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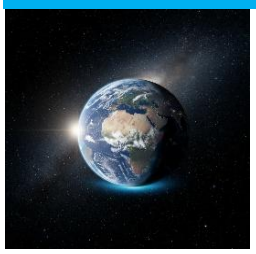

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Lyme Borreliosis in Primary Care: A Review of Current Diagnostic and Therapeutic Guidelines

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ABSTRACT

Introduction:

Lyme disease is still a major public health problem and it can be easily misdiagnosed due to its broad symptomatology. The most recognizable specific sign is erythema migrans (EM) - a distinct skin lesion. However, EM does not appear in every patient with LD and most other signs are non-specific. For that reason, primary care physicians should know about proper

history-taking and when laboratory testing can aid with the diagnosis as the earlier LD is diagnosed, the better the treatment outcome.

Aim of the study:

The aim of this study was to discuss the most recent literature on Lyme disease and extract information that is vital for primary care practice to support General Practitioners in navigating the difficulties that come with Lyme borreliosis.

Materials and methods:

This review of studies is based on articles available across major medical databases, namely PubMed and Google Scholar with a focus on papers from 2020 to 2026. Both domestic and international (USA, UK) guidelines were analysed.

Key findings:

The analysis reveals that a clinical diagnosis is possible when erythema migrans is present and that two-tiered serological testing is essential for disseminated stages. Guidelines outline antibiotic therapy regimens precisely and emphasise their high efficacy. Key findings highlight that post-treatment laboratory follow-up is not indicated. Moreover, effective management of Lyme disease includes careful history-taking (environmental exposure) and the administration of post-exposure prophylaxis when justified.

Conclusion:

Lyme disease is a public health issue and primary care physicians ought to have extensive knowledge on the diagnosis and treatment of the illness. Additionally, it is advised to educate the patients on disease transmission and prevention.

Keywords: Lyme disease; Lyme borreliosis; primary care; erythema migrans; *Borrelia*; tick

INTRODUCTION

Lyme disease, or Lyme borreliosis is the most common tick-borne illness in Europe [1]. It is a zoonotic, multisystem disease caused by spirochetes of the Borrelia genus [2]: Borrelia afzelii and Borrelia garinii in Europe and Asia, Borrelia burgdorferi in North America [3].

In Europe the bacteria are transmitted by Ixodes ricinus ticks which are a major vector of numerous other diseases as well [4].

Lyme borreliosis can affect many body systems and organs, most notably dermatological, musculoskeletal and neurological systems. There's also the risk of developing cardiovascular manifestations, which can have particularly serious consequences for the patients [5].
Patients with this illness may not present to the physician with the most typical presentation, that is erythema migrans (a characteristic skin lesion), which could lead to mistaking Lyme borreliosis for a different disease. Erythema migrans lesion is also the only symptom of Lyme disease that allows for a clinical diagnosis without the need for laboratory testing [6].
Not diagnosing Lyme borreliosis early enough can lead to progression of the disease and complications that cannot be fully reversed with the standard treatment protocols. For this reason it is important for primary care physicians to stay vigilant and know what to watch out for and what to ask the patient to determine whether there is a high risk that the patient developed or might soon develop Lyme disease.

PURPOSE OF THE STUDY

The purpose of this study is to provide a comprehensive review of Lyme borreliosis with a focus on diagnosis, management and prevention. The main objective of this work is to equip primary care physicians with essential clinical tools to address the challenges of diagnosing and treating patients with Lyme disease. We synthesized current guidelines with the aim of increasing diagnostic accuracy and thus achieving better treatment outcomes. Furthermore, this article explores epidemiology, etiopathogenesis and the clinical features as understanding these aspects of Lyme disease is important for accurate diagnosis and the implementation of appropriate antibiotic therapy.

METHODOLOGY

A comprehensive search was done to gather the most recent relevant data on Lyme borreliosis. The literature consists of clinical guidelines from Polish, British and American medical societies, systematic reviews and research papers pertaining to the epidemiology, clinical features, diagnosis, treatment and prevention of Lyme disease. Search was performed with the use of PubMed and Google Scholar databases with the focus on papers released from 2020 to 2026. The following keywords were used:
"Lyme disease", "Lyme borreliosis", "erythema migrans", "tick-borne diseases".
The research process was guided by the following inquiries:

what are the most effective personal methods of tick bite prevention?

what are the standards of clinical and laboratory diagnosis of Lyme disease?

what is the efficacy of established antibiotic therapy protocols?

