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CASE REPORT

Cardiology

Intermittent complete heart block with ventricular standstill after Pfizer COVID-19 booster vaccination: A case report

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Abstract

As the COVID-19 pandemic continues around the globe, vaccines are undoubtedly central to the fight to control the spread of the virus. However, as with any therapy, these vaccines are not without side effects. Documented cardiac complications of COVID-19 vaccination include myocarditis, pericarditis, and cardiac conduction abnormalities. Here, we report a novel case of intermittent complete heart block with ventricular standstill occurring within 24 hours of administration of a Pfizer-BioNTech COVID-19 booster vaccine. The patient presented to the emergency department (ED) via ambulance for evaluation of syncope. On arrival, the patient lost pulses as a result of intermittent complete heart block with ventricular standstill. He required cardiopulmonary resuscitation (CPR) with intubation, transcutaneous pacing, and subsequent transvenous pacing in the ED. After stabilization and extensive workup, the patient was diagnosed with lymphocytic myocarditis and complete heart block that is suspected to be secondary to COVID-19 booster vaccination. Ultimately, the patient's complete heart block resolved spontaneously, and he was discharged home with ambulatory rhythm monitoring.

KEYWORDS
atrioventricular block, COVID-19, COVID-19 vaccines, heart arrest, heart block, myocarditis, vaccination

1 | INTRODUCTION

Since the beginning of the COVID-19 pandemic, more than 493 million individuals have been infected with the virus and more than 6.1 million individuals have died.[1] Despite social distancing measures, quarantines, and mask mandates, the virus continues to spread across the globe.

Novel mRNA vaccines have emerged as a critical tool in the fight against COVID-19. After rigorous testing, the Pfizer-BioNTech COVID-19 vaccine became the first mRNA vaccine to be given full approval by the Food and Drug Administration for use in the United States.[2–4] The Pfizer-BioNTech COVID-19 vaccine is associated with a number of common side effects including local pain, fatigue, chills, and fever.[3] However, more rare and serious reactions have occurred after administration of these vaccines. Documented cardiac complications include myocarditis, pericarditis, and cardiac arrhythmias. Although both myocarditis and pericarditis have been reported with some frequency in the literature, cardiac conduction abnormalities have been less prevalent.[5–7] Ours is the first reported case of intermittent complete heart block with ventricular standstill secondary to lymphocytic

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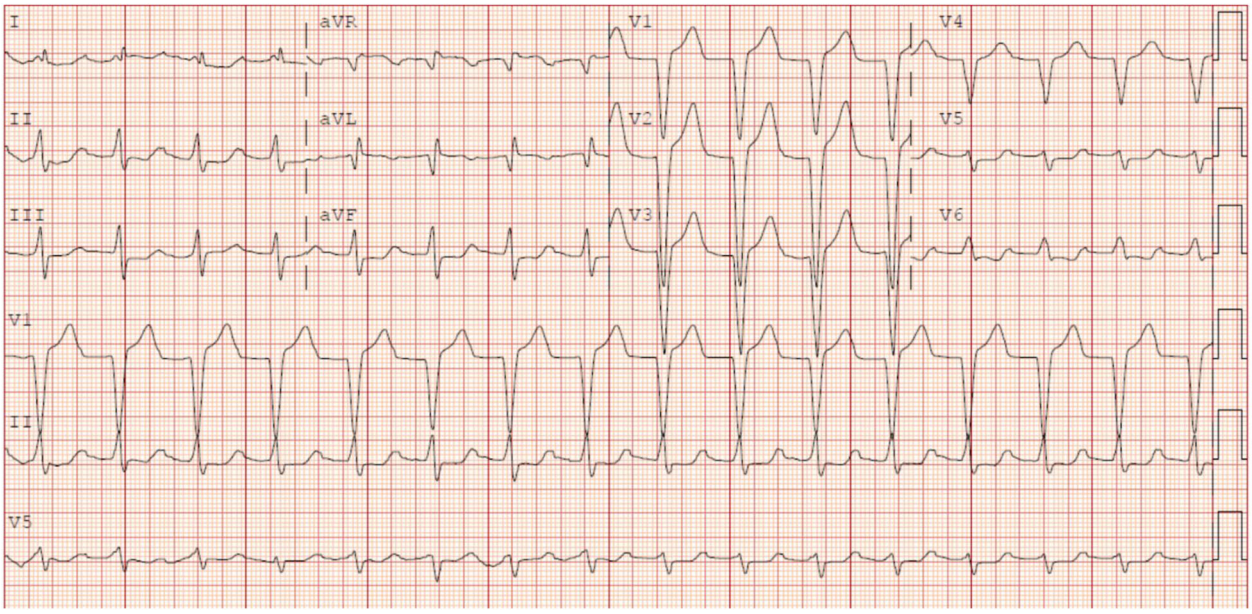

FIGURE 1 Initial electrocardigram (ECG) demonstrating normal sinus rhythm with extreme first-degree atrioventricular block and left bundle branch block morphology

myocarditis suspected to be due to the Pfizer-BioNTech COVID-19 vaccine.

