Lyme disease: A cause of polymorphic ventricular tachycardia

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Introduction
Lyme disease (LD) is common and is transmitted by the black-legged tick (*Ixodes scapularis*, deer tick). Typical cardiac complications of LD include conduction disorders. We present a patient with LD who developed second-degree heart block along with polymorphic ventricular tachycardia (PMVT). PMVT complicating LD is a rare finding with limited documentation in the literature.

Case report
A 38-year-old woman from the rural Midwest was transferred from an outlying hospital for further evaluation and treatment of second-degree heart block and PMVT. The patient had endorsed a febrile illness with presyncopal episodes for 2 weeks prior to her admission. One week prior to her admission, she presented to the emergency department at an outside hospital with a chief complaint of palpitations and increasing shortness of breath. An electrocardiogram at that time was remarkable for first-degree atrioventricular (AV) block and atrial bigeminy. No medications or interventions were initiated at that time and she was discharged home. The patient returned a short time later with palpitations and was found to have second-degree heart block with 2:1 AV conduction (Figure 1). The patient was observed to have paroxysms of PMVT and a transvenous pacing wire was placed. Despite a ventricular pacing rate of 80 beats per minute and being given 2 g of intravenous magnesium, the patient continued to have PMVT. The patient then received a 150 mg amiodarone bolus and was initiated on an amiodarone drip.

After arrival to our hospital, the patient continued to have PMVT (Figure 2). Because of near incessant PMVT, the patient was given a 100 mg lidocaine bolus with lidocaine infusion concurrently with her amiodarone infusion. A cardiac catheterization was pursued and showed normal coronary arteries. An echocardiogram was performed, revealing an ejection fraction of 48%. Thyroid stimulating hormone, calcium, magnesium, and potassium were within normal limits. Upon further investigation, it was discovered that the patient lived in an area (southeastern Ohio) with a high incidence of LD and that multiple family members had recently been diagnosed with LD. The patient was placed on empiric ceftriaxone (2 grams infusion every 24 hours) and the PMVT subsequently abated within 12 hours. The patient’s heart block also reverted to sinus rhythm with mild prolongation of the PR interval (Figure 3) within 4 days. The patient’s workup subsequently demonstrated a positive Lyme antibody screening (DiaSorin CLIA methodology) followed by a confirmatory western blot (performed by Mayo Clinic Laboratories, Rochester, MN) which was IgG Immunoblot positive and IgM Immunoblot positive, consistent with *Borrelia burgdorferi* infection. Further workup with a positron emission tomography scan excluded sarcoidosis.

KEY TEACHING POINTS
- When assessing a patient with refractory polymorphic ventricular tachycardia, Lyme disease should be included in the differential diagnosis.
- Treatment with antibiotics can help with correction of conduction abnormalities.
- Lyme disease labs can vary in time to result; it is important to obtain a thorough history when dealing with a patient with new conduction abnormalities.

KEYWORDS
- Heart block; Lyme disease; Lyme carditis; Polymorphic ventricular tachycardia; Torsades de pointes

(Heart Rhythm Case Reports 2020;6:930–932)

Funding Sources: The authors have no funding sources to disclose. Dislosures: None of the authors have any conflicts of interest to disclose.

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Because her long-term prognosis was unclear, she underwent placement of a dual-chamber defibrillator. The patient was continued on ceftriaxone until her PR interval was less than 300 milliseconds. She was discharged on doxycycline, an 8-week program of amiodarone, and metoprolol with plans for outpatient follow-up.

A cardiac magnetic resonance imaging was obtained 6 weeks later and showed an ejection fraction of 54% and no evidence of late gadolinium enhancement, lowering any suspicion of scar, fibrosis, or infiltrative disease. In over 6 months of implantable cardioverter-defibrillator monitoring, the patient has not had any further ventricular tachycardia off of antiarrhythmic medication.

Discussion

LD is a tick-borne illness caused by the bacteria *Borrelia burgdorferi*, which has become more prevalent in the United States. Once confined to the northeastern parts of the United States, LD is now endemic across much of the country. Symptoms of LD include fever, headache, fatigue, and, rarely, heart rhythm disturbances. LD affects around 1 in 1000 people annually in the United States and according to the U.S. Centers for Disease Control and Prevention (CDC), Lyme carditis (LC) occurred in about 1% of reported LD cases from 2001 to 2010. The predominant arrhythmia associated with LC is AV nodal conduction disease, which can be effectively treated with antibiotics. There have been a few cases of ventricular tachycardia reported and only 1 reported case of torsades de pointes in Europe.

The usual cardiac manifestation of LC is AV nodal conduction disease; PMVT has been rarely reported. From autopsies that have been performed, the pathophysiology of Lyme disease has shown infiltration of the spirochetes into the endocardium, myocardium, and pericardium, which causes a lymphocyte, plasma cell, and macrophage immune response. From research performed on nonhuman primates, there seems to be a correlation between the degree of conduction disease, intensity of inflammation, and number of spirochetes that have invaded the cardiac tissue.

Our patient developed associated PMVT that was not bradycardia dependent and did not suppress with antiarrhythmic drug therapy. A prolonged QTc was not observed. Early use of ceftriaxone appeared to resolve her PMVT and heart block. Patients with LD typically receive at least a 14-day course of antibiotics. The conduction system abnormalities are typically transient in patients who receive antibiotics and resolve in 1–6 weeks. In a review of LC cases, there were 2 associated with mortality identified from 1696 cases of LC reported to the CDC from high-incidence states between 1995 and 2013. In addition, there have been 2 case reports of deaths...
associated with LC proven by cardiac biopsy postmortem. Overall, the prognosis is excellent in LC patients and almost all patients fully recover.

In our patient, we considered a wearable cardioverter-defibrillator at discharge, given the degree of PMVT when the patient presented. However, given the lack of long-term follow-up data in patients with PMVT and LC, we opted for a shared decision-making discussion with the patient that resulted in placement of a transvenous ICD system.

**Conclusion**

We describe a rare complication of LD producing both heart block and PMVT. A prolonged QTc was not observed and other potential causes of PMVT were excluded. Antibiotic treatment was effective in treating both the PMVT and the heart block.

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