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A 34-Year-Old Woman with Third-Degree Heart Block and Atrial Flutter Associated with Lyme Carditis: A Case Report

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Statistical Analysis C
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Manuscript Preparation E
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Patient: Female, 34-year-old
Final Diagnosis: Lyme carditis
Symptoms: Dizziness • dyspnea • fatigue
Medication: —
Clinical Procedure: Cardioversion
Specialty: Cardiology

Objective: Rare disease

Background: Lyme disease is a tick-borne illness caused by bacteria of the *Borrelia* genus, endemic to the northeastern region of the United States. It typically presents with fevers, myalgias, and erythema migrans, but it can result in disseminated symptoms if left untreated. Lyme carditis is a rare, but potentially fatal complication of Lyme disease, occurring in up to 4-10% of untreated cases. Typically, it presents with atrioventricular conduction abnormalities, which resolve with intravenous antibiotics and temporary pacing if indicated. Diverse cardiac pathology, however, has been associated with Lyme carditis, which may be underrecognized in practice.

Case Report: A 34-year-old woman with no significant medical history presented with fatigue, dizziness, and shortness of breath, 2 weeks after camping in Rhode Island. Her presenting electrocardiogram demonstrated third-degree heart block. She was noted to have targetoid rashes on her left shoulder and breast on physical examination. On laboratory work-up, she was found to have positive Lyme total antibody enzyme immunoassay and positive Lyme western immunoblot. The findings were diagnostic for Lyme carditis. The patient's cardiac rhythm subsequently converted to slow atrial flutter with variable ventricular response unresponsive to antibiotic therapy. Given evidence suggesting that atrioventricular conduction was preserved, synchronized electrical cardioversion was pursued and was ultimately successful in rhythm conversion to normal sinus rhythm.

Conclusions: Although Lyme carditis is rare, this diagnosis should be of high clinical consideration in presentations of cardiac conduction abnormalities with acute onset and without other obvious cause, particularly in Lyme-endemic regions such as the northeastern United States.

Keywords: Atrial Flutter • Bradycardia • Lyme Disease

Full-text PDF: <https://www.amjcaserep.com/abstract/index/idArt/933789>



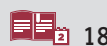
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Background

Lyme disease is a tick-borne illness caused by bacteria of the *Borrelia* genus, endemic to the northeastern and upper Midwest regions of the United States, the northern Pacific Coast, and regions of both Canada and Europe [1,2]. It is the most common vector-borne disease in North America, with reported cases dramatically increasing across the continent in recent years [3]. Lyme disease typically presents with fevers, myalgias, and characteristic erythema migrans rashes, but it can result in disseminated symptoms affecting the musculoskeletal, neurologic, and cardiovascular systems if left untreated [4]. The diagnosis of Lyme disease is dependent upon presenting symptoms corresponding to stage of disease. In cases of typical erythema migrans suggestive of early, localized Lyme disease in the setting of possible tick exposure, a clinical diagnosis is sufficient [2]. In cases presenting with atypical rashes, serologic testing through 2-tiered antibody testing, with enzyme immunoassay followed by western immunoblotting, within 1 week of noting the rashes, may aid in the diagnosis [2].

Lyme carditis is a rare but potentially fatal complication of late disseminated Lyme disease, occurring in as many as 4-10% of untreated cases [5]. Most cases occur between June and December, within 3 weeks of tick exposure [6]. Notably, up to 40% of patients in prior studies do not recall having the characteristic erythema migrans rash [2]. Classically, it presents with atrioventricular conduction disease, and it is treated with intravenous antibiotics and supportive care with temporary pacing if indicated [7]. However, a growing body of literature suggests that Lyme carditis can present with global cardiac disease, including sinus node dysfunction, supraventricular arrhythmia, and bundle-branch block [4,8,9]. This literature includes a case report, authored by Zainal et al [9], describing Lyme carditis complicated by atrial fibrillation. The Suspicious Index in Lyme Carditis (SILC) has emerged as a clinical decision aid to assist in the diagnosis of Lyme carditis in practice [10]. The score's variables include presence of constitutional symptoms, recent outdoor activity or travel to an endemic region, male sex, history of recent tick bite, age of less than 50 years, and presence of a typical erythema migrans rash.

