



The Creative Clinician

Complete Atrioventricular Block Due To Lyme Reinfection In a Six Year-Old Boy

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Lyme borreliosis results from infection by the spirochete *Borrelia burgdorferi*. The *Ixodes scapularis* tick, commonly known as the deer tick, acts as a vector and is endemic in coastal New England and the Mid-Atlantic States. The disease is divided into early (after 3-32 days incubation) and late stages, as well as limited and disseminated disease. Limited disease is manifest by erythema migrans, whereas disseminated disease may have cardiac and neurologic involvement.¹ Common presenting symptoms in children include fever, headache, erythema migrans (15% of cases), arthritis, arthralgia, myalgia, cranial nerve palsies, and meningitis. Carditis is present in only 0.5% of children.² We present the case of a six-year-old boy with early disseminated Lyme disease manifesting as complete **atrioventricular (AV)** block after presentation to the emergency department for a complaint of abdominal pain.

CASE REPORT

A 6-year-old previously healthy boy presented to the **emergency department [ED]** of a hospital with a complaint of right lower quadrant abdominal pain. The pain was present on awakening seven hours prior to arrival to the ED. It was worse with movement, and mild in severity. There was decreased solid intake, but he had been drinking well. According to his parents, he was his normal playful self. The patient denied any nausea, vomiting, or loss of appetite. The medical history was significant for two previous episodes of Lyme disease. The first was at age four; the second was 18 months before presentation. Both episodes were diagnosed by erythema migrans and confirmed by Lyme serum studies. The patient was treated with amoxicillin both times and subsequent titers were negative. Immunizations were up-to-date. He had no known drug allergies and was not taking medications. His family history was negative for congenital heart disease, arrhythmias, and sudden death. Review of systems was significant for no recent tick bites, rashes, or fever. The patient denied cough, shortness of breath, and chest pain.

Physical examination revealed a well-developed boy in no apparent distress. He had a temperature of 37.2°C, blood pressure of 114/50mmHg, heart rate of 55bpm, respiratory rate of 16 respirations per minute, and oxygen saturation of 96% in room air. Height was 118.1cm (25-50th percentile) and weight was 23.6kg (50-75th percentile). Head and neck exam revealed moist mucus membranes and pupils that were equal and reactive to light. Lungs were clear to auscultation. Cardiovascular exam revealed bradycardia, a split S2 with a grade II/VI systolic ejection murmur heard best over the left

sternal border, and a grade I/VI short diastolic rumble at the apex. His abdominal exam revealed a liver edge 3cm below the right costal margin, no palpable spleen tip, no tenderness, and a negative "hop test". There was no peripheral edema; capillary refill was brisk, and peripheral pulses were palpable. Skin exam revealed no rashes.

Two hours after arrival the heart rate was 48bpm with no change in other vital signs. Complete AV block was recognized on EKG and the patient was transferred to a monitored bed in the pediatric intensive care unit. Zoll pads were placed; serum Lyme studies were ordered; a chest radiograph was performed, and the patient was started on intravenous ceftriaxone 2 grams daily (100mg/kg/day) for treatment of presumptive Lyme reinfection. A diagnosis of congenital heart block was also considered, given the absence of any prior cardiology workup. The differential also included myocarditis due to other infectious agents.

Chest radiograph, complete blood count, and electrolytes were all within normal limits. EKG revealed third degree heart block with a junctional escape rhythm, atrial rate of 90 and ventricular rate of 40. (Figure 1) Echocardiogram revealed normal left ventricular systolic function with trace mitral regurgitation and mild tricuspid regurgitation.

The patient's hospital course was significant for persistent bradycardia ranging from thirties to fifties without any symptomatology. Serial EKGs were performed on the first day and revealed fluctuating AV block. (Table 1)

Table 1. EKG rhythm as recorded during hospital course and follow-up

Days after presentation	EKG rhythm
1	Complete heart block with periods of 2:1 AV block
2	Occasional 1:1 AV conduction
3	Normal sinus rhythm with first degree AV block and frequent Wenkebach
5	Sinus bradycardia with first degree AV block and intermittent Type I second degree (Wenckebach) AV block
10	Sinus rhythm with borderline intermittent first degree AV block
30	Sinus rhythm

