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Full article title: It is Time to Uncover the Mysterious veil of Atrioventricular Node Pacing

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Short article title: Wenckebach phenomenon occurred during the HBP procedure.

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Abstract

Wenckebach phenomenon is a well-known electrophysiological character of the atrioventricular node (AVN). AVN-pacing during permanent pacemaker implantation is rare. We herein report the first case of Wenckebach phenomenon in a heart failure patient with chronic atrial fibrillation for more than 30 years during the His-bundle pacing (HBP) procedure. The patient's symptoms improved significantly. AVN-pacing is available, and HBP is helpful for cardiac remodeling and clinical outcomes.

Keywords: Wenckebach phenomenon; His-bundle pacing; Atrial fibrillation

1. Case presentation

A 70-year-old man presented with exertional dyspnea and recurrent pre-syncope for two months was admitted to our center. He had rheumatic heart disease and chronic atrial fibrillation (AF) for nearly 30 years without any sinus rhythm documented on multiple electrocardiographs (ECGs). Six years ago, he underwent the mitral valve replacement (E100-29M-00, Epic, St. Jude Medical Inc., St. Paul, Minnesota, USA) and tricuspid valvuloplasty for severe rheumatic mitral stenosis and tricuspid insufficiency. The admission ECG showed AF with bradycardia (Figure1 A). Coronary computed tomography angiography (CTA) revealed a severely enlarged atrium (Figure 1B). A permanent pacemaker is indicated for symptomatic bradycardia.

During the implantation, His-Bundle pacing (HBP, Figure 1C, site A) using the Select Secure lead (model 3830, Medtronic Inc., Minneapolis, Minnesota, USA) was attempted with right ventricular pacing as a backup (Figure 1C). A clear His-bundle (HB) potential was observed, and the His-ventricular (HV) interval was 68ms at site A (Figure 1D).

