

## Lyme's Disease: Recognition and Management for Emergency Nurses

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## Abstract

Over the last 10 years there has been a significant rise in the numbers of patients who present to the Emergency Department (ED) with a diagnosis of Lyme disease. Although some patients may remain asymptomatic a significant number of patients present with a rash focused around a previous tick bite. Others may present with a wide range of debilitating symptoms that can be very problematic, if left untreated. Due to the growing prevalence of Lyme disease within the United Kingdom (UK) and the US, this article offers an overview of the vector borne nature of this illness and provides the Emergency Nurse with information on the pathophysiology, prevention, presenting symptoms, and management of Lyme disease.

Keywords: *Lyme disease, tick-bite, vector-borne.*

## Introduction

There has been a notable global increase in the numbers of vector-borne diseases in humans (Medlock & Leach, 2015). Lyme Borreliosis (LB) is the most common tick-borne illness in Europe and North America (Borchers et al, 2012). In Europe it is caused by the spirochete *Borrelia afzelii*, *B. garinii*, *B. burgdoferi*. In North America LB is exclusively caused by *B. burgdoferi* (Borchers, Keen, Huntley, & Gershwin, 2015). In the United States (US), according to the Centers for Disease Control and Prevention (CDC), there were 33,461 cases of Lyme disease reported in the US in 2014 (CDC, 2015). However, the CDC reported that the true number of cases of Lyme disease was approximately 6-12 times higher than the number of reported cases, bringing the final figure to 200,000-400,000 cases of LB infection (CDC, 2004). In Scotland, 440 cases of LB infection were reported in 2010. (Mavin, Watson & Evans, 2015). From 2008 to 2013 the average annual incidence of LB infection was calculated to be 6.8 per 100000, with the vast majority of cases being reported by National Health Service (NHS) Highland, located in the very north of Scotland. The rise in LB infection can be due to several factors including climate change, land management strategies, increased tick survival rates, and human behaviors that result in tick exposures (Sathiamoorthi & Smith, 2016).

Though some patients may well remain asymptomatic following infection, others may present with a minor erythema migrans (EM) centered on the area of the tick bite. “Other patients may present with debilitating disease with significant morbidity if left untreated” (Mavin, Watson & Evans 2015). Controversies remain regarding diagnosis and treatment of LB infection, and the nature of persistent symptoms in a sub-population of infected persons. Patients often visit the Emergency Department (ED) to seek treatment for tick bites, and to confirm suspected LD infection. Due to the growing prevalence of LB within the United Kingdom (UK)

and the US, this article offers an overview of the vector borne nature of this illness and provides the Emergency Nurse with information on the pathophysiology, prevention, presenting symptoms, and management of LB.

### **Causative agents**

The main species of tick that carries the borrelia spirochete is the *Ixodes* spp. The bacteria of the borrelia spirochete family are generally grouped into the *B. burgdorferi* sensu lato species (Binder, Telschow & Meyer-Hermann, 2012). Generally, borrelia are thin, agile and stretched bacteria with an outer fluid filled membrane which is fragile in nature (Barbour & Hayes, 1986). Among prokaryotes the genetic makeup of the borrelia bacteria is unusual in the sense that it has small straight chromosomes and circle shaped plasmids (Bundoc & Barbour, 1989). Fig 1 shows the appearance of a tick embedded in the skin.

The adaptable nature of the borrelia bacteria make its movement between arthropods and vertebrates more straightforward (Binder, Telschow & Meyer-Hermann, 2012). Interestingly, there are variations on the type of tick vector depending on the geographical location of the victim being bitten (Franz & Krause, 2003). In the US there are 2 primary tick vector species known to carry borrelia bacteria. On the East side of the US the infecting vector is *Ixodes scapularis* and on the West coast of the US the infecting vector is *Ixodes pacificus* (Danfache & Nadelman, 2008). From a European perspective the principle vector is *Ixodes ricinus* (Stanek & Strle, 2003). For Lyme disease to be spread to a humans, the tick must first be infected with *B. burgdorferi* while feeding from an infected animal host (Gerstenblith & Stern, 2014). Typically, the most common animal reservoirs for *B. burgdorferi* tends to be deer, hares, mice and small birds (Nigrovic et al, 2017). Interestingly, in order for infection to take place the vector must feed on the human host for between 24-48hrs (Borchers et al, 2015).

## Presenting Signs & Symptoms

Diagnosis is challenging because of the inexact clinical presentation associated with Lyme disease. Signs and symptoms can appear anywhere between 3-30 days after a tick bite (Centers for Disease Control and Prevention, 2017). In addition, early symptoms may be similar to the flu leading to a delay in accessing medical care. Furthermore, signs and symptoms vary slightly depending on the specific subtype of the *Borrelia* species (Stranek & Strle, 2003). This is particularly relevant to clinicians who treat patients in the United States, the UK, or in other countries where patients are exposed to ticks carrying a variety of species of the organism.

