CARDIAC ABNORMALITIES AND ELECTROCARDIOLOGICAL PHENOMENA OF LYME CARDITIS – AN INTERESTING TRIP TO THIRD-DEGREE HEART BLOCK AND BACK (a clinical case report)

Andriy Vytrykhovskyy[1,2], Mykhaylo Fedorchenko[1,2], Nataliia Kiritsa[1], Mykola Stovban[3]

[1]CNO «Ivano-Frankivsk regional cardiological center» IFSS,
[2]Ivano-Frankivsk national medical university,
[3]Vasyl Stefanyk Precarpathian National University

Abstract. We present the case Lyme disease of a young male patient who presented only an electrical conduction disorder of myocardium. The result is something that physicians call «heart block», which can vary in degree and change rapidly. Our case illustrates the importance of early recognition and anticipation of progressive cardiac conduction abnormalities in patients presenting with Lyme disease.
Keywords: Lyme disease, carditis, heart block.

Електрокардіологічні феномени та аномалії при кардиті хвороби Лайма – небезінтересна подорож від атріовентрикулярної блокади третього ступеня і назад (клінічний випадок)

А.І. Витриховський А.І.[1,2], М. Федорченко[1,2], Н. Кіріца1, М. Стовбан[3]
КНП «Івано-Франківський обласний клінічний кардіологічний центр» ІФОР, Україна
[2] Івано-Франківський національний медичний університет
[3] Прикарпатський національний університет імені Василя Стефаника

Резюме. Нами представлено випадок хвороби Лайма в молодого пацієнта, який клінічно мав лише порушення електричної провідності міокарда. Результатом є те, що лікарі називають «блокадою серця», яка може бути різного ступеня та швидко змінюватися, від брадисистолії до тахісистолії, і навпаки, відповідно це кардинально змінює тактику терапії. Наш випадок ілюструє важливість раннього розпізнавання, моніторування та передбачення прогресуючих порушень серцевої провідності в пацієнтів із хворобою Лайма.
Ключові слова: хвороба Лайма, кардит, атріовентрикулярна блокада.

УДК: 616.12-073.7+616.995.42
DOI: 10.31793/2709-7404.2024.1-5.27

Lyme disease [LD] is the most common tick-borne disease in the United States and Europe [1]. LD is transmitted bythe *Ixodes* tick (*scapularis* and *pacificus* in North America, *persulcatus* in Asia, and *ricinus* in Europe). The disease is mostly commonly caused by *Borrelia burgdorferi* in North America and *by Borrelia afzelii*, *Borrelia burgdorferi, and Borrelia garinii* in Europe and Asia [2]. LD can evolve into a multisystemic disease and its clinical presentation can vary widely [3]. Lyme carditis [LC] occurs when LD bacteria enter the tissues of the heart [4]. This can interfere with the normal movement of electrical signals from the heart's upper to lower chambers, a process that coordinates the beating of the heart [5]. LC can cause light-headedness, fainting, shortness of breath, heart palpitations, or chest pain [6]. Patients with LC usually have other symptoms such as fever and body aches, and they may have more specific symptoms of LD, such as the erythema migrans rash [7]. Between 1985 and 2019, eleven cases of fatal LC were reported worldwide [8].

Case report

We present the case of a twenty-two-year-old male with no significant diseases in his medical history, who presented to the Emergency Department during summer reporting a one-day history of syncope. There was no contact with any chemical agents and any complaints on the cardiovascular system. Patient had no congenital heart or brain defects. From the anamnesis of life, it is known that during last week he was grazing a cow on the lawn, but he did not mention any insect bites. The only complaints were short-termed loss of consciousness and the pain in his left shoulder that `tied him up` because he slept all night on the grass two weeks before. During examination, the skin was normal in color, without any damage, hematomas and erythemas. Objectively – significant bradycardia (electrocardiogram showing Mobitz Type 2 AV block with episodes of complete AV block), heart rate at 24 beats per minute, and hyperthermia of 38 degrees Celsius that lasted for 4 hours and disappeared on its own (Figure 1, 2). The patient stayed in the cardiology clinic for 4 days and the temperature varied from 36.6 to 37.0 degrees Celsius. Blood pressure was 110/80 mmHg , respiratory rate of 15 breaths per minute. Chest radiograph and laboratory tests, including cardiac enzymes (Troponin I – 0.01 ng/ml (reference < 0.05)), (COVID-19 RNA – negative), were unrevealing. The possibility of cardiac ischemia as an etiology of heart block was less likely as he had no cardiac risk factors, nor did he have chest pain or suggestive EKG findings; his cardiac troponin was normal. Only one laboratory test – NT-proBNT – 900 (reference < 116 pg/ml) was positive. Patient's echocardiogram revealed no structural abnormalities. Cardiac imaging revealing no abnormal findings. Transthoracic echocardiography showing normal end-diastolic and end-systolic chamber dimensions with normal left ventricular ejection fraction (57%) in long-axis

