Pseudo atrioventricular block most likely caused by junctional extrasystoles mimicking Mobitz II second degree atrioventricular block: A case report

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Introduction

Concealed conduction (CC) is a phenomenon that cannot be seen directly on the surface electrocardiogram (ECG), but its occurrence can be deduced by observing atypical and unexpected electrical phenomena. CC occurs when an impulse penetrates a portion of the cardiac conduction electrical system, leaving it in the absolute refractory period and changing the behavior of subsequent impulse.[1] Manifestations include prolongation of conduction and facilitation or failure to propagate an impulse,[2] such as in pseudo atrioventricular blocks. Proper recognition of CC is of paramount importance, since this phenomenon can mimic serious anatomical and physiological abnormalities of the cardiac electrical conduction system.

Pseudo atrioventricular block is an uncommon condition, and for it to occur, a specifically well timed proximal junctional extrasystole must reach the distal part of the atrioventricular junction in the absolute refractory period. As it occurs in a singular moment of the cardiac electrical cycle, the junctional extrasystole does not spread anterogradely, since the conduction system ahead of the ectopy is recovering excitability. At the same time, its retrograde wavefront collides with the anterograde one of the next sinus P wave. Since the junctional ectopy itself does not have any representation on surface ECG, the result is a sudden block of a sinus P wave mimicking a Mobitz II second-degree atrioventricular block.

KEY TEACHING POINTS

- Concealed conduction is a physiological phenomenon little remembered during electrocardiogram analysis.
- Junctional extrasystoles are rare and can be the cause of concealed conduction in the atrioventricular node and pseudo atrioventricular block, leading to misdiagnoses of advanced atrioventricular blocks.
- Pseudo atrioventricular block manifesting as a Mobitz II second- or high-degree atrioventricular block caused by a junctional rhythm is a rare physiological condition that must be recognized in order to avoid an unnecessary pacemaker implantation.

Case report

A 56-year-old hypertensive man was referred to our service for evaluation complaining of palpitations that became more frequent during physical activity. His symptoms appeared 6 months before the evaluation and did not affect his quality of life. On physical examination, the patient had small periods of slightly elevated pulse rate (105 beats/min) with occasional pauses, which was also observed during cardiovascular auscultation.

A resting ECG was performed and revealed a junctional rhythm. In order to better understand his electrocardiographic finding a 24-hour Holter monitor was performed (Figures 1 and 2), and a sinus rhythm with runs of junctional rhythm was observed. At times, some P waves were not conducted to the ventricles owing to functional blocks caused by concealed junctional extrasystoles. Subsequently an exercise test was performed to assess his symptoms during exertion, and blocked P waves were detected in the fourth minute of exertion (Figure 3), also owing to a functional block caused by concealed junctional extrasystoles. Interestingly, the pre-and postblock PR intervals were exactly the same, mimicking a Mobitz II second-degree atrioventricular block.

KEYWORDS Atrioventricular block; Bradycardia; Heart block; Heart conduction system; Pacemaker; Palpitations
(Heart Rhythm Case Reports 2020;6:507–510)

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https://doi.org/10.1016/j.hrcr.2020.05.002

Figure 1 A 3-channel 24-hour Holter monitoring shows a first P wave conducted to the ventricles, followed by a second nonconducted sinus P wave that collides (*black bars*) with a retrograde ectopic junctional wavefront (*first asterisk*). The anterograde wavefront of the junctional beat depolarizes the ventricles. The third sinus P wave is blocked (*black top horizontal bar*), since the conduction system is recovering excitability from the previous beat (effective refractory period [ERP]) or eventually another retrograde wavefront of a junctional beat may have collided retrogradely with an anterograde sinusal wavefront. As the ectopic focus was reset and takes time to recover, the P/QRS relationship changes and then the QRS precedes the P wave. In the next beats, the atria are depolarized by the sinus node and the ventricles by the junctional focus.

Taking into account all the information provided by the noninvasive exams, the diagnosis of pseudo atrioventricular block was made. The patient was reassured with no need for artificial cardiac stimulation, and drug therapy with beta-blockers was started. After 6 months of follow-up, the patient has remained asymptomatic.

Discussion

Pseudo atrioventricular block is a rare clinical entity that must be remembered in the differential diagnosis of true atrioventricular blocks, especially in the presence of narrow QRS and junctional extrasystoles. The pre- and post-block P-wave PR intervals with the same durations during an exertion phase of a stress test usually make Mobitz II second-degree atrioventricular block the main suspected diagnosis. It must be remembered, however, that Mobitz II second-degree atrioventricular block in the absence of a bundle branch block is an uncommon condition found in less than 30% of cases.[3,4] Besides that, true atrioventricular blocks tend to show a progressive worsening of the clinical picture when left untreated, especially after the use of beta-blockers. In this case, the patient's symptoms improved after treatment with beta-blockers.

