Infra-Hisian Atrioventricular Block

Wendy S. Tzou, MD[a,*], T. Raymond Foley, MD[b], Duy Thai Nguyen, MD[a], Ryan G. Aleong, MD[a]

KEYWORDS

• Infra-Hisian atrioventricular block • Pacemaker • Bundle branch block

KEY POINTS

- Bundle branch block and aberrancy can involve multiple, dynamic phenomena.
- The presence of acceleration-dependent and phase 4 aberrancy or block are pathologic, and indicate disease of the conduction system.

CLINICAL PRESENTATION

A 72-year-old woman, with a history of hypertension and hyperlipidemia, presented with episodes of presyncope and 2:1 atrioventricular (AV) block, with alternating left bundle branch block (LBBB) and right bundle branch block (RBBB). She was admitted for further management. Twelve-lead electrocardiograms (ECGs) during her initial presentation are shown in **Fig. 1**.

CLINICAL QUESTION

What is the explanation for the alternating BBB?

ELECTROPHYSIOLOGY STUDY AND CLINICAL COURSE

A quadripolar catheter was placed at the His-bundle region. At baseline, the patient was in sinus rhythm with 2:1 AV block with RBBB on conducted beats (see **Fig. 1**A). Intracardiac recordings demonstrated infra-Hisian block with nonconducted beats (**Fig. 2**). Intermittently, 1:1 AV conduction would resume, sometimes, but not always, following a premature atrial contraction (PAC) with RBBB aberrancy, followed by LBBB with the 1:1 conducted beats (see **Fig. 1**B; **Fig. 3**). Note that the conducted beat following a PAC is of differing RBBB morphology than the beats conducted with 2:1 AV block (see **Figs. 1**B and **3**). Note also that PP (and associated His-His [HH]) intervals also correspond with differing patterns of aberrancy: generally with shorter HH intervals, 1:1 AV conduction with LBBB is observed, while with longer HH intervals, RBBB is observed. Finally, the His-ventricular (HV) interval with 2:1 AV block was normal (58 milliseconds, **Fig. 4**). With 1:1 AV conduction and LBBB, marked prolongation in the HV interval (108 milliseconds, see **Fig. 4**) was observed.

The patient met Class I guidelines for pacemaker implantation (advanced second-degree AV block with bradycardia and symptoms),[1] so the quadripolar catheter was advanced to the right ventricle for backup pacing if needed during dual-chamber pacemaker implantation.

DISCUSSION

Type II second-degree AV block is typically infranodal, usually occurring below the level of the His bundle, as was the case for this patient.[2] Symptoms are common in this group of patients, and progression to complete heart block, as well

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[a] Cardiac Electrophysiology, University of Colorado Anschutz Medical Campus, 12401 East 17th Avenue, Mail Stop B136, Aurora, CO 80045, USA; [b] Department of Medicine, University of Colorado Anschutz Medical Campus, Denver, 12605 East 16th Avenue, Mail Stop B136, Aurora, CO 80045, USA
* Corresponding author.
E-mail address: wendy.tzou@ucdenver.edu