Fig. 1.
Electrocardio-monitoring showing Mobitz Type 2 AV block

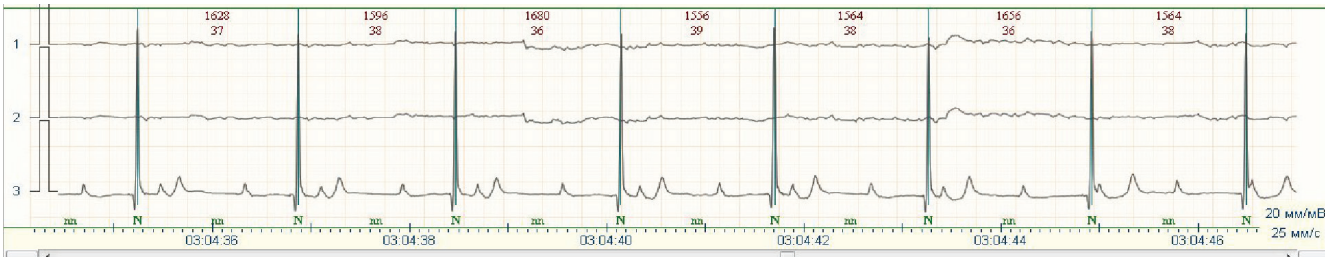
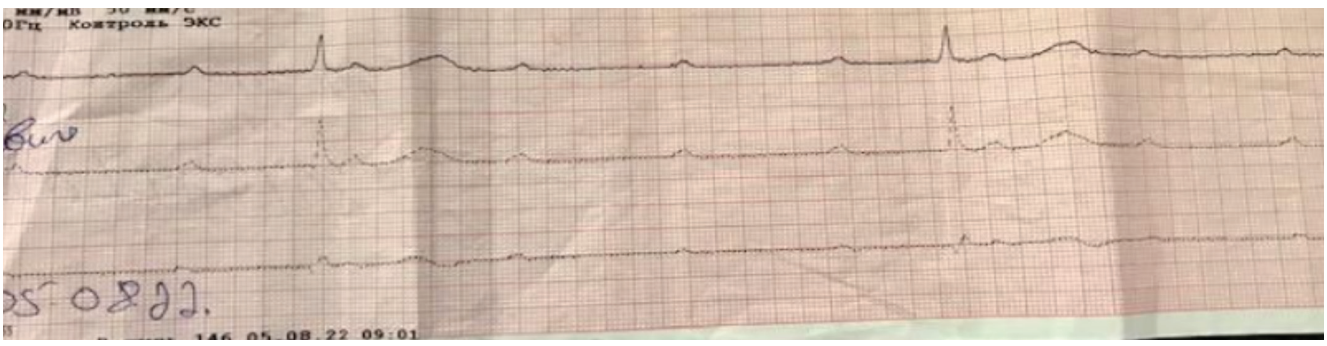


Fig. 2.
Electrocardiogram showing Mobitz Type 3 AV block



four-chamber view. He was diagnosed with Lyme disease, based on the presence of Borrelia antibodies demonstrated by enzyme-linked immunosorbent assay and immunoblot findings (Borelia burgorferi IgG – 9,08 (reference > 1,1 is positive), *Borelia* burgorferi IgM – 2,89 (reference > 1,1 is positive) – were positive). The patient received inotropic agents (0.5% dopamine solution, dose – 0, 35 mg/kg/min) and the heart rate increased from 24 to 122 with infusion on the background, electrocardiogram showing Mobitz Type 3 (atrioventricular) AV block with nodal rhythm with a heart rate of 118 per minute (Figure 3,4). During clinical test – as soon as the dopamine infusion

