

A 16-year-old boy comes to the office in December due to right knee swelling that began earlier that day following soccer practice, although he does not recall any specific injury. The patient has mild associated pain and stiffness. In addition, over the last several months he has experienced fatigue with occasional flu-like illnesses and variable joint pains. The patient's medical history is unremarkable, and he takes no medications. He is the captain of his high school soccer team and spent the summer at a soccer camp in Maine. The patient is sexually active with his girlfriend and uses condoms. Vital signs are normal. Cardiopulmonary examination is normal. The patient is able to bear weight and has a grossly normal gait. Examination of the right knee shows palpable warmth and a mild effusion but no tenderness. Range-of-motion testing shows a mild decrease in flexion in the right knee compared to the left. Other joints are normal. Plain radiographs of the knee joint reveal no bony deformity. Aspiration of the knee joint yields yellow-colored, translucent fluid with a leukocyte count of  $20,000/\text{mm}^3$  (50% neutrophils) and no organisms on Gram stain. Which of the following is the most likely cause of this patient's knee swelling?

- ☐ A. Autoimmune synovial inflammation
- ☐ B. *Borrelia burgdorferi* infection
- ☐ C. Disseminated gonococcal infection
- ☐ D. Meniscus tear
- ☐ E. Prior *Chlamydia trachomatis* infection
- ☐ F. Prior streptococcal throat infection
- ☐ G. Staphylococcal joint infection



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- ☐ A. Autoimmune synovial inflammation [15%]
- ☒ B. *Borrelia burgdorferi* infection [46%]
- ☐ C. Disseminated gonococcal infection [17%]
- ☐ D. Meniscus tear [3%]
- ☐ E. Prior *Chlamydia trachomatis* infection [11%]
- ☐ F. Prior streptococcal throat infection [5%]
- ☐ G. Staphylococcal joint infection [3%]

Proceed to Next Item

Explanation:

User Id: [REDACTED]

Stage	Clinical manifestations of Lyme disease
Early localized (days-1 month after tick bite)	<ul style="list-style-type: none"><li>• Erythema migrans (80% of patients)</li><li>• Fatigue, malaise, lethargy</li><li>• Mild headache &amp; neck stiffness</li><li>• Myalgias &amp; arthralgias</li></ul>



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Early disseminated (weeks-months after tick bite)	<ul style="list-style-type: none"> <li>• <b>Carditis</b> (5% of untreated patients) <ul style="list-style-type: none"> <li>◦ Atrioventricular block, cardiomyopathy</li> </ul> </li> <li>• <b>Neurologic</b> (15% of untreated patients) <ul style="list-style-type: none"> <li>◦ Unilateral or bilateral cranial nerve defects (usually VII), meningitis, encephalitis</li> </ul> </li> <li>• <b>Muscular</b> (60% of untreated patients): Migratory arthralgias</li> <li>• <b>Conjunctivitis</b> (10% of untreated patients)</li> <li>• <b>Skin</b>: Multiple erythema migrans</li> <li>• Regional or generalized lymphadenopathy</li> </ul>
Late or chronic (months-years after tick bite)	<ul style="list-style-type: none"> <li>• <b>Muscular</b> (60% of untreated patients): Arthritis</li> <li>• <b>Neurologic</b>: Encephalomyelitis, peripheral neuropathy</li> </ul>

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This patient's synovial fluid analysis and history of acute monoarticular arthritis following months of migratory arthralgias and a trip to **Maine** are consistent with Lyme arthritis, the hallmark of late Lyme disease. Lyme disease is caused by *Borrelia burgdorferi*, a spirochete carried by the deer tick (*Ixodes scapularis*), and causes disseminated infection by hematogenous spread and migration into various tissues.

Early symptoms (eg, erythema migrans, fever) can be overlooked or misdiagnosed if history of travel to endemic areas is not obtained. Untreated early localized disease can progress to an inflammatory **monoarticular** or asymmetric **oligoarticular arthritis**, most commonly involving the **knee**. Synovial fluid shows an inflammatory profile with an average leukocyte count of 25,000/mm<sup>3</sup>; Gram stain and culture are usually negative, although polymerase chain reaction (done for investigative purposes) may demonstrate *B. burgdorferi* DNA. The diagnosis can be confirmed with serum **ELISA** and **Western blot**.



Late or chronic  
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**(Choice A)** Autoimmune arthritis (eg, rheumatoid arthritis) typically causes a chronic, symmetric, inflammatory arthritis that favors the small joints.

**(Choices C and G)** Staphylococcal and disseminated gonococcal infection can cause an acute inflammatory monoarthritis, but the joint fluid is purulent (higher cell count) and Gram stain is positive, especially with staphylococcal infection. Gonococcus can also cause chronic polyarticular arthralgias, usually with tenosynovitis and pustular skin lesions. Arthritis symptoms are less likely to be present for several months.

**(Choice D)** Meniscus tears in young patients usually result from significant trauma. Effusions are common but are associated with tenderness at the joint line. Range-of-motion testing will show locking or popping rather than a mild decrease in flexion.

**(Choice E)** Reactive arthritis (formerly termed Reiter syndrome) presents 1-4 weeks after an enteric or chlamydial infection. Manifestations include a chronic, asymmetric inflammatory arthritis, often with urethritis and conjunctivitis or uveitis.

**(Choice F)** Rheumatic fever is a rare complication of streptococcal pharyngitis characterized by fever and migratory arthralgias. Joints are painful and tender. Other manifestations include subcutaneous nodules, carditis, and neuropsychiatric signs (eg, chorea).



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#### Educational objective:

Lyme arthritis is the most common late manifestation of Lyme disease. It presents as an inflammatory monoarticular or asymmetric oligoarticular arthritis, most commonly in the knee. Synovial fluid shows an inflammatory profile, but Gram stain and culture are usually negative.

#### References:

1. [Lyme disease and the orthopaedic implications of Lyme arthritis.](#)
2. [The clinical assessment, treatment, and prevention of lyme disease, human granulocytic anaplasmosis, and babesiosis: clinical practice guidelines by the Infectious Diseases Society of America.](#)



Media Exhibit

Lyme Disease: Endemic Areas in the United States

### Lyme Disease: Endemic Areas in the United States