Possible arrhythmias associated with Lyme carditis should first be confirmed through diagnostic electrocardiogram [2,11]. The mainstay of treatment for Lyme carditis is antibiotic therapy, generally initiated with ceftriaxone [3]. After 10 to 14 days of intravenous antibiotic therapy with demonstrated clinical improvement, oral therapy can be subsequently pursued with doxycycline, amoxicillin, or cefuroxime to complete a total antibiotic course of 14 to 21 days [3]. Management of bradyarrhythmias in Lyme carditis, in addition to antibiotic therapy to reverse the underlying cause of bradycardia, also includes temporary cardiac pacing in patients presenting with

symptomatic bradycardia, hemodynamic instability, or high-risk electrocardiographic features, such as an alternating bundle-branch block [3,11]. Pacing is generally done transvenously, although in a recent case reported by Chaudhry et al [8], an external pacemaker was utilized to achieve cardiac pacing. If supraventricular arrhythmias are diagnosed through electrocardiogram, treatment is dependent upon the particular arrhythmia. Modalities of treatment include atrioventricular nodal blocking agents, antiarrhythmic agents that can result in pharmacologic cardioversion, and synchronized electrical cardioversion [12].

Lyme carditis is rarely encountered in clinical practice partly owing to the widespread use of antibiotics prophylactically and in early manifestations of Lyme disease [6]. As the geographic reach of Lyme disease spreads due to climate change, however, Lyme carditis and its diverse pathology are at risk for under-recognition in clinical practice [13]. Furthermore, although the conduction disease of Lyme carditis typically resolves with antibiotic therapy, the time to response can vary significantly between 4 and 42 days, according to prior studies [14]. Variability in antibiotic response to conduction disease in Lyme carditis, particularly in settings unfamiliar with this disease, can potentially result in inappropriate permanent pacemaker placement [10].

We present the case of a 34-year-old woman with clinical, serologic, and electrocardiographic evidence diagnostic of Lyme carditis. Her clinical course was complicated by a persisting, slow atrial flutter with variable ventricular response. Due to a delayed response to intravenous antibiotic therapy, as well as evidence of preserved, intermittent atrioventricular conduction, synchronized electrical cardioversion was pursued and ultimately successful in restoring normal sinus rhythm.

Case Report

A 34-year-old woman presented to a hospital in Rhode Island with fatigue, dizziness, and shortness of breath. The patient had camped in a wooded area 2 weeks prior to hospitalization and noticed targetoid rashes on her left shoulder and breast 2 weeks after camping. Vital signs were notable for a heart rate of 58 beats/min and blood pressure of 105/66 mmHg. The patient was afebrile and breathing comfortably on room air. Cardiovascular examination was notable for an irregular bradycardic rhythm. Skin examination was notable for targetoid rashes present on her left shoulder and left breast, characterized as typical erythema migrans.

The patient's admission electrocardiogram, taken in the Emergency Department, demonstrated third-degree atrioventricular block, and widened QRS complexes with left bundle-branch

