

1:1 AV Tachycardia: What is the Mechanism?

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Case Summary

A 53-year-old man with nonischemic cardiomyopathy, left bundle branch block QRS morphology, and congestive heart failure underwent biventricular implantable cardioverter defibrillator (ICD) (Model V365; St. Jude Medical Corporation, Sunnyvale, CA, USA) placement for primary prevention of sudden cardiac death. The device was programmed with two zones: ventricular fibrillation (VF) zone at 210 bpm (285 ms) and ventricular tachycardia (VT) zone at 170 bpm (352 ms). Detection enhancement was programmed on to diagnose VT if any of the discriminators (“Rate Branch,” “Morphology,” and “Sudden Onset”) indicated VT. ICD interrogation during the routine follow-up visit revealed an episode of tachycardia with 1:1 atrioventricular (AV) relationship (Fig. 1). The tachycardia cycle length was initially slightly longer than the VT detection limit and gradually became shorter than VT detection limit. “Rate Branch” and “Sudden Onset” discriminators indicated supraventricular tachycardia (SVT). However, none of eight tachycardia beats matched the template as indicated by the “X” markers. Therefore, VT was detected and successfully terminated by antitachycardia pacing (ATP) therapy. What is the mechanism of the tachycardia?

Commentary

The possible mechanisms of tachycardia with 1:1 AV relationship are VT with retrograde AV nodal conduction or SVT. During ATP therapy,

the ventricle is paced at a much shorter cycle length without significant changes in the atrial cycle length until the last beat before the tachycardia terminates. Because the atrial rate does not change during ATP, it rules in SVT. Isorhythmic VT and SVT are unlikely because there is a strong ventriculoatrial relationship despite tachycardia cycle length variability. VT in this patient is diagnosed by the device from morphology mismatch, which could be due to aberrant conduction or algorithm error. The possible mechanisms of the SVT include: sinus tachycardia, AV reentry tachycardia, AV nodal reentry tachycardia, and atrial tachycardia. AV reentry tachycardia is ruled out because of the presence of AV dissociation during ATP before the tachycardia terminates. There is significant tachycardia cycle length variation seen at the beginning of the tracing (4th, 5th, and 6th beats). Because atrial cycle length is predicted by the preceding ventricular cycle length, sinus tachycardia and atrial tachycardia are excluded.¹ Therefore, the mechanism of this tachycardia is AV nodal reentry tachycardia.

Inappropriate ICD therapy is the most common ICD complication. The additional atrial information provided by dual-chamber devices can reduce the incidence of inappropriate therapy due to atrial fibrillation or atrial tachyarrhythmia when the atrial rate is faster than ventricular rate. However, it is more difficult to discriminate SVT from VT when the tachycardia exhibits a 1:1 AV relationship. Despite supplemental information from atrial leads and sophisticated algorithms, the ICD can still fail to recognize SVT and inappropriately deliver therapies. Through careful review of the atrial and ventricular relationship during the tachycardia, cycle length variation and ATP therapy can help to distinguish the tachycardia mechanism, as demonstrated in this case. Since the patient had only one episode of AV nodal reentry tachycardia, we decided to treat conservatively and recommended catheter ablation procedure only in the case of recurrence.

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1:1 AV TACHYCARDIA

<p>Initial Diagnosis: VT Time to Diagnosis: 5.25 sec CL 345 ms/173 bpm</p>		<p>Alerts: 1 SVT discriminators disagree</p>	
<p>VT Diagnosis Criteria: Any Rate Branch: Sinus Tach (V = A) Rate Branch Classification: Sinus Tach (V = A) Rate Branch Morphology: Programmed: On, ≥ 60% is a match, ≥ 5 of 8 matches indicate SVT Template Updated: Mar 15, 2007 3:35 PM</p>		<p>Therapy: ATP Results: Below Rate Detection (CL 870 ms)</p>	
<p>Measured: Min Match Score: N/A Max Non-Match Score: 13% No. Template Matches: 0 of 8 (VT Indicated)</p>		<p>ATP Therapy Details: VT Successful BCL: 292 ms Burst 1: 292, 292, 292, 292, 292, 292, 292, 292 ms</p>	
<p>Sudden Onset: Programmed: On, <100 ms indicates SVT Measured Max Delta: 10 ms (SVT Indicated)</p>			

