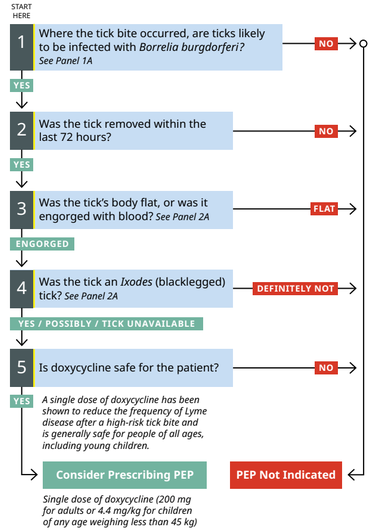
Lyme Disease Post-Exposure Prophylaxis (PEP)



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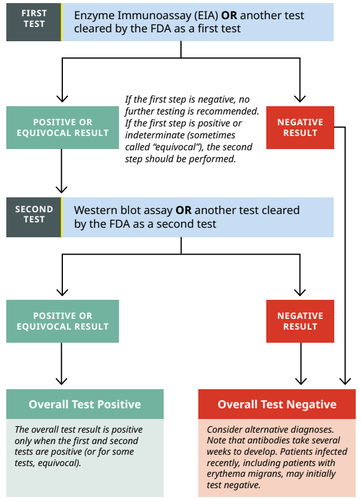
1B

Lyme Disease Serology Testing



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2B

Interpretation of LD Western Blot Results

Positive IgM

At least 2 of these 3 bands	23/24, 39, 41 kDa

Positive IgG

At least 5 of these 10 bands	18, 23/24, 28, 30, 39, 41, 45, 58, 66, 93 kDa

The IgM Western blot is only useful if symptom onset was in the last 30 days. If symptoms have been present for more than 30 days, consider ONLY the IgG Western blot. This is because the IgM result is more prone to false-positive results than the IgG.

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SCAN HERE
For more information on Lyme disease.

3B

Table 4. Treatment of Specific Manifestations of Lyme Disease

Disease Manifestation	Route	Medication	Duration, days (range)[a]
Erythema migrans[b,c]	Oral	Doxycycline	10
		Amoxicillin or cefuroxime axetil	14
		Azithromycin[c]	7 (range: 5–10)
Meningitis or radiculopathy	Oral	Doxycycline	14–21
	IV[d]	Ceftriaxone	14–21
Cranial nerve palsy	Oral	Doxycycline	14–21
Carditis	Oral[e]	Doxycycline, amoxicillin, or cefuroxime axetil	14–21
	IV[e]	Ceftriaxone	14–21
Arthritis			
Initial treatment	Oral	Doxycycline, amoxicillin, or cefuroxime axetil	28
Recurrent or refractory arthritis	Oral	Doxycycline, amoxicillin, or cefuroxime axetil	28
	IV	Ceftriaxone	14[f]
Acrodermatitis chronica atrophicans	Oral	Doxycycline, amoxicillin, Or cefuroxime axetil	21–28
Borrelial lymphocytoma	Oral	Doxycycline, amoxicillin, or cefuroxime axetil	14

Abbreviation: IV, intravenous.

[a]Ranges are given where different durations have been studied, and the optimal duration remains uncertain.

[b]This recommendation applies both to solitary and multiple erythema migrans.

[c]Because of concerns for lower efficacy, macrolide antibiotics including azithromycin are considered second line agents, and should be reserved for patients in whom other antibiotic classes are contraindicated. Azithromycin has not been sufficiently studied for manifestations of Lyme disease other than erythema migrans.

[d]Initial IV therapy agents is ceftriaxone, but cefotaxime and penicillin G are alternatives.

[e]Hospitalization may be indicated for patients requiring hospital admission. Therapy can be completed orally for the same total 14-day duration. Patients with Lyme carditis who do not require hospital admission can be treated orally.

[f]Repeat IV therapy can be extended to 28 days if inflammation is not resolving.