Fig. 3.
Electrocardiogram showing Mobitz Type 3 AV block, nodal rhythm with a heart rate of 118 per minute

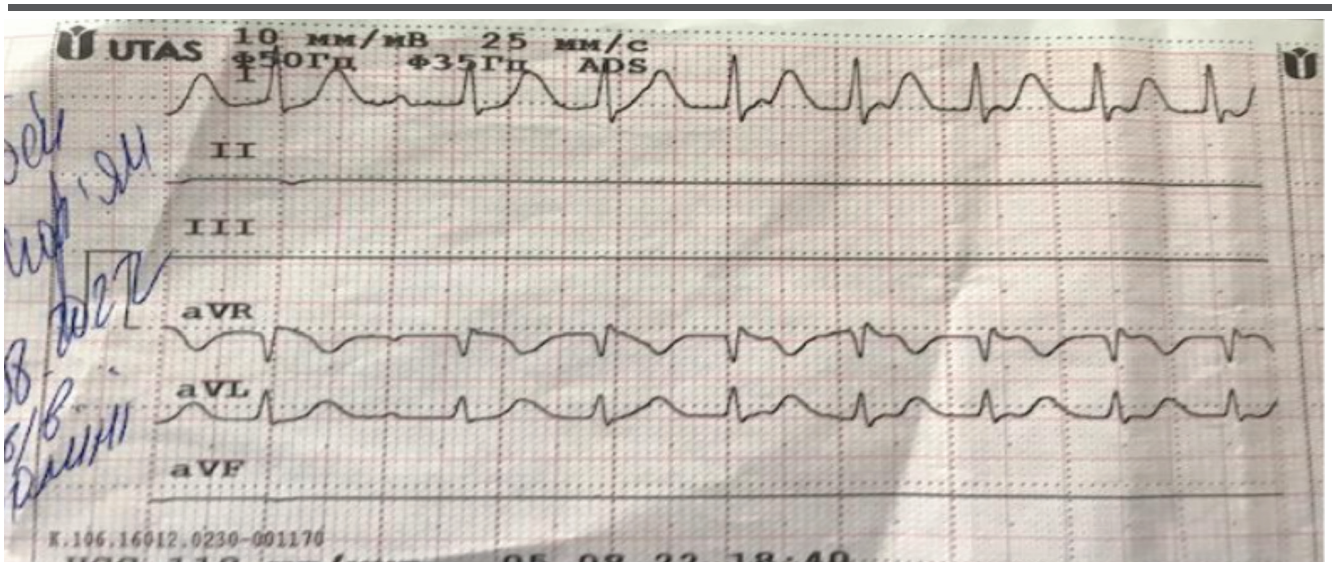


Fig. 4 .
Electrocardiogram showing Mobitz Type 3 AV block, nodal rhythm with a heart rate of 109 per minute