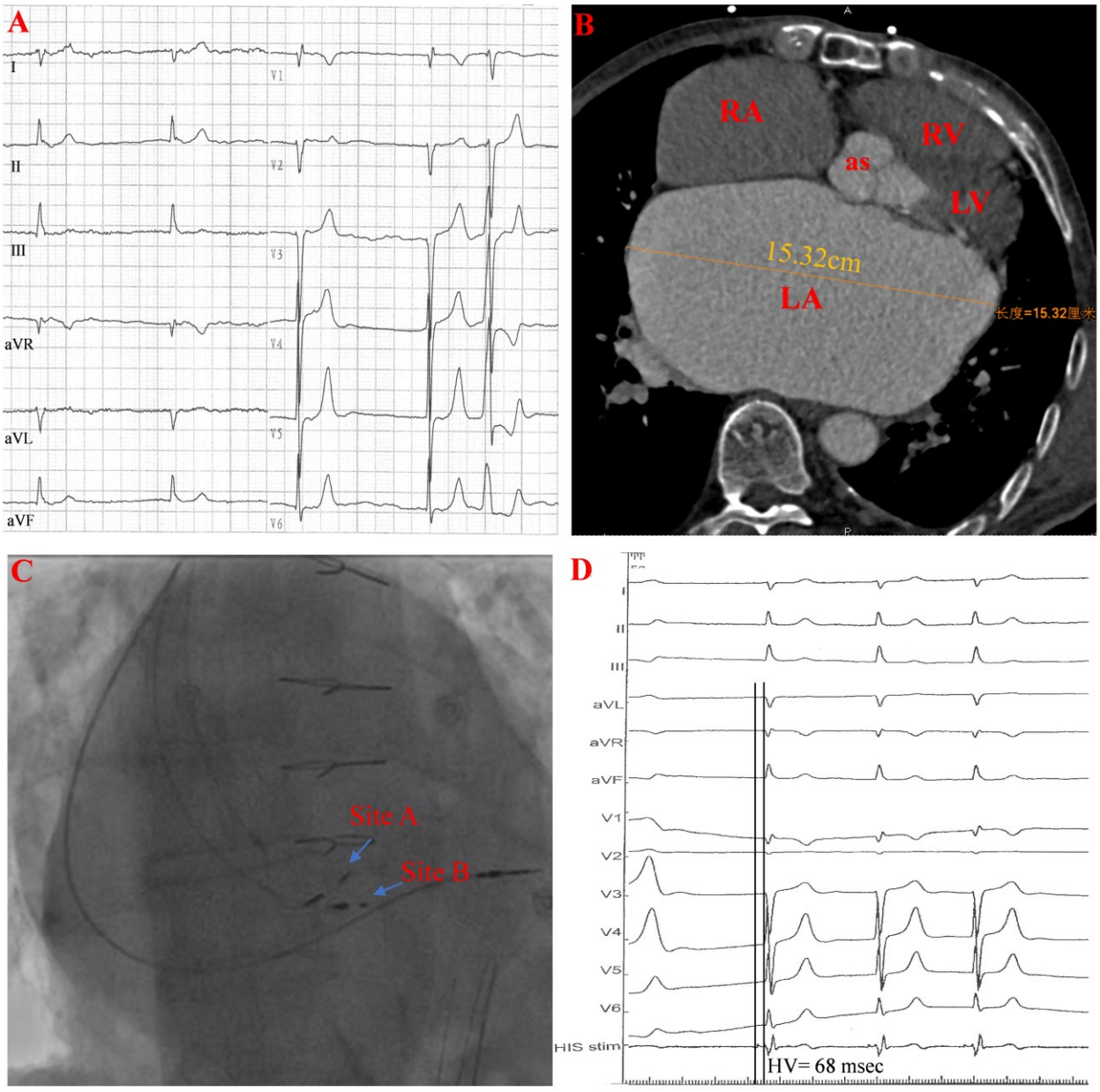

Figure 1. Imagines and ECGs before HBP.

A and B show a preprocedural ECG and large left atrium in cardiac CTA. C and D are fluoroscopic AP view and electrograms with prolonged HV interval during the procedure. CTA, computed tomography angiography; AP, anteroposterior projection; RA, right atrium; LA, left atrium; RV, right ventricle; LV, left ventricle; as, aortic sinus.

