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Lyme Carditis: A Reversible Cause of Acquired Third-Degree AV Block

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Conflict of interest: None declared

Patient: Male, 36-year-old
Final Diagnosis: Lyme carditis
Symptoms: Fatigue • myalgia
Medication: —
Clinical Procedure: Transcutaneous pacemaker
Specialty: Cardiology

Objective: Rare disease

Background: Lyme borreliosis, caused by spirochetes of the *Borrelia burgdorferi* genospecies complex, is the most commonly reported tickborne infection in North America and those infected may present with cutaneous, cardiac, articular, and neuropsychiatric abnormalities. The protean nature of many of its clinical manifestations presents a diagnostic conundrum. Lyme disease can affect the heart, albeit rarely, with cardiac abnormalities usually manifesting as varying degrees of heart block or arrhythmias.

Case Report: We present a case of complete heart block in a young man who participated in outdoor activities in a Lyme-endemic area and developed fatigue and palpitations weeks after a flu-like illness. He noticed that his heart rate was low; he had an intermediate suspicious index in Lyme carditis (SILC) score with positive Lyme serologies. His initial electrocardiogram when he presented to the emergency department showed a complete heart block. In this case, he was successfully managed with intravenous ceftriaxone, amoxicillin, and a transcutaneous pacemaker, obviating the need for a permanent pacemaker.

Conclusions: Electrocardiographic changes such as heart block and arrhythmias with or without symptoms may be the initial manifestation of Lyme carditis in a patient who may or may not remember a tick bite or have a typical skin rash. The SILC score may assist in recognizing these cases and prompt initiation of antibiotics usually leads to the resolution of these electrocardiographic abnormalities and symptoms that may be present.

MeSH Keywords: Heart Block • Lyme Disease • Tick Bites

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Background

The etiologic agent for Lyme disease is the *Borrelia burgdorferi* sensu lato complex borne by vectors such as *Ixodes scapularis* and *I. pacificus* [1]. Lyme disease is the most common vector-borne infectious disease in the United States, with an annual incidence of 23 558 confirmed cases, most of which are from northeastern and north-midwestern states [1,2]. Cardiac abnormalities seen in this infection, typically conduction disturbances, are, however, rare, as only 1.1% of Lyme disease cases reported to the Centers for Disease Control and Prevention between 2001 and 2010 had cardiac manifestations [3–5]. Even though there is an equal distribution of Lyme between men and women, the cardiac manifestation of Lyme disease is more common in men. [4] The incidence of Lyme carditis is higher between June and December [6].

Lyme carditis can be acute or chronic. Acute Lyme carditis manifests mostly as different degrees of atrioventricular (AV) block, arrhythmias, pericarditis, myocarditis, and pancarditis, and these acute pathologies may cause cardiogenic shock, sudden death, or cardiac arrest [7–9]. Chronic Lyme carditis typically manifests as chronic heart failure in a patient with positive serologies and endomyocardial biopsy [10]. The entity of chronic Lyme carditis is a contentious issue in the literature, and the association between *Borrelia* infection and the development of dilated cardiomyopathy (DCM) is also controversial. The correlation between increased *Borrelia* antibodies in patients with DCM was initially suggested by Stanek et al. and Bergler-Klein et al. [10–12] but was not confirmed by subsequent studies [13–15].

We report a case of Lyme-induced complete heart block in a young male patient who made significant clinical and electrocardiographic improvements after treatment with ceftriaxone and amoxicillin.

Case Report

A 36-year-old man with no premorbid illness presented to the Emergency Department with complaints of fatigue and generalized myalgia of 3 weeks' duration. He had fever, cough, fatigue, and myalgia that started when he went camping and engaged in outdoor activities in Upstate New York 3 weeks before presentation. Although fever and cough resolved after the first 3 days of his illness, his fatigue, malaise, and myalgia persisted. He also noticed that his heart rate, measured by a wearable device at home, was in the 40 s and was associated with palpitations, lightheadedness, and dizziness. He denied chest pain, shortness of breath, presyncope, syncope, nausea, vomiting, diarrhea, constipation, and abdominal pain. He did not notice any tick bites, rash, or joint pain. He had no

sick contacts; the last time he went camping was 2 months before his most recent camping trip when he became ill. He denied smoking cigarettes or usage of recreational drugs but occasionally consumed alcohol. On presentation, heart rate fluctuated between 30 and 70 beats/min, and blood pressure was 130/78 mmHg. Physical examination was positive for irregular first and second heart sounds with a cannon A wave on jugular vein examination. The remaining findings for other organ systems were benign.

