

Unexpected QRS complex during atrial pacing in a patient with preexcitation: What is the mechanism?

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CASE PRESENTATION

An 18-year-old man with history of palpitations and a preexcited ECG in the absence of structural heart disease was referred for electrophysiology study (EPS) and potential RF ablation. Resting 12-lead surface ECG revealed sinus rhythm with short PR interval due to preexcitation (Fig. 1). The EPS showed a baseline sinus cycle length, atrial-His (AH) interval, and His-ventricular (HV) interval of 679, 79 and -20 ms, respectively. Ventriculo-atrial conduction was eccentric and non-decremental with the earliest retrograde atrial activation recorded in coronary sinus (CS) 5-6, corresponding to 5 o'clock in the LAO projection.

The retrograde refractory period of the accessory pathway (AP) was 600/380 ms. Programmed high right atrium (HRA) pacing introducing extrastimuli (A1/A2) at progressively shorter coupling intervals, increased preexcitation without change in P to delta time. Atrial coupling interval at 600/280 ms resulted in maximum preexcitation followed by a second narrow QRS complex preceded only by a His deflection and followed by eccentric retrograde atrial activation (Fig. 2).

What is the mechanism?

COMMENTARY

The differential diagnosis of this non-preexcited QRS includes a His extrasystole followed by an echo travelling retrogradely

through the AP, and a “two-for-one” atrio-ventricular conduction using the AP and the normal conduction system (fusion) in the first QRS (preexcited, see asterisk) and using the slow pathway in the second QRS (narrow, see black arrow) followed by an echo conducted retrogradely through the AP (Fig. 2).

Frequently the addition of a second atrial extrastimulus differentiates antegrade conduction via a slow pathway and a His extrasystole. However in the presence of preexcitation the extrastimulus would capture the ventricle via the accessory pathway and obscure the His deflection rendering this manoeuvre less helpful. In the presented case, atrial pacing at 600/280/350 ms resulted in preexcited conduction in both QRS, suggesting a short antegrade refractory period (ARP) of the AP. The ARP of the AP was found at 600/230 ms and 1:1 conduction was found at 240 ms. At first glance this maneuver would appear to be unhelpful in establishing the differential diagnosis (Fig. 3). However on close examination of the surface ECG one can appreciate that despite an increase in the A-A interval the degree of pre-excitation increased (see arrow). This strongly suggests the antegrade AV node is engaged with slow pathway conduction reducing the fusion anticipated with a longer A-A interval.

A successful ablation of the AP was performed using a transeptal approach, and mapping during maximum preexcitation in the antero-lateral aspect of the mitral ring.

Following ablation of accessory pathway, antegrade AV node conduction curve was showed evidence of AV nodal duality with fast pathway ERP, and slow pathway ERP of 600/320 and 600/270 ms respectively. No further arrhythmia was induced. The reproducibility of the

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double response, the increase in pre-excitation despite an increase in the A-A interval during atrial pacing, and the evidence of dual AV node physiology suggested that the most likely explanation for this phenomenon was a “two-for-one” atrio-ventricular conduction (1, 2) using the

AP for the first beat and the slow pathway for the second one.