The selection process was multi-faceted: firstly, article titles and abstracts were evaluated for relevance, secondly certain inclusion criteria were applied:

relevance to the primary care practice

focus on human subjects

articles published in peer-reviewed journals

All authors have independently researched the available literature and subsequently compared their findings to guarantee consistency. Any inconsistencies among the authors' findings have been thoroughly analysed and were resolved through a discussion.

EPIDEMIOLOGY

Incidence

Epidemiological surveillance of Lyme disease in Poland has started in 1996 and beginning in 2019, EU law has also mandated that neuroborreliosis is to be reported to the European Centre for Disease Prevention and Control (ECDC) [7].

According to the ECDC, Poland in its entirety is labeled as an endemic territory for Lyme borreliosis, in spite of the fact that there are vast differences of incidence between voivodeships. The data from National Institute of Public Health NIH [8] reveals that in 2024 there were 29 860 cases of Lyme disease reported and 1041 hospitalizations. That is an increase of cases compared to the previous year, when there were 25 285 reported cases and a slight decrease in hospitalizations (1155 hospitalizations reported in 2023).

Of note is the fact that there is a significant seasonal variation - Q1 had the fewest cases (2207) and Q3 the most (13 438).

Highest incidence was recorded in Podlaskie voivodeship (134,2 per 100 000 inhabitants), Małopolskie voivodeship (132 per 100 000 inhabitants) and Warmińsko-Mazurskie voivodeship (108,5 per 100 000 inhabitants).

Incidence of Lyme borreliosis in 2026 from 1st January to 15th of February was 4,33 per 100 000 inhabitants which shows a further increase in cases compared to the same period of time in 2025, which had the incidence of 3,74 per 100 000 inhabitants [9].

Etiopathology

Lyme borreliosis is caused by bacteria of Borrelia genus that are transmitted through a tick bite. The transmission is possible with both adult and nymph tick forms but it is more likely with the latter [10].

After attaching itself, the tick starts feeding and releases saliva into the wound to fight against the host's hemostatic and immunologic mechanisms as well as the inflammation [11].

For the transmission to occur the tick must typically be attached to the host for at least 36 hours, even up to 48 hours [12]. That is the time it takes for the bacteria to travel from the tick's midgut to its salivary glands [10].

This fact is particularly crucial because it implies that the time the tick is attached is the most critical factor affecting the risk of transmission [13].

Initially the bacteria infect the skin, causing a characteristic skin lesion from which they can be isolated for up to 3 months [14].

Subsequently the spirochetes get into the bloodstream and travel to various organs, leading to the complex symptomatology of Lyme disease.

APPROACH TO HISTORY-TAKING

In primary care detailed history-taking is necessary to determine what the next steps should be. When there is a suspicion of Lyme borreliosis it is especially critical due to the fact that this disease may only present with non-specific symptoms. The following aspects should be assessed [2,15,16]:

- environmental exposure - recent presence in high-risk areas such as forests
- features of the skin lesion to differentiate between erythema migrans and a reaction to the bite
- the timing of the exposure to decide if serological testing is appropriate

It is also helpful to know if the patient is a pet owner as domestic animals can transport ticks into the household.

CLINICAL FEATURES

Lyme disease has a broad symptomatology and its manifestations are grouped into three stages, which means the symptoms evolve over time and can overlap [17].

Early localised disease

The incubation period of early localised disease is between 3 to 30 days [18]. This first stage is characterised by a distinctive skin lesion that is usually a painless, erythematous annular rash with a diameter of over 5cm [19]. Erythema migrans (EM) is accompanied by flu-like symptoms (myalgia, headache and fever) and regional lymphadenopathy [20]. Notably, EM can be either homogenous in color or develop a central clearing [21] and will resolve without treatment over the median course of 28 days [22]. If there is a rash with a diameter of less than 5cm and it does not expand it is most likely only a hypersensitivity reaction to the tick's saliva [19].

