

Device Rounds

Tachycardia in a pacemaker dependent patient: What went wrong?

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Case Summary

A 67-year-old man presented to our emergency department complaining of palpitations, chest tightness, and shortness of breath. He had a history of AV block, for which an Adapta ADDR01 dual chamber pacemaker (Medtronic, Inc., Minneapolis, MN) was placed six years ago. Four weeks prior to presentation, he had undergone pulmonary vein isolation for the management of symptomatic paroxysmal atrial fibrillation. At the time, his pacemaker was programmed to DDDR mode, with a 60 bpm lower rate limit, 130 bpm upper tracking rate, mode switch ON, 180 and 150 ms paced and sensed AV intervals, 0.5 and 2.8 mV atrial and ventricular sensitivities, and atrial and ventricular pacing amplitude/pulse width of 2.0 V/0.4 ms and 2.0 V/0.4 ms, respectively. Pre-ablation, he was programmed to VVI mode, with a 60 bpm lower rate limit, 2.8 mV ventricular sensitivity, and ventricular pacing amplitude/pulse width of 2.0 V/0.4 ms. Post-ablation, the pacemaker was reprogrammed to DDDR mode. An electrocardiogram taken in the ER showed sustained V pacing at 130 bpm (Figure 1). Why is the patient pacing at the maximum programmed rate?

Discussion:

The differential diagnosis of sustained rapid paced ventricular rates on resting electrocardiogram includes pacemaker mediated tachycardia and tracking of rapid atrial rates. Other less common causes are overdrive pacing to terminate tachyarrhythmias, “runaway” pacemaker due to a malfunctioning pulse generator, and tracking of oversensed signals in the atrial channel.¹

Interrogation of the pulse generator revealed an atrial tachyarrhythmia with tracking of the atrial signal and pacing at maximum rate of 130 bpm (Figure 2). This confirmed the diagnosis of recurrence of atrial fibrillation with fast ventricular pacing.

A sensed rapid atrial rate is the most common cause of a fast, paced ventricular rate. When the atrial rate is accelerated, as occurs with atrial arrhythmias, the sensed atrial depolarizations result in ventricular pacing at rates up to the programmed upper pacing rate limit. To avoid this, Adapta pacemakers have Mode Switch, a programmable On or Off feature designed to prevent the tracking of paroxysmal atrial tachycardias when the pacemaker is operating in the DDDR, DDD, and VDD modes. Mode Switch has a programmable Detect Rate that specifies when to switch modes and a Detect Duration setting to screen out short tachycardia episodes. When the pacemaker detects an atrial tachyarrhythmia, it switches from the programmed atrial tracking mode to a non-atrial tracking mode (DDIR, VDIR) and remains in this mode until the atrial tachyarrhythmia ceases. On Adapta pacemakers, Mode Switch is set nominally to ON.^{2,3}

The patient’s programming revealed the following parameters: DDDR mode, with a 60 bpm lower rate limit, 130 bpm upper tracking rate, Mode Switch OFF, 180 and 150 ms paced and sensed AV intervals, 0.5 and 2.8 mV atrial and ventricular sensitivities, and atrial and ventricular

pacing amplitude/pulse width of 2.0 V/0.4 ms and 2.0 V/0.4 ms. Thus, rapid ventricular pacing was due to failure to mode switch given the current programming. But, why was Mode Switch programmed to OFF?

Reviewing the patient's history, he had undergone a Pulmonary Vein Isolation four weeks prior to his presentation. At the time, he was programmed from DDDR to VVI and back to DDDR. On arrival, all programmed parameters were unchanged except for Mode Switch, however, the Mode Switch had not been intentionally deactivated. Hence, the only explanation was that Mode Switch was somehow deactivated automatically. Reprogramming of the pulse generator during initial evaluation revealed the reason why Mode Switch was programmed to OFF. On Adapta ADDR01 pacemakers, when programming from DDD, DDDR, or VDD to VVI and back to the original mode, Mode Switch is automatically switched to be programmed to OFF regardless of the original programming. In our patient, this led to rapid ventricular pacing and heart failure symptoms. The patient was reprogrammed to Mode Switch ON and symptoms improved.

In summary, this is the first report of Mode Switch deactivation when reprogramming Adapta pacemakers from an atrial tracking mode to VVI and then back to its original programming. In patients with atrial dysrhythmias, the resulting programming could lead to fast ventricular pacing at maximum programmed rate with possible serious clinical consequences. This is of particular clinical importance, especially given the frequency with which surgical procedures with temporary pacemaker reprogramming are performed.

