EP CASE REPORT

Level of block: atrioventricular node, infra-Hisian, or intramyocardial?

Niyada Naksuk, Deepak Padmanabhan, Krishna Kancharla, and Siva K. Mulpuru*

Division of Cardiovascular Diseases, Mayo Clinic, 200 First Street SW, Rochester, 55902 MN, USA

*Corresponding author. Tel: 507-266-3089; fax: 507-266-7929. *E-mail address*: Mulpuru.siva@mayo.edu

A 62-year-old woman without known cardiac disease presented with a sudden onset of dizziness. The physical examination found the patient in moderate distress with signs of poor perfusion. Her peripheral pulse was 20–30 b.p.m. The electrocardiogram recorded during the symptomatic episode shows sinus rhythm with 2:1 atrioventricular conduction (*Figure 1A*). The conducted beats have a PR interval of 160 ms followed by a QRS complex with right bundle branch block pattern. The non-conducted P wave is followed by low amplitude, high frequency signal of uncertain origin (*Figure 1A*, blue arrows).

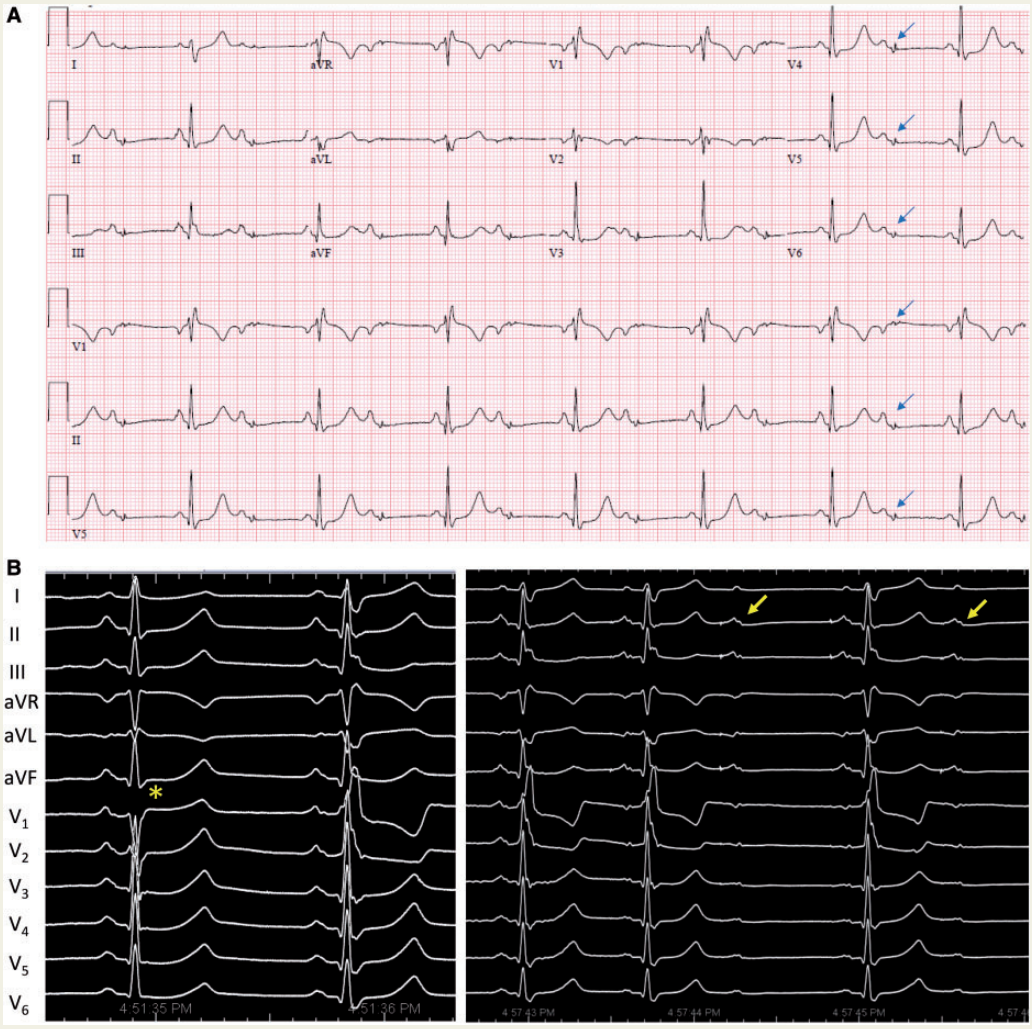

Figure 1 (*A*) ECG recorded during the symptomatic episode reveals sinus rate of 90 b.p.m. with ventriculophasic phenomenon and 2:1 atrioventricular block. Blue arrows present the signals of our interest following the non-conducting P wave. (*B*) Presents ECG recorded at speed of 50 millimeter per second during pacemaker implantation. Left, spontaneous left bundle branch block (asterisk) with constant sinus rate and PR interval, supporting diseased Purkinje system. Right, the first beat represents baseline sinus rhythm with right bundle branch block. Note there is no sharp signals of interest recorded after the non-conduct P wave (yellow arrows), compared to the tracing on the right.

Giving that her physical examination at the time of electrocardiogram recorded suggested symptomatic heart block, electrical artefact signals are less likely. The remaining differentials include atrial repolarization, delayed atrial depolarization, and depolarization of a limited portion of the ventricular myocardium with intramyocardial block. The atrial repolarization and delayed atrial depolarization are generally not discernible unless there is a complete atrioventricular block. However, the observed signal with concordant axis to the preceding P wave and the high frequency characteristic is not consistent with repolarization that is low amplitude and low frequency.[1] A delayed depolarization due to a slow conduction to a small portion of the atrium is generally found in scarred atria. In this patient without history of prior cardiac surgery or ablation, such an amount of delay is less likely.

The patient underwent a pacemaker implant, and limited pacing manoeuvres were conducted. During sinus rhythm, spontaneous alternating bundle branch block was observed (*Figure 1B*, asterisk), confirming significant infra-Hisian disease. The paced P waves with atrioventricular block lacks the signal of interest suggesting that the signal is not an atrial component (*Figure 1B*, yellow arrows). We hypothesized that the site of block is potentially in the left bundle just distal to the exit of the septal fascicle, and thus there is still a preserved left to right septal activation, resulting in the signal of our interest that most resembles patient's Q wave based on the PR interval, vector axis, and voltage. In addition, this case represents an unusual form of intramyocardial block occurring likely due to a source–sink mismatch,[2] when there are inadequate impulses to depolarize the entire myocardium and thus lack of remaining portion of the QRS.

In conclusion, this is a rare presentation of a patient with multi-level conduction system disease along with an uncommon intramyocardial block likely from a source–sink mismatch phenomenon.

References

1. Tranchesi J, Adelardi V, de Oliveira JM. Atrial repolarization—its importance in clinical electrocardiography. *Circulation* 1960;**22**:635–44.
2. Spach MS, Boineau JP. Microfibrosis produces electrical load variations due to loss of side-to-side cell connections; a major mechanism of structural heart disease arrhythmias. *Pacing Clin Electrophysiol* 1997;**20**:397–413.