Unraveling the Dynamic Progression: Lyme Carditis Transforming from AVB Type 1 to Complete Heart Block

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Abstract

This case report describes the presentation of a 47-year-old female living in Pennsylvania who presented with a two-week history of palpitations associated with episodes of pre-syncope. Initially, the patient's electrocardiogram (EKG) showed a heart rate in the 90s with type 1 atrioventricular (AV) block; however, once admitted, her EKG revealed complete heart block. This case highlights the importance of considering vector borne diseases as a potential cause of heart block in patients with relevant exposure and the significance of vigilant history-taking, especially in regions endemic for tick-borne diseases.

Introduction

Lyme disease, resulting from Borrelia burgdorferi infection transmitted via tick bites, is the most common tick-borne ailment in the US. Typical symptoms encompass fever, headache, fatigue, and the distinctive *Erythema migrans* rash [1]. If left untreated, it can lead to serious complications, including Lyme carditis, where the bacteria invade heart tissues, disrupting the heart's electrical system. This invasion can cause symptoms like dizziness, fainting, shortness of breath, palpitations, or chest pain [2]. Lyme carditis occurs in 1% to 10% of Lyme disease cases [3], adding to the challenge of managing its fluctuating nature, requiring medical intervention to minimize disease duration and cardiovascular risks [4] [5] [6] [7]. Within cardiology, Lyme carditis manifests as an atrioventricular (AV) conduction abnormality [2] [8], disrupting the typical conduction sequence of a P wave followed by a QRS complex [8]. AV block, a delay in impulses from atria to ventricles, can stem from causes like coronary artery disease, congenital heart defects, inflammation, or certain medications [8] [9]. There are four types of AV blocks: first degree, Mobitz I, Mobitz II, and third-degree block, each varying in severity and conduction pattern [8] [9][12]. Proper identification and management of AV blocks, especially in Lyme carditis cases, are vital to prevent complications [10] [6] [7]. This study explores Lyme carditis intricacies, including clinical manifestations, diagnosis, and management, addressing challenges in cardiological contexts.

Case

A 47-year-old female residing in Pennsylvania, USA with no remarkable PMH presented to the emergency department with a two-week history of palpitations, described as a sensation of rapid and irregular heartbeats. These palpitations were associated with periods of feeling lightheaded and nearly fainting. She reported no chest pain, shortness of breath, or other symptoms. The episodes occurred at rest and were paradoxically better with physical activity. Over the two weeks, she noted a progressive increase in the frequency and severity of these episodes. On initial evaluation in the emergency department, the patient exhibited stable vital signs including a temperature of 98.2°F, respiratory rate of 18 breaths per minute, heart rate of 82 beats per minute, and blood pressure of 124/61 mmHg. The initial EKG indicated first degree AVB. Given the concerning EKG findings and recurrent pre-syncope, she was admitted to the telemetry unit for further evaluation and management. While in the hospital and within hours of admission, the heart rate dropped to 57 beats per minute, and complete AVB was observed on the EKG, accompanied by a decrease in blood pressure to 114/51 mmHg and later to 99/43 mmHg. Laboratory investigations, including troponins, electrolytes, and thyroid levels, remained within normal limits. An echocardiogram revealed moderate concentric left ventricular hypertrophy without valvular abnormalities or changes in ejection fraction.

Considering her history, exposure status to ticks and the negative tests for other possible contributors to her AV block [11], serologic testing for Lyme disease was performed and she was started on empiric intravenous antibiotics with ceftriaxone [2] [4] and received treatment in the ICU with dopamine infusion for symptomatic bradycardia which needed to be uptitrated from the start dose of 5mcg/kg/min to 15mcg/kg/min to achieve adequate heart rate control [12]. Transvenous pacemaker placed on standby [3] [11]. After a 3-hour infusion of dopamine and the initiation of ceftriaxone therapy, the heart rate improved to 60 beats per minute. Over the course of 7 hours with continuous therapy, the heart rate increased to 80 beats per minute, but persistent complete AVB with premature ventricular contractions (PVC) and a junctional escape rhythm was noted. Subsequently, after one day of antibiotic therapy, the heart rate stabilized at 75 beats per minute with a return to first-degree AVB on the EKG. On the second and third days, the heart rate further improved to 78 beats per minute with consistent first-degree AVB on the EKG. Serologic testing for Lyme returned positive for Borrelia antibodies via enzyme-linked immunosorbent assay findings (IgG: 4.69 (0.00–0.90) and IgM: 5.17 (0.00–0.79) confirming the diagnosis of Lyme disease-induced complete heart block [13]. Her clinical condition improved after 3 doses of Ceftriaxone [2] [3] [5] with follow-up EKG demonstrated reversal from complete heart block to baseline EKG of AV1 block [4]. Patient was subsequently transitioned to oral doxycycline to complete treatment course [2] as an outpatient.