Early disseminated disease

In present times early localised disease is frequently recognized and promptly treated, therefore it will usually be patients with asymptomatic early localised disease that develop, and then present with early disseminated symptoms to the physician. It takes 3 to 10 weeks for early disseminated disease to appear, leading to dermatologic, neurologic, musculo-skeletal or, less commonly, cardiologic symptoms [3]. The patient can present with multiple secondary EM lesions which are the same size, are lighter in color and have less edema than the primary EM lesion [3]. Neuroborreliosis can manifest as neck stiffness, radiculopathy and Bell's palsy that can be uni- or bilateral [23]. If the patient complains of mono- or oligoarticular (1 to 5 joints affected [2]) swelling and pain, especially of the knee, and does not have systemic symptoms - Lyme arthritis should be included in the differential diagnosis [24]. While less frequent - Lyme carditis is a serious disease presentation for the reason that it may lead to severe heart block with palpitations or lightheadedness as the main complaint [25].

Late disease

Late stage may occur after several months or years from the initial infection. Knee arthritis is the hallmark pathology, with the pain not as severe as the large joint edema would suggest. Over time Baker's cyst may develop in the affected knee [26]. The neuropsychiatric variant of

the late disease manifests as a decline in cognitive function, however it requires a thorough mental state examination to recognize it [27]. Late neuroborreliosis may also manifest as peripheral neuropathy causing numbness to the patient's hands and feet [3]. Acrodermatitis chronica atrophicans (ACA) is an indication of skin involvement. *B. afzelii* is primarily responsible for the lesion, therefore ACA is mostly diagnosed in Europe. ACA starts as a reddish discoloration of the skin accompanied by edema, most frequently affecting extensor surfaces of hands and feet. Over the course of a few months the lesions become less edematous and skin atrophy starts to take place [28]. With the skin thinning, the veins become more visible which poses the risk of mistaking ACA for venous insufficiency. Moreover, in two-thirds of cases, there is sensory loss of the limb on which ACA developed [26].

DIAGNOSIS

If the patient presents with a typical EM lesion, that is sufficient to diagnose Lyme disease and start treatment [6]. As previously mentioned, EM does not have to have a central clearing and can be homogenous instead [21]. If there are any doubts, serologic testing is the standard way to aid with the diagnosis, however if the patient does not have any characteristic symptoms, laboratory tests alone are not enough to make the diagnosis. There is a two-tiered protocol in place: the first test is ELISA and if it comes out positive or equivocal, Western Blot is used to confirm [12,29]. On the other hand, serologic testing has limitations: the window period, lasting a few days to a few (2-4) weeks, when the patient has not yet produced enough antibodies (leading to false-negative results) and the fact that testing cannot distinguish between an active and past infection [30]. Patients with chronic fatigue without any specific symptoms should undergo a thorough diagnostic process to rule out other causes such as anemia, hypothyroidism or depression. Lyme borreliosis manifesting solely as general weakness is to be differentiated from fibromyalgia and chronic fatigue syndrome due to their largely overlapping clinical presentations [14].

MANIFESTATIONS REQUIRING INPATIENT MANAGEMENT

Lyme disease in its early stages should be treated in an outpatient setting with an oral course of antibiotics. However, one of the key aspects of general practice is staying vigilant of red flags - symptoms that suggest a hospitalization and intravenous antibiotic therapy may be required. The more severe manifestations can be put into three domains:

Lyme arthritis: the first episode of lyme arthritis can be treated with oral antibiotics but if the outcome is not satisfactory and joint pain and swelling persist it is suggested to treat with IV antibiotics which will guarantee a better tissue penetration [24].

Neuroborreliosis: severe cases should be treated in the inpatient setting. These include meningitis and radiculopathy [2].

Lyme carditis: severe forms of Lyme carditis such as second- or third-degree atrioventricular block leading to chest pain, dyspnea or syncope are an indication for hospitalization [31].

