Lyme Disease in West Virginia

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Outline

• Brief overview of Lyme Disease
• Epidemiology of Lyme Disease in the United States and West Virginia
• How/why we are seeing an increase in cases
• Case reporting
• Reporting process
• Requirements/pitfalls
• What we do with case reports at the state level
• Reasons a case may not be considered a confirmed case
• Why case reporting matters
Lyme Disease Overview

- Lyme Disease is a bacterial infection caused by the spirochete *Borrelia burgdorferi*

- Transmitted via the bite of infected black-legged ticks
  - *Ixodes scapularis* in eastern United States
  - *Ixodes pacificus* in western United States

- Clinical manifestations vary based on stage of infection
Stages of Lyme Disease

**Early localized stage**
(3-30 days post-tick bite)
- Erythema migrans (EM) (also called Bull’s eye rash)
- Fever, malaise, headache, stiff neck, muscle and joint aches, and swollen lymph nodes

**Early disseminated stage**
(days to weeks post-tick bite)
- Additional EM lesions
- Facial or Bell’s palsy
- Headache and stiff neck due to meningitis
- Pain and swelling of joints
- Heart block and dizziness

**Late disseminated stage**
(months to years post-tick bite)
- Arthritis that affects large joints (particularly knees)
- Chronic neurological complications (e.g. shooting pains, numbness, and tingling in hands and feet)
• Ticks are often found in hard to see areas of the body

• Ticks must be attached for 36-48 hours before *B. burgdorferi* can be transmitted

• Most human infections are from bites from nymph-stage ticks
• *Ixodes scapularis* follows the three-host life cycle
• Each stage feeds once on a different vertebrate host
• Younger tick life stages feed on smaller hosts closer to the ground
United States and Lyme Disease

• **Why is Lyme Disease a concern?**
  • Lyme Disease is the number one reported tickborne disease in the United States, being the most common vectorborne disease
  
  • Lyme Disease is the 6th most reported notifiable infectious disease and condition in the United States
  
  • If left untreated, Lyme Disease may lead to severe neurological, arthritic and/or cardiac complications

Lyme Disease is normally cured with a 2 - 4 week course of oral antibiotics.

Post-Treatment Lyme Disease is when a patient has symptoms of pain, fatigue or difficulty thinking that linger for more than six months after treatment is completed.

Theories:
1. “Auto-immune” response triggered causing symptoms to last well after the infection is gone.
2. Persistent infection that is difficult to detect.
3. Symptoms are due to causes unrelated to having Lyme Disease.

No proven treatment.

Patient generally gets better with time, but can take months.
Reported Cases of Lyme Disease - United States

2001 → 2017

www.cdc.gov/lyme/datasurveillance/maps-recent.html
Lyme Disease - Reported cases by year, United States, 1997-2017

*National Surveillance case definition changed in 2008 to include probable cases

www.cdc.gov/lyme/stats/graphs.html
Lyme Disease - Confirmed cases by month of disease onset, United States, 2017

www.cdc.gov/lyme/stats/graphs.html
United States Clinical Features

Lyme disease - Relative frequency of clinical features among confirmed cases - United States, 2008 - 2017

- Meningitis or Encephalitis: 2%
- Erythema Migrans (EM) Rash: 71%
- Radiculoneuropathy: 4%
- Facial Palsy: 9%
- Carditis: 1%
- Arthritis: 28%

www.cdc.gov/lyme/stats/graphs.html
West Virginia Counties Reporting Lyme Cases by Year, 2010-2019
Data as of September 20, 2019
Map based on Longitude (generated) and Latitude (generated). The marks are labeled by Jurisdiction. Details are shown for Jurisdiction.
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2018

- 671 confirmed and probable Lyme Disease cases were reported in 2018
- 49 counties reported at least one case
2019
(as of October 4, 2019)

- 610 confirmed and probable Lyme Disease cases reported so far in 2019
- 50 counties have reported at least one case
Lyme Disease Risk Map - 2018
Lyme Disease in West Virginia, 2014-2018

Reported cases (confirmed and probable) of Lyme Disease by year — West Virginia, 2014–2018 (N=2,112)

Year
2014 2015 2016 2017 2018
Cases
136 289 368 648 671
Reported cases of Lyme Disease (confirmed and probable) by month of disease onset, West Virginia, 2018 (N=671)
Relative frequency of clinical features of Lyme Disease among confirmed cases - West Virginia, 2018

- Meningitis or Encephalitis: 1%
- Erythema Migrans (EM Rash): 49%
- Radiculoneuropathy: 3%
- Facial Palsy: 8%
- Carditis: 1%
- Arthritis: 38%
Drivers of Increase in Tickborne Diseases, United States

- Reforestation
- Overabundant deer
- Expansion of suburbia into wooded areas
- Abundant habitat around homes for Lyme Disease reservoir hosts
- Increased number of ticks
- Increased exposure opportunities in people
- Climate change causing vector to move westward
Lyme Disease Surveillance in West Virginia

- Became a nationally notifiable condition in the United States in 1991
- The current case definition was last updated in 2017
- The West Virginia Lyme Disease Surveillance System involves many stakeholders with different responsibilities

[www.cdc.gov/lyme/datasurveillance/maps-recent.html](www.cdc.gov/lyme/datasurveillance/maps-recent.html)
West Virginia Case Process

SURVEILLANCE DATA FLOW

- Patients
- Healthcare Providers
- Diagnostic Laboratorians
- Local Health Department
- State Health Department
- General Public
- CDC
- Veterinarians
- Healthcare Providers
- Private Citizens

