

Case report

Lyme Carditis in Clinical Practice

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SUMMARY

Introduction. Lyme disease is an infectious disease transmitted by the Ixodes ticks and is manifested by damaging various organs and systems (most often - migrating erythema, damage to the nervous system, musculoskeletal system, heart, liver and eyes). According to various authors, heart damage in Lyme borreliosis ranges from 4% to 10% and is an understudied pathology.

Case report. The article describes a clinical case of infectious myocarditis associated with Lyme disease in a 51-year-old patient. The course of the disease and the results of treatment of the patient were analyzed. The severe rhythm and conduction disorders were revealed: atrioventricular (AV) block of the first degree, transient AV block of the II degree (Mobitz 2) and III degree, polytopic extrasystoles. Due to timely diagnosis, including serological, prescribed etiotropic antibacterial treatment, the patient achieved a significant improvement in both clinical condition and positive serological and electrocardiogram (ECG) dynamics with improved AV conduction.

Conclusions. The most frequent ECG changes in Lyme carditis (LC) are conduction disorders with the development of blockades of various stages. For patients with myocarditis, which is accompanied by complex arrhythmias, and conduction disorders estimated as intermediate and high risk by Suspicious Index in Lyme Carditis (SILC) scale, serological examination should be recommended in order to verify the borreliosis etiology of myocarditis. In this particular case, early diagnostics and prescribed etiotropic treatment, in addition to treatment of heart failure, contributed to a significant improvement in both the clinical condition and positive serological and ECG dynamics.

Keywords: myocarditis, Lyme carditis, AV block, diagnostics, treatment

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INTRODUCTION

Lyme disease is an infectious disease transmitted by the Ixodes ticks and is manifested by damaging various organs and systems (most often - migrating erythema, damage to the nervous system, musculoskeletal system, heart, liver and eyes) (1, 2). It is the most common vector-borne disease in Europe and a particularly dangerous infection. According to various authors, heart damage in Lyme borreliosis (lyme carditis) rates ranges from 4% to 10% and is an understudied pathology. Lyme carditis (LC) most often develops at the stage of the disseminated infection (1 - 3 months after infection) and is manifested by cardialgia, palpitations, shortness of breath, dizziness, short-term syncope, decreased tolerance to physical loading (3 - 5). The relevance of the study of this disease is significant because of the steady increase in morbidity not only in Ukraine but worldwide. According to the American Center for Infectious Disease Control, the incidence of Lyme disease in endemic areas of Europe and America can reach 500 cases per 100,000 population. Annually, the American Center for Infectious Disease Control reports about 30,000 cases of Lyme disease, 3% - 4% of which are diagnosed with myocarditis. For example, in Austria, up to 16% of the population report the tick bites, and the morbidity is about 100 cases per 100,000 population. A similar incidence rate is registered in Slovenia; in other European countries, it is slightly lower. There is a male predominance with the ratio of 3:1. Clinically, Lyme disease occurs in the following stages: early localized, early disseminated, and late persistent (6 - 8).

We present a description of a clinical case of myocarditis associated with Lyme disease.

CASE REPORT

51-year old patient B. was admitted to the Cardiology Department of Ternopil University Hospital on February 1, 2019, with complaints of chest pain in the supine position, in the body forward tilt, shortness of breath, dizziness when changing body position, headache, severe general weakness, and periodic increase in blood pressure. The first symptoms appeared in the last decade of January, in 2019, when he felt sharp chest pain at rest, strong general weakness, which led to hospitalization in the Cardiology Department of Ternopil University Hospital.

The patient had been suffering from hypertension for 15 years, had a burdened heredity (his mother had arterial hypertension). He took antihypertensive drugs irregularly. The patient lived in the countryside of Ternopil region, was engaged in householding, and reported repeated tick bites.

Objective data: condition of the patient of moderate severity due to pain and shortness of breath. The skin was pale, dry, with no rash. Arrhythmic activity of the heart (bradyarrhythmia), attenuation of the first tone and systolic murmur over the apex of the heart, as well as the accent of the second tone over the aorta were observed. On auscultation, vesicular harsh breathing above the lower lungs were heard. Heart rate was 54 beats/ min. Blood pressure was 165/95 mmHg. The liver was palpated at the level of the right costal arch with the rounded edge. Pitting edema of the feet was found.

