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Junctional beats and pure His bundle pacing: Surface ECG appraisal in an atypical preexcitation variant

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An 11-year-old boy was referred to our assessment for recurrent episodes of paroxysmal supraventricular tachycardia despite antiarrhythmic therapy and evidence of ventricular preexcitation on the surface ECG. Transthoracic echocardiogram did not reveal any relevant abnormalities. The basal 12-lead ECG (Fig. 1A) showed sinus rhythm with minimal ventricular preexcitation (P-delta 110 ms, QRS duration 100 ms). Electrophysiological study was performed, and diagnostic catheters were introduced via the femoral veins and positioned at the His bundle (HB) region and within the coronary sinus. The AH and HV intervals were 70 and 20 ms, respectively. During the procedure, spontaneous junctional rhythm (Fig. 1B) was observed replicating the preexcitation pattern. Moreover, during para-Hisian pacing maneuver, phases of pure HB pacing (Fig. 1C) produced a similar QRS morphology on the surface ECG, despite subtle changes (1st QRS, most apparent in lead V3) that might due to a slight shift or change of the actually captured area within HB (or proximal right bundle) with pacing catheter motion and pacing output adjustment. These electrocardiographic features suggested an *infra-nodal* accessory pathway (AP), and the preexcitation pattern was related to a fasciculo-ventricular (FV) pathway. Indeed, QRS morphology did not change during multisite atrial pacing and programmed atrial stimulation (Fig. 1D) despite a significant P-delta increment. Mechanically-induced right bundle branch block did not cause loss of preexcitation, indicating a more proximal take-off of this FV-AP relatively to the block level (Fig. 1E) [1]. During para-Hisian pacing, the transition from combined HB and ventricular capture (Fig. 2A) to pure HB capture (Fig. 2B) did not affect retrograde atrial activation despite the delay in local ventricular depolarization suggesting HB-dependent (i.e., nodal) retrograde conduction. However, incremental ventricular pacing revealed an occult left-lateral AP and orthodromic AV reentry tachycardia was inducible during Isoproterenol infusion (Fig. 3) with a bystander role of the FV-AP. Catheter ablation of the occult AP was successfully performed at the lateral mitral annulus via a transeptal approach rendering the tachycardia not inducible anymore. The patient remained asymptomatic, and no arrhythmias were detected during the subsequent follow-up.

FV-APs are typically innocent bystanders in patients with normal hearts but may coexist with other accessory pathways [2]. The various surface ECG findings described above of a FV-AP are all electrophysiologic equivalents to the usual intracardiac hallmark finding of a fixed and short HV interval. Recognizing this atypical preexcitation variant is critical to avoid unnecessary, and potentially harmful, catheter ablation adjacent the HB region, which is the usual insertion site of these tracts. Careful analysis of 12-lead ECG is valuable to demonstrate the minimal and fixed preexcitation degree during multisite and programmed atrial pacing. Importantly, preexcited junctional rhythm, observed either spontaneously or simulated by pure HB pacing, provides additional clues to establish the diagnosis.

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Declaration of competing interest

None.

References

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Fig. 1. Appraisal of surface ECG in an atypical preexcitation variant. 12-lead ECG recordings in a patient with a fasciculo-ventricular pathway during sinus rhythm (A), junctional rhythm (B), pure His bundle pacing (C), programmed atrial stimulation (D), and sinus tachycardia with right bundle branch block (E). The arrows in panel B indicate sinus beats competing with the junctional rhythm; the asterisk in panel D indicates fixed QRS morphology despite P-QRS increment with premature atrial stimuli; S: stimulus. From (A) to (D) there is similar QRS morphology/preexcitation degree despite different underlying rhythms.