In general, clinical features can be described as occurring in three stages: early (with erythema migrans lesion), early disseminated, and late (Lipsett & Nigrovic, 2016; Nigrovic et al., 2017). Patients may present to the emergency department or primary care facility anywhere along the illness trajectory so a good understanding of the main symptoms associated with each stage.

Erythema migrans (EM) (see fig 2) is the classic sign associated with the early stage of Lyme Disease (Centers for Disease Control and Prevention, 2017; Stranek & Strle, 2003) EM appears in approximately 90% of patients with Lyme Disease in the US and between 70-95% of patients in Europe (Borchers, Keen, Huntley, & Gershwin, 2015). It is described as a red, ring-like rash (Centers for Disease Control and Prevention, 2017) often found in the axilla, the groin, behind the knee or at the belt line (Chaaya, Jaller-Char, & Ali, 2016). The head or neck is the primary site in 20-40% of children. This painless rash typically begins as a single papule at the site of the tick bite, then progresses to a erythematous border with clearing in the center of the ring (Lipsett & Nigrovic, 2016) often described as a bull's eye (Centers for Disease Control and Prevention, 2017; Chaaya et al., 2016) (see Figure x). Size of the rash can vary from 5 cm to up

to more than a meter in diameter (Borchers et al., 2015; Stranek & Strle, 2003). While about 80% of patients with Lyme Disease present with a rash, only about one third appear as a bull's eye appearance (Chaaya et al., 2016). Patients who do not present with a rash may have fever and chills, fatigue, muscle ache, lymphadenopathy and headache (Centers for Disease Control and Prevention, 2017; Nigrovic et al., 2017). Systemic symptoms are more common in the US than in Europe (Borchers et al., 2015; Stranek & Strle, 2003).

Signs and symptoms associated with the early disseminated stage can appear anytime between several weeks and several months after the original infection. These symptoms typically appear in patients who have not been treated effectively at symptom onset. Secondary lesions of the infection can appear as multiple, smaller EM lesions that appear similar to the original EM (Borchers et al., 2015). Cardiac and neurological symptoms are common in this stage.

The three main neurological manifestations of LD are cranial neuritis, lymphocytic meningitis, and radiculoneuritis (Borchers et al., 2015). Patients may experience these symptoms alone or in combination. Facial palsy (Bell's palsy) is the most common manifestation of cranial neuritis in the US. This can be unilateral or bilateral in adults. Severe radicular pain, worse at night, is the most common neurologic symptom in European patients (Borchers et al., 2015; Stranek & Strle, 2003). Children are more likely to experience unilateral facial palsy and symptoms associated with meningitis (Borchers et al., 2015; Lipsett & Nigrovic, 2016). Meningitis is rare in adults.

Lyme carditis can occur within days to months after the onset of EM (Borchers et al., 2015; Centers for Disease Control and Prevention, 2017). Signs and symptoms include lightheadedness, syncope, palpitations, dyspnea and chest pain (Lee & Singla, 2016). EKG can

reveal atrioventricular conduction defects, particularly second or third degree heart block (Borchers et al., 2015; Lee & Singla, 2016). Conduction defects can develop suddenly and fluctuate over the clinical course and progress to third degree heart block rapidly (Borchers et al., 2015). In fact, nearly half of cases of patients with Lyme carditis progress to third degree heart block (Borchers et al., 2015).

European patients with Lyme disease are more likely to exhibit acrodermatitis chronica atrophicans (ACA) (see Fig. 3). ACA is a late, chronic integumentary manifestation affecting predominantly women of middle-age or older (Borchers et al., 2015; Stranek & Strle, 2003). It initially appears as a bluish-red discoloration usually on the extensor surfaces areas of the hands or feet typically exposed to the sun (Borchers et al., 2015). ACA may be unilateral or bilateral but unlike EM, it does not resolve spontaneously but can persist over months or even years (Borchers et al., 2015; Stranek & Strle, 2003).

Lyme arthritis is considered a late stage manifestation of untreated infection. While symptoms of Lyme arthritis can appear in days or weeks after EM, they generally don't appear until months or years after infection.(Borchers et al., 2015; Moore, 2015) Arthritis typically is intermittent, asymmetrical and involves large joints such as the knee, elbow, shoulder or ankle. In some cases, the temporomandibular joint can be involved. Patients may have effusions and soft tissue swelling with joint inflammation.(Borchers et al., 2015) A small percentage of patients will have additional neurological symptoms such as cognitive impairment, shooting pains, numbness, or tingling of the hands, and feet (Moore, 2015).

