Lyme Carditis Progressing to Second Degree 2:1 Type 2 AV Block

Mia Pestle, PA-S2 and Sheree Piperidis, MHS, PA-C
Quinnipiac University Physician Assistant Program

Introduction

- Lyme disease is a well-established tick-borne illness most commonly caused by the *Borrelia burgdorferi* spirochete[1] and transmitted by the *Ixodes Scapularis* tick.[2]
- It is estimated that approximately 476,000 people are diagnosed and treated for Lyme disease in the United States annually.[3] Only 1.5% of patients diagnosed with Lyme disease will develop Lyme carditis, most commonly in males 20-40.[4]
- Diagnosis of Lyme disease is made via two-tiered testing: initial screening with enzyme immunoassay or immunofluorescence assay, followed by confirmation testing of positive results using IgG/IgM immunoblots.[5] A modified testing is an acceptable alternative.[6]
- Lyme carditis is diagnosed by EKG or signs of acute myocarditis/pericarditis with a positive Lyme serology.[7]
- Lyme disease presentation depends on the stage of disease. Symptoms typically include low grade fever, myalgias, and joint pain.[8] Lyme carditis is a complication of early disseminated Lyme disease.[9]
- Patients with Lyme carditis typically present with generalized symptoms beforehand including malaise, fatigue, headache, stiff neck, fevers, myalgia, and lymphadenopathy. Cardiac symptoms occur a median of 21 days after erythema migrans.
- Varying AV blocks are the most common abnormality of Lyme carditis.
- Symptoms of Lyme carditis may include palpitations, syncope, chest pain, and shortness of breath.[10]

Case Description

History of Presenting Illness

CC: "My heartrate is very irregular!"

- 33-year-old male presented to the ER with 24 hours of palpations in late August.
- Patient's heartrate progressively increased irregularity in the past 24 hours.
- 3-week history of persistent body aches and joint pain.
- ~2 weeks ago, patient was diagnosed with a "viral exanthem" due to an abdominal maculopapular rash and was prescribed a prednisone taper.
- 6 days later, the patient was seen at urgent care and was prescribed doxycycline for empiric treatment of Lyme disease. No Lyme disease testing was done.
- The patient was told not to take the doxycycline if symptoms improve. The patient opted to not take the antibiotics, as his symptoms were improving.
- Patient denied any known recent tick bites
- ROS: No dyspnea, chest pain, dizziness, or syncopal episodes. No joint/extremity swelling, facial droops, or weight loss.

Past Medical History

- Medical History: Anaplasmosis 6 years ago treated with doxycycline
- Surgical History: No pertinent
- Medications: 15-day prednisone taper completed one day prior
- Allergies: Penicillin; reaction-hives
- Family History: Negative for heart disease or rheumatologic conditions
- Social History: Patient spends a lot of time outside and has dogs that are outdoors often. Occupation is not outdoors. Denies recent travel.
  - Alcohol use: 10-12 standard drinks/week.
  - Cigarette: Current (15 pack-year)
  - Drugs: Denies

Physical Examination

Vitals
- BP: 126/72 mmhg
- Pulse: 57 beats per minute
- Oxygen Saturation: 99%
- Temperature: 97.8° F

Physical
- General: No acute distress, non-toxic appearing
- Cardiac: Bradycardia present with irregular rhythm. Clear S1 and S2. No murmurs. Radial pulses 2+, symmetric, irregular, and non-bounding.
- Pulmonary: No respiratory distress. Vesicular sounds throughout. No wheezing, crackles, or rhonchi.
- Abdomen: Soft, non-tender and non-distended.
- Musculoskeletal: 5/5 strength and full ROM in all extremities bilaterally. No joint swelling or lower extremity edema.
- Skin: Mild erythematous maculopapular rash of the lower abdomen. No bulls-eye appearance. No tick bites.
- Neurological: No focal deficits.

