

Successful treatment of acquired heart block with ablation



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Introduction

Transient episodes of atrioventricular (AV) block may be due to vagal stimuli such as in neurocardiogenic syncope, paroxysmal AV block due to His/Purkinje disease, inflammation, infection, or injury. In this case, a unique explanation for episodic heart block is suggested, with successful treatment.

Case report

A 12-year-old female patient was referred to the pediatric electrophysiology clinic for a 3-week history of recurrent paroxysmal palpitations. The onset of symptoms was the day after she received her first COVID vaccine. Episodes occurred a few times per week at rest and lasted up to 10 minutes. Her smart watch reported a heart rate in the 190s during the episodes. Her remaining history and exam were unremarkable. Electrocardiogram, echocardiogram, and cardiac magnetic resonance imaging were normal. The suspicion for supraventricular tachycardia was high, so she was provided with a 1-week patch monitor to document symptoms.

She had no symptoms during the monitoring period. The monitor results documented a total of 596 episodes (>100 per day) of paroxysmal high-grade AV block with asystolic pauses of up to 6 seconds (Figure 1) occurring throughout the day and night. Some episodes of block were preceded by PR prolongation and sinus rate slowing, suggestive of a vagal stimulus; but others began with atrial rate variability followed by sinus rate acceleration during continued AV block, more characteristic of paroxysmal AV block.¹ Owing to the concern for paroxysmal AV block, a pacemaker implant was planned, prior to which a repeat patch monitor was obtained. There was speculation that the abnormality might be transient and related to the COVID vaccine, given rare reports of myocardial effects. The repeat monitor showed a significant reduction in AV block episodes, only

KEY TEACHING POINTS

- A new diagnosis of episodic atrioventricular block in an otherwise healthy young patient should stimulate the consideration of transient, reversible, or treatable causes.
- In rare cases, episodic atrioventricular block may be treatable with ablation targeting the slow pathway or, in cases due to vagal triggers, ganglionic nerve plexi ablation.
- Episodic atrioventricular block could be a rare complication after COVID-19 vaccination.

13 pauses lasting up to 3.8 seconds in 24 hours. The pacemaker procedure was postponed to allow ongoing surveillance with the hope that full resolution would be forthcoming. Two additional monitoring periods over the following 6 weeks showed persistence of 10–20 high-grade AV block episodes per day. She also continued to have occasional episodes of palpitations that did not correlate to arrhythmia on the monitor.

Electrophysiology study (EPS) was performed to assess level of block in the His/Purkinje system and inform the decision to consider pacemaker implantation. Baseline testing showed a normal HV interval and no signs of His/Purkinje disease. Dual AV node physiology was noted during atrial extrastimulus testing and echo beats consistent with typical AV nodal reentrant tachycardia (AVNRT) were inducible. Retrograde VA activation during ventricular pacing was concentric and consistent with FP conduction. Isoproterenol infusion resulted in inducibility of sustained typical AVNRT. The slow pathway was targeted with cryoablation, resulting in elimination of both dual AV node physiology and inducible AVNRT. No episodes of heart block were witnessed during the procedure.

Follow-up testing included a 5-day patch monitor after the ablation with no episodes of AV block. A 24-hour patch monitor at 5 months postablation was also normal, with 2 physiologic episodes of Wenckebach AV block during likely sleeping hours. No further symptoms were noted.

KEYWORDS Acquired AV block; AVNRT; Cryoablation; Slow pathway; Pediatrics (Heart Rhythm Case Reports 2022;8:745–747)

Funding Sources: None. Disclosures: Drs LaPage and Bradley have no conflict of interest. Ms Dechert has no conflict of interest. **Address reprint requests and correspondence:** Dr Martin J. LaPage, 1540 E. Hospital Drive, 11th Floor Pediatric Cardiology, Ann Arbor, MI 48108. E-mail address: mlapage@med.umich.edu.

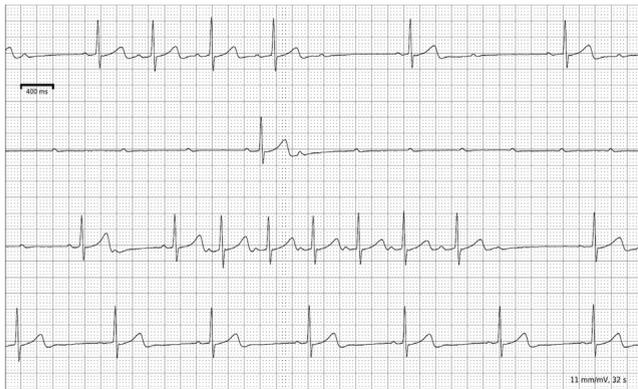


Figure 1 Example of an atrioventricular block episode from the presented case. Onset with sinus slowing and persistence of block despite sinus acceleration. Terminates with run of likely sinus tachycardia before return to normal sinus rhythm.