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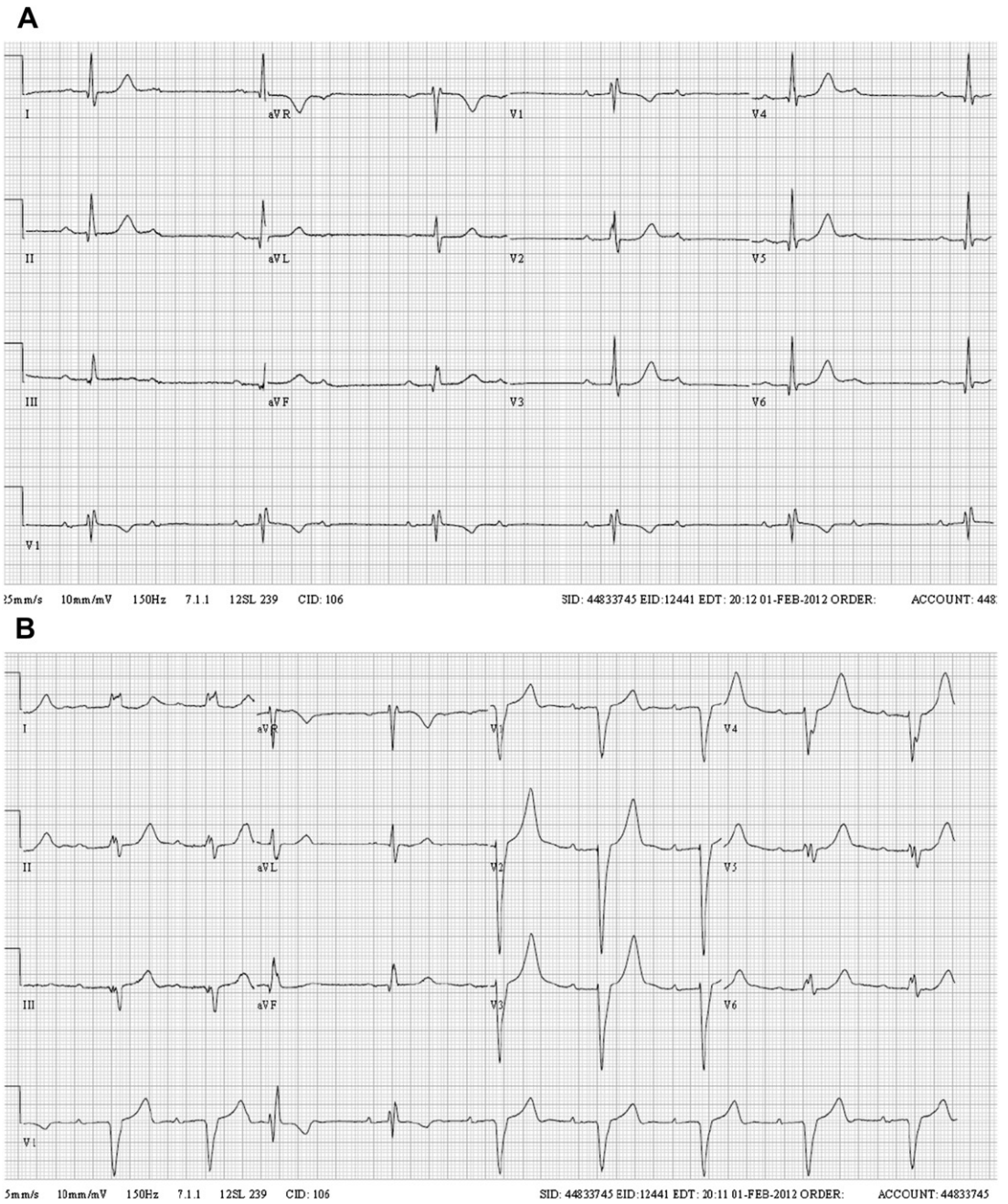

Fig. 1. 12-Lead electrocardiograms (ECGs) of patient's presenting rhythm. (*A*) 2:1 Atrioventricular (AV) block with right bundle branch block (RBBB) on AV conducted beats. (*B*) Alternating bundle branch block during 1:1 AV conduction, with differing RBBB aberrancy noted during ventricular conduction following premature atrial contraction, compared with that observed during 2:1 AV block.

as mortality, is increased in comparison with those without evidence for infranodal disease.[3,4]

Potential mechanisms of conduction block or delay include phase-3 block, acceleration-dependent block, phase-4 (bradycardia-dependent) block, and concealed conduction.[5–8] Phase-3 block occurs when a premature impulse attempts to depolarize His-Purkinje tissue during phase 3 of the action potential, at the time of relative refractoriness, and is a physiologic phenomenon, in contradistinction to acceleration-dependent block whereby conduction delay occurs in response to