Diagnostics

- CBC: WBC- 8.4x10⁹cmm, HgB- 14.0 g/dl, Hct: 42.5%, Platelets- 248,000 mcL
- CMP: Unremarkable
- ProBNP: 342 pg/mL
- Troponins: 14 →13 ng/mL
- Echocardiogram: Preserved biventricular function with a left ventricular EF of 66% and no significant valvular disease.
- EKG: Second degree AV nodal block type 1 with left anterior fascicular block.
- Tick-borne disease serology sent and Lyme disease positive on hospital day 3.

Differential Diagnosis

- Anaplasmosis
- Rocky Mountain Spotted Fever
- Babesia Microti
- Lyme Disease
- Scarlett Fever
- Lyme Carditis
- Rheumatic Fever
- Thyroid Disease
- Myocarditis
- Sarcoidosis
- SLE

Diagnosis: Lyme Carditis

Case Outcome

- The patient was discharged with a Hotler monitor and was scheduled to follow up with cardiology.
- A PICC was line inserted at discharge for 21 days outpatient IV ceftriaxone.
- 3 weeks post discharge, patient was asymptomatic. He was transitioned to doxycycline 100 mg PO x 3 weeks.
- Patient was to follow up with infectious disease in 3 months.

Discussion

- Lyme carditis typically presents as fluctuating AV nodal blocks.[10]
- The pathogenesis of Lyme carditis involves the vascular spread of the spirochete to cardiac tissue. After colonization, there is an over-exaggerated immune response causing lymphocytic infiltration and collagen deposit in the cardiac tissue. This is thought to cause some of the conduction abnormalities.[11]
- EKGs are only recommended on patients diagnosed with Lyme disease who are experiencing cardiac symptoms.
- Those with a PR interval over 300 ms, arrythmias, or myopericarditis should be treated inpatient with continuous cardiac monitoring.
- For patients with symptomatic bradycardia or significant AV nodal blocks, temporary pacing should be used.
- Permanent pacemakers are typically unnecessary as Lyme carditis is usually temporary.
- The inpatient treatment of Lyme carditis is 2 g IV ceftriaxone daily until cardiac symptoms resolve. Patients may then transition to oral antibiotics.
- Doxycycline is the first line oral antibiotic that will cover Lyme disease. Other oral antibiotics include doxycycline, amoxicillin, cefuroxime axetil, and azithromycin.
- Patients with acute myocarditis or pericarditis with an unknown cause should be tested for Lyme disease.[7]
- The prognosis of Lyme carditis is typically good, however there have been reports of sudden cardiac death.[11]
- Those in high endemic areas of Lyme disease should do frequent tick checks after being outdoors. High risk tick bites are those with attachment over 48 hours.[12]
- Prophylaxis is recommended only for high-risk tick bites with a single dose of 200 mg doxycycline.[13]

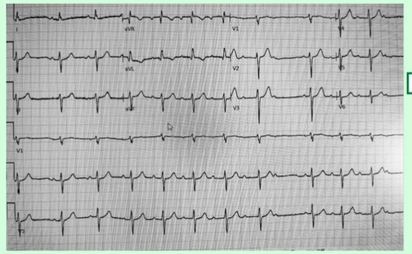
Conclusion

- The most common presentation of Lyme carditis involves varying forms of AV block
- Only patients with Lyme disease presenting with cardiac symptoms require an EKG.
- Lyme carditis is treated with antibiotics, typically IV ceftriaxone.
- Lyme carditis is typically transient, and permanent pacemakers are usually not necessary.
- Clinicians in areas of high endemic Lyme disease should have Lyme carditis on the differential in patients presenting with sudden onset AV blocks, myocarditis, or pericarditis.

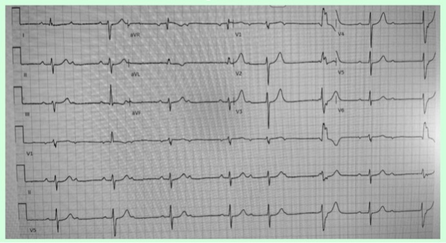
Hospital Course

Patient was treated empirically with 2g IV ceftriaxone daily and was monitored on telemetry throughout.

Admission
Tickborne illness labs drawn and pending.
EKG showed second degree AV nodal block type 1 with left anterior fascicular block.



