EP CASE REPORT

Failure of an Implantable Defibrillator to detect transition from sinus tachycardia to slow ventricular tachycardia with 'Onset' discrimination algorithm activated

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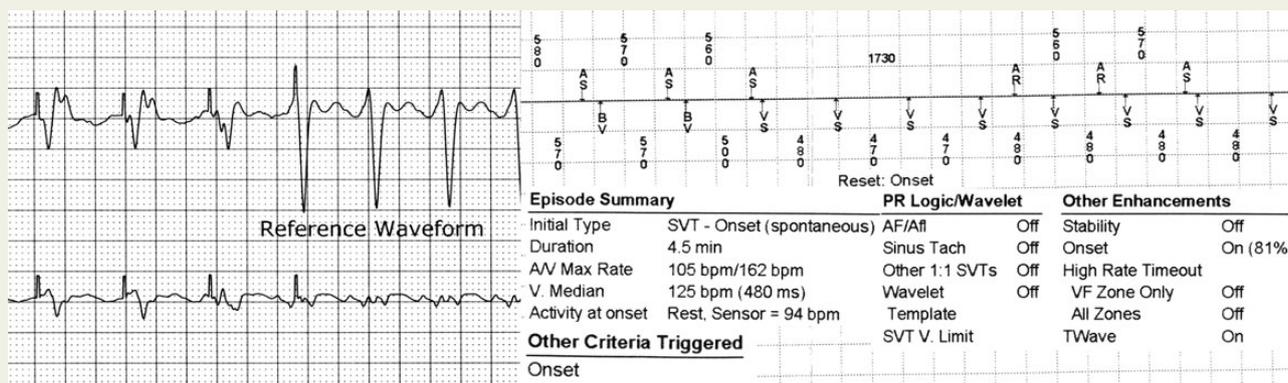
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A patient with advanced congestive heart failure had sustained ventricular tachycardia (VT) for which no defibrillator therapy was delivered. A high sinus rate coupled with slow VT rate led to misclassification of the rhythm, owing to a sinus tachycardia discrimination algorithm. Sudden onset discrimination criteria should be programmed with care in this clinical context.

A 74-year-old male with severe, inotrope-dependent congestive heart failure (CHF) and previous episodes of slow ventricular tachycardia (VT) was evaluated for ongoing VT which persisted despite several attempts at ablation. The patient had a dual-chamber, biventricular Medtronic defibrillator programmed with a VT-1 zone of 500 ms and with 'Onset' as the only active discriminator. He had a history of complete heart block, and thus, the 'PR Logic' algorithm was not programmed. On telemetry monitoring, he was noted to have a sustained, wide complex tachycardia (*Panel A*). Although the tachycardia cycle length (CL) of 480 ms was faster than the VT-1 cutoff of 500 ms, no therapy was given. Stored electrograms from the event showed a sudden onset tachycardia with a CL of 490 ms with AV dissociation (*Panel B*). Thus, this rhythm was indeed VT. The patient's sinus CL was 580 ms, related to the use of dobutamine for inotropic support. The change in CL from sinus tachycardia compared with slow VT was 84.5% ([490/580] × 100). As this value exceeded the programmed cutoff of 81%, the rhythm was not classified as VT, and no therapy was delivered. Following inactivation of the onset discriminator, additional episodes of slow VT were appropriately treated. The patient ultimately underwent left ventricular-assist device implantation.

This case illustrates an important limitation of the 'onset' discriminator criterion. This algorithm requires a programmable decrease in CL over four consecutive beats to detect VT. Supraventricular tachycardia algorithms, such as 'PR Logic', are activated only after a rhythm is determined to not be sinus tachycardia by an activated onset discriminator. When programmed on, the default value is 81% and programmable range is from 72 to 97% in increments of 3%. The algorithm has been demonstrated to be most useful in distinguishing between sinus tachycardia and VT.[1] In patients with high resting heart rates, as would commonly be encountered in the advanced heart failure population with low cardiac output or ongoing inotropic support, the difference between a slow VT rate and the sinus rate may be too small to fall below the nominal value of 81%. The use of antiarrhythmic drugs may also contribute to slower VTs. Clinicians should be aware of the limitations of the onset algorithm when used in the advanced heart failure population, particularly those with fast resting heart rates and/or clinical need for lower VT rate cut-offs.

Episode Summary		PR Logic/Wavelet		Other Enhancements	
Initial Type	SVT - Onset (spontaneous)	AF/Afl	Off	Stability	Off
Duration	4.5 min	Sinus Tach	Off	Onset	On (81%)
A/V Max Rate	105 bpm/162 bpm	Other 1:1 SVTs	Off	High Rate Timeout	
V. Median	125 bpm (480 ms)	Wavelet	Off	VF Zone Only	Off
Activity at onset	Rest, Sensor = 94 bpm	Template		All Zones	Off
Other Criteria Triggered		SVT V. Limit		TWave	On
Onset					

Reference

1. Swerdlow CD, Chen PS, Kass RM, Allard JR, Peter CT. Discrimination of ventricular tachycardia from sinus tachycardia and atrial fibrillation in a tiered-therapy cardioverter-defibrillator. *J Am Coll Cardiol* 1994;**23**:1342−55.