Discussion

We hypothesize that the high-grade AV block was attributable to antegrade concealed conduction into the slow AV nodal pathway followed by concealed retrograde conduction into the fast pathway and insufficient source-sink stimulation from the slow pathway to common lower pathway or His-Purkinje system (Figure 2). The variation in conductivity ranging from high-grade AV block to sustained typical AVNRT may have been due to intrinsic conduction properties of the slow pathway, requiring catecholamines to support consistent conduction; or potentially due to transient effects from the COVID vaccine. The marked improvement from initial presentation (100 episodes/day) to the later pre-EPS monitor findings (10–20 episodes/day) suggests a transient but incompletely resolving etiology. Complete resolution of heart block with slow pathway ablation implicates the slow pathway's role in the etiology. An alternative possibility for successful treatment with ablation is that the posterior medial left ganglionated plexus was coincidentally ablated while targeting the slow pathway. This ganglion provides vagal input to the AV node. Ablation of this plexus has been used to successfully treat vagal-mediated AV block.² For this patient, the lack of any symptoms with the AV block episodes and the occurrence of transient block episodes atypical for a vagal stimulus may make this explanation less likely. Additionally, we cannot rule out the possibility that the heart block was a long-term problem unrelated to the COVID vaccine, as the patient had never had prior rhythm monitoring.

We were unable to identify any prior reports of high-grade AV block due to concealed conduction in the slow pathway, or a report of successful AV block treatment with slow pathway ablation. Concealed conduction has occasionally been the subject of electrophysiology concept reviews.^{3,4} Prior authors have attributed second-degree AV block episodes to concealed conduction and/or described concealed reentry in the AV node as a cause of variable AV conduction with premature atrial beats.⁵

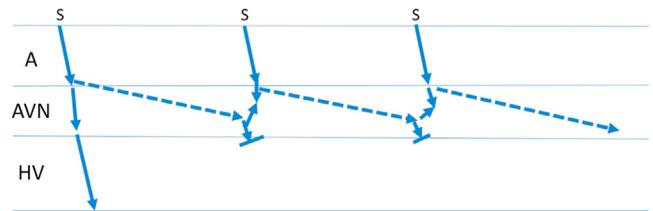


Figure 2 Proposed ladder diagram of concealed reentry pattern causing high-grade atrioventricular block. Block dependent on dynamic conduction changes potentially due to intrinsic factors or COVID-19 vaccine effects.

Paroxysmal AV block was previously comprehensively reviewed and is known to be a high-risk form of sporadic AV block requiring pacemaker implantation.¹ Paroxysmal AV block is primarily a disease of older adults and is attributable to His/Purkinje disease. There have been rare reports in children, including 1 17-patient series, though that study was of primarily congenital heart disease patients and may have been owing to a different etiology than that typically afflicting adults.⁶ Whereas in transient vagal-stimulated block conduction recovers with sinus acceleration, in paroxysmal AV block the block typically continues despite the acceleration and ends with an escape beat. Some aspects of the reported patient's block episodes were consistent with a paroxysmal AV block type, but all features were not present and, ultimately, infranodal disease was not demonstrated in the EPS.

Though data are still being compiled, there have been reports of heart block associated with both COVID-19 infection and the COVID-19 vaccine.^{7,8} A global survey to electrophysiology professionals found 8% of respondents had encountered a patient with complete heart block believed secondary to COVID-19 cardiac effects.⁹ At the time of this writing, there was at least 1 report of transient heart block after receiving the COVID vaccine in an older adult with underlying conduction system disease.¹⁰ Whether or not the COVID vaccine played a role in our patient is unclear, though the timing of events is suspicious. Any potential vaccine effects almost certainly played a dynamic role, in conjunction with the patient's underlying slow pathway substrate, given the result of ablation.

We believe this to be the first report of intermittent heart block incidentally successfully treated with ablation. Although this is certainly a rare phenomenon, it may stimulate the consideration of EPS in a pediatric patient presenting with paroxysmal episodes of heart block, particularly when there may be an infectious or transient insult coincident with the onset.

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