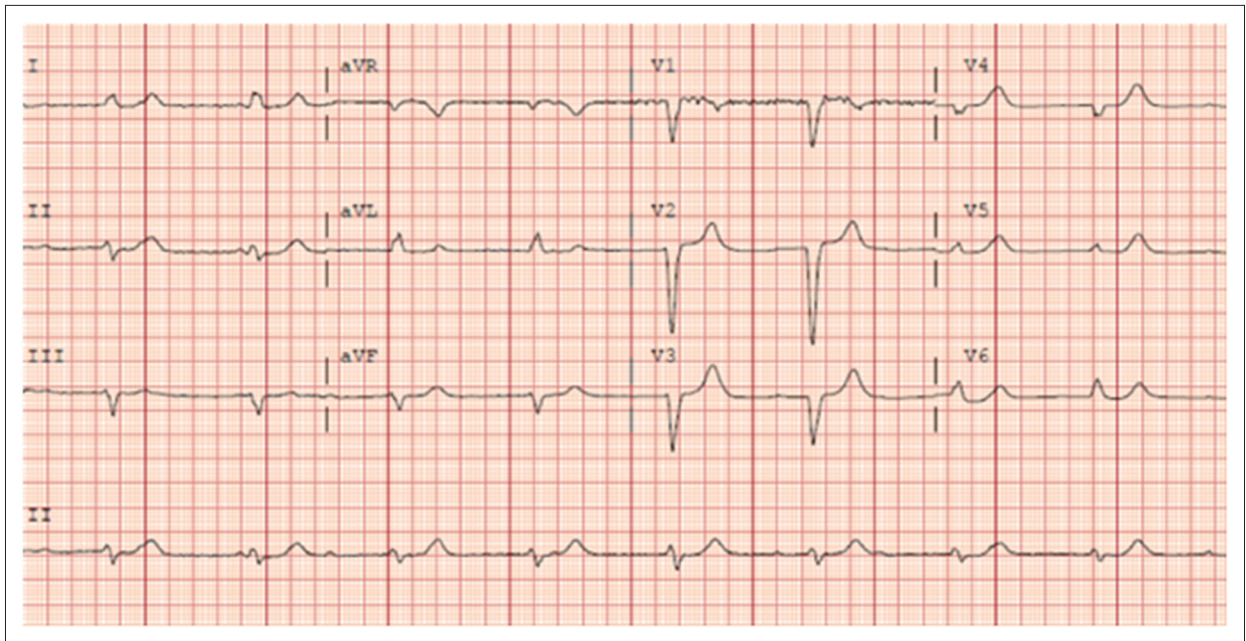


Figure 1. The patient's admission electrocardiogram, taken in the Emergency Department, demonstrating third-degree heart block with atrioventricular dissociation and wide QRS complexes.

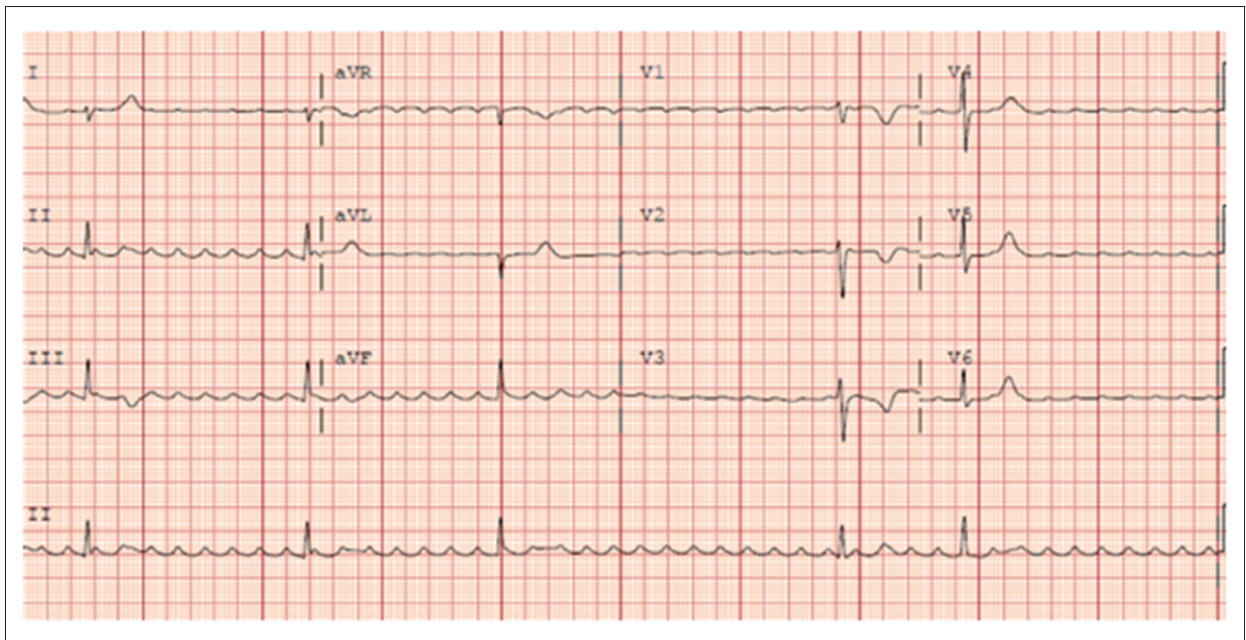


Figure 2. The patient's electrocardiogram on arrival to the Coronary Care Unit, suggestive of a reverse typical right-sided atrial flutter with slow ventricular response and variable conduction blockade, demonstrating T-wave inversions in V1-V3.

block morphology suggestive of infra-Hisian conduction disease (**Figure 1**). Given the patient's clinical presentation and high SILC score of 11, Lyme carditis was strongly suspected [10]. The patient was empirically treated with 2 g of ceftriaxone intravenously and admitted to the Coronary Care Unit with continuous telemetry observation. Subsequent laboratory data were notable for positive Lyme total antibody enzyme

immunoassay and Lyme western immunoblot [2]. D-dimer level was markedly elevated. Thyrotropin, electrolytes, troponin I, and brain natriuretic peptide were all within normal limits. SARS-CoV-2 testing, anaplasma phagocytophilum polymerase chain reaction, parasite thick smear, and antinuclear antibodies were negative. Iron studies were unrevealing for hemochromatosis. Transthoracic echocardiogram demonstrated