2 | CASE PRESENTATION

A 57-year-old male with a past medical history of hypertension on valsartan and recent COVID-19 booster vaccination presented to the emergency department (ED) by ambulance for evaluation of syncope. The patient had received his third dose of the Pfizer-BioNtech COVID-19 vaccine the previous day. He subsequently experienced multiple syncopal events for which 911 was called. During emergency medical services transport, the patient had another syncopal episode with reported asystole on the cardiac monitor; this episode resolved spontaneously and cardiopulmonary resuscitation (CPR) was not performed. Upon arrival to the ED, the patient was awake and asymptomatic. The patient's initial vital signs were blood pressure: 113/101 mmHg; heart rate: 90 beats per minute; respiratory rate: 26 breaths per minute; peripheral oxygen saturation: 95% on room air; and temperature: 36.1°C. He was taken to a resuscitation bay where an ECG was obtained that showed normal sinus rhythm with extreme first-degree atrioventricular (AV) block and left bundle branch block (LBBB) (Figure 1). The patient's ECG did not meet Sgarbossa criteria.[8]

Shortly after being attached to the cardiac monitor, the patient lost consciousness and went into complete heart block with ventricular standstill with loss of pulses (Figure 2). CPR was initiated; however, before completion of the first round of compressions the patient regained consciousness with return of spontaneous circulation and normal sinus rhythm. The decision was made to intubate the patient for airway protection. While being prepared for intubation, the patient again developed complete heart block with ventricular standstill. CPR was restarted and the patient was given 1 mg of intravenous epinephrine. Given that the patient did intermittently regain consciousness, he was administered etomidate and rocuronium before successful first-pass intubation using delayed sequence intubation. Transcutaneous pacing was initiated and mechanical capture was obtained with normalization of hemodynamics. Postintubation analgosedation was managed with intravenous fentanyl as needed and a propofol infusion.

Given the patient's recurrent episodes of complete heart block with ventricular standstill, the decision was made to place a transvenous pacemaker (TVP) for sustained pacing. The right internal jugular vein was cannulated under dynamic ultrasound guidance using sterile technique. Using the standard Seldinger technique, a percutaneous sheath introducer was placed. A balloon-tipped transvenous pacing catheter was floated through the sheath to 40 cm with successful electromechanical capture. TVP was programmed to VVI mode with a rate of 90 beats per minute, output of 7 mA, and sensitivity of 3.5 mV. Simultaneously, a radial arterial line was also placed for continuous monitoring of blood pressure and mechanical capture. A chest X-ray was obtained that confirmed appropriate endotracheal tube and TVP placement. The patient stayed in a paced rhythm throughout the remainder of his time in the ED. He remained hemodynamically stable while intubated and transvenously paced. He was transferred to the cardiovascular ICU (CVICU) for continued evaluation and treatment.

ED laboratory testing was notable for elevated initial high-sensitivity troponin I of 7959 ng/L (reference: ≤59 ng/L), and mildly elevated aspartate transaminase of 67 U/L. Ultimately, the patient's high-sensitivity troponin I peaked at 14,042 ng/L 5 hours after initial presentation. His magnesium, potassium, renal function, and complete blood cell count were within normal limits. Additionally, testing for infectious etiologies including COVID-19, parvovirus, Lyme disease,

