EWA ZIENKIEWICZ¹, KRZYSTYNA MITOSEK-SZEWCZYK¹, TADEUSZ ZIENKIEWICZ²,

Increasing of Lyme disease incidence in Poland and necessity of education
Wzrost zapadalności na boreliozę i potrzeba edukacji

Key words: borreliosis, Lyme disease, tick, Borrelia burgdorferi
Słowa kluczowe: borelioza, choroba z Lyme, kleszcz, neuroborelioza, Borrelia burgdorferi

EPIDEMIOLOGY

Lyme borreliosis is a multisystemic disease caused by spirochaetes belonging to the Borrelia burgdorferi sensu lato complex [1]. Clinicians first recognized Lyme disease in the United States in 1977 when a cluster of juvenile “rheumatoid arthritis” cases occurred in Lyme, Connecticut. Researchers identified the source of the cluster of cases as a tick-borne infection rather than an autoimmune disease. By 1983, investigators identified the causative agent, a previously unrecognized spirochetal bacteria called Borrelia burgdorferi [1, 2]. In the United States, only in the first half a year of 2011, 33,097 cases of LB were registered [2]. About 85 000 cases are reported annually in Europe. However, this number is largely underestimated as case reporting is highly inconsistent in Europe and many LB infections go undiagnosed. Lyme borreliosis is the most common vector-borne disease in the northern hemisphere including Poland [3, 4, 5].
In Europe and Asia, Lyme disease is caused by two other Borrelia genospecies, B. afzelii and B. garinii, which results in regional variations in disease manifestations. In Europe, several of these are pathogenic to humans: B. afzelii, B. garinii, B. burgdorferi sensu stricto (ss), B. bavariensis (previously B. garinii OspA serotype and B. spielmanii, while the pathogenicity of others such as B. lusitaniae, B. valaisiana, and B. bissetii is still uncertain [6]. In ticks, B. afzelii and B. garinii are the most common European circulating genospecies, followed by B. burgdorferi ss and B. valaisiana [7], whereas B. lusitaniae has a more focal distribution, especially in the Mediterranean basin. Several genospecies may also be present simultaneously in a vector [7]. Different genospecies are also associated with other clinical manifestations of the disease: B. burgdorferi ss is most often associated with arthritis and neuroborreliosis, B. garinii with neuroborreliosis, and B. afzelii with the chronic skin condition acrodermatitis chronica atrophicans, despite the fact, that all pathogenic genospecies may cause erythema migrans (a red rash or patch on the skin).

Rizzoli (2011) indicates, that current epidemiological studies shows the mean annual number of LB notified cases (including qualified estimates) in Europe is more than 65,400 (incidence rates per country range from less than one per 100,000 population to about 350 per 100,000 population). In Europe, Lyme borreliosis occurs between 35 °N and 60 °N, and generally below 1,300 metres above sea level. However, there is strong heterogeneity in spatial distribution: the level of antibodies to B. burgdorferi ss is highest in residents of northern and central countries and lowest in those in the southern countries. In addition, at a local level, there is a focal pattern of distribution related to suitable tick habitat, including some hotspots where more than 100 cases per 100,000 population per year are recorded (e.g. parts of Slovenia, Germany and Austria, the Baltic coastline of southern Sweden, and some Estonian and Finnish islands) [6].

The basic tick vector of the spirochaete in Europe is Ixodes ricinus [8, 9], and the main responsible of Borrelia transmission to humans are tick nymphs. They quest most actively from spring to autumn in microenvironments with more than 85% relative humidity, such as deciduous or mixed woodland, as well as suburban and urban environments and roadsides [10]. The economic and social costs of managing the disease represent an important burden on both health services and society [11]. Some studies describe a 2 to 3.6-fold increase in the incidence of this disease over the last decade, in Europe as well as in the United States [12].