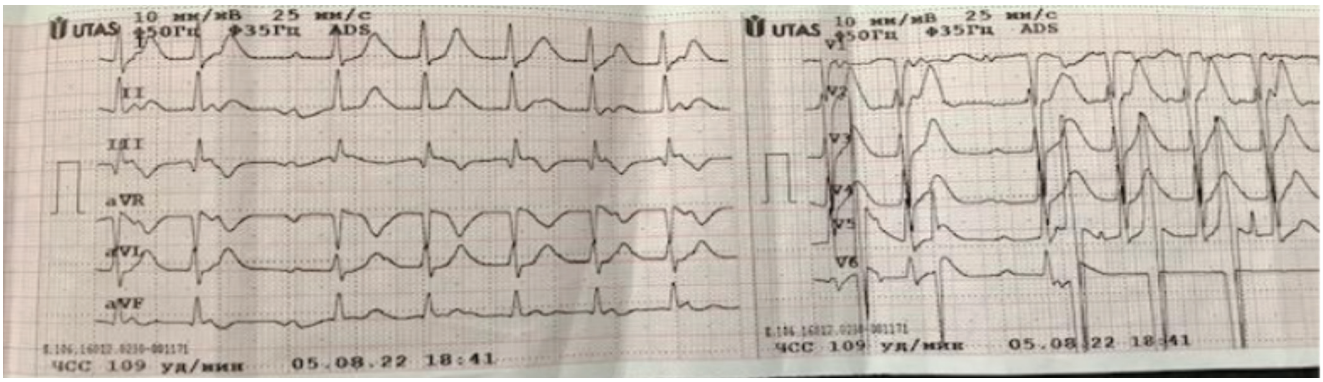


Fig. 5.
Electrocardiogram showing Mobitz Type 3 AV block, nodal rhythm

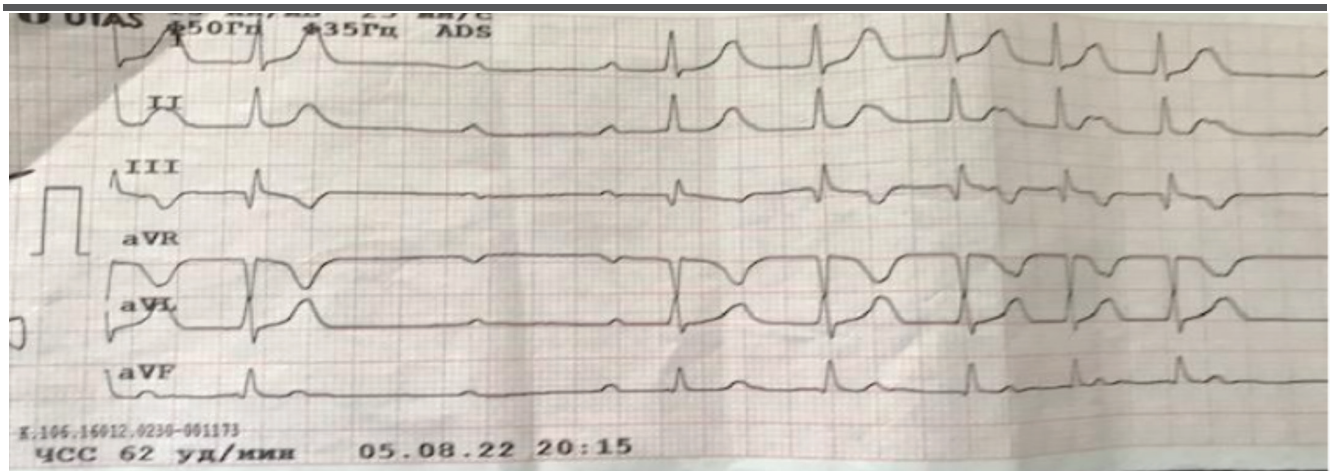


Fig. 6.
Electrocardiogram showing Mobitz Type 3 AV block, nodal rhythm

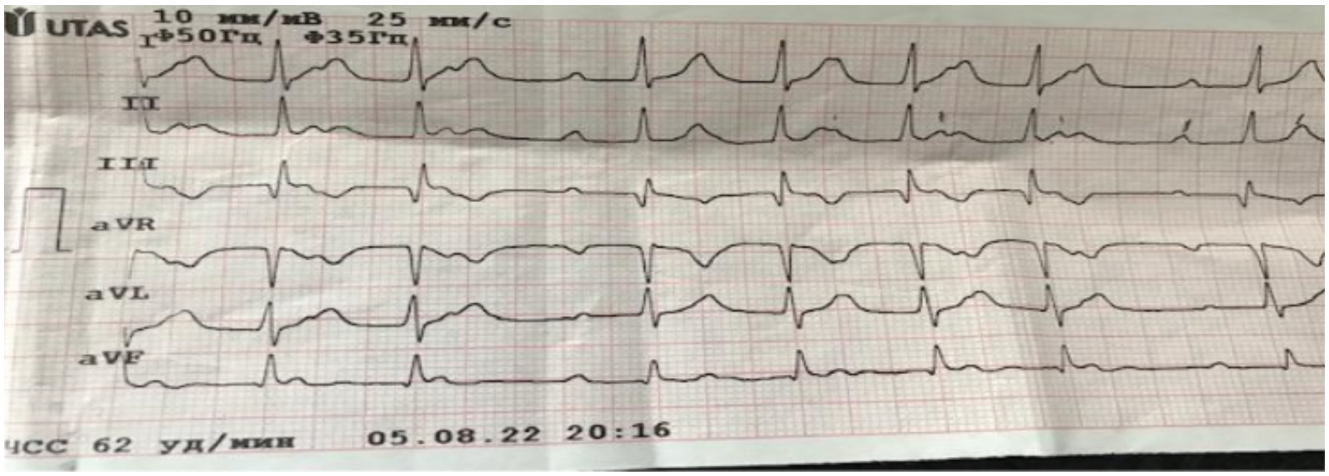
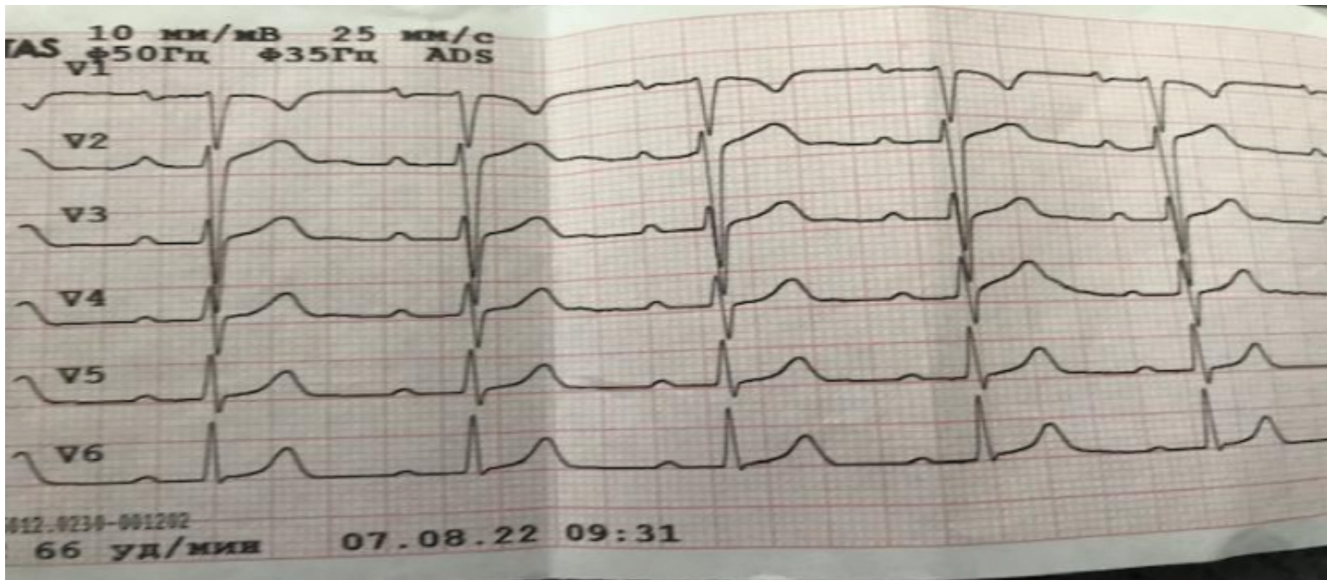


Fig. 7.
Electrocardiogram showing Mobitz Type 1 AV block



was stopped, within 20 seconds the heart rate dropped to 51 beats per minute, electrocardiogram showing Mobitz Type 3 AV block and nodal rhythm (Figure 5). The peculiarity was that the frequency of heart contractions increased due to the work of the artioventricular node, while the frequency of contractions of the atria remained low. The monitor recorded – AV dissociation of the III degree, nodal rhythm with a heart rate of 118-127 per minute (Figure 6). AV conduction was restored on the 3rd day after the onset of the disease. An initial electrocardiogram showed a first-degree AV block with a PR interval of 220 milliseconds. And on the 4th day – PR interval was less than 200 milliseconds (Figure 7). The patient was discharged from the hospital in four days after admission to complete a 21-day course of daily intravenous ceftriaxone therapy. One month later when the patient was examined in an outpatient cardiology clinic for follow-up, he was asymptomatic and hiselectrocardiogram showed a normal sinus rhythm.