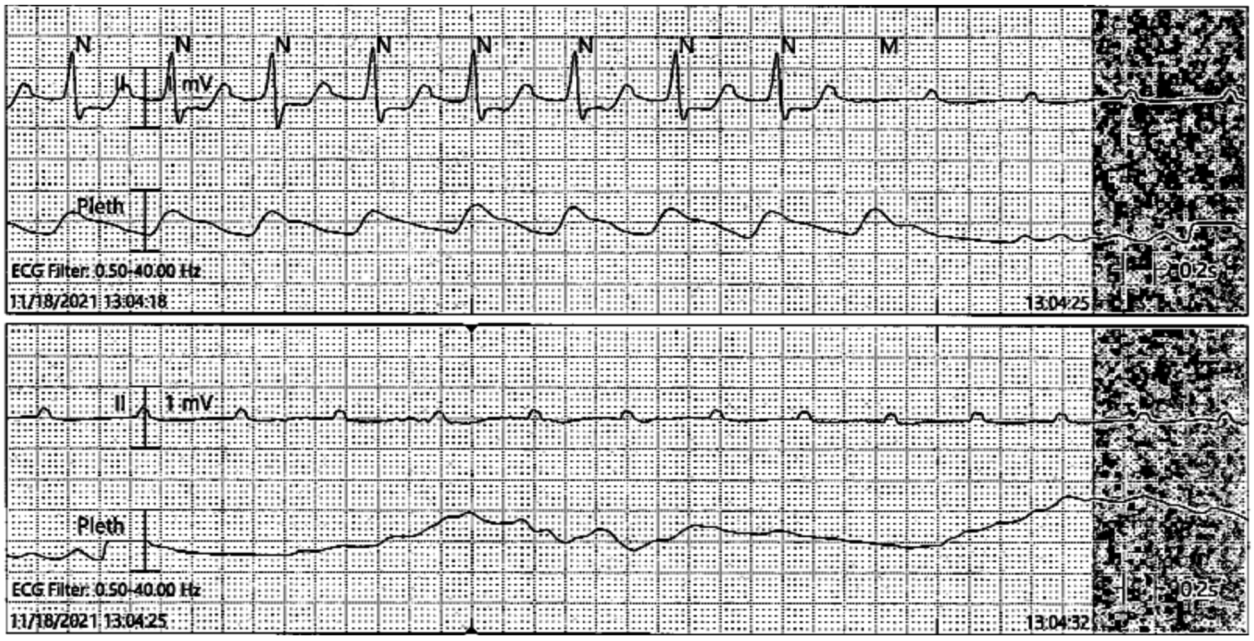

FIGURE 2 Emergency department telemetry monitoring demonstrating sudden onset of complete heart block with ventricular standstill and subsequent loss of plethysmography coinciding with the patient's syncope and loss of pulses

influenza A/B, cytomegalovirus, enterovirus, Epstein-Barr virus, adenovirus, human immunodeficiency virus, and respiratory syncytial virus ultimately returned negative.

Throughout his CVICU stay, the patient had an extensive cardiac evaluation. On the day of admission, a transthoracic echocardiogram was performed that demonstrated reduced left ventricular ejection fraction (45%–50%) and severe asymmetric left ventricular septal hypertrophy. A coronary angiogram completed that same day showed angiographically normal coronary arteries. He was started on goal-directed medical therapy. Taken together, the patient's constellation of new onset conduction abnormalities, ventricular dysfunction, and absence of ischemic disease raised concern for infiltrative versus inflammatory cardiomyopathy.

Subsequent cardiac positron emission tomography scan and nuclear medicine cardiac pyrophosphate scan did not identify evidence of sarcoidosis or transthyretin amyloidosis, respectively. Cardiac magnetic resonance imaging (MRI) was more illuminating with evidence of global left ventricular inflammation and late gadolinium enhancement of the basal septum consistent with myocarditis. This diagnosis was confirmed by endomyocardial biopsy that demonstrated lymphocytic myocarditis with negative immunohistochemical staining for amyloid and viral etiologies including parvovirus, adenovirus, herpes simplex virus, and cytomegalovirus.

Ultimately, the patient experienced full resolution of his intermittent complete heart block by hospital day 4. An externalized temporary permanent (active fixation of lead) pacemaker was placed by cardiology on the day of admission and was maintained on VVI mode with a rate of 90 beats per minute. The patient remained 100% ventricularly paced until hospital day 2. At that time, the patient's pacemaker rate was decreased to 60 beats per minute with resumption of normal sinus rhythm with intermittent episodes of complete heart block with ventricular standstill requiring ventricular pacing. By the fourth day of hospitalization, the patient's intermittent heart block had resolved and he maintained sinus rhythm for the remainder of the admission. A repeat ECG on hospital day 6 showed normal sinus rhythm with resolution of prior LBBB and first-degree AV block (Figure 3).

The patient was discharged home on hospital day 12 without need for long-term pacing. Subsequent 30-day cardiac event monitoring revealed a single 4-beat episode of ventricular tachycardia but no recurrence of heart block. Repeat outpatient cardiac MRI and transthoracic echocardiography showed normalization of left ventricular systolic function and regression of left ventricular concentric hypertrophy. ECG obtained at cardiology follow-up 2 months post discharge again demonstrated sinus rhythm, now with improved R wave progression (Figure 4).