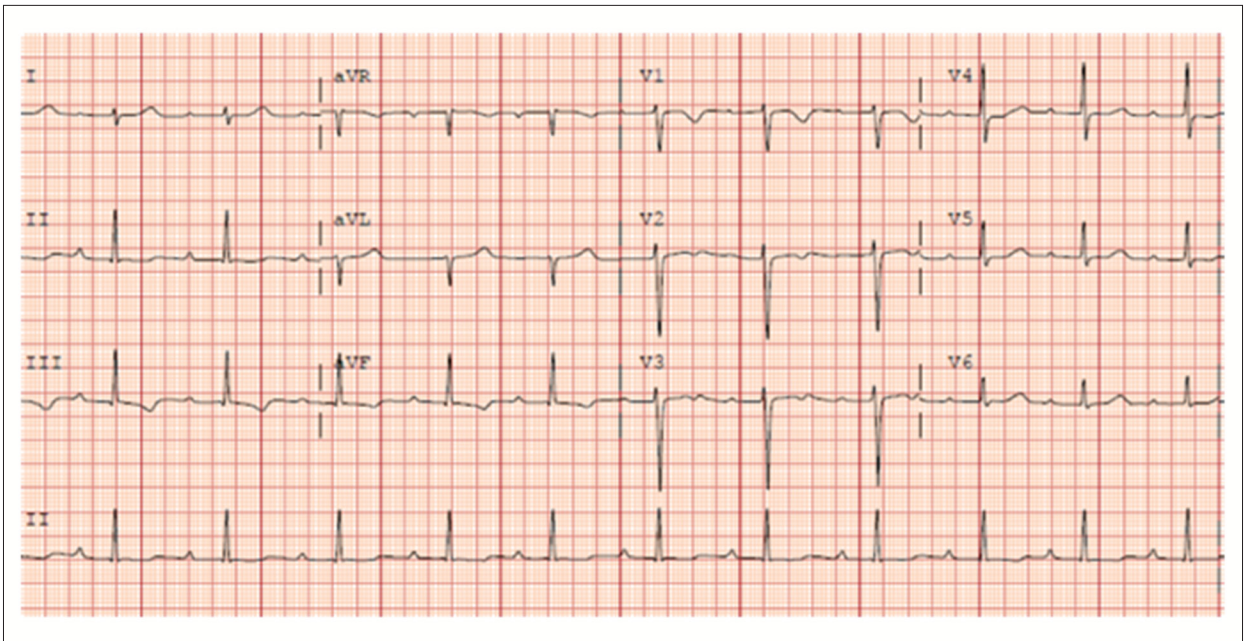


Figure 3. The patient's electrocardiogram after synchronized electrical cardioversion, demonstrating restoration of normal sinus rhythm with first-degree atrioventricular block

mild mitral regurgitation and stigmata consistent with elevated right atrial pressures. Cardiac magnetic resonance imaging demonstrated no late gadolinium enhancement. A later electrocardiogram, taken on arrival to the Coronary Care Unit, demonstrated positive flutter deflections in the inferior leads and negative flutter waves in V1, suggestive of reverse typical atrial flutter (Figure 2). An irregular ventricular response suggested that some degree of residual atrioventricular conduction remained with recurrent concealed penetration contributing to slower conduction and inhibition of nodal escape rhythm [15]. Of note, the patient's electrocardiogram in Figure 2 also demonstrated T-wave inversions in the septal leads.

Although Lyme carditis was of high clinical suspicion early in our patient's presentation, our team also considered other diagnoses, including infectious etiologies associated with cardiac tissue organotropism, infiltrative cardiac disease (including sarcoidosis and hemochromatosis), dysautonomia, and hypothyroidism. Our diagnostic work-up, however, was ultimately not suggestive of these diseases.

Infectious disease and electrophysiology services were subsequently consulted, concurring with this diagnosis and management strategy with empiric ceftriaxone. The patient remained asymptomatic, and in atrial flutter with slow, variable ventricular response for several days. Given the persistence of her arrhythmia, electric cardioversion was pursued, preceded by a transesophageal echocardiogram confirming the absence of a cardiac thrombus or left atrial appendage clot. The patient's postcardioversion electrocardiogram demonstrated restoration

of normal sinus rhythm with first-degree heart block, as well as interval improvement of known T-wave inversions (Figure 3).

Postprocedurally, the patient was initiated on a 4-week course of apixaban (5 mg orally, twice daily). After observation with telemetry monitoring for 24 h, she was discharged with doxycycline (100 mg orally, twice daily) to complete a 28-day antibiotic course and systemic anticoagulation. Follow-up appointments with a primary care physician and cardiologist in her home state were also coordinated.