Discussion

Lyme carditis is an uncommon presentation of early disseminated Lyme disease and occurs during the early disseminated phase of this condition. Steere et al. were the first to publish a case series on this clinical entity in 1980 [9]. Although LC can manifest as myocarditis, pericarditis, and/or left ventricular dysfunction, its most common presentation is an electrical conduction disorder [10]. The most common symptoms of LC include chest pain, palpitation, dizziness, and shortness of

breath. Rarely, syncope and sudden cardiac death have also been reported [8, 13, 14]. In the case series by Steere et al., PR interval >300 milliseconds was associated with progression of AV block [9]. In LC, the conduction abnormality is commonly supra-Hisian, typically in the AV node. There have been rare reports of an infra-Hisian involvement indicated by QRS widening. Some other rare conduction abnormalities reported include QT prolongation, alternating bundle branch block, and ventricular and supraventricular tachyarrhythmias [11]. By far the most common conduction disorder involves the AV node, causing various AV blocks from first degree to complete heart block [12]. In a review of over 100 cases, van der Linde reported that approximately 12% of cases presented with first-degree AV block, 16% as second-degree AV block, and 49% as third-degree heart block. The rest of the cohort (23%) did not have any conduction abnormalities. The worsening of the degree of AV block may occur within minutes as demonstrated in our case. In the review by van der Linde, 35% of the cohort had required temporary pacing, and only 5.7% required a permanent pacemaker of which only one patient remained pacer dependent. LC is a reversible disorder and in the vast majority of cases a permanent pacemaker is not required. In a systematic review of LC associated third-degree heart block permanent pacemaker was required in only two (4.4%) out of forty-five cases [13]. It is believed that, at the early disseminated stage of LD, the spirochete spreads hematogenously to the targeted organ systems. Spirochetes have been isolated in the heart tissue from patients with myocarditis and pancarditis at autopsy. It is suspected that the immunological inflammatory response to the spirochete in the cardiac layer and electrical system explains the AV conduction disorders [14]. Experimentally it has also been shown that, through immunologic mimicry, IgM antibodies against the spirochetes may cross-react with heart tissues causing inflammatory response [15]. A previous report demonstrated a late gadolinium enhancement consistent with focal myocarditis in the atrioventricular region of a patient with LC [16, 17, 18]. Our case highlights how rapidly the conduction disorder in LC can fluctuate; thus it is very important that patients carrying this diagnosis are admitted to the telemetry unit.

Conclusion

Our case highlights the importance of considering LD as an etiology of acute AV nodal conduction disorders in patients who present with cardiac symptoms. This case highlights the importance of taking a good travel history and emphasizes the importance of appropriate and timely therapy to prevent unnecessary interventions such as permanent pacemaker insertion.