Hospital Day 1
Patient developed 2:1 type 2 second degree AV nodal block with ventricular escape beats and left anterior fascicular block.
Patient was transferred to the ICU and placed on transcutaneous pacer pads.



Hospital Day 2-3
Patient alternated between second degree type 1 and type 2 AV nodal block on telemetry.
On day 3, Lyme disease labs were positive.

Hospital Day 4
Patient converted to first degree AV block with episodes of varying second degree AV nodal block on telemetry.

Days 5: Discharge
Patient remained in first degree AV nodal block

References

1. Pritt BS, Mead PS, Johnson DK, et al. Identification of a novel pathogenic Borrelia species causing Lyme borreliosis with unusually high spirochaetemia: a descriptive study. *Lancet Infect Dis*. 2016;16:556–564. doi:10.1016/S1473-3099(15)00464-8
2. Wallis R, Brown S, Klotter K, Main A. Erythema chronicum migrans and Lyme arthritis: field study of ticks. *Am J Epidemiol*. 1978;108(2):322–327. doi.org/10.1093/oxfordjournals.aje.a112626
3. Kugeler KJ, Schwartz AM, Delorey M, et al. Estimating the frequency of Lyme disease diagnoses-United States, 2010-2018. *Emerg Infect Dis*. 2021;27(2):616-619. doi:10.3201/eid2702.202731
4. Schwartz AM, Hinckley AF, Mead PS, Hook SA, Kugeler KJ. Surveillance for Lyme disease — United States, 2008–2015. *MMWR Surveill Summ*. 2017;66(22):1–12. doi: doi.org/10.15585/mmwr.ss6622a1
5. Molins CR, Sexton C, Young JW, et al. Collection and characterization of samples for establishment of a serum repository for Lyme disease diagnostic test development and evaluation. *J Clin Microbiol*. 2014;52:3775-62. doi:10.1128/JCM.01409-14
6. Pegalajar-Jurado A, Schriefer M, Welch R, et al. Evaluation of modified two-tiered testing algorithms for Lyme disease laboratory diagnosis using well-characterized serum samples. *J Clin Microbiol*. 2018;56(8):e01943-17. doi.org/10.1128/jcm.01943-17
7. Lantos P, Rumbaugh J, Bockenstedt L, et al. Clinical practice guidelines by the Infectious Diseases Society of America (IDSA), American Academy of Neurology (AAN), and American College of Rheumatology (ACR): 2020 guidelines for the prevention, diagnosis and treatment of Lyme disease. *Clin Infect Dis*. 2021;72(1):e1-48. doi.org/10.1093/cid/ciaa1215
8. Steere AC, Bartenhagen NH, Craft JE, et al. The early clinical manifestations of Lyme disease. *Ann Intern Med*. 1983;99(1):76-82. doi:10.7326/0003-4819-99-1-76
9. Duray P. Clinical pathologic correlations of Lyme disease. *Rev Infect Dis*. 1989;11(6):S1487-S1493. doi: 0162-0886/89/1105-0025$02.0010.
10. Steere A.C., Batsford W.P., Weinberg M., et al. Lyme carditis: Cardiac abnormalities of Lyme disease. *Ann Intern Med*. 1980;93:8–16. doi: 10.7326/0003-4819-93-1-8.
11. Muehlenbachs A., Bollweg B.C., Schulz T.J. et al. Cardiac tropism of Borrelia burgdorferi: an autopsy study of sudden cardiac death associated with Lyme carditis. *Am J Pathol*. 2016, 186: 1195. doi:10.1016/j.ajpath.2015.12.027
12. Piesman J, Schneider BS, Zeidner NS. Use of quantitative PCR to measure density of Borrelia burgdorferi in the midgut and salivary glands of feeding tick vectors. *J Clin Microbiol*. 2001;39(11):4145-4148. doi: 10.1128/JCM.39.11.4145-4148.2001
13. Zhou, G., Xu, X., Zhang, Y. et al. Antibiotic prophylaxis for prevention against Lyme disease following tick bite: an updated systematic review and meta-analysis. *BMC Infect Dis*. 2021;21:1141. https://doi.org/10.1186/s12879-021-06837-7