Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Amelia Breyre, MD; Jeffrey Tabas, MD; Esther H. Chen, MD

0196-0644/$-see front matter

https://doi.org/10.1016/j.annemergmed.2021.04.005

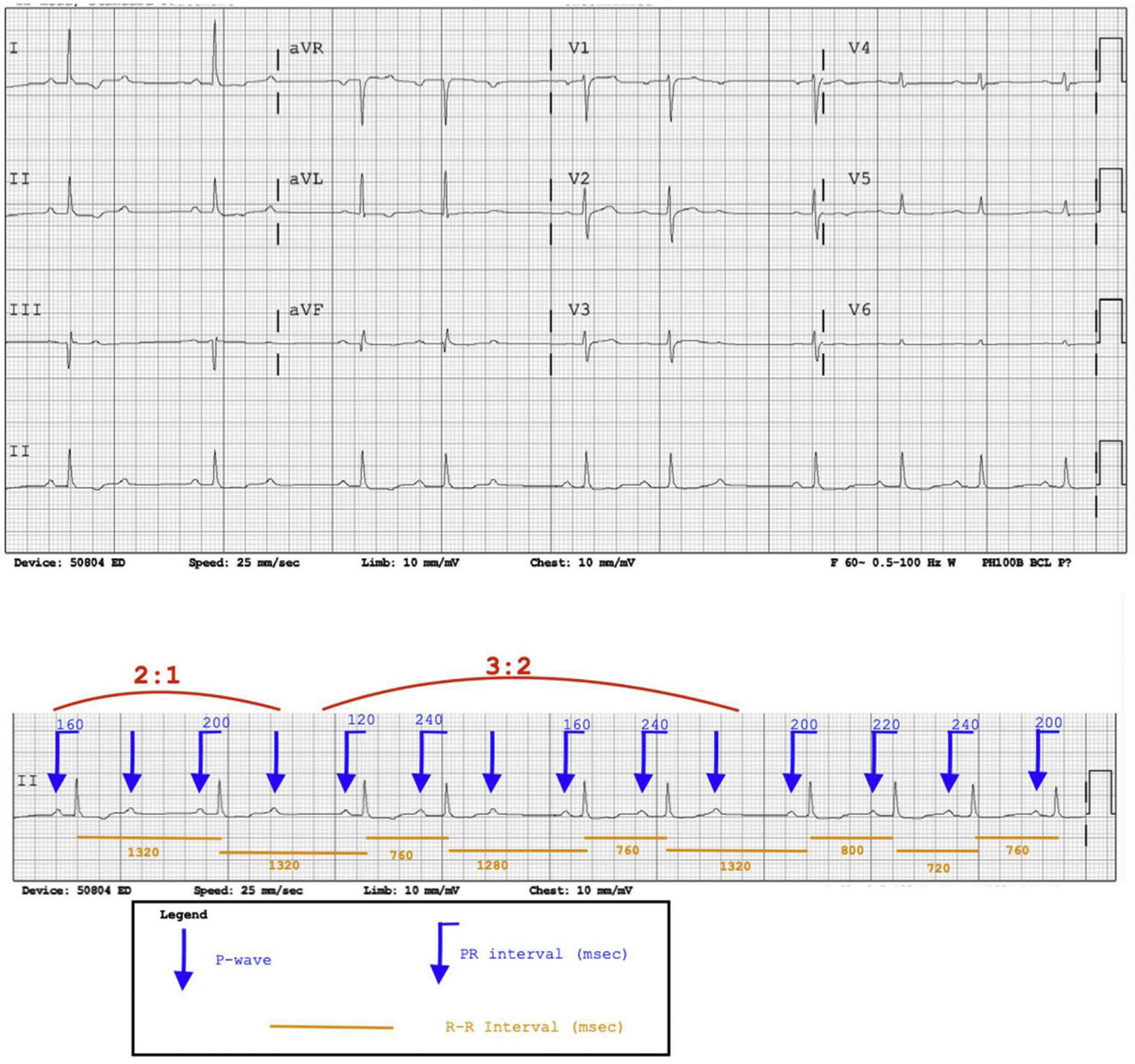

Figure 1. ECG with annotated rhythm strip.

CLINICAL PRESENTATION

[Ann Emerg Med. 2021;78:271-273.]

A 46-year-old woman with a history of hypertension and diabetes presented with a one-day history of left upper quadrant abdominal pain, nausea, and vomiting. She had been diagnosed with COVID-19 4 months prior and has required home oxygen (2 L/min) since diagnosis. She did not experience any chest pain. On arrival, her vital signs were within normal limits. Her physical examination was notable for mild upper abdominal tenderness. A 12-lead ECG was obtained given concren for a possible abnormal rhythm given her history and symptoms (Figure 1).

ECG OF THE MONTH

(continued from p. 271)

DIAGNOSIS:

Clinical Question

What are the critical findings on this ECG, and are they associated with COVID-19 infection?

ECG Interpretation

The ECG demonstrates a ventricular rate of 60 beats/min, exhibited by 10 QRS complexes on the 10-second strip. The P waves arise from the sinus node as they are upright in lead II and inverted in aVR, and the atrial rate is 84 beats/min, exhibited by 14 P waves on the 10-second strip. The rhythm strip reveals nonconducted P waves after the first 2 QRS complexes (2:1 block), followed by 2 pairs of QRS complexes with a 3:2 block and 4 QRS complexes in a row without any dropped P waves. In the group with the 3:2 block, there are gradually increasing PR intervals and shortening R-R intervals before the nonconducted P wave. The QRS and QT intervals, ST segments, and precordial R wave progression are normal. There is T wave flattening throughout and T wave inversions in I, II, and aVL.