Список використаної літератури

1. *Naik M, Kim D, O'Brien F, Axel L, Srichai MB. Images in cardiovascular medicine. Lyme carditis. Circulation. 2008;118(18):1881-1884. DOI: 10.14740/jmc3529.*
2. *Fish AE, Pride YB, Pinto DS. Lyme carditis. Infect Dis Clin North Am. 2008 Jun;22(2):275-88. DOI: 10.1016/j.idc.2007.12.008*
3. *Forrester JD, Mead P. Third-degree heart block associated with lyme carditis: review of published cases. Clinical Infectious Diseases. 2014;59(7):996-1000. DOI: 10.1093/cid/ciu411*
4. *Afari ME, Marmoush F, Rehman MU, et al. Lyme carditis: an interesting trip to third-degree heart block and back. Case Rep Cardiol. 2016;54541-60. PMCID: PMC5116334. DOI: 10.1155/2016/5454160*
5. *Bourji KI, Newsome T, Meyerhoff J. Rapid complete atrioventricular heart block reversal due to Lyme carditis. J Community Hosp Intern Med Perspect. 2018;8(4):241-243. DOI: 10.1080/20009666.2018.1503918*
6. *Cunha BA, Elyasi M, Singh P, Jimada I. Lyme carditis with isolated left bundle branch block and myocarditis successfully treated with oral doxycycline. IDCases. 2018;11:48-50. PMCID: PMC5760251. DOI: 10.1016/j.idcr.2017.12.006*
7. *Kannangara DW, Sidra S, Pritiben P. First case report of inducible heart block in Lyme disease and an update of Lyme carditis. BMC Infect Dis. 2019 May 16;19(1):428. PMCID: PMC6524294. DOI: 10.1186/s12879-019-4025-0*
8. *Muehlenbachs A, Bollweg BC, Schulz TJ, et al. Cardiac Tropism of Borrelia burgdorferi: An Autopsy Study of Sudden Cardiac Death Associated with Lyme Carditis. Am J Pathol. 2016 May;186(5):1195-205. PMID: 26968341. DOI: 10.1016/j.ajpath.2015.12.027*
9. *Steer AC, Malawista SE, Newman JM. Antibiotic therapy in Lyme disease. Ann Intern Med. 1980 Jul;93(1):1-8. PMID: 31096922. PMCID: PMC6524294. DOI: 10.1186/s12879-019-4025-0*
10. *Kashou AH, Braiteh N, Kashou HE. Reversible atrioventricular block and the importance of close follow-up: two cases of Lyme carditis. J Cardiol Cases. 2018 Feb 13;17(5):171-174. PMID: 30279884. PMCID: PMC6149643. DOI: 10.1016/j.jccase.2018.01.001*
11. *Fuster LS, Gul EE, Baranchuk A. Electrocardiographic progression of acute Lyme disease. Am J Emerg Med. 2017 Jul;35(7):1040.e5-1040.e6. PMID: 28279540. DOI: 10.1016/j.ajem.2017.02.052*
12. *Wan D, Blakely C, Branscombe P, Suarez-Fuster L, Glover B, Baranchuk A. Lyme carditis and high-degree atrioventricular block. Am J Cardiol. 2018 May 1;121(9):1102-1104.*
13. *van der Linde MR. Lyme carditis: clinical characteristics of 105 cases. Scandinavian Journal of Infectious Diseases, Supplement. 1991;22(7). PMID: 29598856. DOI: 10.1016/j.amjcard.2018.01.026*
14. *Forrester JD, Meiman J, Mullins J, et al. Centers for Disease Control and Prevention (CDC). Notes from the field: update on Lyme carditis, groups at high risk, and frequency of associated sudden cardiac death--United States. MMWR Morb Mortal Wkly Rep. 2014 Oct 31; 63(43):982-3. PMID: 25356607. PMCID: PMC5779475*
15. *Kennel PJ, Parasram M, Lu D, Zisa D, Chung S, Freedman S, Knorr K, Donahoe T, Markowitz SM, Halazun HA. Case of Lyme Carditis Presenting with Atrial Fibrillation. Case Rep Cardiol. 2018;2018:5265-5298. PMID: 30245891. PMCID: PMC6139209. DOI: 10.1155/2018/526529*

16. *Yeung C, Baranchuk A. Diagnosis and treatment of Lyme carditis: JACC Review Topic of the Week. J Am Coll Cardiol. 2019; 73:717-26. PMID: 30765038. DOI: 10.1016/j.jacc.2018.11.035*

17. *Vytrykhovskyi A., Nesterak R., Sovtus V. The risk of life-threatening arrhythmias and sudden death forecast scale. European Heart Journal. European Journal of Preventive Cardiology, Volume 31, Issue Supplement_1, June 2014, zwae175.009, DOI: 10.1093/eurjpc/zwae175.009*

18. *Oleg Libruk O., Vakaljuk I., Warenytsia E, Vytrykhovskyi A . Bradycardic variant of sudden cardiac death in patient with left ventricle aneurysm . Cor et Vasa.– October 2017;Volume 59 Issue 59.- e457-e459. DOI: 10.1016/j.crvasa.2016.12.007*

Для цитування: Витриховський А, Федорченко М, Кіріца Н, Стовбан М. Електрокардіологічні феномени та аномалії при кардиті хвороби Лайма – небезінтересна подорож від атріовентрикулярної блокади третього ступеня і назад (клінічний випадок) // Терапевтика / імені професора М.М. Бережницького. 2024;1(5):27-32. DOI: 10.31793/2709-7404.2024.1-5.27.