In Poland, during the considered period increasing of Lyme disease incidence is observed (Tab. I). In the testing last five years the number of people falling from the disease has risen nearly 58%, from 8.783 cases in 2009. to 13.870 in 2015., which far exceeds the European Statistics. It is significant that the number of people hospitalized in Poland for Lyme disease infection is higher than eg. In France where in 2009. for 5.725 cases of LB in France less than 1,000 were hospitalized.

In the analysed period also increased the incidence rate of 23.6 per 100,000 inhabitants in 2010 to 35.4 cases per 100,000 inhabitants in 2015.
Tab. I Number of cases, hospitalization and incidents rate of Lyme Disease prevalence in Poland in period 2010-2015

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of cases</th>
<th>Incidence rate per 100,000 inhabitants</th>
<th>Hospitalization</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>8 783</td>
<td>23,6</td>
<td>2 317</td>
<td>26,4%</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>9 003</td>
<td>23,8</td>
<td>2 095</td>
<td>23,3%</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>9 170</td>
<td>22,8</td>
<td>2 064</td>
<td>22,5%</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>12 760</td>
<td>33,1</td>
<td>2 155</td>
<td>16,9%</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>13 624</td>
<td>36,0</td>
<td>2 236</td>
<td>16,4%</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>13 870</td>
<td>35,4</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
</tr>
</tbody>
</table>

Source: own work based on data from the “Choroby zakaźne w Polsce”, PZH for years 2010-2015

Lyme disease takes the form of early and late (chronic). Early onset of Lyme disease is often limited to skin symptoms, and it is called erythema migrans. It is produced at the site of the tick bite. Erythema often accompanied by flu-like symptoms. Usually appears after about 1-3 weeks after the bite, usually disappear spontaneously after about a month. If you remain longer, you may indicate the spread of the disease spirochete and the transition from skin to form early disseminated.

Initially, erythema is in the form of radiating red spot. Inside, we find a small area of intact skin lesions or clear. There may be an unusual form - with irregular border, changes to a tendency to bleeding, without internal brightness and with a ca. 5 cm diameter. Erythema uniform appearing quickly (within 1-3 days of exposure to the insect) and a diameter of less than 5 cm may point against the diagnosis of Lyme disease (according to the guidelines of the Polish Society of Epidemiologists and Infectious Diseases).

A recent study of the European scientific society EUCLAB say, however, about the increasingly frequent appearance of blush traveling with a diameter of less than 5 cm, and therefore difficult to spot can be similar to mosquito bites or allergic.

Important is not only the appearance and size of erythema and a time at which it appears.

Erythema of LB appear not earlier than 3 days after the tick bite, and the time of its maintenance is long. In contrast e.g. erythema. Allergy occurs rapidly (1-3 days) and usually disappears quickly. Please note that the rash does not appear at all as many as 40-70% bitten, too often remains unnoticed, if performed at the invisible parts of the body, eg. On the back of the head. Therefore it is extremely important to carefully check the whole body after returning from the forest, park or other location where the threat of bites by ticks is particularly high in children.

Erythema is an absolute indication for starting antibiotic therapy, the duration of which depends on the progress of the disease. Frequently, it takes 4 to 6 weeks. The later the bites implement the antibiotics, the greater the likelihood of the spread of the spirochete bacteria in the body, infecting other tissues, resulting in a prolonged antibiotic therapy. If you blush a few can be a sign of metastatic process. In any doubtful case, it is necessary to consult with your family doctor, and sometimes consult a specialist in the department of infectious diseases. Let us remember that
thorough history and physical exam guarantee early and appropriate to the clinical condition of the therapy according to the prescribed standards.

Some patients observe lymphocytic infiltrate (small lymphocytic lymphoma of the skin, lymphocytes, borrelia lymphocytoma) - described as painless red nodule, usually on the ear lobe, scrotum, nipples) [13, 14]. Changing untreated may persist for several years. It occurs in less than 1% of patients.

The early diagnosis and start therapy is very important, because the providing drugs later after infection always cause the lower its effectiveness.

