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Interesting response to ventricular overdrive pacing during regular narrow QRS tachycardia. What is the mechanism?



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ABSTRACT

33 year old gentleman has undergone an electrophysiology study for recurrent paroxysmal palpitation. During one of the episodes of palpitation a regular narrow QRS tachycardia was documented which has terminated with intravenous adenosine. Baseline electrocardiogram did not show any pre-excitation. Atrial-His (AH) and His-Ventricular (HV) intervals were normal at baseline. There was no evidence of dual atrioventricular (AV) nodal physiology. Earliest atrial electrogram during ventricular pacing was recorded at coronary sinus (CS) 9,10 dipoles placed at CS OS region. Narrow QRS tachycardia with cycle length (TCL) of 400 ms and earliest retrograde atrial activation at CS 9,10 dipoles was induced with programmed ventricular stimulation. Ventricular overdrive (VOD) pacing was performed at 30 ms shorter than TCL during the tachycardia (Fig: 1). What is the mechanism of tachycardia?

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1. Commentary

The differentials of the narrow QRS tachycardia are 1) atypical AV nodal reentrant tachycardia, 2) orthodromic AV reentrant tachycardia involving right sided concealed bypass tract and 3) atrial tachycardia. Fig. 1 shows beginning of VOD. In the beat prior to the beat where the His bundle electrogram (EGM) is accelerated to the pacing rate (5th beat) does not show a His deflection. It is presumed that this His deflection is buried within the pacing stimulus and hence not seen. However, the His EGM is not seen even in the beat preceding (4th beat in the tracing). This may be due to catheter motion during pacing. Since the His bundle EGM is not seen, one cannot conclude on H–H interval changes for these beats. But the 4th and 5th beats appear to be fused beats (intermediate in morphology between tachycardia and paced beats). This would imply antegrade His bundle activation for these beats. Apart from that measuring the A–A and H–H intervals shows that atrial entrainment has preceded the His entrainment, i.e., A–A interval has accelerated to the ventricular paced cycle length prior to the acceleration of H–H interval without any change in the polarity of

H signal suggesting antegrade His activation or orthodromic His capture. An orthodromically captured His potential can be considered as evidence of fusion, indicating that orthodromic AV reentry is present, even if the QRS complex morphology during pacing is that of a paced beat.

Matushita et al. has shown the relationship between the first entrained A–A cycle and the immediate preceding H–H cycle. In the presence of an accessory pathway, atrial activation occurs rapidly through the pathway and the His bundle is activated in an anterograde fashion. In this situation, atrial entrainment occurs before the H–H interval becomes equal to the pacing cycle length. In the study by Matsushita et al., this finding was seen in every patient with AV reentry suggesting a high specificity for this finding [1].

During entrainment of AV reentrant tachycardia, when collision between the orthodromic and antidromic wave fronts occurs below the His bundle recording site, and the His bundle is activated in an anterograde fashion, orthodromic capture is said to have occurred. The observation that fusion can occur, with antegrade activation of the His (therefore making the His bundle refractory) in close timing to the paced ventricular beat as well as the fact that at times, the ventricular paced beat occurs at the time of His bundle refractoriness (similar to a His-refractory PVC) and therefore advances the subsequent atrial activation in presence of an accessory pathway

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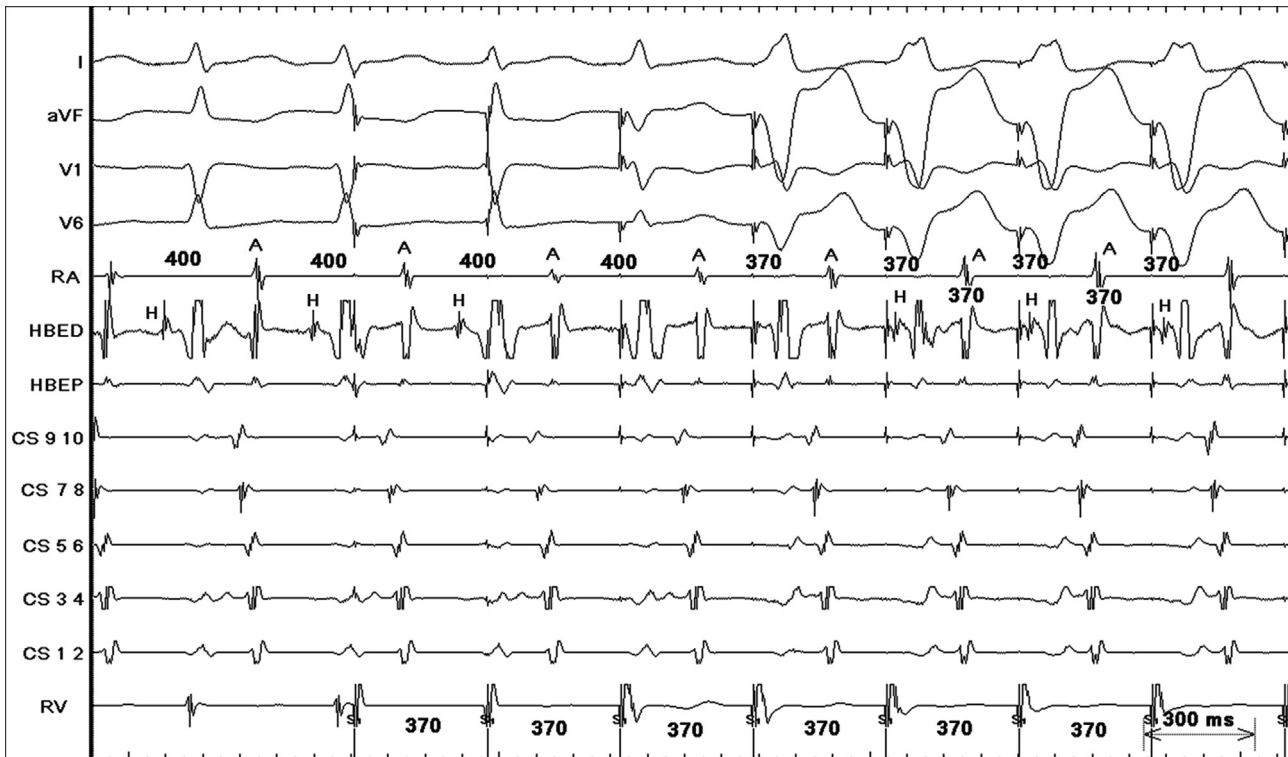


Fig. 1. Selected surface electrocardiogram (I,aVF,V1,V6) and selected intracardiac electrograms - right atrial appendage (RA), His bundle distal (HBED), His bundle proximal (HBEP), right ventricular base (RV), coronary sinus at OS region (CS) 9,10 to CS 1,2 at distal region showing the tachycardia and beginning of VOD.

has been reported by Rosman et al. [2] and AlMahameed [3] et al. in their respective series.

Our patient had an orthodromic AV reentrant tachycardia as suggested by a orthodromic His capture during VOD representing fusion, and short corrected Post Pacing Interval - Tachycardia Cycle Length difference and SA - VA difference. His synchronous premature ventricular complex preexcited the atrial electrogram further confirming the diagnosis of AV reentry. The pathway was mapped to 8 O' clock of the tricuspid annulus and successfully ablated.

In patients with supra ventricular tachycardia, if the tachycardia repeatedly terminates during attempted VOD, it may be difficult to arrive at a diagnosis. In this situation, entrainment with orthodromic His capture is diagnostic of AV reentry.

Orthodromic His capture during VOD even though described, is rarely demonstrated.

Declaration of competing interest

The authors have no competing interests, funding or financial relationships to disclose.

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