Blood studies revealed a slightly elevated leukocyte count ($12.54 \times 10^9/L$). The complete metabolic panel was normal. Troponin T was within a normal range. Lyme VISE total antibody, as well as western blot immunoglobulin (IgG and IgM, were positive. Rapid coronavirus disease polymerase chain reaction and antibody tests were negative. Blood cultures were also negative. Electrocardiographic examination (EKG) revealed a sinus rhythm at 61 beats/min with a third-degree AV block (Figure 1A, 1B). A chest radiograph showed no acute pulmonary disease. Transthoracic echocardiography demonstrated an ejection fraction of 60% with normal diastolic function and cardiac dimensions.

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. Sarcoidosis, a known cause of heart block in the young, was also ruled out as he did not have any feature suggestive of erythema nodosum, shortness of breath, or blurred vision. He had a normal chest X-ray and a normal serum calcium level. In this case, a history of camping antedating constitutional symptoms, positive Lyme antibodies, and the presence of complete heart block in a young man prompted the diagnosis of Lyme carditis. Along with constant telemetry monitoring, the patient received intravenous (IV) ceftriaxone 2 g daily for 7 days. He also had a transcutaneous pacemaker for 5 days on account of high-risk features. His symptoms, as well as cardiac conduction abnormalities, showed marked improvement over 7 days. He was switched to oral amoxicillin 500 mg twice a day when his PR interval was persistently <300 ms over 72 h and was discharged with the same antibiotics for another 21 days. When he was seen in the clinic 20 days after discharge, he was completely asymptomatic, with a regular heart rate of 73 beats/min and blood pressure of 124/77 mmHg. He was counseled on protection from tick bites when outdoors.

Discussion

The natural course of Lyme disease is characterized by an early, localized stage that manifests as erythema migrans (EM) rash associated with a flu-like illness and fever occurring at a median of 12 days (range 5–48 days) after inoculation of *B. burgdorferi* after a tick bite. These initial manifestation usually