Unfortunately, despite of erythema migrans, Lyme disease is not typical symptoms themselves. Each of the patients may experience other symptoms. There are over 60 different ailments on the checklist of symptoms of the disease, and as emphasized by authors are still incomplete. At the time of diagnosis must first check the risk profile of the infection, or being in places where it is as forests, parks, gardens, riverside areas, around lakes and other water reservoirs.

The most common tick bites occur In Poland in July and August, but are quoted from May to November also. We can be protected by recommended protective clothing (tightly covering most of the body) in bright colours, using of impregnation of clothing footwear containing permethrin and its derivatives, and control of the body and clothing after returning from the forest, avoiding areas vulnerable ticks, use of repellents ticks (repellents), especially those containing DEET.

Among other emerging distressing symptoms observed in people bitten by ticks, preceded by a period of supposedly influenza (temperature fluctuations break, headaches and joint pain, mood variable)

The most common neurological complication is facial nerve palsy. Cardiac complications are even rarer concern about 5% of untreated people [15]. Rare is the presence of various clinical forms in the same patient. After many years of infection in untreated patients may develop late symptoms of Lyme disease, which can lead to permanent damage to the nervous system or organs of movement [14].

Both erythema migrans, lymphocytic infiltration, and atrophic skin (acrodermatitis chronica atrophicans) are pathognomonic, that is sufficient for the diagnosis and treatment implementation.

Untreated Lyme disease most often leads to the stage of infection, distributed in the form of:

1. Recurrent arthritis that reveals from two weeks to two years after the first symptoms of Lyme disease. Takes the form of several weeks of recurrent episodes of pain and swelling of joints. The inflammation usually affects one or two fewer joints and covers large joints: the knee, elbow, ankle, rarely others. Most often runs asymmetric. Each subsequent tightening is getting milder until the resolution of symptoms. Unfortunately, some patients may go into a chronic condition [14].

2. Irritation or inflammation of lymphocytic meningitis and peripheral nerves. Meningitis are mild, the only symptom may be a headache, it has been reported ra-
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rely inflammation of the brain or spinal. Cerebrospinal fluid (CSF) in patients with inflammation of meningitis in the course of neuroborreliosis is characterized by lymphocytic pleocytosis, and moderate increase in protein concentration and normal blood glucose levels. In other form neuroborreliosis changes in CSF is rare

3. Inflammation of cranial nerves - in the early stages of the most common facial palsy, sometimes bilateral, may have a relapsing course [16].

4. Myocarditis. Relatively rare. It reveals itself in the form of conduction disorders as atrophicventricular block of varying [14]. Asymptomatic. Less frequently described step is in the form of chronic infection: atrophic dermatitis, which discloses many years after infection [8], usually occurs on the lower extremities in the elderly. Is the most common complication of late Lyme disease [15]. The changes initially have an inflammatory character of colored bluish red, asymmetrically arranged. There may be fire and increased pigmentation and telangiectasia. With time comes to atrophic changes of the thinning of the skin with a visible enlargement of the veins. These changes are often accompanied by paresthesia and joint pain.

5. Neuroborreliosis - is present in 10-15% of untreated patients are the most common [14, 17, 18]:
   a. peripheral neuropathy - there are sensory disturbances and paralysis of peripheral nerves,
   b. inflammation of the nerve root and peripheral nerves.
   c. cognitive disorders and chronic encephalopathy
   d. with a dominant image in impaired memory and concentration, annoyance, drowsiness, and personality changes (indicated psychiatric consultation)
   e. Chronic arthritis, rarely permanent damage and mild inflammation of the muscles, tendons, bursae

**DIAGNOSIS OF LYME DISEASE**

The basic role in the diagnosis of Lyme disease plays a serological diagnostics. Currently, it is recommended that the two-stage diagnosis. The first stage involves the study of serological assay of high (up to 100% [19]) Sensitivity ELISA, fluorescence immunoassay (IIFT), technical quality ELFA. In case of a positive or doubtful is necessary to use the confirmation test - western blot, which has a high (up to 100% [20]) specificity.