### **Management**

LB is often diagnosed based on the characteristic symptoms and from the presence of erythema migrans (Bhate & Schwartz, 2011). Nevertheless, diagnosing and managing Lyme

disease may be problematic due to its atypical manifestations and multisystem involvement. The National Institute of Clinical Excellence (NICE) report that the core treatment option for LB is anti-biotics therapy (NICE, 2017). Table 1 outlines the current draft guideline for non-pregnant adults.

## **Implications for Emergency Nursing Practice**

### **Patient and Family Teaching**

Patients who present to the Emergency Department with suspected Lyme infection, should be taught simple preventative measures to avoid future exposure or infection. Teach patients to avoid areas of overgrown brush, wooded areas, or areas of high grass. Patients should be taught to wear long-sleeved shirts and trousers tucked into socks or boot tops. Wearing light-colored clothing can make ticks more visible to the eye. Individuals spending time in areas where ticks are common should apply N-diethyl-3-methylbenzamide (DEET) insect repellent. As the chance of infection increases with the duration of a tick's attachment to the host, teach patients to check for the presence of ticks and remove them promptly using a tweezers to grasp the tick close to the skin for removal. Once removed, the area should be cleaned with 70% isoprophyl alcohol and soap and water (Seybold, Reiser, & Schlenk, 2008). Application of pesticides to the landscape around a patient's residence will assist in controlling tick populations (Chaaya, Jaller-Char & Ali, 2016). Instruct the patient and family to report symptoms of Lyme carditis.

### **Emergency Department Assessment**

Symptoms of systemic infection with LB ranges from mild generalized illness to an illness with significant morbidity. Note the presence of erythema migrans, if present. Consider a diagnosis of Lyme disease even if the patient present s with a non-specific rash in an endemic



area (Lee & Singla, 2015). Confirming a diagnosis of Lyme disease is controversial. Evaluation of patients with suspected Lyme disease requires a thorough medical and social history to assess risk and potential exposure to LB. Although guidelines for the diagnosis and treatment of Lyme disease are based in scientific evidence, improper interpretation of serologic tests can increase the likelihood of false positive results. The use of indirect-antibody assays or the two-tiered approach to serologic testing recommended by the CDC using an enzyme immunoassay followed by a separate immunoglobulin IgM and IgG western blots for borderline or positive first-tier results.

In addition, persistent symptoms such as fatigue, musculoskeletal pain and cognitive changes attributed to chronic Lyme infection may result in months of unnecessary antibiotic treatment, cost and potentially antibiotic resistance (Sathiamoorthi & Smith, 2016). Thus, correctly identifying the specific patients that would benefit from serologic testing would prevent false positive results in those not infected, and identify those infected individuals who should begin treatment. An electrocardiogram can detect early conduction abnormalities, a non-specific finding indicative of Lyme carditis. Finally, ED nurses should advise patients to monitor for signs and symptoms of Lyme infection for up to 30 days post ED visit.

### Psychological Support

Nurses must be sensitive to psychological stress associated with Lymes Disease. The nature of having an infection that has been transmitted by a small arachnid that is part of an order of parasitiformes that itself was infected by potentially feeding on rodents is likely to cause a certain amount of anxiety, heightened emotions and potentially phobic response. Popular reports in the papers from stars such as Richard Gere to Matt Dawson have been effected does little to align fears (Usborne, 2017).

This fear can be manifested in signs and symptoms such as a dry mouth or hyperventilating. The nurse should try to elicit which symptoms are related to fear and those to any the clinical impact of a tick bite. This element of the assessment includes identifying if the patient is feeling

uncomfortable discussing the issue including looking at pictures of ticks where there is a need to confirm what has caused the bite. If the patient is anxious or tearful then offer reassurance before continuing. The nurse should address each point individually and ensure the patients understands the information they have received. It is important to be positive about the diagnostic outcome by keeping to the empirical evidence, whilst normalizing the condition and not overwhelm the patient with information.

The associated stigma (Institute of Medicine, 2011) can potentially inhibit help seeking behaviour and therefore needs to be addressed sensitively with the first point of clinical contact. The patient may also be concerned that the disease can be transmitted to their spouse, partner, family and friends and needs assurance of the facts over the myths. The assessment must include asking the patients how they view this disease whilst addressing patient concerns sensitively and with compassion (See Table 1). Importantly allow the patient time to articulate their concerns including the impact on their wider friends and family.

