vector tick species. Larval and nymphal ticks feed on small mammals, and adult ticks feed primarily on deer. The majority of Lyme disease cases result from bites by infected nymphs.

Mode of Transmission

Tickborne: In experimental animals, transmission by *I. scapularis* and *I. pacificus* usually does not occur until the tick has been attached for 24 hours or more: this may also be true in humans.

Incubation Period

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

Infectious Period

No evidence of natural transmission from person to person. There are rare case reports of congenital transmission, but epidemiologic studies have not shown a link between maternal Lyme disease and adverse outcomes of pregnancy.

Outbreak Recognition / Epidemic Measures

In hyperendemic areas, particular attention should be paid to identification of the tick species involved and areas infested, and to recommendations for avoiding tick infested areas and taking precautions if unable to avoid these areas.

Case Definition

Clinical Description

A systemic, tickborne disease with protean manifestations, including dermatologic, rheumatologic, neurologic, and cardiac abnormalities. The best clinical marker for the disease is the initial skin lesion (i.e., erythema migrans (EM) that occurs in 60%–80% of patients.

Laboratory Criteria for Diagnosis

1. Isolation of *Borrelia burgdorferi* from a clinical specimen; or

2. Demonstration of diagnostic immunoglobulin M (IgM) or immunoglobulin G (IgG) antibodies to *B. burgdorferi* in serum or cerebrospinal fluid (CSF). Requires a two-test approach using a sensitive enzyme immunoassay (EIA) or immunofluorescence antibody (IFA) test followed by Western immunoblot confirmation.

Case classification

Confirmed:

- A case with physician diagnosed EM measuring at least 5 cm; or

- A case with at least one late manifestation (as defined below in comments section) that is laboratory confirmed (diagnostic total antibody with confirmatory Western immunoblot).

Comment

This surveillance case definition was developed for national reporting of Lyme disease; it is not intended to be used in clinical diagnosis.

Definition of terms used in the clinical description and case definition:

1. Erythema migrans: 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 clearing. A single primary lesion must reach ≥5 cm in size. 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, headache, mildly stiff neck, arthralgia, or myalgia. These symptoms are typically intermittent. **A physician must make the diagnosis of EM.** Laboratory confirmation is recommended for person with no known exposure.

2. Late manifestations: Late manifestations include any of the following **when an alternate explanation is not found:**
   a. 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.
   b. Nervous system: Any of the following, alone or in combination: lymphocytic meningitis; cranial neuritis, particularly facial palsy (may be bilateral); radiculoneuropathy, or, rarely, encephalomyelitis. Encephalomyelitis must be confirmed by demonstration of antibody production against *B.burgdorferi* in the CSF, evidenced by a higher titer of antibody in CSF than in serum. Headache, fatigue, paresthesia, or mildly stiff neck alone are not criteria for neurologic involvement.
   c. Cardiovascular system: Acute onset of high-grade (2^o or 3^o) 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.

3. Exposure: Exposure is defined as having been in wooded, brushy, or grassy areas (i.e., potential tick habitats) in a county in which Lyme disease is endemic within the 30 days prior to onset of EM. A history of tick bite is not required.

4. Disease endemic to county: A county in which Lyme disease is endemic is one in which at least two confirmed cases have been previously acquired or in which established populations of a known tick vector are infected with *B. burgdorferi.*

Laboratory Diagnosis

Diagnosis is made clinically during the early stages of Lyme disease if EM is present. While cultures of a biopsy specimen of the perimeter of this lesion frequently yield the organism, *Borrelia* cultures (which require special media) are not available commercially. In patients without rash who manifest signs of a later stage of Lyme disease, diagnosis also should be based on clinical findings, using serologic tests as an adjunct.