Form A
Form B
Relay Patient Information
West Virginia Incidence Status

- West Virginia is currently listed as a high incidence state for Lyme Disease
- High incidence states are those that have a disease incidence of at least 10 confirmed cases/100,000 for three consecutive reporting years
Case Definition

- Defines clinical, laboratory, and epidemiologic information needed to assign a “surveillance” case status

- **Case status options**
  - Confirmed
  - Probable
  - Suspected
  - Not a case

**IMPORTANT:** A surveillance case status does not always match a diagnostic case status

[www.cdc.gov/nndss/conditions/lyme-disease/case-definition/2017/]
Clinical Criteria

- **Erythema migrans (EM) ≥5 cm in diameter**

- **Late manifestations**
  - **Musculoskeletal system**: recurrent, brief attacks of joint swelling followed by chronic arthritis
  - **Nervous system**: lymphocytic meningitis, cranial neuritis, facial palsy, radiculoneuropathy, or encephalomyelitis
  - **Cardiovascular system**: acute onset of high-grade 2\(^{nd}\) degree or 3\(^{rd}\) degree atrioventricular conduction detects (myocarditis)

Case Definition (cont’d)

For the purposes of surveillance, laboratory evidence includes:

• A positive culture for *B. burgdorferi*

  OR

• A positive two-tier test - This is defined as a positive or equivocal enzyme immunoassay (EIA) or immunofluorescent assay (IFA) followed by a positive Immunoglobulin M (IgM) or Immunoglobulin G (IgG) western immunoblot (WB) for Lyme Disease

  OR

• A positive single-tier IgG WB test for Lyme Disease
Suspected
- A case with evidence of infection but no clinical information available (e.g., a laboratory report)

Probable
- Any other case of physician-diagnosed Lyme Disease that has laboratory evidence of infection

Confirmed
- A case of EM with exposure in a high incidence state,
  OR
- A case of EM with laboratory evidence of infection and a known exposure in a low incidence state,
  OR
- Any case with at least one late manifestation that has laboratory evidence of infection
Lyme Disease Toolkit


No laboratory evidence of infection
OR
Insufficient/inappropriate laboratory testing conducted

Physician-diagnosed erythema migrans (EM) at least 5 cm with known exposure2 in a high incidence state

Physician-diagnosed EM at least 5 cm with known exposure2 in low incidence state

One or more late manifestations of disease3

Physician-diagnosed Lyme disease lacking clinical criteria (EM and/or late manifestations) of a confirmed case

No/unknown clinical information available

Physician-diagnosed EM at least 5 cm with no known exposure4

Confirmed Case

Probable Case

Suspect Case

Not A Case

Appropriate laboratory testing4
A positive culture for *B. burgdorferi*
OR
A positive two-tier test. (This is defined as a positive or equivocal enzyme immunoassay (EIA) or immunofluorescent assay (IFA) followed by a positive Immunoglobulin M (IgM)* or Immunoglobulin G (IgG) western immunoblot (WB) for Lyme disease
OR
A positive single-tier IgG WB test for Lyme disease

*EIA/IIFA and the IgM WB need to be completed within 30 days of symptom onset.

1Laboratory tests in this guide are the only ones recommended for case ascertainment. Other diagnostic tests (e.g. PCR) should not be used. CDC recommends a two-tier approach for Lyme disease testing using serum (EIA/IIFA with reflex to Western blot). CSF and synovial fluid are not considered appropriate specimens for two-tier testing.

2Exposure 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 (see https://www.cdc.gov/lyme/stats/tables.html). A history of tick bite is not required.

3Late manifestations include musculoskeletal (recurrent, brief attacks of joint swelling followed by chronic arthritis), nervous system (lymphocytic meningitis, cranial neuritis, facial palsy (may be bilateral), and radiculoneuropathy, or rarely encephalomyelitis), and cardiovascular (acute onset 2nd -3rd atrioventricular conduction defects that resolve in days to weeks) signs of disease.

4Exposure in a low-incidence state is considered unknown exposure.
Case Definition Criteria Not Met

Common reasons that cases are not considered confirmed cases based on the case definition:

- Inappropriate or insufficient laboratory testing
- No illness onset date
- Lack of response/Form A not completed
Inappropriate or Insufficient Lab Tests

These tests **will not** meet the laboratory criteria:

- Capture assays for antigens in urine
- Lymphocyte transformation tests
- Quantitative CD57 lymphocyte assays
- Polymerase chain reaction (PCR)
- Tests that measure antibodies in joint fluid (synovial fluid)
- IgM WB test without a previous EIA/IFA
- EIA/IFA only
Why Reporting Matters

• At the State
  • Gain a wider understanding of Lyme Disease trends in West Virginia vs. nationwide so we can:
    • Educate healthcare providers and the public
      • Annual and bi-weekly summary reports developed for public access
      • Educational outreach and presentations in public venues
      • Educational materials dispersed through outdoor recreational venues
    • Provide public health recommendations and issue alerts when necessary
State Reports Produced

- Biweekly Vectorborne Disease reports created during peak season (June-Sept)
- Annual Reports:
  - Zoonotic Disease Annual Report
Why Reporting Matters (cont’d)

• At the Centers for Disease Control and Prevention
  • Understand the epidemiology of Lyme Disease nationwide so they can:
    • Educate healthcare providers and the public
    • Conduct research to improve diagnostics, surveillance and prevention and control
      • Develop better repellents
      • Permethrin treated clothes
      • Use of rodent-targeted treatments/vaccines to reduce tick load around the house
    • Discover new tickborne diseases (e.g. *Borrelia mayonii*)
Contact

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References