4B

Table 3. Drug Doses

Drug	Dosage for Adults	Dosage for Children
Oral Regimens		
Preferred		
Amoxicillin[a]	500 mg 3 times daily	50 mg/kg divided 3 times daily (maximum 500 mg per dose)
Doxycycline[b]	100 mg twice daily or 200 mg once daily[b]	4.4 mg/kg divided twice daily (maximum 200 mg daily)
Cefuroxime axetil[a,c]	500 mg twice daily	30 mg/kg divided twice daily (maximum 500 mg per dose)
Alternative		
Azithromycin[b]	500 mg once daily	10 mg/kg once daily (maximum 500 mg per dose)
Intravenous Therapy		
Preferred		
Ceftriaxone	2000 mg once daily	50–75 mg/kg once daily (maximum 2000 mg per dose)
Alternative		
Cefotaxime[a]	2000 mg three times daily	150–200 mg/kg divided 3–4 times daily (maximum 6000 mg daily)
Penicillin G[a]	18–24 million units divided every 4 hours	200 000–400 000 units/kg divided every 4 hours (maximum 18–24 million units daily)

[a]Regardless of the treatment regimen, complete response to treatment may be delayed beyond the treatment duration. Relapse may occur with any of these regimens; patients with objective signs of relapse may need a second course of treatment.

[b]Dose of some beta lactam antibiotics (amoxicillin, penicillin, cefuroxime, and cefotaxime) may require adjusted dosing for patients with impaired renal function.

[c]There is increasing favorable information on the safety of short courses of doxycycline in young children, which should impact the risk to benefit ratio of using this antibiotic in patients with various manifestations of Lyme disease; see the General Principles and the individual treatment sections of this guideline for further discussion.

[d]The oral suspension of cefuroxime is currently not available in the USA.

[e]Because of concerns for lower efficacy, macrolide antibiotics including azithromycin are considered second line agents, and should be reserved for patients in whom other antibiotic classes are contraindicated.

Tables 3 & 4 reprinted from Lantos PM, Rumbaugh J, Bockenstedt LK, et al. Clinical Practice Guidelines by the Infectious Diseases Society of America (IDSA), American Academy of Neurology (AAN), and American College of Rheumatology (ACR): 2020 Guidelines for the Prevention, Diagnosis and Treatment of Lyme Disease. Clinical Infectious Diseases. 2021;72(1):e1-e48. Copyright 2020, with permission of Oxford University Press. To access these charts and more, go to: https://www.idsociety.org/practice-guideline/lyme-disease/

5B

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Lyme Disease Pocket Guide

The National Association of Pediatric Nurse Practitioners (NAPNAP) values our members and their commitment to pediatric health care.

NAPNAP is proud to bring this practice tool to you. Our hope is that it becomes a tool you can rely on in daily practice.

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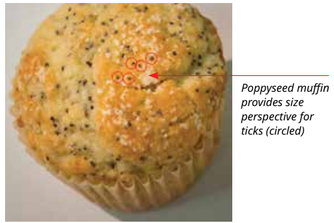
Health care providers have an implied responsibility to use the newly acquired information to enhance patient outcomes and their own professional development. The information presented in this activity is not meant to serve as a guideline for patient management. Any medications, diagnostic procedures, or treatments discussed in this publication should not be used by clinicians or other health care professionals without first evaluating their patients' conditions, considering possible contraindications or risks, reviewing any applicable manufacturer's product information, and comparing any therapeutic approach with the recommendations of other authorities.

National Association of Pediatric Nurse Practitioners™

What Is Lyme Disease?

- Tickborne illness caused by the spirochete *Borrelia burgdorferi*
- Usually causes a local rash; if not treated, can disseminate to other sites over days to weeks

The deer tick (blacklegged tick), *Ixodes scapularis*, spreads the infection in Northeastern, mid-Atlantic and North Central states. The Western blacklegged tick, *Ixodes pacificus*, spreads the infection along the North Pacific coast.



