

## A Preexcited Tachycardia: What is the Tachycardia Mechanism?

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### Case Presentation

A 35-year-old woman underwent an electrophysiology procedure because of recurrent episodes of paroxysmal tachycardia. During sinus rhythm there was ventricular preexcitation, with a sinus cycle length of 800 msec, atrial-His interval of 70 msec, His-ventricular interval of 0, and QRS duration of 110 msec. Atrial pacing induced a preexcited tachycardia that had a cycle length of 330 msec (Fig. 1). The intracardiac electrograms recorded during the tachycardia are shown in Figure 2, as is the response to atrial pacing at a cycle length of 330 msec in the setting of sinus rhythm.

What is the tachycardia mechanism?

### Commentary

The possible mechanisms of a regular, preexcited tachycardia, such as the one shown in Figure 1, consist of antidromic reciprocating tachycardia, atrial flutter, atrial tachycardia, and atrioventricular nodal reentrant tachycardia in which the ventricle is activated through an accessory pathway that is an "innocent bystander." The 12-lead electrocardiogram is consistent with any of these possibilities, but the additional information provided in Figure 2 is helpful to establish the mechanism. Inspection of the high-right atrial and His-bundle electrograms reveals

that the atrial depolarizations are coincident with the QRS complexes. In antidromic reciprocating tachycardia, the atria and ventricles are depolarized sequentially, and therefore the simultaneous activation of the atrium and ventricle seen in Figure 2 rules out this possibility. Because the atrial cycle length is 330 msec, atrial flutter also is ruled out.

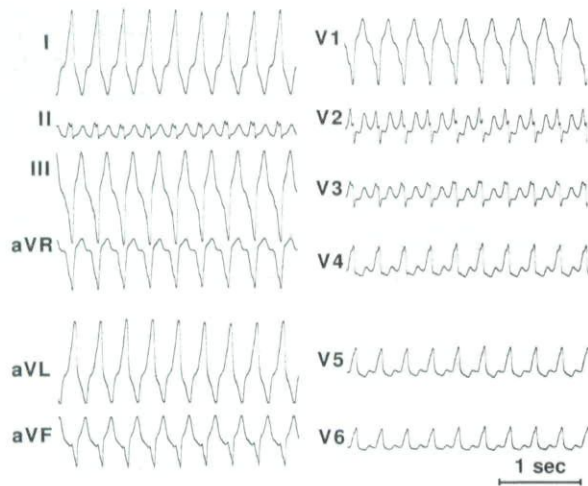
The two remaining possible mechanisms are atrial tachycardia and atrioventricular nodal reentrant tachycardia. The response to atrial pacing at the same cycle length as the tachycardia is consistent with either of these two mechanisms. During atrial pacing, there is maximal preexcitation and the atrioventricular interval is approximately 120 msec. In contrast, the interval between the right atrial electrogram and the QRS complex during tachycardia is zero. This can be explained by sequential activation of the right atrium and right ventricle during atrial pacing, compared to simultaneous activation of these two chambers during atrioventricular nodal reentrant tachycardia. The discrepancy in atrioventricular intervals can also be explained by an atrial tachycardia that does not arise in the high-right atrium; simultaneous conduction from the site of origin of an atrial tachycardia to the high-right atrium and through the accessory pathway to the right ventricle could also result in an apparent atrioventricular interval of zero.

Additional maneuvers are necessary to distinguish atrioventricular nodal reentrant tachycardia from atrial tachycardia. In this case, mapping within the coronary sinus demonstrated that there was a concentric pattern of atrial activation, and ventricular pacing terminated the tachycardia without advancing the atrial electrograms, indi-

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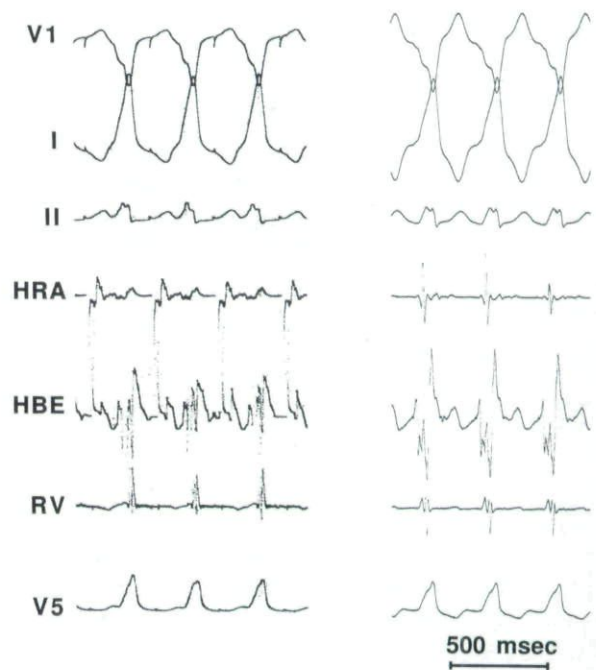


**Figure 1.** Tachycardia, cycle length 330 msec, induced by atrial pacing. Intracardiac electrograms demonstrated that there was ventricular preexcitation during this tachycardia. The pattern of preexcitation is consistent with a posteroseptal accessory pathway, and this was confirmed by mapping.

cating that this was an atrioventricular nodal reentrant tachycardia.

Consistent with the pattern of preexcitation in Figure 1, the patient also had a posteroseptal accessory pathway, and ventricular activation during the atrioventricular nodal reentrant tachycardia occurred over the accessory pathway. The site of earliest ventricular activation during preexcitation was found to be in the posterior septum of the right atrium, near the coronary sinus, at a site at which slow pathway ablation is typically performed. An application of radiofrequency energy at this site abolished accessory pathway as well as slow pathway conduction, and the tachycardia was no longer inducible.

In general, an impulse originating in the atrio-



**Figure 2.** Atrial pacing at a cycle length of 330 msec in the setting of sinus rhythm is shown on the left, and the pre-excited tachycardia, cycle length 330 msec, is shown on the right. HBE = His-bundle electrogram; HRA = high-right atrial electrogram; RV = right ventricular electrogram.

ventricular junction is more likely to activate the ventricles through the His-Purkinje system than through an extranodal accessory pathway. In this patient, presumably because the atrial insertion of the accessory pathway was very close to that of the slow pathway, the atrioventricular nodal reentrant wavefront penetrated the accessory pathway and slow pathway simultaneously reaching the ventricles first through the more rapidly conducting accessory pathway.

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