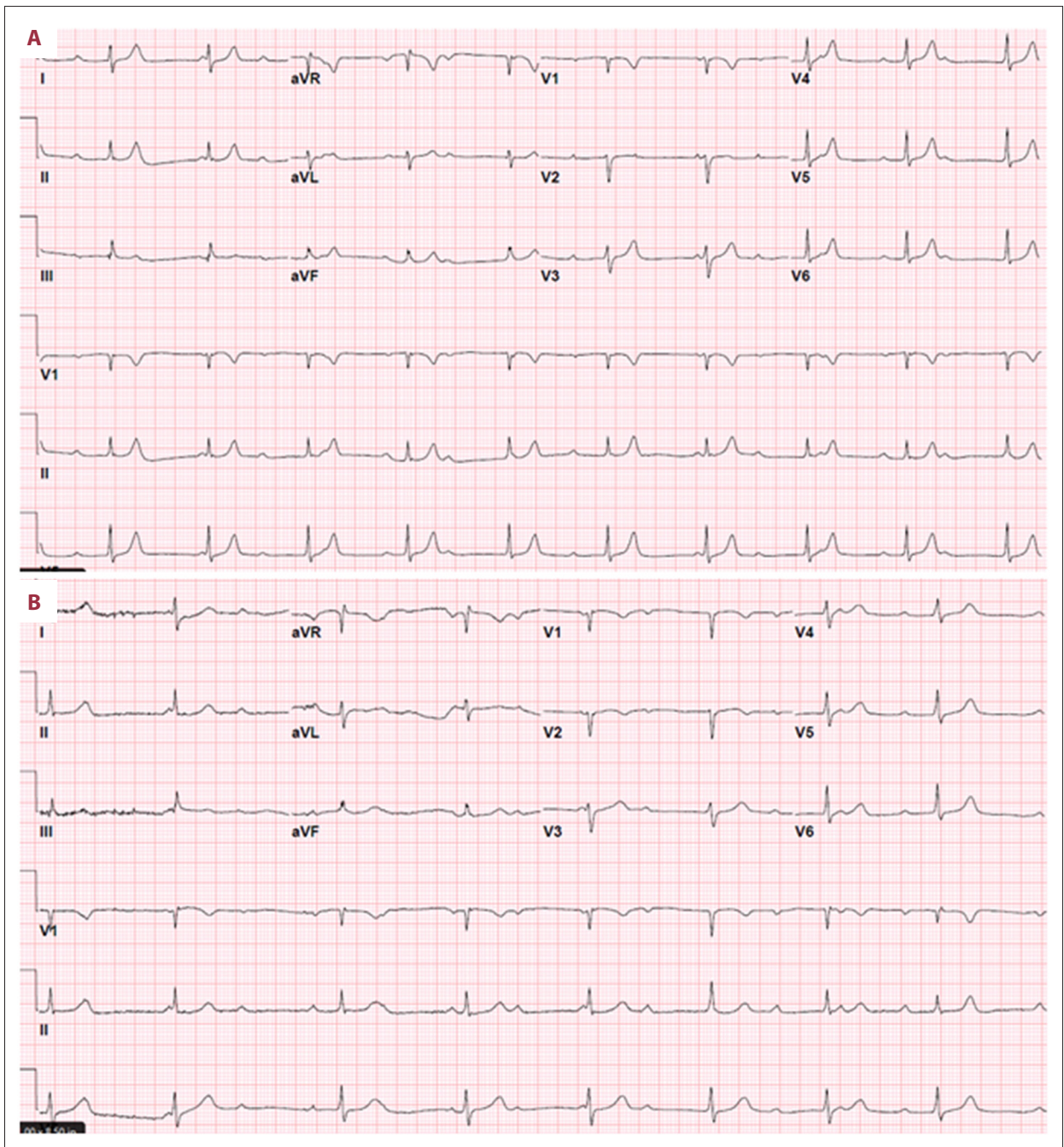


Figure 1. (A) EKG at admission showing complete heart block. (B) EKG 12 h after admission showing complete heart block.

resolve with or without antibiotics within 3 to 4 weeks [16,17]. Cardiac manifestations are a late clinical feature of Lyme disease in untreated patients usually presenting with a varying degree of AV block, which may manifest as dizziness, syncope, and shortness of breath with or without chest pain [18].

The suspicious index in Lyme carditis (SILC) score was propounded as a way of evaluating the probability that a patient's second- or third-degree AV block is caused by Lyme

carditis [19]. This new risk stratification method used the summation of scores assigned to different risk factors to categorize patients into low, intermediate, and high risk. These scores include age <50=1; male sex=1; outdoor activity or endemic area=1; constitutional symptoms of Lyme disease, including fever, malaise, arthralgia, dyspnea, presyncope, and syncope=2; a history of tick bite=3; and EM=4. A total score of 1–2 is a low probability, 3–6 is intermediate probability, and 7–12 is a high probability [20].