The laboratory data (04.02.2019): leukocytosis - $10,7 \times 10^9/l$ (e - 1%, n - 5%, s - 51%, l - 30%, m - 13%), increase of erythrocyte sedimentation rate (ESR) to 36 mm/h, a moderate increase in Creatine phosphokinase (CPK-MB) to 33.0 IU/l (reference range 0 - 24 IU/l), more than a 10-fold increase in C-reactive protein (CRP) - 29.08 mg/l (reference range 0.0 - 5.0 mg/l), increased level of antistreptolysin O (ASL-O) - 230.2 IU/ml (normally up to 200 IU/ml), seromuroid to 10.0 IU (reference range 0 - 6 IU), troponin T up to 28.61 (reference range 12,7-24,9 ng/ml) and N-terminal pro-B-type natriuretic peptide (NT-proBNP) up to 824 pg/ml (reference range 0 - 125 pg/ml).

ECG data from 01.02.2019: sinus bradycardia, heart rate 54/min, blocked atrial contractions, I degree AV block, transient AV block of the II and III degree.

Holter monitoring (HM) was provided to the patient on February 4, 2019. The sinus rhythm was alternated with ectopic beats with an average frequency of 67 beats/ min, min heart rate - 48 beats/min, max heart rate - 105 beats/min; also, the complex rhythm and conduction disorders were revealed: I and II degree AV block, transient III degree AV block, ventricular polymorphic extrasystole, episodically paired, and pauses lasting more than 2.4 seconds with replacement contractions.

The data of echocardiography (05.02.2019): Left atrium (LA) - 4.2 cm ($V=50 \text{ cm}^3$). The size of the left ventricular wall was 1.1- 1.2 cm, normokinesis. A small amount of fluid (2 mm) was found in the pericardium in diastole above the right atrium. End-

diastolic dimension (EDD) was 5.4 cm. The size of right ventricle was 2.4 cm. Ejection fraction – 61 %. In the dynamics of echocardiography from 05.03.2019: the volume of the LA - 48 cm³, thickening of the mitral annulus, small areas in the lower septal and lower segments which moved dyskinetically. The ejection fraction in the dynamics decreased slightly - up to 52%.

The X-ray examination held on February 5, 2019 showed no signs of infiltration.

Magnetic resonance imaging (MRI) (7.02.19) of the heart showed the signs of myocarditis, an active inflammatory process (infiltration of perifocal areas of fibrosis). Minimal exudative effusion in the pericardial cavity was noted. The global contractility of the left ventricle was preserved and the volume of the cavities was within normal range.

The coronary angiography results (11.02.2019) were only notable for the recessive anterior interventricular artery and stenosis up to 50% in the 7th segment.

We used the SILC scale to estimate the probability of borreliosis etiology of myocarditis (4). The score (8 points) indicated a high risk of Lyme carditis. In order to verify the diagnosis, the patient was recommended for a serological examination to have the titer of antibodies to *Borrelia* specific antigens determined.

The Blot analysis (February 7, 2019): *Borrelia burgdorferi*, IgG antibodies were detected, VIsE (*Borrelia afzelii*) - borderline result, VIsE (*Borrelia burgdorferi*) - borderline result, p41 were detected, OspC (*Borrelia afzelii*) were detected.

Infectiologist detected Lyme borreliosis with a predominant lesion of the cardiovascular system: acute focal myocarditis.

Neurologist detected: I degree dyscirculatory encephalopathy with vestibular, cephalic paroxysms and cognitive impairment.

Based on clinical and laboratory-instrumental data, the patient B. was diagnosed with acute myocarditis associated with Lyme borreliosis. Complex arrhythmias and conduction disorders: sinus bradycardia, I stage AV block, transient II stage AV block (Mobitz 2 type) and III stage AV block, ventricular polymorphic extrasystoles, blocked supraventricular extrasystoles. Arterial hypertension of II stage, II degree hypertension. High cardiovascular risk (CVR) was detected. Heart failure functional New York Heart Association (NYHA) class II. I degree dys-

circulatory encephalopathy with vestibular, cephalic paroxysms and cognitive impairment.