Discussion

Our case describes a presentation of Lyme carditis complicated by atrial flutter with slow, variable ventricular response, eventually resolved with both antibiotics and synchronized electrical cardioversion. From an electrophysiologic perspective, our patient's case demonstrated the diversity of cardiac pathology and rhythm disturbances that can be associated with Lyme carditis [3]. It underscores the utility of employing the SILC score to characterize patient presentations of unexplained bradycardia and conduction abnormalities [10]. Finally, it also illustrates the use of synchronized electrical cardioversion to address a persisting arrhythmia of atrial flutter with slow and variable ventricular response associated with Lyme carditis.

In comparison with the case reported by Zainal et al [9], our case also describes multiple conduction abnormalities and arrhythmias associated with Lyme carditis. The patient in their

case initially presented with atrial fibrillation with rapid ventricular response, with subsequent conversion notably to Mobitz I second degree atrioventricular block. In both our case and their case, cardiac pacing was deferred. In contrast to these 2 cases, the patient described in the case report by Chaudhry et al [8] did require an external pacemaker. In that case, the patient experienced loss of their stable junctional escape rhythm and subsequently experienced third-degree heart block and asystole with near syncope. In all 3 cases, the patients involved were of younger age, between 26 and 43 years old, without a significant past medical history [8,9].

Our patient's case was illustrative of the diverse conduction abnormalities and arrhythmias that may be associated with Lyme carditis. In serial electrocardiograms, this diversity included third-degree heart block suggestive of atrioventricular nodal disease, T-wave inversions suggestive of myocarditis, widened QRS complexes with left bundle-branch block morphology suggestive of infra-Hisian conduction abnormalities, and atrial flutter indicative of a supraventricular arrhythmia. The atrial flutter, in this case, followed a reverse typical flutter pattern and was likely derivative of electrically hypoactive zones in the right atrium. Although it did demonstrate mild improvement with antibiotics, synchronized electrical cardioversion was ultimately invoked to convert our patient to normal sinus rhythm.

The decision to pursue electric cardioversion, a class I recommendation for acute treatment of atrial flutter, was made as part of a rhythm control strategy and after a discussion of risks and benefits with the patient and among the care team [16]. Treatment standards for bradyarrhythmia in Lyme carditis are well-established and involve antibiotics, as well as temporary pacing in the case of persisting symptoms, hemodynamic instability, or in the absence of a stable rhythm [17]. However, standards are yet to be determined specifically for supraventricular tachyarrhythmias within this disease process. Atrial flutter, in this case, likely indicated impaired atrioventricular node conduction with recurrent concealed penetration. In assessing the role of synchronized electrical cardioversion, we considered the risk of asystole due to sinus node dysfunction, but asystole with cardioversion is generally very low; in this case, there was partial recovery of atrioventricular conduction and previous demonstration of a stable escape rhythm noted during third-degree heart block on the patient's admission electrocardiogram [15,18]. Among the benefits considered were the traditionally high rates of effectiveness of synchronized electrical cardioversion in restoring normal sinus rhythm from atrial flutter. As the patient remained asymptomatic and

hemodynamically stable and had a stable escape rhythm before pursuit of synchronized electrical cardioversion, transvenous pacemaker placement was deferred, given its inherent risks, including local infection, pneumothorax, and myocardial perforation.

Although a broad differential diagnosis was considered in this case, empiric treatment for Lyme carditis was initiated given the high clinical suspicion and potentially fatal consequences if left untreated [5]. In our patient's case, several risk factors favored her ultimate diagnosis. In addition, her presentation to a tertiary referral center in Rhode Island, where clinicians frequently encounter Lyme disease, ensured early consideration of Lyme carditis in her hospital course. However, the diverse manifestations of Lyme carditis leave it susceptible to misdiagnosis [3]. As the geographic reach of Lyme disease expands due to climate change, greater vigilance among all clinicians is warranted to ensure that the disease is recognized expeditiously, particularly given its implications for management and prognosis [13]. This may be achieved through employment of risk stratification scores, such as the SILC score, in clinical scenarios of unexplained conduction abnormalities or slow arrhythmias [10].

Conclusions

This report describes the case of a 34-year-old woman with no significant medical history presenting with fatigue, dizziness, and shortness of breath 2 weeks after camping in Rhode Island. She was found to have third-degree heart block with clinical, serologic, and electrocardiographic criteria diagnostic of Lyme carditis. Although Lyme carditis is rare, this diagnosis should be of high clinical consideration in presentations of cardiac conduction abnormalities with acute onset and without other obvious cause, particularly in Lyme-endemic regions such as the northeastern United States [1].

Department and Institution Where Work Was Done

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Declaration of Figures Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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