A Rare Type of Pacemaker Mediated Tachycardia

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ABSTRACT

We report a case of a 67 year-old man with a VDD pacemaker system and an inappropriate increase in his heart rate despite appropriate rate control therapy. The increase in heart rate was due to oversensing of atrial flutter waves by atrial sensing circuit. Direct current cardioversion was performed for rate control.

KEYWORDS
Atrial flutter, oversensing, pacemaker mediated tachycardia

Nadir Bir Kalp Pili Aracılı Taşikardi

ÖZET

VDD modlu kalıcı pili bulunan, uygun hız kontrolü tedavisine rağmen uygunsuz taşikardisi olan 67 yaşında bir erkek hastayı sunduk. Bu kalp hızı artışının nedeni atriyal algılama devresinin atriyal flutter dalgalarını aşırı algılamasıydı. Kalp hızı kontrolü için hastaya elektriksel kardiyoversiyon uygulandı.

ANAHTAR KELİMELER
Atriyal flutter, aşırı algılama, kalp pili aracılı taşikardi

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Pacemaker implantation is an effective treatment in the management of many cardiac arrhythmias and recently heart failure. One of the rare complications of these devices is pacemaker-mediated tachycardia. The most frequent causes of this complication are premature atrial depolarizations, loss of atrial capture, return to a demand mode after asynchronous magnet mode pacing, loss of atrial sensing, long AV delays, premature ventricular contractions (PVCs), and oversensing of noise (1). The common denominator of all these causes is a ventriculoatrial (VA) conduction with a retrograde P wave or noise occurring outside the postventricular atrial refractory period (PVARP), both resulting in ventricular tracking at the programmed upper rate. However, oversensing of atrial depolarizations like in atrial tachyarrhythmias is also rare. An example for a pacemaker-mediated tachycardia is due to tracking of atrial fibrillation, atrial fibrillatory waves, by the pacemaker (2). We describe here a case where a patient with a VDD pacemaker developed an inappropriate increase in heart rate due to oversensing of flutter waves.

Case Report

A 67-year-old man was admitted to our clinic with the complaint of palpitation for 6 months. A VDD pacemaker had been implanted to right ventricular apex (lead: Biotronik, solox slx6513, bipolar) via left subclavian route for complete AV block in 2005 (Biotronik, Axios SLR). He has been evaluated with telemetric control for palpitation for 2 times and it has been reported that pacing functions were normal with pulse voltage of 2.3 V, pulse width of 0.40 ms, lead impedance of 446 ohm, and maximum sensor rate of 120 paced per min. However, ventricular response was high due to high atrial rate (ventricular rate of 125 beats/min) (Figure 1). His beta-blocker therapy, metoprolol, had been increased from 100 mg to 150 mg for rate control. However, at the second control, ventricular rate had been still too high and dose of metoprolol had been increased to 200

![Figure 1](image-url)

An electrocardiogram showing a regular paced rhythm with a ventricular rate of 125 beats/min, consistent with pacemaker mediated tachycardia.
mg. Thereafter, the patient was admitted again with no response to therapy. Patient was hospitalized. Telemetric evaluation has showed atrial sensing and ventricular pacing with a ventricular rate of 125 beats/min. The mode of pacemaker was changed to VVI with a ventricular rate of 60 beats/min and it has been seen that baseline atrial rhythm was atrial flutter (Figure 2). Cardioversion was decided to perform for rate control. After performing transesophageal echocardiography, no thrombus was detected and under the therapy of anticoagulation direct current cardioversion was performed throughout anterior-posterior paddle position. Sinus rhythm was achieved and the mode of pacemaker was changed to previous mode of VDD with a ventricular rate of 65 beats/min (Figure 3). Oral anticoagulant treatment was initiated and the patient was discharged.

**Discussion**

Pacemakers are subject to interference from biologic and more commonly, nonbiologic sources such as electromagnetic interference. Rate responsive pacemakers might induce pacing at inappropriate faster rates up to the maximum tracking rates in response to electromagnetic interference (3). The hemodynamic advantages of maintaining AV synchrony through AV synchronous pacing are widely known as compared to single chamber pacing. DDD pacemaker implantation is technically more challenging in terms of the need to insert a second lead into the atrium for sensing and pacing the atria. This also increases the cost of the procedure and the total fluoroscopy time of the procedure. VDD pacing system displays their clinical performance via sensing atrial events and using these for triggered ventricular pacing in patients with AV block. All the features performed by pacemaker are achieved with a single lead system. In combination with dedicated VDD pulse generators that offer a higher atrial sensitivity than conventional DDD pacemakers, the atrial sensing safety margins typically are 4–6 times higher than

![Figure 2](image-url)

*After change of mode to VVI, baseline atrial rhythm of flutter with large flutter waves are seen*
the corresponding atrial sensing threshold. With such programming, intermittent atrial undersensing occurs in less than 1% of all atrial depolarizations rendering VDD pacemakers highly reliable in the long term (4). However, normal sinus node function is a prerequisite for the long term success of VDD pacing. A specific problem in VDD pacing is the high sensitivity of the atrial sensing circuit, which may cause myopotential or noise sensing leading to inappropriate pacemaker tachycardia (noise tracking). However, with bipolar atrial sensing, atrial oversensing has clinically become negligible. Herein, in this case, the patient has developed atrial flutter. Amplitudes of flutter waves have been adequate for sensing by atrial sensing circuit. Therefore, pacemaker has sensed the flutter waves as normal sinus P waves and increased the triggered ventricular pacing rate up to maximum sensor rate. Upgrading the pacemaker to dual chamber by adding an atrial lead might be a solution. Because most pacemaker pulse generators today have mode switching programs that would appropriate sense the atrial arrhythmia and automatically revert to DDI(R) or VVI(R). In addition, atrial pacing might also maintain sinus and prevent or decrease atrial arrhythmias. Finally, the EP programs built into modern pulse generators may allow pacing of atrial flutter back to sinus (or atrial paced) rhythms.

In conclusion, in patients with a VDD pacemaker system when a pacemaker induced tachycardia is detected, pacing mode should be switched to VVI mode. So, baseline atrial rhythm can be evaluated.

![Figure 3](image-url)

*Figure 3*

*After direct current cardioversion and re-change of mode to VDD, sinus rhythm with atrial sensing and ventricular pacing are seen with a ventricular rate of 65 beats/min.*
REFERENCES