Besides antihypertensive (ramiprili 10 mg) and metabolic treatment, the antibacterial therapy consisting of doxycycline 200 mg/day in two servings for 21 days was prescribed.

The patient was discharged from hospital with general condition improvement. At the outpatient stage, the patient was recommended to continue antihypertensive therapy and treatment of the heart failure.

On April 20, 2019 the daily Holter ECG monitoring was performed. During the observation, an incorrect sinus rhythm was registered. Stops of a sinus node and pauses were not revealed. During the observation, the average heart rate was 83 beats/min (91 beats/min during the day, 70 beats/min at night). The maximum heart rate was 122 beats/min, represented by the correct rhythm. The minimum heart rate was 56 beats/min, represented by bradycardia during sleep. The following arrhythmias were detected: tachycardia with a total duration of 5 h 38 min 20 s; supraventricular extrasystole 31: single 29, even 2; ventricular arrhythmia: 19 – monomorphic. Conduction disorders were represented by a stable AV block of the I degree and transient blockade of the II degree of Mobitz 2. Transient changes of a T wave (inversion) were detected.

In order to control the dynamics of the disease on 05. 02. 2021, the patient B. underwent a repeated general clinical, serological examination, Holter ECG monitoring. By the time of examination, the patient noted the shortness of breath in case of extreme physical stress only. Objectively: the activity of the heart was rhythmic and the accent of the second tone over the aorta was heard. Heart rate was 66 beats/min. Blood pressure reached the target value - 135/85 mm Hg.

On the February 5, 2021, Blot analysis was performed the aim of which was to determine the antibodies to *Borrelia* specific agents: antibodies IgG were not detected.

Two years later, on February 5, 2021, the Holter ECG monitoring revealed no clinically significant arrhythmias. Baseline rhythm was sinus with an average heart rate 62, minimum - 55 beats/min, maximum - 87. During the day, the average heart rate was 65, at night - 59 beats/min. Analysis of the PQ segment revealed a slowdown in AV conduction throughout the monitoring period (average PQ - 262 ms, oscillation range 232 - 288). QTc elongation was

observed during 25 % of the monitoring period (average QTc - 445 ms, range of oscillations 414 - 490 ms). A negative T in the lead which reflects the potentials of the anterior wall of the left ventricle was noted. Heart rate variability was slightly reduced: SDNN - 95.4 ms. LF / HF - 1.42.

RESULTS AND DISCUSSION

Cardiac involvement in Lyme disease usually occurs 2 - 3 months after a tick bite. The virulence of *Borrelia* involves many mechanisms of proliferation and colonization of multiple tissues and evasion of the host's immune response. *Borrelia* first migrates in the skin around the bite site and spreads through the lymphatic system, causing regional adenopathy and then spreads hematogenously to other organs, provoking serious immune response. LC is believed to occur as a result of direct invasion of the myocardium by *Borrelia*, followed by enhanced macrophage and lymphocytic inflammatory response in cardiac tissues (1, 5, 7). The manifestation of heart damage by this bacterium is myocarditis, which occurs as a result of the reaction of the host's immune cells to bacteria entering the tissue. *Borrelia* can infect all parts of the heart, including the conduction system around the atrioventricular node, the outer or inner lining of the heart, the heart muscle, and, less commonly, the coronary vessels or valves of the heart (8, 9). A typical manifestation of LC is AV block of different degree, which is mainly alleviated by etiotropic antibiotic therapy. Given this, it is important to diagnose borreliosis in time, be alert to possible heart damage in these patients and prescribe adequate treatment, including etiotropic one, if the diagnosis of Lyme carditis is confirmed. However, the diagnosis of LC is complicated due to the polymorphism of clinical manifestations, lack of clear anamnestic data on tick bites, frequent absence of migrating erythema and often asymptomatic course of the disease (10 - 15).

Besant G, Wan D, Yeung C, et al. from the Kingston Health Science Center offered the SILC scale to examine patients with conduction disturbances, especially high-grade AV blockade, and established the main clinical characteristics, included in the SILC scale by retrospective study and their own observations (Table 1) (16).