The diagnosis of Lyme disease can be difficult, in part because of poor standardization and inappropriate use of serologic diagnostic tests. The IgM–specific antibody titer usually peaks between weeks 3 and 6 after the onset of infection; specific IgG antibody titers usually rise slowly and generally are highest weeks to months later. Localized EM

typically occurs from 3 to 32 days (mean 7 to 10 days) after the tick bite; therefore, antibodies against *B. burgdorferi* will not be detectable in most patients presenting with EM. Some patients who are treated early with antimicrobial agents never develop antibodies against *B. burgdorferi.* However, most patients with early-disseminated disease and virtually all patients with late disease will have antibodies against *B burgdorferi.* As with other infections, once such antibodies develop, they may persist for many years despite cure of the disease. Consequently, tests for antibodies should not be used to assess the success of treatment.

The enzyme immunoassay (EIA) is the most commonly used test for detection of antibodies against *B. burgdorferi.* This test and the immunofluorescense assay (IFA) may give false-positive results because of cross-reactive antibodies in patients with other spirochetal infections (e.g., syphillis, leptospirosis, relapsing fever), certain viral infections (e.g., varicella), and certain autoimmune diseases (e.g., systemic lupus erythematosus). While antibodies to *B. burgdorferi* cross-react with other spirochetes, including *Treponema pallidum* (syphillis), patients with Lyme disease do not have positive non-treponemal syphilis test results, such as VDRL or RPR (rapid plasma reagin). In addition, antibodies directed against bacteria in the normal oral flora may cross-react with antigens of *B. burgdorferi* and produce a false-positive test result.

Currently, the Western immunoblot assay is the most useful test for corroborating positive or equivocal EIA or IFA results and, as a result, a 2-test approach is required for the serologic diagnosis of *B. burgdorferi* infection. Serum specimens that give positive or equivocal results by EIA or IFA must be confirmed by a Western immunoblot assay. Serum specimens that give negative results by EIA of IFA do not require immunoblot confirmation. If a patient with suspected early disease has a negative serologic test result, evidence of infection is best obtained by testing of paired acute- and convalescent-phase serum samples. Persons with early disseminate or late-stage Lyme disease almost always have a robust antibody response to *B burgdorferi* antigens.

The widespread practice of ordering serologic tests for patients with nonspecific symptoms (such as fatigue or arthralgia) who have a low probability of having Lyme disease is not recommended. Almost all positive serologic test results in these patients are false-positive results.

Preventive Interventions

Prevention measures can be effective in reducing exposure to infected ticks.

Share these prevention methods with the public:

- Avoid potential tick habitat (such as woody, brushy, or grassy areas) when possible.
- Minimize exposure by wearing light colored clothing that covers legs and arms so that ticks are more easily seen; tuck pants into socks and apply tick repellent such as diethyltoluamide (DEET, Autan) to the skin (according to label directions) or permethrin (a repellent and contact acaricide) to pant legs and sleeves.

- If working or playing in an infected area, search the total body area daily, do not neglect haired areas, and remove ticks promptly; these ticks may be very small.
- Remove any attached ticks by using gentle, steady traction with tweezers applied close to the skin to avoid leaving mouth parts in the skin; protect hands with gloves, cloth or tissue when removing ticks from humans or animals. Following removal, cleanse the attachment site with soap and water.

Treatment

Doxycylcline (age ≥8 years) and amoxycillin are the preferred drugs for early disease. Intravenous ceftriaxone or penicillin G are given for patients with late manifestations.

Surveillance Indicators

- Proportion of cases with complete demographic information.
- Proportion of cases with complete clinical information (i.e., presence of physician diagnosed EM or late manifestations).
- Proportion of cases with complete tick exposure history.
- Proportion of cases with complete laboratory work-up (i.e., diagnostic total antibody with confirmatory Western blot).
- Proportion of case investigations that are totally complete: complete WV BPH Confidential Reportable Disease Case report (yellow card), complete CDC Lyme disease case report form, and copies of supporting laboratory results are sent to WVBPH with complete information and within a week of disease being diagnosed.