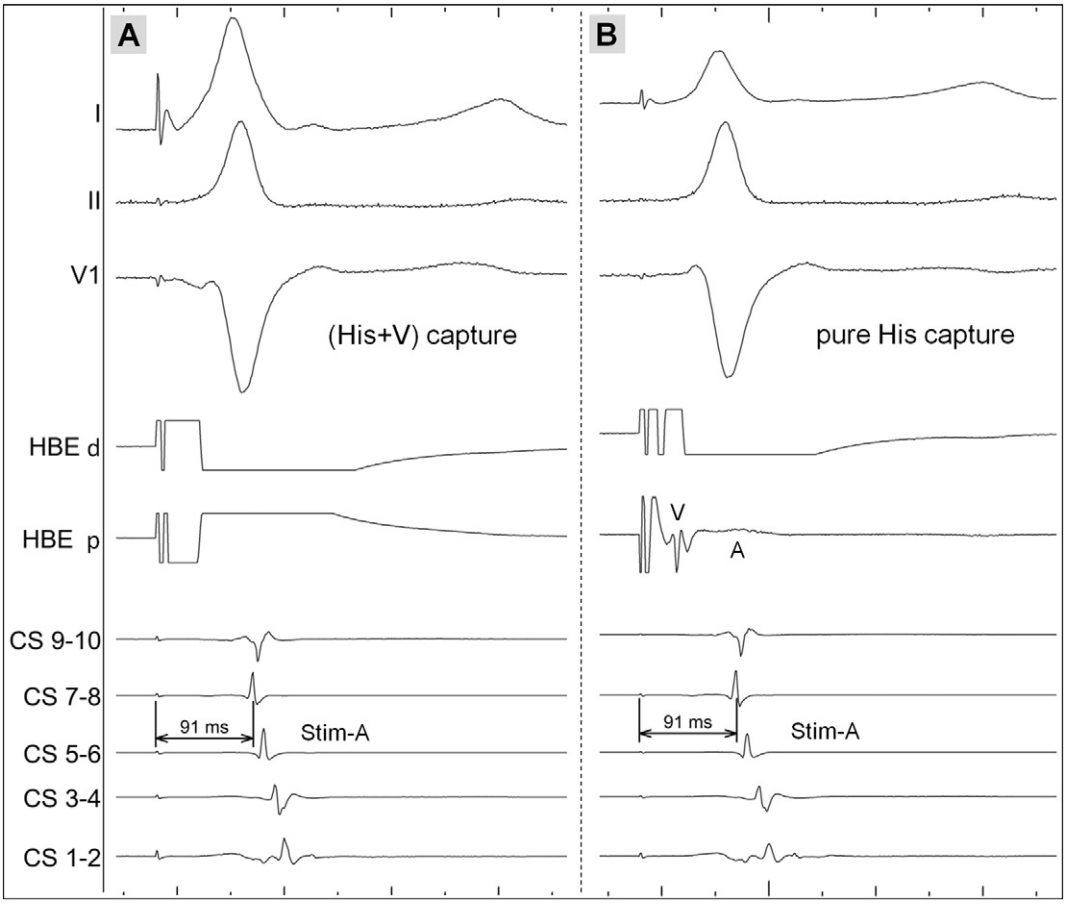

Fig. 2. Surface ECG and intracardiac recordings during para-Hisian pacing maneuver showing combined His and ventricular capture (A), and pure His capture (B). The delay in local ventricular depolarization at His channel during pure His capture (panel B) did not affect retrograde atrial activation suggesting a nodal pattern. A: atrium; CS: coronary sinus (1 to 10: distal to proximal electrodes); d: distal; HBE: His bundle electrogram; p: proximal; Stim: stimulus; V: ventricle.

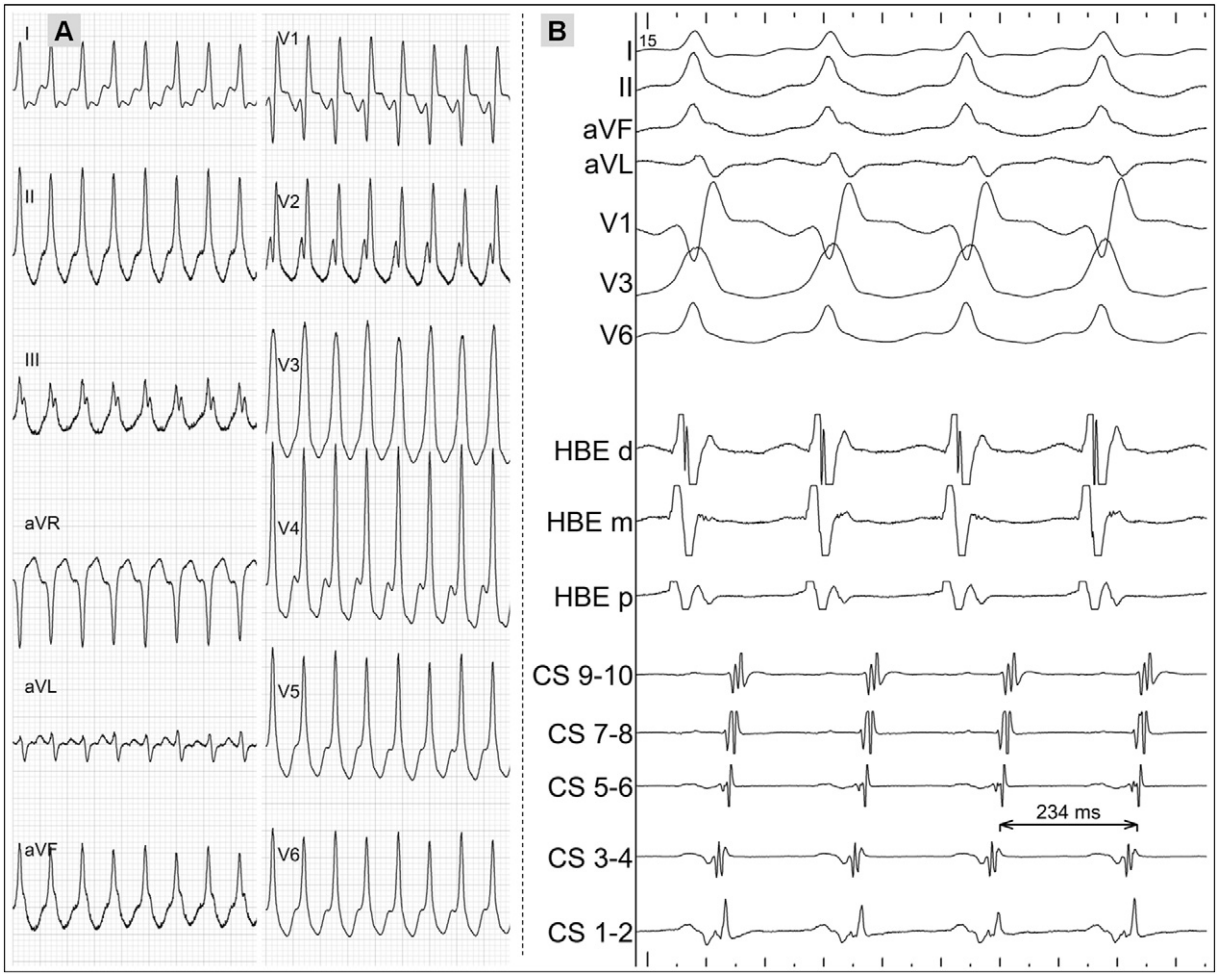

Fig. 3. 12-lead ECG (A) and intracardiac recordings (B) during orthodromic AV reentrant tachycardia over a left lateral accessory pathway in the presence of right bundle block and bystander preexcitation over the fasciculo-ventricular pathway. m: mid; other abbreviations are as in Fig. 2.