

## Heart stopping tick

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### Abstract

Although Lyme carditis is relatively rare within 4-6 wk of exposure, it can uncommonly present as the first sign of disseminated Lyme disease. Here we present 17 year old boy who presented to the emergency department with chest discomfort and was later found to have complete atrioventricular block due to Lyme carditis. He had uneventful recovery after empiric treatment with ceftriaxone. Our case highlights the importance of considering reversible causes of complete AV block since appropriate therapy can avoid the need for permanent pacemaker insertion.

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**Key words:** Lyme carditis; Heart block; Antibiotic; Pacemaker; Disseminated Lyme; *Borrelia burgdorferi*; Tick bite

**Core tip:** Seventeen-year man presented with acute chest discomfort following a tick bite 5 wk back. His hospital course was complicated with the development of first degree AV block which rapidly deteriorated to total AV block. Due to high grade of suspicion of Lyme disease and positive Lyme enzyme-linked immunosorbent assay and Lyme IgM (Western blotting), treatment with Ceftriaxone and doxycycline was started with

complete remission. It is important to consider the reversible causes of complete AV block since appropriate therapy can avoid the need for permanent pacemaker insertion.

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### INTRODUCTION

The incidence of cardiac involvement in Lyme disease has been estimated to be 4%-10% in the adult population in the United States<sup>[1,2]</sup>. Lyme disease should be suspected as a cause of AV block in a patient living in an endemic area or a recent trip to an endemic area. Our case depicts the importance of starting treatment early awaiting serology in order to prevent serious morbidity and mortality. We also discuss the clinical presentation, diagnosis and treatment.

### CASE REPORT

A 17-year-old man presented to the Emergency Department with acute chest discomfort for 1 d. Two weeks ago, he had developed a febrile illness with headache. At that time he was seen in outpatient clinic and was diagnosed with a viral illness and sent home with supportive care. Over the course of the week his fever resolved, however, he reported some nonspecific chest discomfort which became progressively worse. His social history was significant for living in woody area and being bitten by a tick 5 wk back. However, he denied being tested or treated for Lyme disease, history of rash and joint pain. His family history was not significant for any heart disease or sudden cardiac death.

His physical examination was unremarkable with normal vital signs. Electrocardiography (ECG) revealed



**Figure 1 Electrocardiography.** A: AV-dissociation (III degree heart block) in lead II; B: first degree AV block in lead II following regression of complete heart block 2 d after treatment.

sinus arrhythmia and first degree AV block with a ventricular rate of 97 beats/min. Echocardiogram showed no evidence of structural heart disease. His complete blood count, basic metabolic panel and urine analysis were all within normal limits. Streptococcal throat swab done 2 wk ago was normal. He was placed in observation unit and monitored on telemetry. In the subsequent 24 h he had first degree heart block initially followed by intermittent episodes of complete heart block with AV dissociation (Figure 1A). However he was hemodynamically stable during the whole time. ECG showed sinus tachycardia with an atrial rate in the range of 100 beats/min with complete heart block with narrow escape beat. Empirical treatment with IV Ceftriaxone 2 g once a day was started and patient was monitored on telemetry. Further tests done including peripheral smear, serological titers for ehrlichiosis, Rocky Mountain spotted fever, streptococcal throat culture blood and urine culture were all negative. Lyme enzyme-linked immunosorbent assay (ELISA) was positive. Lyme IgM through Western blotting was consistent with early infection. After 2 d he had regression of his complete heart block to first degree heart block (Figure 1B). He was discharged on doxycycline to be taken for total of 3 wk. He remains asymptomatic with normal ECG after 3 wk.

## DISCUSSION

Lyme disease, caused by spirochaete *Borrelia burgdorferi* is transmitted by the bite of Ixodes tick. It constitutes one of the most common tickborne infections in the Northern hemisphere<sup>[3]</sup> and can involve multiple organs. The clinical manifestations of Lyme disease can be divided into 3 stages. Stage 1 is the acute illness, usually presenting 2 wk after the initial infection with erythema migrans with or without constitutional symptoms. Approximately two thirds of patients progress to stage 2 or dissemination phase, which can involve cardiac or neurologic abnormalities, weeks to months later<sup>[4]</sup>. Stage 3 or late chronic phase presents months to years later and classically involves the musculoskeletal system with destructive chronic arthritis, with the potential for late neurologic abnormalities<sup>[5]</sup>.