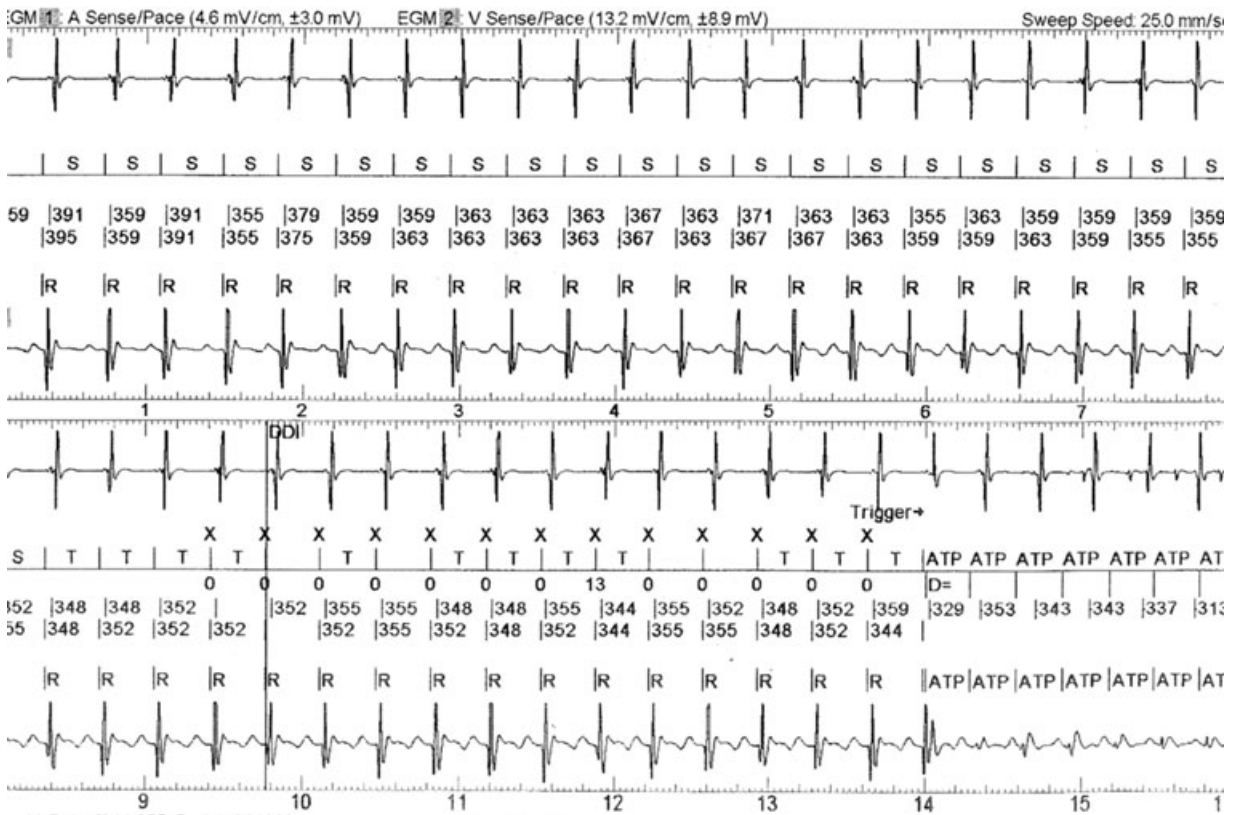


Figure 1. Episode details (top) and stored intracardiac electrograms (bottom).

Reference

1. Crawford TC, Mukerji S, Good E, Chugh A, Bogun F, Pelosi F Jr., Oral H, et al. Utility of atrial and ventricular cycle length variability in determining the mechanism of paroxysmal supraventricular tachycardia. J Cardiovasc Electrophysiol 2007; 18:698-703.