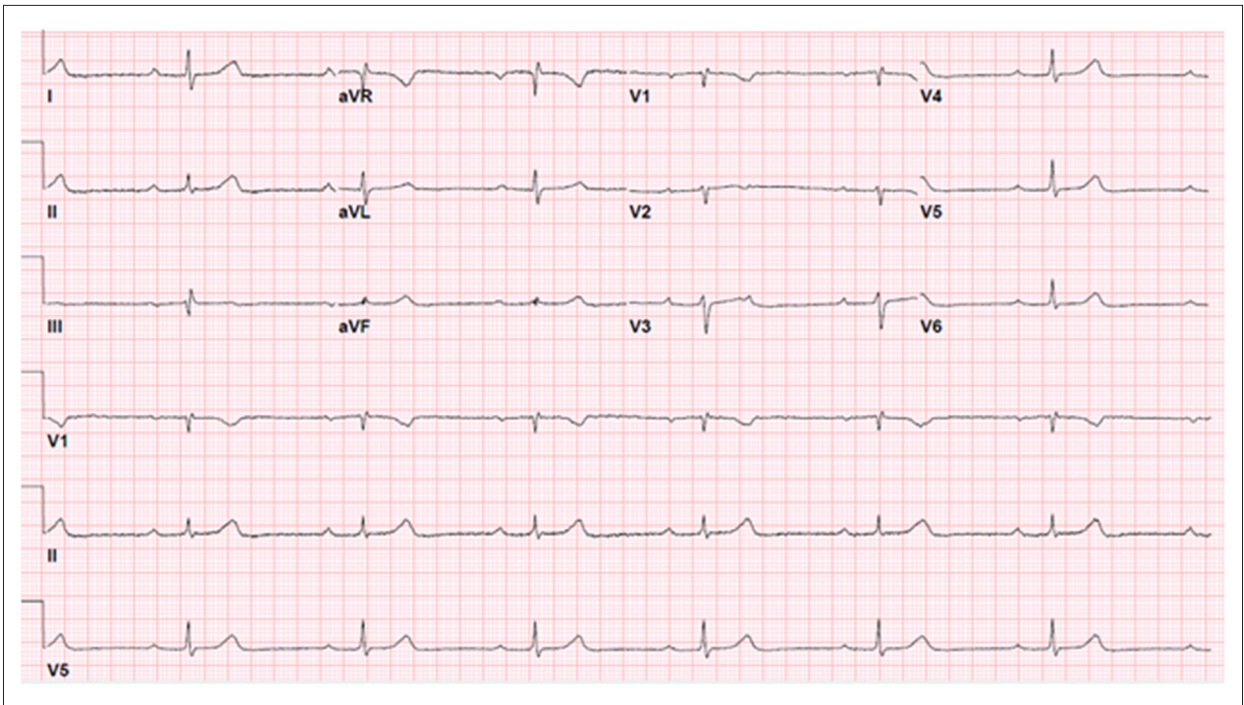


Figure 2. EKG on day 3, about 48 h after starting intravenous ceftriaxone, showing first-degree AV block with a PR interval of 308 ms and a ventricular rate of 40/min.