#### Departmental Public Health Promotion

Emergency departments alongside PHC practices can provide a pivotal role in reducing Lymes Disease by providing public health and prevention advice to stop infection. Medically unexplained clinical symptoms can be assigned to previously unrecognized Lyme disease. People with undiagnosed Lyme disease may present with chronic fatigue, neuropsychological impairments and autistic spectrum disorders. (Marzillier, 2009). In addition, there are mental health problems with depression, psychotic disorders and cognitive impairment including memory and concentration problems (Sno, 2012). After consultation, it can prove useful to ensure the patient is directed to a suitable national website (that can be shared with spouse and family) outlining detail regarding Lymes Disease (National Health Services (NHS) Choices, 2018).

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| Ser | Table 1  |
|-----|--|
| 1   | Keep calm, maintaining good eye contact and be confident in responses.   |
| 2   | Place patient in a comfortable position.   |
| 3   | If the patient is showing signs of raised of autonomic arousal such as hyperventilating, encourage him or her to take deep and slow breaths, and praise their efforts. |
| 4   | If the patient is panicking, then explain to them calmly that that this is a normal reaction.  |
| 5   | If the patient complains of a dry mouth, give him or her water.  |

|    |   |
|----|---|
| 6  | Carefully explain what the treatment involves whilst ensuring that the patient does not feel overwhelmed by the information. Avoid using jargon or clinical terms unless it is clear that the patient understands them.   |
| 7  | Explain that pain or does not necessarily mean harm.  |
| 8  | Provide the patient with an opportunity to ask questions and respond to his or her concerns.  |
| 9  | After you have explained the treatment, ask the patient to provide feedback and confirm that he or she understands the information they have received.  |
| 10 | Provide the patient with direction to an approved National website so that can access further information once they get home. For example, the UK NHS:<br><a href="https://www.nhs.uk/conditions/lyme-disease/">https://www.nhs.uk/conditions/lyme-disease/</a> |
| 10 | If the patient is to be discharged, then ensure they are calm and relaxed if driving home. With their permission, contact a friend or relative if appropriate.  |
|    | <b>Psychological management of tick bites in the ED department.</b><br><br><i>Adapted from McGhee et al, 2015</i>   |

### **Conclusion**

A differential diagnosis of Lyme disease is partially based upon the medical and social history of the patient's exposure. Emergency Department nurses should maintain a high degree of suspicion for Lyme disease when the patient presents with a localized rash, who were in an area where tick-borne diseases are present, and who are symptomatic. It is important that clinicians understand who should be tested for Lyme disease to avoid false positive results. Nurses should ensure that first-tier diagnostic strategies for the detection of Lyme disease are followed, and that the patient receives the appropriate treatment and follow-up.

Fig1.



Fig 2.



Table 1.

| Symptoms | Treatment | First alternative | Second alternative |
|----------|-----------|-------------------|--------------------|
|----------|-----------|-------------------|--------------------|

|  |  |   |   |
|--|--|---|---|
| Erythema migrans   | Doxycycline 100 mg twice per day or 200 mg once per day for 21 days  | Amoxicillin 1 g 3 times per day for 21 days                         | Azithromycin 500 mg on 3 consecutive days each week for 3 consecutive weeks |
| Non-focal symptoms   | Doxycycline 100 mg twice per day or 200 mg once per day for 21 days  | Amoxicillin 1 g 3 times per day for 21 days                         | Azithromycin 500 mg on 3 consecutive days each week for 3 consecutive weeks |
| Lyme disease affecting the cranial nerves or peripheral nervous system | Doxycycline 100 mg twice per day or 200 mg once per day for 21 days  | Amoxicillin 1 g 3 times per day for 21 days                         |   |
| Lyme disease affecting the central nervous system                      | Intravenous ceftriaxone 2 g twice per day or 4 g once per day for 21 days (consider switching to oral doxycycline when no longer acutely unwell) | Doxycycline 200 mg twice per day or 400 mg once per day for 21 days |   |
| Arthritis  | Doxycycline 100 mg twice per day or 200 mg once per day for 28 days  | Amoxicillin 1 g 3 times per day for 28 days                         | Intravenous ceftriaxone 2 g once per day for 28 days                        |
| Acrodermatitis Chronica atrophicans                                    | Doxycycline 100 mg twice per day or 200 mg once per day for 28 days  | Amoxicillin 1 g 3 times per day for 28 days                         | Intravenous ceftriaxone 2 g once per day for 28 days                        |
| Carditis   | Doxycycline 100 mg twice per day or 200 mg once per day for 21 days  | Intravenous ceftriaxone 2 g once per day for 21 days                |   |
| Carditis and hemodynamically unstable                                  | Intravenous ceftriaxone 2 g once per day for 21 days (consider switching to oral doxycycline when no longer acutely unwell)                      |   |   |

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