Poppyseed muffin provides size perspective for ticks (circled)

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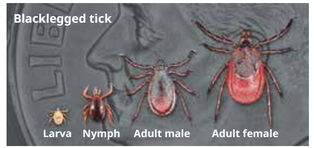
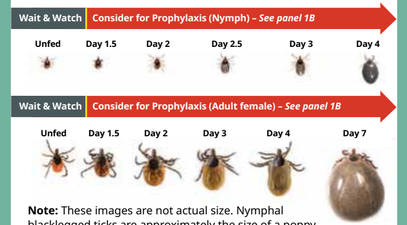
Tick Size and LD Risk with Attachment



- Transmission of the *Borrelia burgdorferi* bacteria typically occurs after at least 24 hours of tick attachment
- Removing an attached tick as soon as possible is important to reduce risk of Lyme disease



Note: These images are not actual size. Nymphal blacklegged ticks are approximately the size of a poppy seed, and adult blacklegged ticks are approximately the size of a sesame seed.

Figure reprinted from Lantos PM, Rumbaugh J, Bockenstedt LK, et al. Clinical Practice Guidelines by the Infectious Diseases Society of America (IDSA), American Academy of Neurology (AAN), and American College of Rheumatology (ACR): 2020 Guidelines for the Prevention, Diagnosis and Treatment of Lyme Disease. Clinical Infectious Diseases. 2021;72(1):e1–e48. Copyright 2020, with permission of Oxford University Press.

Visual Examples: Erythema Migrans Skin Lesions

- May occur within 3 to 30 days of bite
- Flat to slightly raised erythematous expanding lesion, typically larger than 5 centimeters
- May not appear as classic bull's-eye lesion or have central clearing
- One or multiple lesions may be present

Photo credits:
A. *Crusted centers: ©DermAtlas, Bernard Cohen. Used with permission;*
B. *Skin of color: Brown Skin Matters, https://brownskinmatters.com/525;*
C. *Classic bull's-eye lesion: James Gathany, http://phil.cdc.gov/phil*

Visual Examples: Erythema Migrans Skin Lesions

Photo credits: ***D.*** *Expanding erythema migrans: Reprinted from Bhate C, Schwartz RA. Lyme disease: Part I. Advances and perspectives. J Am Acad Dermatol 2011;64:619-36, with permission from Elsevier;* ***E.*** *More than one rash: ©DermAtlas, Bernard Cohen. Used with permission;* ***F.*** *Red-blue lesion with central clearing: ©DermAtlas, Robin Stevenson, Used with permission;* ***G.*** *Appearing anywhere on the body: Courtesy of New York State Department of Health, Used with permission.*

Presentations of Disseminated Lyme Disease

Lyme Carditis

Typically presents as atrioventricular nodal block. Varying degrees of heart block can occur, which can progress to or fluctuate between complete heart block. Pericarditis and myocarditis can also occur. Symptoms may include:

- dyspnea
- palpitations
- syncope
- chest pain
- exercise intolerance

An ECG does not need to be performed routinely on all patients with Lyme disease. However, an ECG should be performed urgently for any patient with suspected Lyme carditis.

Lyme Arthritis

Marked swelling primarily affecting large joints, most commonly the knee. This is the most common presentation of late Lyme disease in children. Predictors of Lyme arthritis include:

- known history of tick bite
- isolated knee involvement
- lack of fever

Lyme arthritis can be difficult to differentiate from septic arthritis. Predictors of septic arthritis may include:

- absolute neutrophil count ≥10k cells/mm^3
- ESR ≥40 mm/hour
- hip involvement
- pain with short arc motion

Image used with permission: Centers for Disease Control and Prevention, https://www.cdc.gov/lyme/signs_symptoms/index.html

Presentations of Disseminated Lyme Disease

Cranial Neuritis

Cranial neuritis usually involves the facial nerve (CN VII) and less often, the trigeminal (CN V), oculomotor and abducens (CN III, VI), and vestibulocochlear nerves (CN VIII). When the cranial nerves are affected, facial palsy can occur on one or both sides of the face.

Lyme Meningitis

Presentation is similar to enteroviral and other aseptic meningitis. This may include:

- fever
- headache
- photosensitivity
- neck stiffness or pain
- CSF lymphocytic pleocytosis

The presence of the following increases likelihood of Lyme meningitis:

- co-occurrence of facial nerve palsy
- mononuclear cell predominant CSF pleocytosis

Radiculoneuritis

This presentation is rare in children, but if present, may include:

- numbness
- tingling
- "shooting" pain
- weakness in arms or legs

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