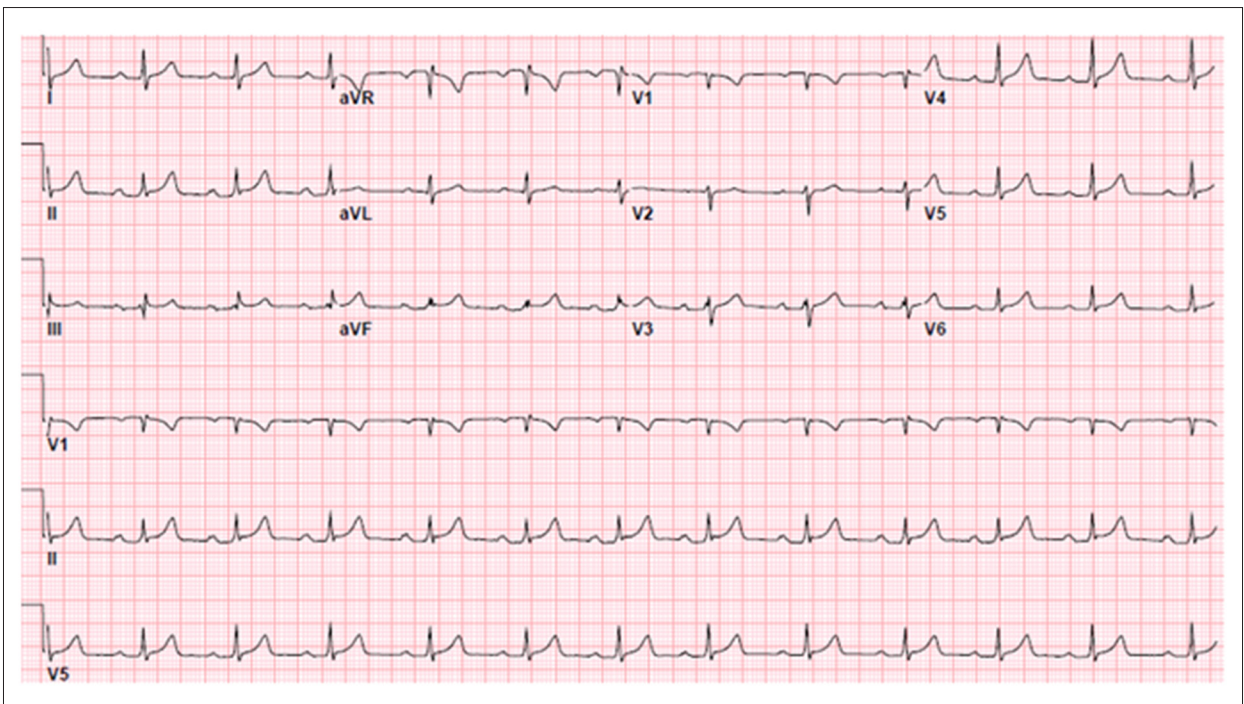


Figure 3. EKG on day 7 showing sinus rhythm with first-degree AV block with a PR duration of 210 ms and a ventricular rate of 74/min.

Even though there are no studies that specifically deal with the treatment of Lyme carditis, there are no randomized controlled treatment trials in Lyme carditis, and there is no proof to suggest that parenteral antibiotic therapy is better than enteral antibiotic therapy [21]. Intravenous antibiotics should be started on the basis of an intermediate or high SILC score, before serology results, which often take several days to weeks to return [22]. Given the paucity of evidence-based guidelines in this area, some expert opinion in the literature currently recommends that the duration of therapy consist of IV antibiotics for 10–14 days, followed by oral antibiotics for a total 14–21-day course [22]. Other experts recommend a total duration of 14–21 days of antibiotics, suggesting a switch from IV to oral therapy once the high-grade AV block resolves and the PR interval is less than 300 ms [21]. The low-probability group should have a standard permanent pacemaker.

A review article by Scheffold et al. [5] summarizes how cardiac magnetic resonance imaging may help confirm the diagnosis of Lyme carditis, as the presence of wall edema with increased signal intensity on T1-weighted images reflects myocardial inflammation. However, the criterion standard for confirming myocarditis irrespective of etiology is an endomyocardial biopsy. Our index patient had normal systolic and diastolic functions on echocardiography and did not have any clinical evidence of heart failure, precluding the need for endomyocardial biopsy.

Our index case had a SILC score of 5 with a positive Lyme serology. He was started on IV ceftriaxone from the first day of admission and also had a transcutaneous pacemaker placed. He made significant clinical and electrocardiographic improvement as symptoms of fatigue and palpitations improved 48 h after admission and so did the AV block as there was a change

from a third- to a first-degree AV block after 48 h of IV ceftriaxone (Figure 2). He continued IV ceftriaxone for 7 days with telemetry monitoring and daily EKGs and was discharged on oral amoxicillin for 3 more weeks. EKG on the day of discharge showed sustained electrocardiographic improvement (Figure 3). In a similar case reported by Isath et al. [23], their patient had a single chamber leadless permanent pacemaker placed as a high-grade AV block persisted despite 3 days of appropriate antibiotic therapy, whereas in our index case his complete heart block reverted to a first degree after 48 h of appropriate antibiotics; hence a permanent pacemaker was not indicated [24].

The prognosis in Lyme carditis is good, as most patients treated appropriately usually recover. Patients with high-degree infra-Hisian block usually recover within 1 week, whereas those with first-degree conduction disorder recover within 6 weeks [25].

Conclusions

A prompt diagnosis using the SILC scoring system and initiation of appropriate antibiotics in a patient with Lyme carditis whose only clinical manifestation may be cardiac symptoms and EKG abnormalities abrogate the need for unnecessary insertion of a permanent pacemaker as electrocardiographic and clinical perturbations are readily reversible.

Acknowledgments

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References:

1. Prevention CfDca. Lyme disease data tables: Historical data. Reported cases of Lyme disease by state or locality, 2009–2018, 2019 www.cdc.gov/lyme/stats/tables.html
2. Simmons T, Shea J, Myers-Claypole M et al: Seasonal activity, density, and collection efficiency of the blacklegged tick (*Ixodes scapularis*) (Acari: Ixodidae) in mid-western Pennsylvania. *J Med Entomol*, 2015; 52(6): 1260–69
3. Stanek G, Wormser GP, Gray J et al: Lyme borreliosis. *Lancet*, 2012; 379(9814): 461–73
4. Forrester JD, Meiman J, Mullins J et al: Update on Lyme carditis, groups at high risk, and frequency of associated sudden cardiac death – United States. *MMWR Morbid Mortal Wkly Rep*, 2014; 63(43): 982
5. Scheffold N, Herkommer B, Kandolf R et al: Lyme carditis – diagnosis, treatment and prognosis. *Deutsches Ärzt Int*, 2015; 112(12): 202
6. Fish AE, Pride YB, Pinto DS: Lyme carditis. *Inf Dis Clin N Am*, 2008; 22(2): 275–88
7. Clinckaert C, Bidgoli S, Verbeet T et al: Peroperative cardiogenic shock suggesting acute coronary syndrome as initial manifestation of Lyme carditis. *J Clin Anesth*, 2016; 35: 430–33
8. Jensen TB, Dalsgaard D, Johansen JB: Cardiac arrest due to torsades de pointes ventricular tachycardia in a patient with Lyme carditis. *Ugeskr Laeg*, 2014; 176(35): V03140168
9. Cary N, Fox B, Wright D et al: Fatal Lyme carditis and endodermal heterotopia of the atrioventricular node. *Postgrad Med J*, 1990; 66(772): 134–36
10. Bergler-Klein J, Ullrich R, Glogar D et al: Lyme borreliosis and cardiomyopathy. *Wien Med Wochenschr*, 1995; 145(7–8): 196–98
11. Stanek G, Klein J, Bittner R et al: Isolation of *Borrelia burgdorferi* from the myocardium of a patient with longstanding cardiomyopathy. *N Engl J Med*, 1990; 322(4): 249–52
12. Stanek G, Klein J, Bittner R et al: *Borrelia burgdorferi* as an etiologic agent in chronic heart failure? *Scand J Infect Dis Suppl*, 1991; 77: 85–87
13. Lelovas P, Dontas I, Bassiakou E et al: Cardiac implications of Lyme disease, diagnosis and therapeutic approach. *Int J Cardiol*, 2008; 129(1): 15–21
14. Sonnesyn SW, Diehl SC, Johnson RC et al: A prospective study of the seroprevalence of *Borrelia burgdorferi* infection in patients with severe heart failure. *Am J Cardiol*, 1995; 76(1): 97–100
15. Sangha O, Phillips CB, Fleischmann KE et al: Lack of cardiac manifestations among patients with previously treated Lyme disease. *Ann Intern Med*, 1998; 128(5): 346–53
16. Oschmann P, Dorndorf W, Hornig C et al: Stages and syndromes of neuroborreliosis. *J Neurol*, 1998; 245(5): 262–72
17. Cox J, Krajdin M: Cardiovascular manifestations of Lyme disease. *Am Heart J*, 1991; 122(5): 1449–55

18. Tugwell P, Dennis DT, Weinstein A et al: Laboratory evaluation in the diagnosis of Lyme disease. *Ann Intern Med*, 1997; 127(12): 1109–23
19. Besant G, Wan D, Blakely C et al: Lyme carditis presenting with high-degree atrioventricular block: A systematic review. *J Electrocardiol*, 2018; 51(6): 1165
20. Yeung C, Baranchuk A (eds.), Systematic approach to the diagnosis and treatment of Lyme carditis and high-degree atrioventricular block. Healthcare, Multidisciplinary Digital Publishing Institute, 2018
21. Wormser GP, Dattwyler RJ, Shapiro ED et al: The clinical assessment, treatment, and prevention of Lyme disease, human granulocytic anaplasmosis, and babesiosis: Clinical practice guidelines by the Infectious Diseases Society of America. *Clin Infect Dis*, 2006; 43(9): 1089–134
22. Yeung C, Baranchuk A: Diagnosis and treatment of Lyme carditis: JACC Review Topic of the Week. *J Am Coll Cardiol*, 2019; 73(6): 717–26
23. Isath A, Padmanabhan D, Naksuk N et al: Leadless pacemaker used as long-term temporary therapy in Lyme carditis with high-grade atrioventricular block. *Europace*, 2019; 21(1): 8
24. Crinion D, Yeung C, Baranchuk A: Lyme carditis atrioventricular block: Management strategies. *EP Europace*, 2019; 21(8): 1280–82
25. McAlister HF, Klementowicz PT, Andrews C et al: Lyme carditis: An important cause of reversible heart block. *Ann Int Med*, 1989; 110(5): 339–45