ARRHYTHMIA OF THE MONTH

Section Editor: Fred Morady, M.D.

A Regular, Wide-QRS Complex Tachycardia: What is the Tachycardia Mechanism?

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Case Presentation

A 45-year-old woman underwent an electrophysiology procedure because of a 20-year history of recurrent episodes of paroxysmal tachycardia. The baseline sinus cycle length, atrial-His, and His-ventricular intervals were 700, 60, and 45 msec, respectively, and the QRS duration was 80 msec. Ventricular pacing at a cycle length of 300 msec induced a tachycardia that had a cycle length of 320 msec and a QRS duration of 120 msec, with a right bundle branch block configuration (Fig. 1). The tachycardia was terminated by ventricular pacing at cycle lengths shorter than 290 msec. Atrial pacing at a cycle length of 320 msec was performed in the setting of sinus rhythm (Fig. 2).

What is the mechanism of this tachycardia?

Commentary

The His-ventricular interval during this tachycardia is 45 msec, which is the same as during sinus rhythm. This, along with the fact that atrial pacing results in the same right bundle branch block QRS configuration as during the tachycardia, rules out the possibility of ventricular tachy-

Figure 1. *A wide-QRS complex tachycardia that has a cycle length of 320 msec. Shown are leads I, II, and III, the high right atrial electrogram (HRA), His-bundle electrogram (HBE), and a right ventricular electrogram (RV).*

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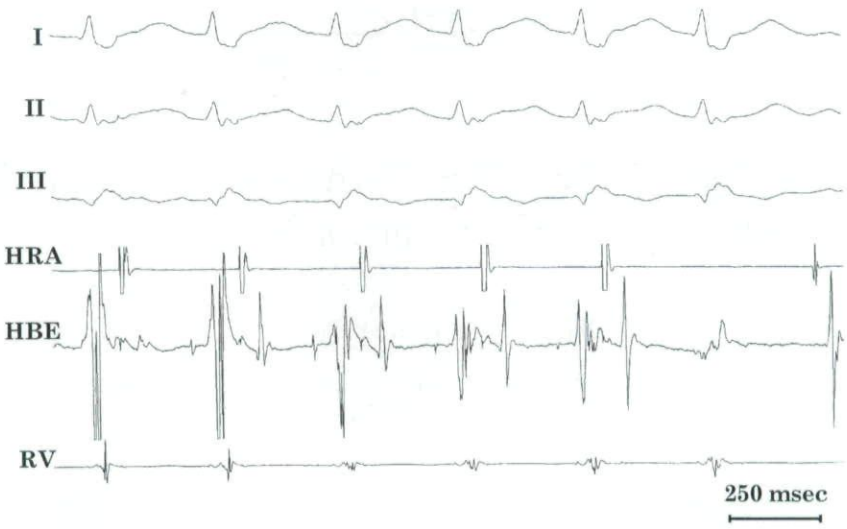

Figure 2. *Atrial pacing at a cycle length of 320 msec, in the setting of sinus rhythm. Abbreviations same as in Figure 1.*

cardia and indicates that this is a supraventricular tachycardia with a rate-related bundle branch block.

The RP interval in this tachycardia is longer than the PR interval, and the three most common causes of this type of paroxysmal supraventricular tachycardia are atypical atrioventricular (AV) nodal reentrant tachycardia, orthodromic reciprocating tachycardia, and atrial tachycardia. The intracardiac electrograms in Figure 1 do not provide any information helpful in distinguishing these possibilities. However, the response to atrial pacing at the same cycle length as the tachycardia (Fig. 2) does provide useful information. The atrial-His interval during the tachycardia is 70 msec, compared to 150 msec during atrial pacing. This large discrepancy in atrial-His intervals between tachycardia and atrial pacing at the same cycle length is characteristic of atypical AV nodal reentrant tachycardia.[1] In orthodromic reciprocating tachycardia or atrial tachycardia, there may be a difference in atrial-His intervals between tachycardia and atrial pacing (attributable to penetration of the AV node from different directions), but this difference is rarely greater than 10 to 20 msec. An 80-msec discrepancy in atrial-His intervals, as found in the present case, is specific for atypical AV nodal reentrant tachycardia. The difference in atrial-His intervals is attributable to conduction through the fast AV nodal pathway during atrial pacing and through the slow AV nodal pathway during tachycardia.

It may be argued that this type of discrepancy in atrial-His intervals is diagnostic of dual AV nodal pathways, but not atypical AV nodal reentrant tachycardia. However, in actual practice, when atrial tachycardia or orthodromic reciprocating tachycardia occurs in a patient with dual AV nodal pathways, the same pathway (either fast or slow) is utilized for conduction to the ventricle both during tachycardia and during atrial pacing at the same cycle length as the tachycardia.

It should be noted that there is one other type of tachycardia consistent with the findings in Figures 1 and 2, namely an automatic junctional tachycardia. During an automatic junctional tachycardia, 1:1 retrograde conduction through the AV node to the atrium could result in an apparent atrial-His interval that is shorter than the actual atrial-His interval present during atrial pacing. An automatic junctional tachycardia can be differentiated from AV nodal reentrant tachycardia by the response to atrial and ventricular pacing; AV nodal reentrant tachycardia is entrainable, whereas automatic junctional tachycardia is not.

Consistent with atypical AV nodal reentrant tachycardia, the tachycardia was successfully eliminated (along with retrograde conduction through the AV node), by radiofrequency ablation of the slow pathway.

Reference

1. Man KC, Niebauer M, Daoud E, et al: Comparison of atrial-His intervals during tachycardia and atrial pacing in patients with long RP tachycardia. J Cardiovasc Electrophysiol 1995;6:700-710.