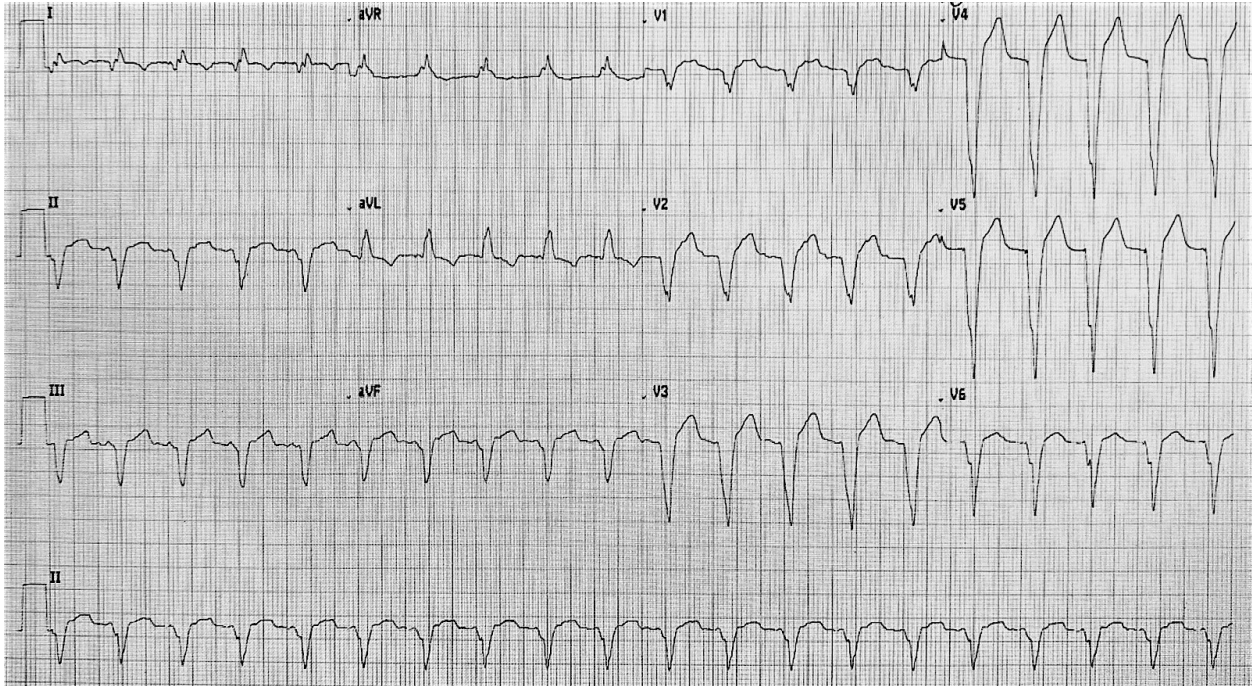


Figure 1. ECG showing sustained ventricular pacing at the maximum programmed rate of 130 bpm.

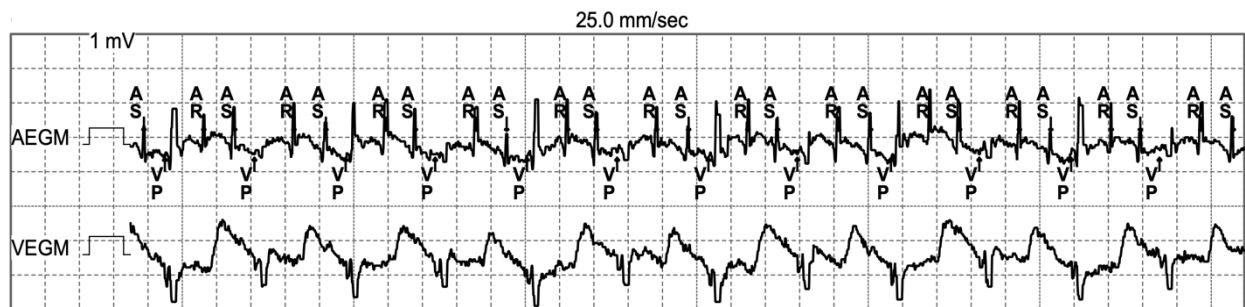


Figure 2. Interrogation of the pulse generator showing an atrial tachyarrhythmia with tracking of the atrial signal and pacing at maximum rate of 130 bpm.

Bibliography:

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