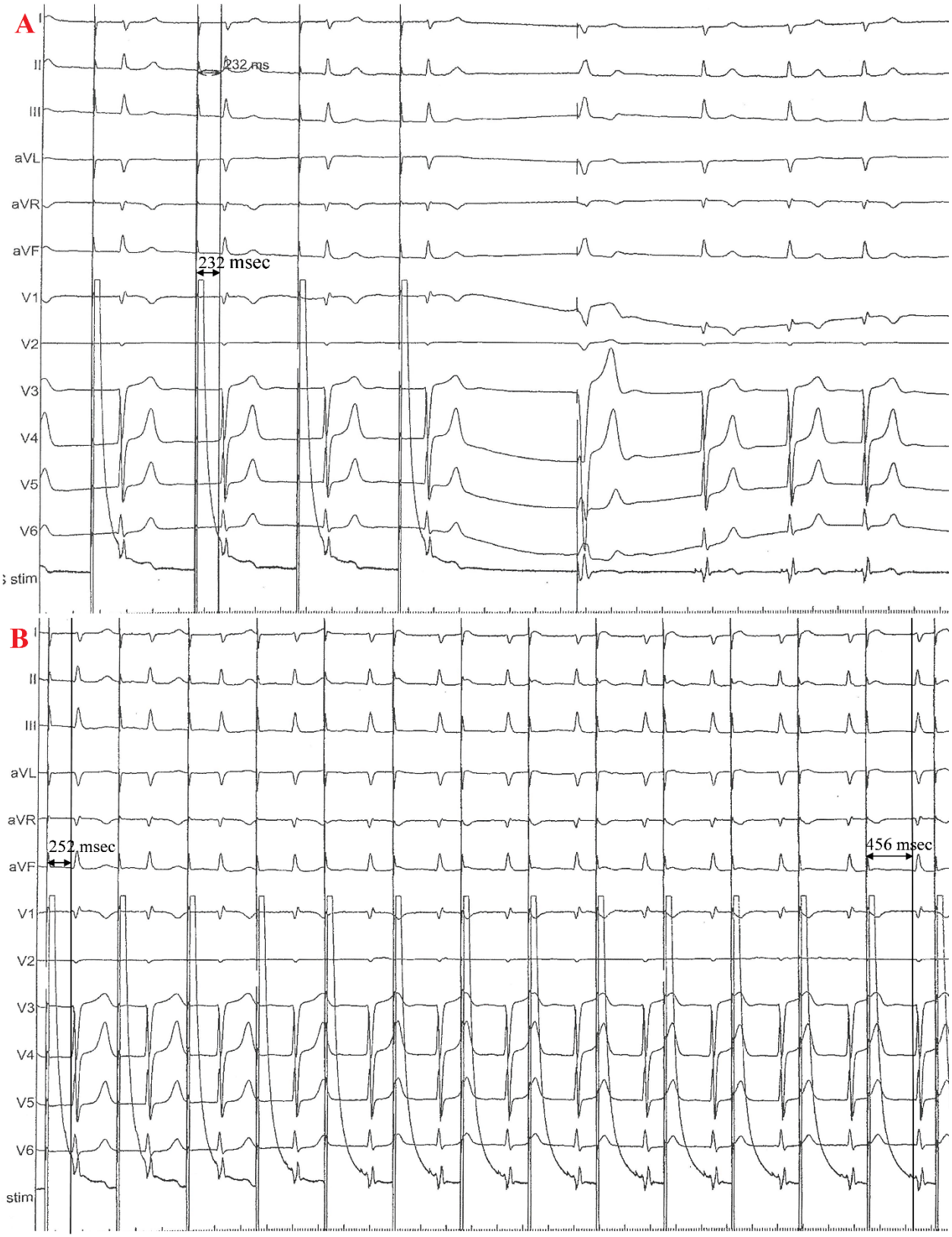

Figure 2. EGM during the implantation.

A, S-QRSonset was 232 msec when paced at the rate of 60 BPM at site A. B, S-QRSonset progressively lengthens from 256 msec to 456 msec when the pacing rate is 90 BPM at site A.

The duration from the stimulus signal to the onset of the paced QRS complex (S-QRSonset) at site A was 232 msec when pacing at 60 beats per minute (BPM) with the pacing threshold of 2.0V/0.5 msec (Figure 2A). The S-QRSonset was longer than the H-V interval and had a progressive prolongation from 252 msec to 456 msec during the pacing at the rate of 90 BPM (Figure 2B) with the same QRS morphology as the intrinsic conduction. The finding suggests that the pacing lead is at or close to the atrioventricular node (AVN). Then we placed another 3830 lead distally at Site B, where the S-QRS interval remains constant at 68 msec, the same as the HV interval (Figure3A, B). We chose site B, the HB pacing, as the final lead position to minimize progressive S-QRS prolongation.

The patient's symptoms improved significantly at the 12-month follow-up. Bilateral atrial sizes were reduced (Figure3C).