By ELISA detected antibodies IgM and IgG. Specific IgM antibody appears in the blood of 3-4 weeks after infection (may be detected by the second week of the disease, but most patients appear later), and resolve within 4-6 months. Specific IgG are detected 6-8 weeks after infection and persist for many years even in patients successfully treated with antibiotics [17]. Seropositive without clinical symptoms typical of Lyme does not have diagnostic significance [10]. In patients with the
diagnosis of erythema migrans should be based on clinical diagnosis without confirmation of serological tests, the results of this phase of the disease are often negative [14].

The cerebrospinal fluid test, in the CNS neuroborreliosis, is necessary, wherein the antibody detected in classes IgM and IgG. To demonstrate CNS neuroborreliosis, it is important to demonstrate the high levels of antibodies (the ratio of the specific antibodies in the cerebrospinal fluid to serum values), typically > 2 [14].

Confirmation of diagnosis of myocarditis about the etiology requires demonstration of the presence of IgM antibodies in serum and cardiac confirmed by ECG.

PCR is a diagnostic method that detects bacterial DNA. The method exhibits the greatest usefulness in early infection, before there were produced antibodies against Borrelia Lyme bacteria. At a later stage, after the formation of antibodies PCR is a method complementary, in cases where the diagnosis is based on antibodies is difficult because immune defects or severe comorbidity [21]. PCR is not widely used due to economic reasons and to frequent false-positive results [22] and false negative results [23]. Detection of DNA spirochete is not synonymous with an active infection. In addition, a positive result does not indicate whether treponemal DNA from living or dead organisms. A negative result cannot conclusively rule out infection [21].

**TREATMENT**

Lyme disease is treated with antibiotics. The choice of embodiment depends on (stage) of the disease. In the treatment are used: penicillins, cephalosporins and tetracyclines. The duration of treatment also depends on the form of the disease - varies from 21 to 28 days. Sometimes relapses of the disease, which require repeated antibiotic treatment. They should be distinguished from weakening ailments that require only symptomatic treatment. Appropriate antibiotic therapy provides a cure in > 90% of cases [17]. There is no scientific basis for repeat treatment or many months of antibiotics. An important issue is also the diagnosis and treatment of tick-borne co-infections that require separate treatment.

The described after-Lyme disease syndrome means number of persistent symptoms in patients with Lyme disease after treatment. The main symptoms include fatigue and pain in the joints and muscles [24]. In some cases, it can take up to 6 months. The exact cause of this syndrome is not yet known. Most experts believe that it is the result of tissue damage and immune system, resulting in the course of infection. Similar symptoms occur as a result of other infections such as Campylobacter (Guillain-Barré syndrome), Chlamydia (Reiter's syndrome) and streptococci (rheumatic fever). Discussion seems to be a long-term antibiotic therapy, taking into account the side effects of drugs, in order to eliminate the after Lyme disease syndrome.
Figure 1 Lyme borreliosis hospitalization, Poland, 2010-2015 (according to Tab. I)

In Poland, every year more than 2,000 people are hospitalized because of getting Lyme disease (Figure 1). The persistence of this number at a fairly constant level stems more from the concluded contracts with the NFZ hospitals than he actual need for hospitalization.

Due to numerous complications and consequences of Lyme disease, it is possible that the number of hospitalized persons who are diagnosed with other illnesses, caused by Lyme disease as the primary, number of hospitalized persons is much greater.

CONCLUSION

A significant increase in the incidence of Lyme disease indicates the need for public education in the field of preventing the incidence of Lyme disease.

Increased interest in the population of their own health manifesting itself more and more frequent visits to the forests and meadows areas in combination with global warming, poses a growing threat of Lyme disease infection.

Preventing Lyme disease is associated primarily with the personal protection of each person visiting woodlands, parks and areas of scrub or grassland especially in the period from May to October.