Although the electrophysiological study had been considered, this tool was considered unnecessary for conducting the case for the following reasons: first, the symptoms of palpitations were more compatible with extrasystoles than with severe atrioventricular blocks; second, the documentation of junctional extrasystoles leading to atrioventricular block during the electrophysiological study is fortuitous and unpredictable, so this invasive diagnostic tool does not guarantee the registration of the phenomenon.

Although it is not possible to exclude other possibilities, such as conduction through a slow pathway (1:2 phenomenon)

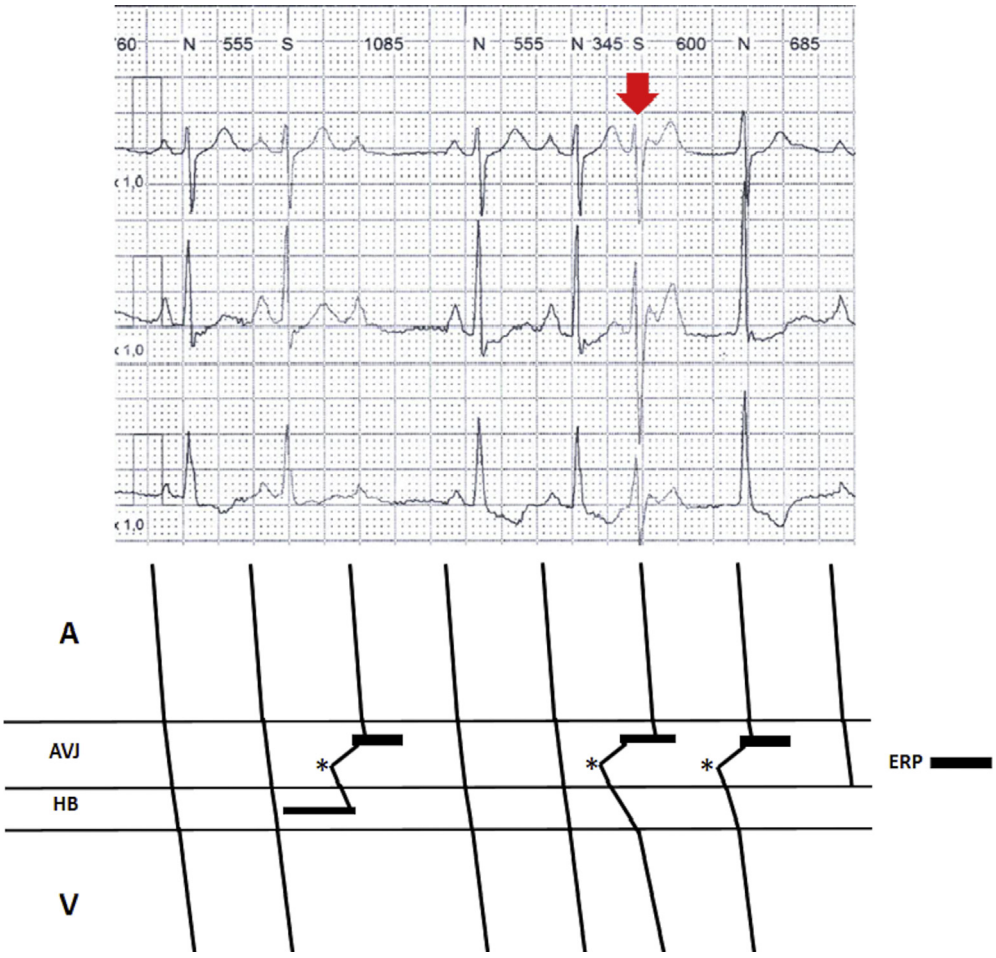

Figure 2 A 3-channel 24-hour Holter monitoring with the first 2 P sinus waves depolarizing the ventricles. Then, a concealed ectopic beat from the atrioventricular junction (*black asterisk*) collides retrogradely with the sinus wavefront at the level of the atrioventricular junction (*black top horizontal bar*), avoiding the propagation of the first. The ectopic beat does not depolarize the ventricles (*black bottom horizontal bar*), as they are in the effective refractory period (ERP). The 2 subsequent sinus P waves depolarize the ventricles and then a retrograde junctional beat wavefront collides (*black top horizontal bar*) with an anterograde sinus one and simultaneously depolarizes the ventricles with aberrancy (*red arrow*). The preceding and post-P-wave blocked PR intervals are the same and could be misdiagnosed as a Mobitz II second-degree atrioventricular block.

or intranodal conduction delay, without performing an electrophysiological study, there are reasons why we believe these hypotheses are less likely. First, the presence of a junctional rhythm should raise the suspicion that a physiological phenomenon such as CC may be occurring, especially in the absence of bundle branch block. Second, it is unlikely that conduction through a fast pathway will switch to a slow one during atrial activation with fixed coupling interval in the absence of significant modulation of the autonomic nervous system. Third, intranodal conduction delay could be a possibility; however, the presence of atrioventricular dissociation at certain moments excludes this hypothesis.