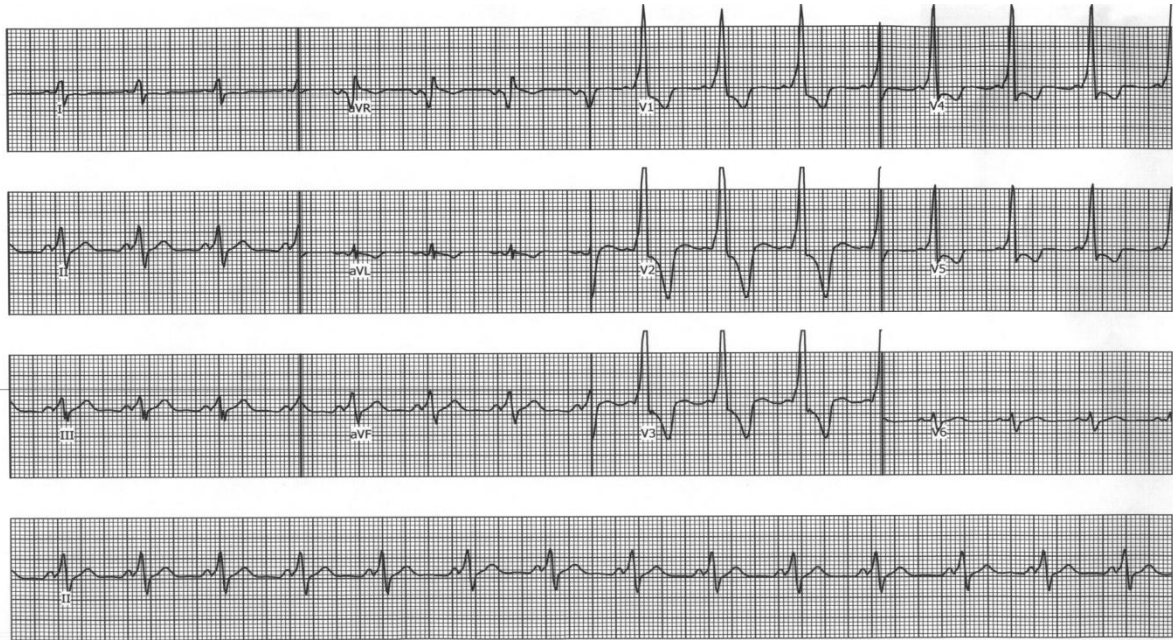


Figure 1: 12-lead electrocardiogram showing preexcited sinus rhythm.