TREATMENT

According to the Recommendations for the diagnosis and treatment of Lyme Borreliosis of the Polish Society of Epidemiologists and Infectious Disease Physicians (PTEiLChZ) and National Institute for Health and Care Excellence (NICE) guidelines choosing the right antibiotic is dependent upon clinical manifestation, patient's age and other factors such as pregnancy [2,16]. Patients presenting with EM ought to be prescribed doxycycline for 7-21 days. There are reports that reveal just 7 days of treatment is enough [32,33], however NICE guidelines recommend following the 21-day protocol. Lyme carditis requires a management of the same duration, whereas Lyme arthritis and ACA - a longer, 28-day, course of antibiotics. In the specific scenario of the recurrence of musculoskeletal symptoms another course of antibiotics can be administered, with intravenous ceftriaxone being the first choice. It is critical to point out that doxycycline should not be prescribed to children under 8 years of age and to pregnant women. For most clinical forms (Lyme arthritis, Lyme carditis, ACA) safe alternatives include amoxicillin and cefuroxime axetil. Moreover, one of the most important side effects of doxycycline is photosensitivity so it is key to advise the patient to minimize sun exposure when prescribing this medication [34].

There is no evidence that different Borrelia species respond differently to the medication [35].

Dosage of antibiotics recommended for the treatment of Lyme disease [2]:

doxycycline - 100 mg twice daily or 200 mg once daily orally (for adults and children ≥12 years of age)

doxycycline - 4.4 mg/kg in 2 divided doses (max 200 mg daily) orally (for children between the ages of 8 and 12)

amoxicillin - 500 mg 3 times a day orally (for adults and children ≥12 years of age)

amoxicillin - 50 mg/kg in 3 divided doses (max 500 mg per dose) orally (for children <12 years of age)

cefuroxime axetil - 500 mg 2 times a day orally (for adults and children ≥12 years of age)

cefuroxime axetil - 30 mg/kg in 2 divided doses (max 500 mg per dose) orally (for children <12 years of age)

Treatment success is based upon clinical improvement (the resolution of symptoms) - routine follow-up laboratory testing is not indicated due to the fact that antibodies may remain even after complete eradication of the spirochetes. Treatment failure is indicated by the persistence of objective signs of disease activity such as arthritis, neuropathy and meningitis [15].

When treating LD one must be aware of the Jarisch–Herxheimer reaction: fever, chills, headaches and myalgia appearing soon after starting treatment. It can last 1-2 days and is self-limiting [36]. Lastly, it is important to note that antibiotic treatment of Post Lyme syndrome has not been found to be effective [37,38].

PREVENTION

Non-specific methods

Primary care physicians ought to inform the patients that most tick bites do not lead to Lyme borreliosis and prompt tick removal is crucial and further reduces the risk of transmission. Non-specific preventive measures include [2,15,39]:

avoiding places with a high probability of ticks

wearing clothing that entirely covers the skin, if possible

spraying uncovered skin surface with a repellent (DEET)

showering after being in a high-risk area

inspecting the skin regularly

removing the tick promptly and correctly (using fine-tipped tweezers to grasp the tick as closely to the surface of the skin as possible and pulling upwards; spraying substances like oil on the tick is ill-advised)

Being a pet owner increases the risk of a tick bite [40], therefore it is recommended to frequently check the pet's skin for ticks.

Specific methods

There is no vaccination against Lyme disease [41–44]. Post-exposure antibiotic prophylaxis is to be considered under certain conditions. It is justified when the patient is an adult, has been bitten multiple times by an *Ixodes spp.* tick in an endemic area and the bites are high-risk

meaning the ticks were attached for at least 36 hours. If the patient is unsure of how long the tick has been attached for, the physician should evaluate the degree of the tick's engorgement. If these high-risk criteria are met, then, a single dose, 200 mg, of doxycycline can be administered orally [2,15,42,44]. Guidelines by the Infectious Diseases Society of America, American Academy of Neurology, and American College of Rheumatology state that a dose of 4.4 mg/kg (up to 200 mg) is to be given for children of all age groups [15], however PTEiLChZ and NICE guidelines remain more restrictive, stipulating that this antibiotic should only be administered to children that are, respectively, over the age of 8 and 9 [2,16].

CONCLUSION

Lyme disease remains an important public health issue with early diagnosis and prompt antibiotic treatment being vital for a patient's full recovery. Strictly clinical diagnosis is possible when the characteristic erythema migrans rash is present. Laboratory serological testing may yield false-negative results, especially in the early stages of the illness. Adherence to established antibiotic regimens (PTEiLChZ, NICE) ensures high treatment efficacy. Routine post-treatment laboratory follow-up is advised against. The role of primary care physicians is careful history-taking, educating the patient on the preventive measures and deciding when a post-exposure prophylaxis should be administered.

DISCLOSURE

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