Given the temporal association of the patient's pathology with vaccination, rapid resolution of conduction abnormalities and systolic dysfunction, reduction in septal hypertrophy, and results of hospital testing otherwise negative for viral/inflammatory etiologies, the patient's lymphocytic myocarditis and complete heart block with ventricular standstill were suspected to be secondary to administration of the Pfizer-BioNTech COVID-19 vaccine.

3 | DISCUSSION

Vaccines remain critical in the fight to end the ongoing COVID-19 pandemic. To date, more than 500 million COVID-19 vaccine doses have been administered in the United States.[9] Given the prevalence of these vaccines, it is important that the emergency medicine community be

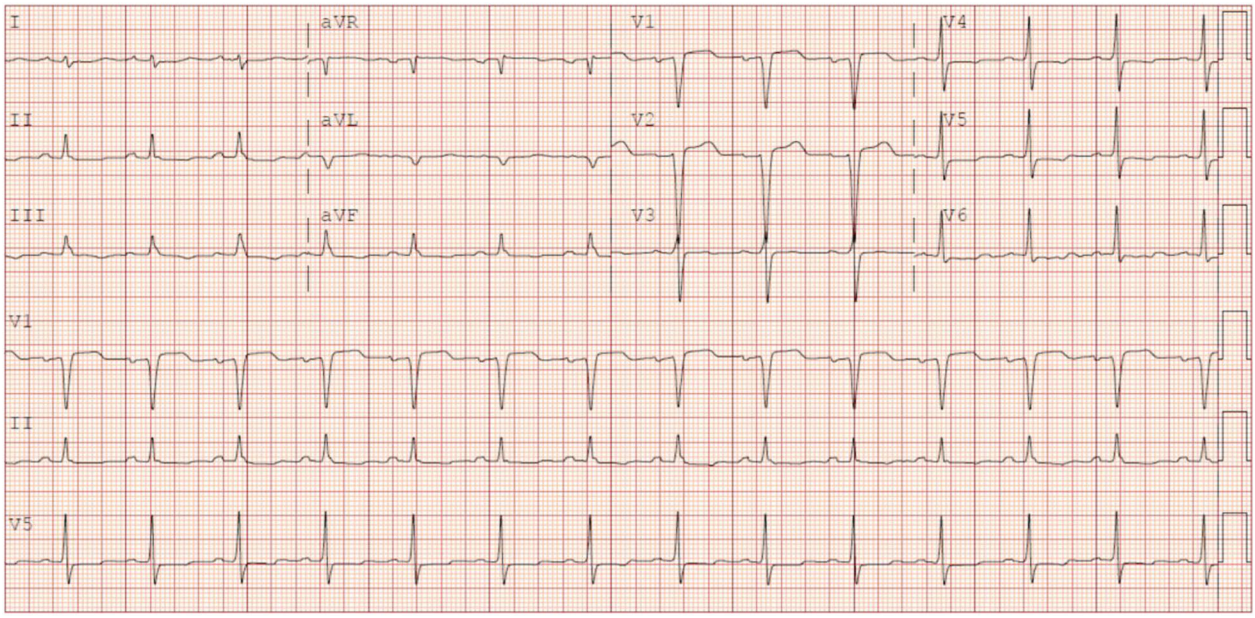

FIGURE 3 Electrocardiogram (ECG) on hospital day 6 demonstrating normal sinus rhythm with resolution of previous left bundle branch block and first-degree atrioventricular block