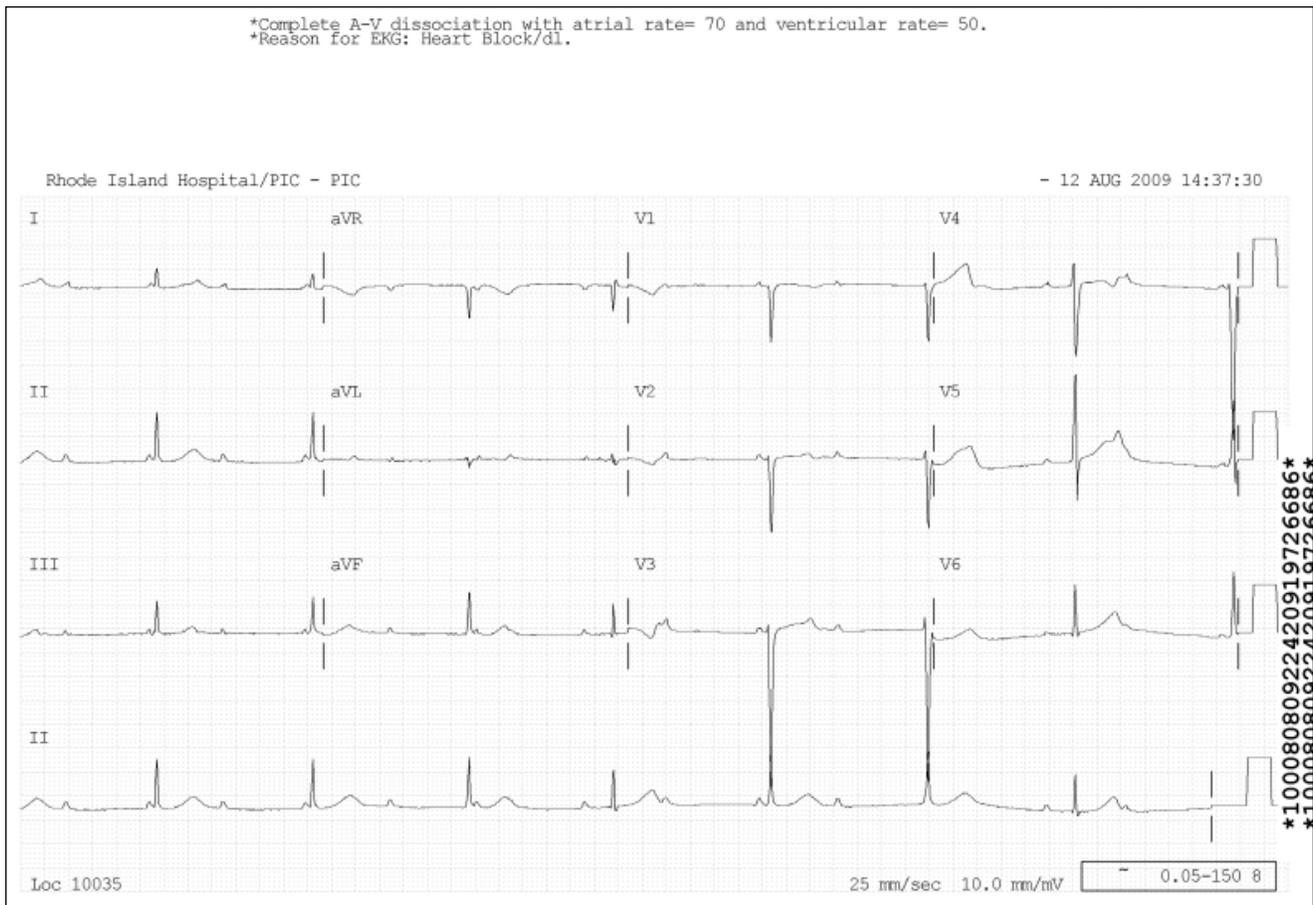


Figure 1. EKG upon arrival to the pediatric intensive care unit showing complete atrioventricular block.