Conclusion

Pseudo atrioventricular block manifesting as a Mobitz II second-degree atrioventricular block caused by a junctional rhythm is a rare physiological condition that must be promptly recognized in order to avoid an unnecessary pacemaker implantation.

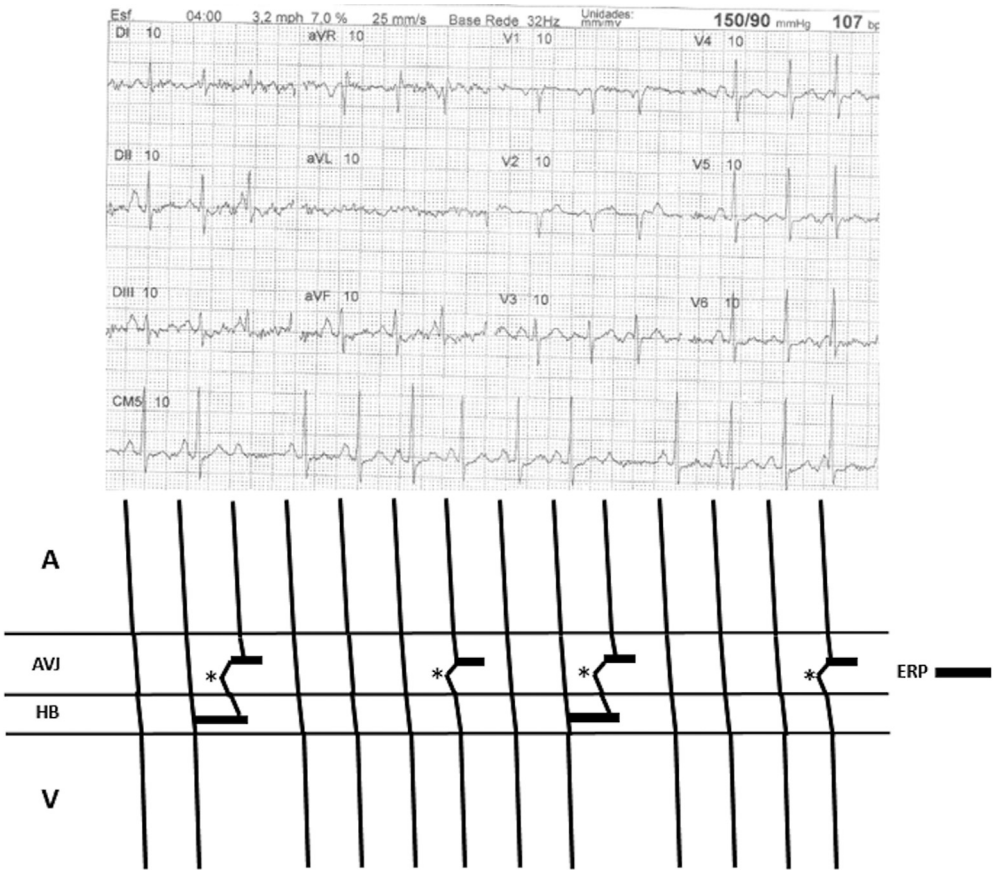

Figure 3 Two blocked P waves in the fourth minute of a treadmill test in CM5 derivation. The PR interval before and after the 2 blocked P waves are the same:160 ms. The first 2 sinus P waves are conducted to the ventricles. The third P wave is blocked by a concealed junctional beat that collides retrogradely with the anterograde sinus wavefront (*black top horizontal bar*). The junctional beat does not depolarize the ventricles, since they are in the effective refractory period (ERP) (*black bottom horizontal bar*). From the fourth to the sixth sinus beats the impulses are normally conducted to the ventricles. The seventh QRS is probably generated by the junctional ectopic beat, since the PR interval shortens slightly abruptly. The tenth P wave is blocked by another concealed junctional extrasystole that collides retrogradely with the sinus beat (*black top horizontal bar*) but does not depolarize the ventricles because they are in the ERP (*black bottom horizontal bar*). The last beat is a junctional QRS (*black asterisk*) dissociated from the sinus P wave. It is worth noting that CM5 is recorded at a different time from the other leads that are simultaneously recorded. The third P wave recorded by the other leads is dissociated from the subsequent QRS, suggesting that the ventricles were depolarized by the junctional ectopic beat.

References

1. Jazayeri MR. Concealed conduction and allied concepts. Card Electrophysiol Clin 2014;377–418.
2. Jazayeri MR. Role of concealed conduction and allied phenomena in the genesis, maintenance, and termination of cardiac arrhythmias. Pacing Clin Electrophysiol 2019;42:779–804.
3. Issa Z, Miller JM, Zipes DP. Atrioventricular conduction abnormalities. In: Issa Z, Miller JM, Zipes DP, eds. Clinical Arrhythmology and Electrophysiology, 1st ed. Philadelphia: Saunders Elsevier; 2009. p. 129–136.
4. Josephson ME. Atrioventricular conduction. In: Josephson ME, ed. Clinical Cardiac Electrophysiology. Techniques and Interpretations, 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2008. p. 100–103.