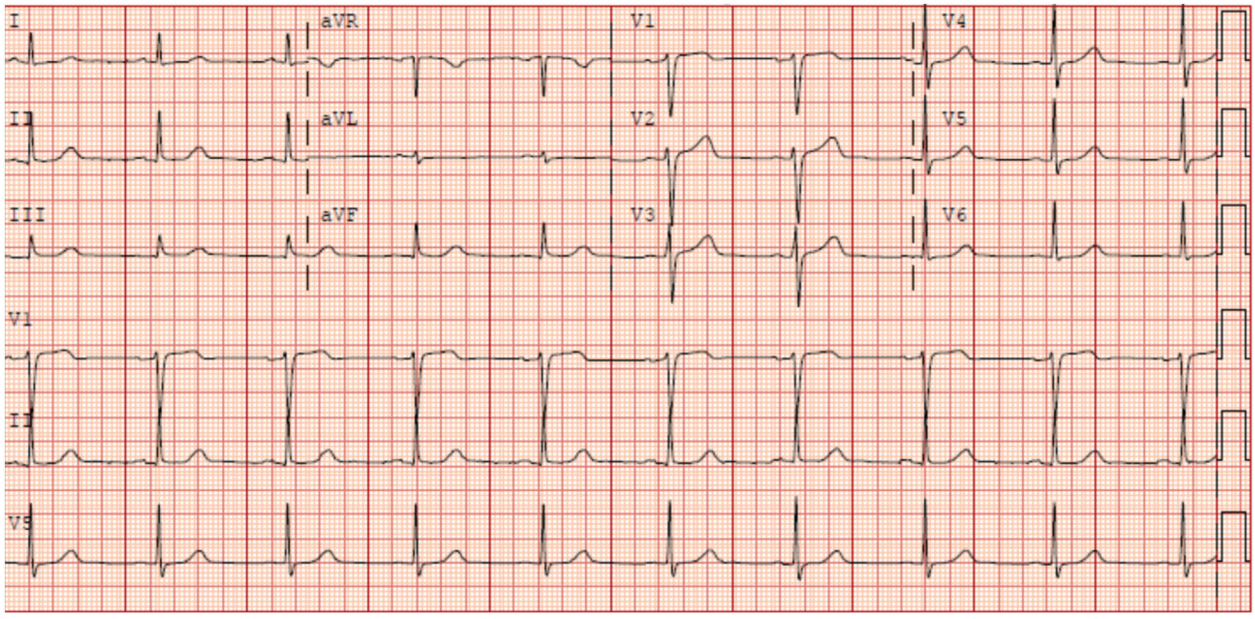

FIGURE 4 Electrocardiogram (ECG) 2 months after discharge demonstrating sinus rhythm and improved R wave progression

aware of serious complications associated with vaccine administration. This case report highlights the possibility of both myocarditis and intermittent complete heart block with ventricular standstill after COVID-19 vaccine administration.

The association between COVID-19 vaccination and myocarditis is now well established. As of June 11, 2021, there were 1226 reports of probable myocarditis and pericarditis documented within the Vaccine Adverse Event Reporting System.[6] Numerous such cases have also been published recently.[10–12] The mechanism of postvaccination myocarditis and pericarditis has not been fully defined. However, male patients and young patients—similar to our patient—are more commonly affected.[6]

As opposed to myocarditis, reports of vaccine-induced conduction abnormalities have been scarce. The initial phase 2 and 3 clinical trial data for the Pfizer-BioNTech vaccine detailed only a single case of paroxysmal ventricular arrhythmia after vaccination. No additional cardiac arrhythmias were reported.[4] Since that time, the literature has reported only a handful of such cases. Marshall et al detailed a case of complete heart block in a 16-year-old male after administration of a second Pfizer-BioNTech COVID-19 vaccine.[10] Similarly, Shams et al

published a case of non-high grade AV block after administration of the Chinese COVID-19 BBIBP-CorV vaccine.[13] However, ours is the first reported case of paroxysmal complete heart block with ventricular standstill secondary to lymphocytic myocarditis suspected to be due to administration of the Pfizer COVID-19 vaccine.

This case report should not be taken as a refutation of mRNA vaccine technology broadly or the Pfizer-BioNTech COVID-19 vaccine more specifically. Although, cases of vaccine-induced myocarditis occur, studies suggest that COVID-19 infection results in an increased incidence of myocarditis when compared to vaccination—40 per 1 million versus 1–10 per 1 million, respectively. Likewise, the incidence of cardiac arrhythmia appears to be much higher after COVID-19 infection than vaccination.[14] Further, numerous cases of complete heart block have been documented after COVID-19 infection.[15]

On a population basis, vaccination remains safe and beneficial.[6] Nevertheless, emergency medicine physicians must be aware of possible rare but serious side effects related to COVID-19 vaccination, including both myocarditis and paroxysmal complete heart block with ventricular standstill, and of how to support similarly critically ill patients.

4 | CONCLUSION

We present a case of a patient presenting to the ED with syncope from intermittent complete heart block with ventricular standstill secondary to lymphocytic myocarditis suspected to be due to Pfizer-BioNTech COVID-19 vaccine administration.

CONFLICTS OF INTEREST

Ethan Kimball, Kyle Buchwalder, and Cameron Upchurch: none; Bory Kea: Prior site investigator for AztraZeneca COVID-19 vaccine, site investigator for Abbott BinaxNow.

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