(A) First Degree AVB with PR interval of 384 ms (day 1). **(B)** Complete Heart Block with dissociation of Atrial and Ventricular contractions (Day1). **(C)** Third-degree AVB with a junctional escape rhythm (day 1) **(D)** First Degree AVB with PR interval of 320 ms (Day2). **(E)** First Degree AVB with PR interval of 240 ms (Day 3). AVB = Atrioventricular Block

FIGURE 1:

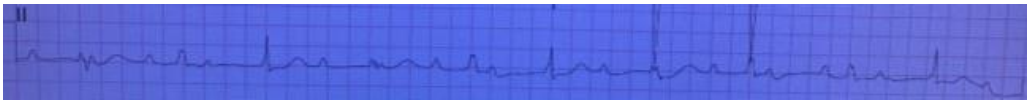

FIGURE 2:

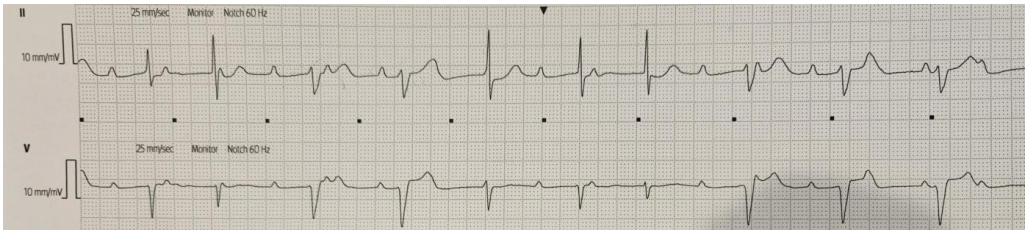

FIGURE 3:

FIGURE 4:

FIGURE 5:

Discussion

This case underscores the importance of considering tick borne diseases as a potential cause of complete heart block in patients with a history of tick exposure, even in the absence of other symptoms [3]; especially in the absence of other more obvious causes such as ischemia and known arrhythmia [6]. The primary identifiable sign of Lyme carditis is the atrioventricular (AV) conduction block. This block can swiftly shift in severity, ranging from first degree AV block to more severe forms and occasionally reverting back within minutes. [6] [14] When Lyme carditis is strongly suspected and other causes are ruled out, it is crucial to initiate antibiotic treatment promptly, preferably with ceftriaxone especially with high degree blocks [2]. If the patient shows symptoms, interventions like pacing, dopamine, or epinephrine, alongside antibiotics, should be considered. Early recognition and intervention are vital in managing Lyme carditis [14]. Lyme carditis diagnosis relies on serology to aid diagnosis and treatment, Besant and colleagues devised the Suspicious Index in Lyme Carditis (SILC) score, boasting 93% sensitivity. This score evaluates the likelihood of new-onset AVB being due to Lyme carditis based on CO-STAR factors: constitutional symptoms, outdoor activity in endemic areas, male sex, tick bite, age under 50, and rash (EM). Patients with high-degree AVB and SILC score > 2 should undergo Lyme serology and begin antibiotic treatment while awaiting results [10].

Conversely, those with SILC score ≤ 2 and high-degree AVB should receive standard AVB treatment without antibiotics [17]. While serology isn't usually needed for the latter, healthcare teams might opt for testing based on unique case circumstances [17]. Yeung and Baranchuk outlined a thorough cardiac testing protocol for Lyme carditis patients, encompassing both pre- and post-discharge assessments. After the restoration of 1:1 AV conduction, the temporary pacemaker can be removed. Prior to discharge, a stress test is recommended to assess the stability of AV conduction and decide on the necessity of a permanent pacemaker. Furthermore, all Lyme carditis patients should have an outpatient ECG performed 4 to 6 weeks after discharge to detect any rhythm or conduction abnormalities [17]. Finally, to minimize the risk of Lyme disease, it's crucial to adopt preventive measures such as wearing appropriate clothing and using insect repellent when in wooded areas or regions with high Lyme disease prevalence. Additionally, individuals at risk of Lyme disease should consider prophylactic treatment with a single dose of doxycycline (200mg) under specific conditions. All the following should be met in order to achieve the greatest benefit from prophylaxis- tick is identified as an engorged deer tick and has been attached for a minimum of 24 hours, individuals live in areas where Lyme disease prevalence among ticks exceeds 20%, treatment commencing within 72 hours of tick removal, and there are no contraindications to using doxycycline. Implementing this approach, even by primary care physicians, significantly reduces the risk of disseminated Lyme disease [9].

Conclusion

This case highlights the critical importance of considering tick borne vectors as a potential cause of palpitations and syncope, particularly in patients residing in regions endemic for tick-borne diseases like Pennsylvania. Lyme carditis, an uncommon but serious manifestation of Lyme disease, exhibits a propensity for rapid progression, with first-degree heart block transitioning to complete heart block in a matter of minutes to hours. Therefore, suspicion in at-risk population should prompt evaluation for Lyme disease and starting empiric antibiotic therapy in a timely manner. The management of Lyme carditis involves a two-fold approach: controlling the heart rate with temporary pacing and/or medications as necessary and initiating empiric antibiotics. Timely administration of antibiotics targeting Borrelia Burgdorferi can be curative, as it not only addresses the infection but can also reverse the heart block, preventing the need for long-term pacing. Consequently, maintaining a high index of suspicion for Lyme disease in patients with cardiac conduction abnormalities can significantly impact their prognosis and improve clinical outcomes.

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