Адреса для листування: Витриховський Андрій Ігорович, vytryhovskiy@yahoo.com; Івано-Франківський клінічний кардіологічний центр, вул. Мазепи, 114, Івано-Франківськ, Україна.

Відомості про авторів: Витриховський Андрій Ігорович, професор, доктор медичних наук, заслужений лікар України, професор кафедри терапії, сімейної та екстреної медицини факультету післядипломної освіти, завідувач інфарктного відділення з палатами інтенсивної терапії КНП «Івано-Франківський обласний клінічний кардіологічний центр» ІФОР, Україна. ORCID ID: https://orcid.org/0000-0001-6279-0130. Федорченко Михайло, доктор філософії з медицини, асистент кафедри терапії, сімейної та екстреної медицини факультету післядипломної освіти, лікар інфарктного відділення з палатами інтенсивної терапії КНП «Івано-Франківський обласний клінічний кардіологічний центр» ІФОР, Україна. ORCID ID: https://orcid.org/0000-0002-9564-791X. Кіріца Наталія, лікар інфарктного відділення з палатами інтенсивної терапії КНП «Івано-Франківський обласний клінічний кардіологічний центр» ІФОР, Україна. Стовбан Микола, доктор мед. наук, професор кафедри терапії, реабілітації та морфології Прикарпатського національного університету імені Василя Стефаника. ORCID ID: https://orcid.org/0000-0002-6576-7494.

Особистий внесок: Витриховський Андрій – концепція та дизайн дослідження, збір даних, аналіз та інтерпретація даних, складання статті, критичний огляд, остаточне затвердження роботи. Федорченко Михайло – збір даних, складання статті. Стовбан Микола – збір даних. Кіріца Наталія – збір даних, складання статті.

Фінансування: не було.

Декларація з етики: Автори задекларували відсутність конфлікту інтересів і фінансових зобов'язань.

Проходження статті: Надійшла до редакції 07.08.2024 р.; прийнята на друкування 13.08.2024 р.; надрукована 30.12.2024 р.

For citation: Vytrykhovskyy A, Fedorchenko M, Kiritsa N, Stovban M. Cardiac abnormalities and electrocardiological phenomena of lyme carditis – an interesting trip to third-degree heart block and back (a clinical case report) // Therapeutics / named after professor M.M. Berezhnytskyi. 2024;1(5):27-32. DOI: 10.31793/2709-7404.2024.1-5.27.

Correspondence address: Vytrykhovskyi Andriy Igorovych, vytryhovskiy@yahoo.com;

Information about the authors: Vytrykhovskyi AI, Professor, MD, Ph.D Med. DSci, Honored Doctor of Ukraine, member of ESC. Prof of Department of Therapy, Family and Emergency Medicine, Faculty of Postgraduate Education Ivano-Frankivsk National Medical University, Cardiologist of higher attestation category, Cardiologist of higher attestation category, head of the myocardial infarction department with intensive care wards Ivano-Frankivsk Regional Clinical Cardiology Clinic, Ukraine. ORCID ID: https://orcid.org/0000-0001-6279-0130 Fedorchenko MV, MD, PhD, Assistant of the Department of Therapy, Family Medicine and Emergency, Faculty of Postgraduate Education Ivano-Frankivsk National Medical University. ORCID ID: https://orcid.org/0000-0002-9564-791X. Kiritsa NM, Cardiologist of higher attestation category Ivano-Frankivsk Regional Clinical Cardiology Clinic, Ukraine. Stovban MP., Professor, Med. DSci, Vasyl Stefanyk Precarpathian National University. ORCID ID: https://orcid.org/0000-0002-6576-7494

Personal contribution: Vytrykhovskyi Andriy – conception and design of the study, acquisition of data, analysis and interpretation of data, drafting the article, critical review, final approval of work. Fedorchenko Mykhaylo – acquisition of data, drafting the article. Stovban Mykola – acquisition of data. Kiritsa Nataliia – acquisition of data, drafting the article.

Funding: This research received no specific grant from any funding agency, commercial or not-profit sectors.

Declaration of Ethics: I declare on behalf of all authors that the research was conducted according to the Declaration of Helsinki.

Article: Received 07.08.2024; accepted 13.08.2024; published 30.12.2024.