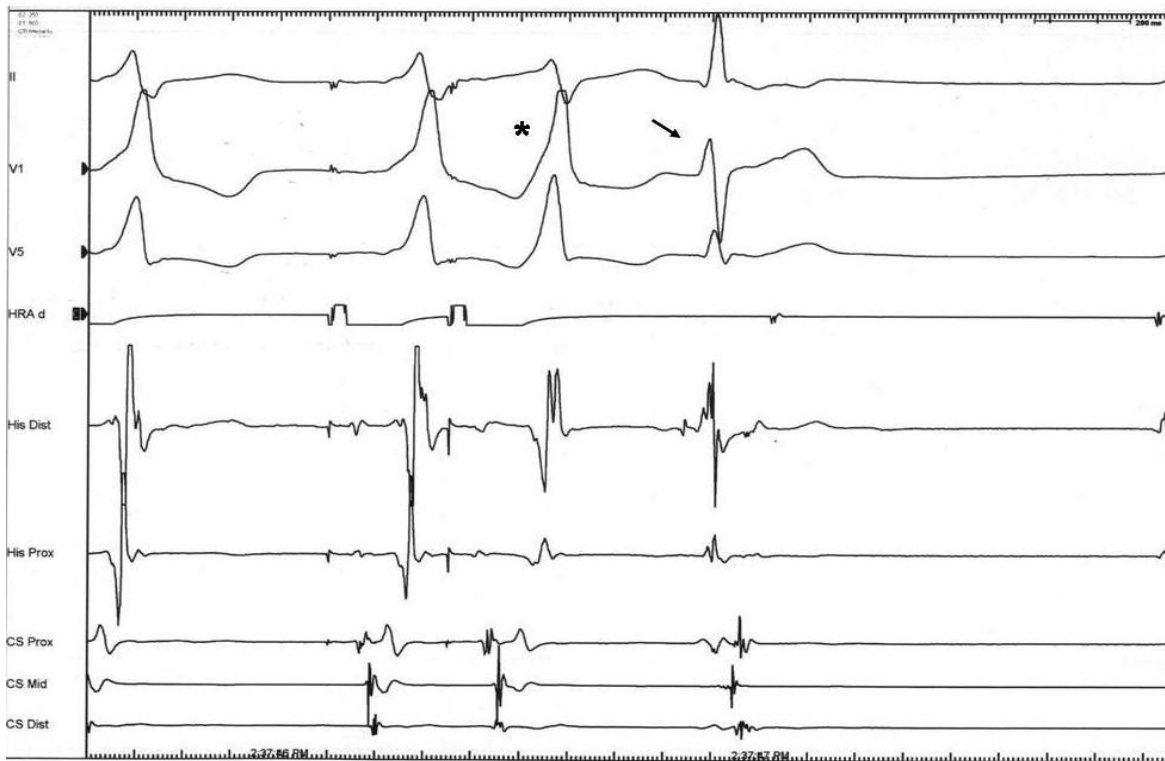


Figure 2: High right atrium (HRA) pacing with coupling interval 600/280 ms. It depicts from top to bottom: leads II, V1 and V6, HRA intracardiac electrograms, distal His bundle (His Dist), proximal His bundle (His Prox), coronary sinus proximal (CS Prox), medial (CS Mid) and distal (CS Dist).

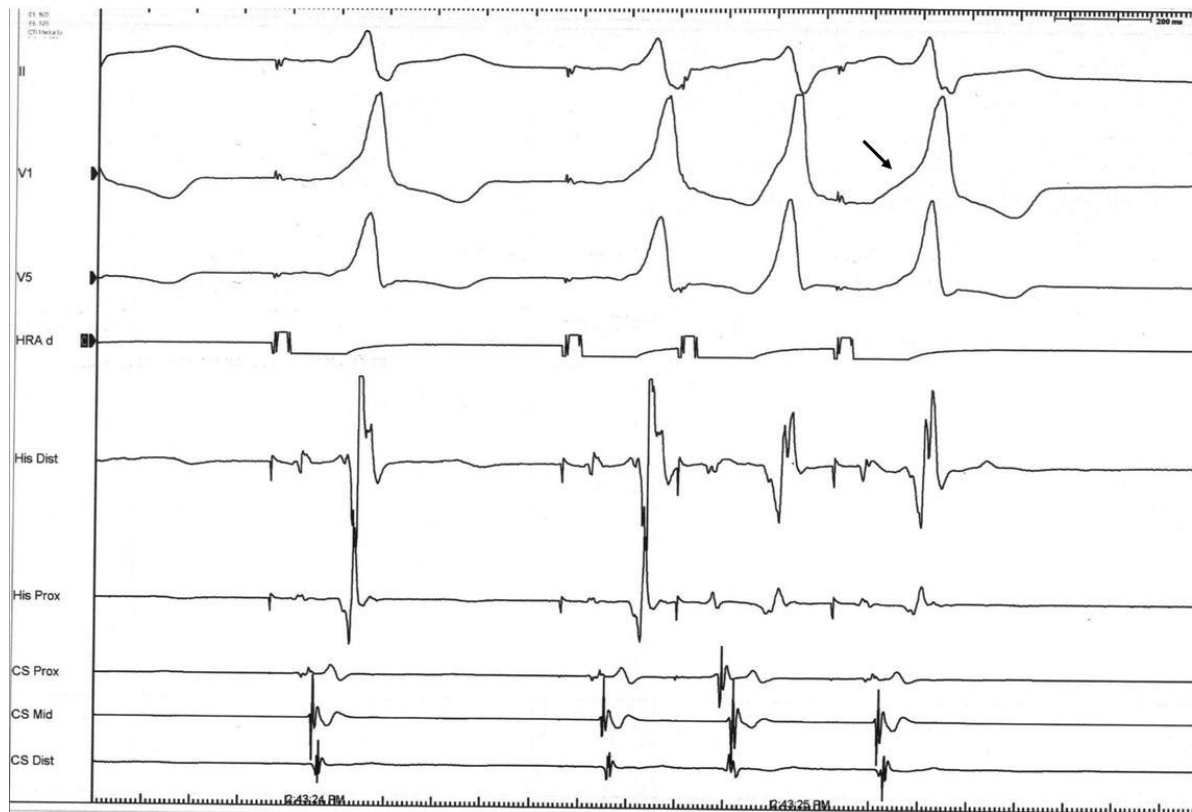


Figure 3: High right atrium (HRA) pacing with coupling interval 600/280/350 ms. Arrow highlights increase in pre-excitation despite an increase in atrial pacing intervals. See text for details.

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