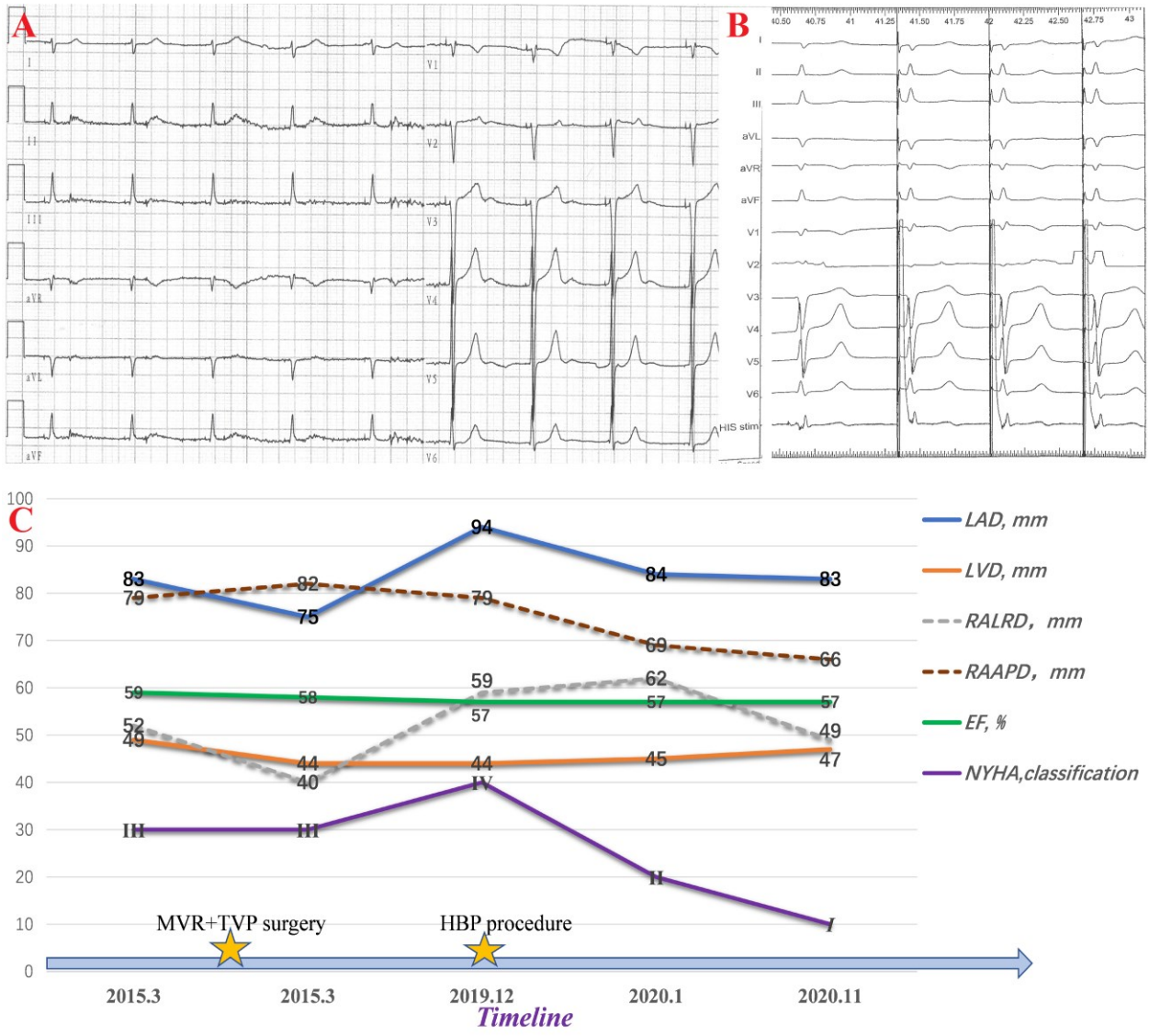

Figure 3. Changes after HBP procedure.

A shows postoperative ECG. B is EGM of HBP. C shows changes in cardiac remodeling. LVD, left ventricular diameter; LAD, left atrial diameter; RALRD, right atrial left-right diameter; RAAPD, right atrial anteroposterior diameter; EF, ejection fraction; NYHA, New York Heart Association.

2. Discussion

Wenckebach phenomenon is a well-known electrophysiological character of the AVN. This is the first case to report the intraoperative AVN pacing during AF. AVN pacing was once noted in a case of HB lead-induced current injury during sinus rhythm.[1] The pacing lead at site A might be at the distal end of the AVN because both the Wenckebach phenomenon and the HB potential were recorded. The prolonged HV interval of 68 msec and decreased Wenckebach block point suggested that the impaired conduction system function. Although AVN pacing is physiological with a narrow QRS complex, HBP is preferable to control ventricular pacing rate. We chose site B and fixed the HB lead there for better pacing thresholds.

One concern with HBP is the increased capture thresholds with time.[2] In our case, a stable and favorable pacing threshold (1.5/0.4 msec) and the amplitude of R wave (4.5mV) were confirmed during the follow-up.

Disclosures

None.

References

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