EKG on day 2 of hospitalization showed complete heart block with periods of 2:1 AV block. EKGs were repeated daily for 3 days. A PICC line was placed for long-term antibiotic treatment. Lyme enzyme immunoassay was positive, as well as confirmatory IgM and IgG Western blot, which confirmed recent infection. On the fourth day of hospitalization the patient was discharged with instructions to avoid vigorous activities. He was to continue ceftriaxone for 21 days and to follow up with the cardiologist.

DISCUSSION

Cardiac complications including conduction system disturbances such as varying degrees of AV block, myopericarditis, and congestive heart failure are possible manifestations of early disseminated Lyme disease.³ In general, recovery occurs in greater than 90% of treated patients, although temporary cardiac pacing is sometimes necessary.⁴ In a recent study of patients with advanced heart block, the median time to resumption of sinus rhythm was 3 days.⁵ Late complications such as dilated cardiomyopathy may occur. Although echocardiography usually shows normal myocardial function in acute Lyme disease, it is a reasonable study in patients with depressed ventricular systolic function⁵ and a useful tool to monitor for dilated cardiomyopathy secondary to Lyme disease.⁴ A diagnosis of Lyme carditis should be considered when systemic features of Lyme are present, there is serological evidence of current or recent infection, and there is epidemio-

logic exposure. Rarely, complete heart block is the presenting complaint and only manifestation of illness.

A positive Lyme western blot IgM is generally obtained for establishing the diagnosis of an acute infection. In order of decreasing incidence, the following are the most common cardiac manifestations: AV block (77%), pericarditis (16%), intraventricular conduction disturbance or bundle branch block (13%), and heart failure (13%).³ In the case of complete heart block, there is often a progression through intermediate degrees of heart block to first-degree heart block and ultimately normal AV conduction, as demonstrated in this case report. Heart block most commonly involves the AV node, but can occur at the sinoatrial node and intra-atrial conduction system as well.

Antibiotic therapy should be initiated to prevent progression to late illness. The Infectious Diseases Society of America as well as the American Academy of Pediatrics recommend treatment with intravenous ceftriaxone for 14 to 21 days in children with carditis. Amoxicillin, cefuroxime, and doxycycline are also acceptable treatments. Atropine sulfate may be considered for treatment of symptomatic bradycardia, but is usually not efficacious in Lyme carditis. Pacing is a possible modality in symptomatic patients and Costello notes a need for temporary pacing in 12% of patients studied. It is reasonable to refer children with severe myocardial dysfunction to pediatric cardiology centers with ECMO capabilities: this may be a life saving intervention in such patients.⁵



Figure 2. Rhythm strip demonstrating progression to second degree heart block.

Outpatient follow-up is appropriate in patients without high degree AV block or PR intervals greater than 300 ms. A restriction of vigorous activity is advised in those patients with a minor prolongation of the PR interval.⁷

It is unclear how repeated infection with Lyme at this age has contributed to the severity of the patient's cardiac disease. Studies should be conducted in endemic areas to elucidate what effect reinfection may have on the myocardium and the conduction system.

CONCLUSION

Lyme carditis is a rare finding in children. To our knowledge this is the youngest documented case of asymptomatic complete heart block in the literature. Further investigation into the risk of carditis in patients with an extensive history of Lyme disease is necessary.

REFERENCES

1. Nagi KS, Joshi R, Ranjan TK. Cardiac manifestations of Lyme disease. *Can J Cardiol* 1996;12:503-6.
2. Gerber MA, Shapiro ED, et al. The Pediatric Lyme Disease Study Group. Lyme Disease in Children in Southeastern Connecticut. *NEJM* 1996 335: 1270-4.
3. vanderLinde MR. Lyme carditis. *Scand J Infect Dis Suppl* 1991;77:81.
4. Xanthos T, Lelovas P, et al. Lyme carditis. *Hellenic J Cardiol* 2006;47:313-6.
5. Costello JM, Alexander ME, et al. Lyme carditis in children. *Pediatrics* 2009; 123:e835-41.
6. Seino G, Gasser R, et al. Cardiac manifestations of Lyme borreliosis with special reference to contractile dysfunction. *Acta Med Austriaca* 1998;25:44-50.
7. Steere AC, Batsford WP, et al. Lyme carditis. *Ann Intern Med* 1980;93:8.

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Disclosure of Financial Interests

The authors and spouses/significant others have no financial interests to disclose.

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