Lyme carditis is defined as myocarditis, pancarditis or acute AV conduction disturbance, usually above the bundle of His<sup>[1,2]</sup>. It is usually clinically apparent 3 wk after

the onset of erythema migrans. Generally, cardiac complications occur in the early disseminated phase. Disturbance of AV nodal conduction is the most common cardiac manifestation of Lyme disease. This is usually self-limited and does not require permanent cardiac pacing<sup>[6]</sup>. Patients usually complain of dizziness, shortness of breath, substernal chest pain, and palpitations. ECG findings include T-wave flattening or inversions in the lateral and inferior leads<sup>[1]</sup>. Other conduction disturbances in Lyme disease with unfavourable prognosis are low escape rhythms with severe AV block, which are slow and of wide QRS pattern; transient lack of any escape rhythm, with brief asystoles; and fluctuating bundle branch block depicting either transient His-Purkinje involvement or intranodal AV block<sup>[7]</sup>. In addition, pericarditis, endocarditis, myocarditis, pericardial effusion, myocardial infarction, coronary artery aneurysm, QT interval prolongation, tachyarrhythmias and congestive heart failure have been reported<sup>[8]</sup>. Myopericarditis is rare but may lead to transient cardiomegaly or pericardial effusion with non-specific ST and T wave changes on the electrocardiogram<sup>[9]</sup>.

Although the cause of the AV nodal dysfunction in Lyme carditis is unknown, autopsy findings of transmural lymphoplasmacytic infiltrate, necrosis of myocardial fibers, and spirochetes in the endomyocardial space of myocardial cells<sup>[4]</sup> have been reported. Direct dissemination of spirochetes into cardiac tissues, the inflammatory response associated with the infection, or both have also been implicated as the cause of AV nodal dysfunction<sup>[10]</sup>.

The diagnosis of Lyme carditis can be challenging if it is the initial presentation of the disease process and patient does not remember having a tick bite. AV block may be the first and only sign of Lyme disease. ELISA testing is preferred for early diagnosis, but most patients are seropositive for IgG antibody only after several weeks. Immunofluorescence assays and Western blotting can also be used<sup>[11]</sup>. A two-step protocol for the evaluation of *Borrelia burgdorferi* antibodies in sera has been recommended in the United States<sup>[12]</sup>. The history of tick bite, positive lyme serology, negative serology for babesiosis, ehrlichiosis, in our case helped us to establish the cause of complete heart block.

More than 90% of the patients with Lyme carditis have complete recovery with only up to a third of the patients requiring temporary cardiac pacing<sup>[13]</sup>. Although

recovery may be delayed and late complications such as dilated cardiomyopathy may occur, the overall prognosis of Lyme carditis is very good. It has recently been demonstrated that, unless meningitis is present, oral doxycycline is as effective as parenterally administered ceftriaxone in preventing the late manifestations of Lyme disease<sup>[6]</sup>. Patients with minor cardiac involvement (first-degree AV block with PR interval < 0.3 s) could be treated orally with doxycycline, tetracycline, or amoxicillin. Doxycycline is the drug of choice as it is also effective for other tick borne diseases (babesiosis, ehrlichiosis, anaplasmosis) that could be co-transmitted and lead to a more serious outcome<sup>[14-16]</sup>. Patients with more severe conduction system disturbances (first-degree AV block with a PR interval > 0.3 s, second or third-degree AV block) should be hospitalised in a coronary care unit and treated with either intravenous antibiotics like ceftriaxone or high-dose penicillin G. Insertion of a temporary transvenous pacemaker may be required<sup>[5]</sup>. As in our case the degree of heart block can fluctuate rapidly from first degree to second degree to complete AV block very quickly in minutes to hours so careful observation is prudent. Treatment with an antibiotic can revert the AV block within 48 h of therapy<sup>[1]</sup>.

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