The SILC scale is a new tool which allows assessing the likelihood of a conduction disorder in a patient with myocarditis caused by Lyme disease by

Table 1. SILC scale

Variable	Value
Age < 50	1
Male	1
Outdoor activity/Endemic area	1
Constitutional symptoms ¹	2
Tick bite	3
Erythema migrans	4

¹ Fever, malaise, arthralgia, dyspnea

assigning scores to risk factors. The final total score classifies patients with low risk (0 to 2), intermediate risk (3 to 6) or high risk (7 to 12). In our patient, the calculation on the SILC scale was 8 points, which shows a high risk of Lyme carditis.

Serological testing is recommended for intermediate and high-risk LC patients. If the borreliosis etiology of myocarditis was confirmed, antibiotic therapy is highly recommended (16). In particular, our patient received antibiotic therapy with doxycycline at a dose of 200 mg/day in two servings for 21 days.

In regions that are endemic for Lyme disease, early serological testing provides a favorable prognosis with timely diagnosis and adequate treatment of LC, and, in many cases, allows to restore cardiac conduction and avoid pacemaker implants (17, 18). In the patient B., an improvement in AV conduction was achieved after long-term antibiotic therapy, and III degree AV block was not detected on the Holter ECG monitoring in the dynamics.

CONCLUSION

1. In the patient B., who was diagnosed with acute Lyme carditis, rhythm and conduction disorders such as sinus bradycardia, I degree AV block, transient AV block of the II degree (Mobitz 2) and of the III degree, and blocked supraventricular extrasystoles were revealed.

2. Patients with the myocarditis, accompanied by complex arrhythmias and conduction disorders and medium and high risk on the SILC scale are highly recommended for serological examination to have the borreliosis etiology of myocarditis verified.

3. Due to the timely diagnosis of LC and prescribed etiotropic antibiotic treatment, in addition to antihypertensive therapy and treatment of heart failure, the patient B. achieved significant improve-

ment in clinical dynamics, having successful correction of conduction disorders.

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Article info

Received: August 27, 2022

Revised: January 9, 2024

Accepted: January 15, 2024

Online first: March 7, 2024

Lajmski karditis u kliničkoj praksi

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SAŽETAK

Uvod. Lajmska bolest je infektivna bolest koju prenose krpelji iz roda *Ixodes* i manifestuje se oštećenjima različitih organa i sistema; najčešće manifestacije su migrirajući eritem, oštećenje nervnog sistema, muskulo-skeletnog sistema, srca, jetre i očiju. Prema rečima različitih autora, oštećenje srca kod lajmske borelioze kreće se od 4% do 10% i još nije dovoljno ispitana patologija.

Prikaz slučaja. Rad opisuje klinički slučaj infektivnog miokarditisa udruženog sa lajmskom bolešću kod pedesetjednogodišnjeg bolesnika. Analizirani su tok bolesti i rezultati lečenja. Uočeni su ozbiljni poremećaji ritma i provodljivosti: atrioventikularni (AV) blok prvog stepena, prolazni AV blok drugog stepena (Mobitz 2) i trećeg stepena, kao i politopijske ekstrasistole. Zahvaljujući pravovremenoj dijagnozi, serološkom ispitivanju i etiotropskoj antibakterijskoj terapiji, kod bolesnika je uočeno značajno poboljšanje kliničkog stanja. Takođe, zabeleženi su pozitivni rezultati seroloških testova i dinamike elektrokardiograma (EKG-a), sa poboljšanjem AV provodljivosti.

Zaključak. Najčešće promene na EKG-u kod lajmskog karditisa predstavljaju poremećaji provodljivosti uz pojavu blokada različitog stepena. Kod bolesnika sa miokarditisom, koji je praćen aritmijama i poremećajima provodljivosti koji se na osnovu SILC (engl. *Suspicious Index in Lyme Carditis*) skale ocenjuju kao poremećaji srednjeg i visokog rizika, trebalo bi preporučiti serološka ispitivanja kako bi se kod miokarditisa verifikovala etiologija borelioze. U ovom konkretnom slučaju, rana dijagnostika i prepisana etiotropska terapija nisu doprineli samo lečenju srčane slabosti nego i značajnom poboljšanju kliničkog stanja, te pozitivnim rezultatima seroloških testova i EKG dinamike.

Ključne reči: miokarditis, lajmski karditis, AV blok, dijagnostika, tretman