It should be remembered that before the walk:

- spray the body (except the face) and clothing materials repellents ticks. In the case of small children should not apply repellents highly concentrated (preferably less than 10% DEET), and do not spray it directly on the skin of the child but clothing only;
Wellness and education

- wear appropriate clothing: long pants, socks, long sleeves, boots, hat. On the bright clothing ticks are more visible and can be precipitated before they reach the exposed parts of the body;
- in a period of intense ticks’ attacks, after walking we should browse the entire area of the body. Children ticks usually located on the scalp in adults on the legs, buttocks, groin and the abdomen. Holders of pets should check the animals’ skin each time after returning home from the places the prevalence of ticks.

In the case of a tick bite, tick must be removed as quickly as possible because the risk of transmission of Lyme disease increases significantly after 24 hours. By precipitation should get rid of, the tick has not had time to tie, and to remove already attached, use tweezers (with blunt ends), or the lack thereof, do the fingertips wrapped in a handkerchief or gloves. To remove it, grasp the tick near stomatitis, as close to the skin, and pull firmly but not too tightly, so as not to tear the body of the tick. After removing always wash the place with alcohol or disinfectant, or soap and water. Other popular ways to remove ticks, such as smearing butter, vaseline or other fat, use gasoline, kerosene, alcohol, nail polish, burning with a match or a cigarette, are generally ineffective and may even be dangerous. Spreading tick fat or other substances increases the likelihood of infection with Lyme disease. Stress caused by the obstruction of breathing holes insect causes increased secretion of saliva and revocation of intestinal contents.

Some studies suggest that a single dose of doxycycline after a tick bite prevents Lyme disease. The person can take doxycycline (not pregnant or breastfeeding or a child <8 years of age). If the person meets the criteria, the recommended dose of doxycycline is a single dose of 200 mg for adults and 4 mg/kg, up to a maximum dose of 200 mg, in children ≥ 8 years. At the moment there is no a vaccine against Lyme disease on market [25].

In the US, such a vaccine has been developed and approved by the FDA in December 1998 but was withdrawn in early 2002 because of the numerous side effects [26].

REFERENCES
WELLNESS AND EDUCATION


ABSTRACT

The incidence of Lyme disease in Poland still shows an upward trend, a cause of hospitalization of patients and in more severe form causes a number of complications. Early treatment and implementation of antibiotic therapy, the appropriate prevention and education aims to reduce the incidence of Lyme disease. The aim of this paper is to introduce new diagnostic methods are necessary for the diagnosis of Lyme disease in the form of early and reduce the consequences of the chronic form and bringing epidemiological issues relating to the disease. However, the same problem of Lyme disease has been known for years and the proper protection of being bitten by a tick and early prevention to reduce the risk of getting severe consequences and complications, a lack of education causes an increase in the incidence of Lyme disease in Poland.

STRESZCZENIE

Zapadalność na boreliozę w Polsce wciąż wykazuje tendencję wzrostową, stanowi powód hospitalizacji pacjentów a w ostrzejszej formie jest przyczyną szeregu
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powikłań. Wczesne leczenie i wdrożenie antybiotykoterapii, właściwa prewencja i edukacja ma na celu zmniejszenie zapadalności na boreliozę. Celem niniejszej pracy jest przybliżenie nowych metod diagnostycznych koniecznych do rozpoznania boreliozy zarówno w postaci wczesnej jak i zmniejszenie konsekwencji wystąpienia postaci przewlekłej oraz przybliżenie problematyki epidemiologicznej dotyczącej tego schorzenia. Jakkolwiek sam problem boreliozy jest znany od lat a prawidłowa ochrona przed ukąszeniem przez kleszcza i wczesna prewencja zmniejszają znacznie ryzyko zachorowania i dotkliwych w skutkach powikłań, to brak odpowiedniej edukacji powoduje wzrost zapadalności na boreliozę w Polsce.

Artykuł zawiera 26986 znaków ze spacjami + grafika