CLINICAL COURSE

Evaluation of the patient's abdominal pain included laboratory analysis notable for leukocytosis of 22,700/μL and an unremarkable abdominal computed tomography scan. She was diagnosed with viral gastritis. The high-sensitivity troponin was within normal limits. Given concern for the abnormal cardiac rhythm in the setting of a complicated COVID-19 infection, the patient was admitted for telemetry monitoring and further workup. The patient's transthoracic echocardiogram was unremarkable. After 2 days, the patient's ECG normalized to sinus rhythm without conduction abnormalities, and she was discharged with cardiology follow-up. The etiology of her arrhythmia was unclear.

DISCUSSION

When a pattern of nonconducted P waves is noted on ECG, several diagnoses must be considered, including second-degree atrioventricular block (further classified into Mobitz type I and Mobitz type II), third-degree atrioventricular block, nonconducted premature atrial complexes, and atrial flutter or another supraventricular tachycardia that is too rapid to conduct in a 1:1 pattern. In Mobitz type I (Wenckebach) second-degree atrioventricular block, there is progressive prolongation of the PR interval that culminates in a nonconducted P wave. The R-R intervals progressively shorten and the longest cycle (the dropped beat) is less than twice the shortest cycle. The diagnosis is confirmed by constant P-P intervals with progressive PR interval lengthening and R-R interval shortening until the nonconducted P wave. In Mobitz type II block, the ECG shows intermittent nonconducted P waves without progressive prolongation of the PR interval.

Clinically, any patient with concerning symptoms related to bradycardia from either type I or type II second-degree atrioventricular block warrants observation and further evaluation to determine inciting causes and the need for a pacemaker. In a stable patient, the distinction between the 2 types has important implications. A type I block is usually benign, rarely progressing to complete atrioventricular block or requiring a pacemaker. It commonly occurs in the atrioventricular node and may be associated with reversible conditions that increase vagal tone, medications that slow atrioventricular nodal conduction, cardiac ischemia, or myocarditis. A type II block is less common but is more likely to progress to a complete block. It is also frequently associated with a bundle branch block pattern, and the defect is infranodal, representing a block to the other bundle branch. Causes may or may not be reversible, including myocardial infarction, idiopathic fibrosis of the conducting system, autoimmune/inflammatory/infectious (Lyme) myocarditis, infiltrative myocardial conditions, electrolyte imbalance (hyperkalemia), or medications.

When a type I block is seen with prolonged QRS complexes (ie, bundle branch block), the defect is infranodal in 70% of cases.[1] Infranodal blocks are clinically concerning for their progression to complete heart block, so patients with newly diagnosed type I block with bundle branch block or type II block should be admitted or receive cardiology evaluation before discharge.

In our patient, the initial 2:1 pattern of the atrioventricular block makes the distinction between type I and type II challenging. The pattern then changes to 3:2 and ends with 4 beats in a row without dropped P waves. Myocarditis was considered, but this is less likely with a normal echocardiogram and normal serial negative troponin levels.

Notably, this patient had a complicated, prolonged recovery from COVID-19. While COVID-19 primarily affects the respiratory system, a report from Wuhan, China, reported that 16.7% of patients had cardiac arrhythmias, including 44.4% in patients requiring intensive care.[2] There are also case reports of COVID-19 patients with second- and third-degree atrioventricular blocks in particular.[3,4] A systematic review of cardiovascular manifestations among COVID-19 patients demonstrated that atrial fibrillation was the most common tachyarrhythmia, although life-threatening ventricular arrhythmias were also reported (17% ventricular tachycardia and 2% ventricular fibrillation).[5] It is unclear whether our patient's prior COVID-19 infection contributed to her atrioventricular block. Ultimately, her Wenckebach pattern with narrow QRS complexes was reassuring, and a shorter period of observation may have been appropriate.

TEACHING POINTS

1. The emergency department management of second-degree atrioventricular block is determined by the severity of symptoms, whether the cause is reversible, and whether the block is likely infranodal and at risk of progression to complete heart block.
2. Mobitz type I second-degree atrioventricular block with a narrow QRS is likely due to atrioventricular nodal pathology and usually requires no intervention.
3. In both Mobitz type I block with a prolonged QRS and Mobitz type II second-degree atrioventricular block, the pathology is likely infranodal and warrants determination of whether the cause is reversible and whether a pacemaker is needed because of the high risk of progression to complete heart block.
4. COVID-19-associated cardiac injury includes atrioventricular blocks, atrial arrhythmias, and ventricular arrhythmias.

Author affiliations: From the Department of Emergency Medicine, University of California San Francisco, San Francisco, CA.

REFERENCES

1. Barold SS. Type I Wenckebach second-degree AV block: A matter of definition. *Clin Cardiol*. 2018;41:282-284.
2. Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA*. 2020;323:1061-1069.
3. Mahdawi TE, Wang H, Haddadin FI, et al. Heart block in patients with coronavirus disease 2019: A case series of 3 patients infected with SARS-CoV-2. *HeartRhythm Case Rep*. 2020;6:652-656.
4. Kir D, Mohan C, Sancassani R. Heart brake: an unusual cardiac manifestation of COVID-19. *JACC Case Rep*. 2020;2:1252-1255.
5. Thakkar S, Arora S, Kumar A, et al. A systematic review of the cardiovascular manifestations and outcomes in the setting of Coronavirus-19 disease. *Clin Med Insights Cardiol*. 2020;14:1179546820977196.