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Lyme Disease: A Tick's Risky Bite

Jana Keller

Otterbein University, jana.keller@otterbein.edu

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Lyme Disease: A Tick's Risky Bite

Jana Keller, RN, BSN

Introduction

Lyme Disease is a bacterial infection transmitted primarily by the deer tick and is commonly seen in the United States. It is an infectious disease caused by the bacterium *Borrelia burgdorferi*, which is a spirochete (Pearson, 2014). Lyme disease's prevalence is confirmed by the Centers for Disease Control and Preventions whom estimates that 30,000 people per year are diagnosed with Lyme disease in the United States (Moore, 2015). It is imperative that primary health care workers (such as Nurse Practitioners) are familiar with this disease and the early signs and symptoms. If early signs and symptoms go unnoticed or misdiagnosed by a healthcare professional, the spirochete infection may lead to a more difficult disease pathway that may be fatal (Moore, 2015).

Below: Reported cases of Lyme Disease in 2001
Copyright 2015 by CDC

Reported Cases of Lyme Disease -- United States, 2001



1 dot placed randomly within county of residence for each reported case

Pathophysiological Process

Lyme Disease is transmitted when the bacteria *Borrelia burgdorferi* enters the body (most commonly through a tick bite). Studies have shown there is a delay of thirty-six hours from the time the tick attaches to the host to transmission of the spirochete to the host (Nichols & Windemuth). The bacteria pass from the tick to the human through the tick's saliva and multiply. During transmission, the spirochete binds with a tick salivary protective protein to shield against host antibodies and complement. The spirochetes then multiply and eventually move away from the site of the initial bite. The pathogenesis continues by Lyme borrelia that do not directly degrade extracellular matrix, they instead rely on their motility and the expression of adhesins and proteins that bind host proteases to invade tissues (Bockenstedt & Wormser, 2014). The spirochetes also create a production of matrix metalloproteinases, which makes tissues more permissive to pathogen invasion furthering incidence of infection (Bockenstedt & Wormser, 2014).

Below: Relative size of blacklegged tick
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Blacklegged Tick (*Ixodes scapularis*)



Pathophysiological Significance

During transmission, when the spirochetes bind to the tick's saliva, the protein cover that is formed works as a shield against the host's antibodies and complement. The *B burgdorferi* genome does not have virulence factors or toxins, therefore the clinical signs of Lyme disease is a result from the immune response to the infection (Bockenstedt & Wormser, 2014). The bacteria spreads through the blood and lymphatic system to other organs or skin sites and can cause joint inflammation, cardiac involvement, as well as neurologic symptoms (Marchese & Primer, 2013).

Case Study

A 32-year old pregnant woman from southeastern Connecticut presents to her physician in July at 26 weeks' gestation because of a skin lesion. She reports she has had fatigue, arthralgia, and headache for 2 days and a rash in her left axilla for 1 day. She lives in a wooded area and works in her garden frequently. Six weeks earlier, she had removed a small tick that was attached behind her right knee. On physical examination, she is afebrile. She has an erythematous, oval macular lesion, 7 to 8cm in diameter, in her left axilla, with enhanced central erythema (Shapiro, 2014). The patient is evaluated for Lyme Disease.



Well known sign of Lyme Disease: erythema migrans (EM) rash.
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Case Study Significance

The patient described in the case study has a rash that is consistent with erythema migrans, 6 weeks after a tick was removed from the back of her knee. The patient should be recommended to start antibiotics (safe for pregnancy) prophylactically to treat Lyme disease. The patient should be given emotional support that early treatment leads to excellent outcomes, and that congenital Lyme disease has never been documented (Shapiro, 2014). Serological testing can also be done for diagnosis of disease.

Signs and Symptoms

There are three different phases of Lyme disease. The first phase, early localized, consists of a dermatologic involvement, such as erythema migrans rash. This rash is described as a "bull's eye" rash. This is often the most identifiable and earliest sign presenting days to weeks after the initial tick bite, but does not present in all cases. Other early symptoms may be flu-like, headache, fever, malaise, muscle soreness, or a headache with recent tick exposure (Grisanti, 2015). As the infection advances, especially if untreated, it affects the body systemically via the lymphatic system or blood. Months later the patient may move into the early disseminated phase which affects cardiac (atrioventricular block), multiple erythema migrans lesions, musculoskeletal (arthralgia, myalgia) and neurologic (lymphocytic meningitis, facial nerve palsy and encephalitis). The late phase of Lyme disease includes arthritis and advanced neurologic symptoms with worsening encephalomyelitis and peripheral neuropathy (Wright, Riedel, Talwani & Gilliam, 2012).

Nursing Implications

It is imperative for healthcare professionals to be aware of Lyme disease to start antibiotic treatment early and prevent late phase development. Lyme disease can be difficult to diagnose because the symptoms may often mimic other diseases. The healthcare professional should be mindful to ask the patient about possible exposure to ticks and wooded areas. High Lyme disease endemic areas are considered to be the northeastern part of the United States from Maine to Maryland, as well as Wisconsin and Michigan (Snow, 2013). Healthcare professionals in these areas should be aware of the increased incidence of Lyme disease. Patients with active lifestyles that enjoy camping, hiking, or any activities in wooded areas should be made aware of the risks of Lyme disease and the importance of checking for ticks. For the reason that the tick must be attached for greater than 36 hours to transmit *Borrelia burgdorferi*, the removal of ticks right away is of utmost importance (Muschart & Blommaert, 2015).

Conclusion

Lyme Disease is the most commonly reported vectorborne disease in the United States (Shapiro, 2014). It is important for healthcare workers to be aware of exposure risks and early diagnosis of Lyme disease for their patients. The nonspecific symptoms make the illness difficult to diagnose. The clinical manifestations of Lyme disease occur as a reaction to the host inflammatory response to the *Borrelia burgdorferi* pathogen. With early diagnosis and treatment, patient's outcomes can be successful. Late diagnosis without treatment can lead to the later phases of the disease, which leads to much more severe and lifelong complications. Continuing research about Lyme disease and the pathophysiological process of the late phases are continually being studied.



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