CASE REPORT

Efficacy of patient activated antitachycardia pacing therapy using the Medtronic AT500 pacemaker

Stefan Weber*, Andreas Jeron, Hans J. Schneider, and Frank Muders

Klinik und Poliklinik für Innere Medizin II, University of Regensburg, Franz-Josef-Strauss-Allee 11, 93042 Regensburg, Germany

Received 21 August 2005; accepted after revision 24 February 2006; online publish-ahead-of-print 2 May 2006

A 28-year-old female with corrected anomalous pulmonary venous drainage presented with multiple atrial arrhythmias many years later. Ablation techniques eliminated most of the arrhythmias except atrial tachycardia with 1:1 AV conduction. A dual-chamber pacemaker with antiatrial tachycardia features was implanted and was shown to be effective in arrhythmia control when the standard algorithm was overridden by an external patient activation device.

KEYWORDS
Atrial arrhythmias; Pacemaker; Electrophysiology; Cardiac surgery

Introduction

After surgical repair of a total anomalous pulmonary venous drainage, patients are often vulnerable to atrial arrhythmias. In long-term follow-up, this group of patients developed significant arrhythmias with an incidence of 30–50%, including supraventricular tachycardia such as atrial re-entry mechanism related to surgical scar areas, focal atrial tachycardia, and atrial fibrillation. Furthermore, bradyarrhythmia and sick sinus syndrome have been reported.1–3 Electrophysiological investigation and ablation procedures in such patients may be very difficult and time consuming and have a limited success rate. Therefore, the implantation of a pacemaker with the ability of atrial overdrive stimulation to terminate atrial arrhythmias in patients with drug refractory tachycardias is a potential treatment option.4

Case presentation

A 28-year-old female with a long history of paroxysmal atrial tachycardias after surgical repair of a total anomalous pulmonary venous drainage in infancy was referred to our electrophysiological laboratory for electro-anatomic mapping and radiofrequency ablation. The patient had several ECG-documented episodes of sustained atrial tachycardia causing cardiac decompensation. The patient had several ECG-documented episodes of sustained atrial tachycardia causing cardiac decompensation. Pharmacological treatment with classes I, II, and III antiarrhythmic drugs had failed to prevent atrial tachycardia recurrences or had to be discontinued because of drug-related side-effects (amiodarone). Using an electro-anatomic mapping system (CartoTM), more than four different re-entry circuits and additional focal activity could be identified. The frequency of atrial arrhythmias was significantly reduced but not completely abolished using radiofrequency as well as cryo-ablation tools. Owing to the fact that the tachycardia could easily be terminated using burst stimulation and documentation of a pathological sinus node recovery time in the absence of any antiarrhythmic medication, the implantation of a DDD-pacemaker (Medtronic AT500TM Minneapolis, MN, USA) with atrial antitachycardia pacing (ATP) therapies was recommended.

Three months later the patient was re-admitted to the hospital with the same atrial tachycardia lasting for 24 h (Figure 1A). The interrogation of the pacemaker showed that the tachycardia was properly detected by the system, but therapy delivery was inhibited because of 1:1 AV conduction and 1:1 AV conduction of the tachycardia. The tachycardia could be successfully terminated using the programmed overdrive stimulation manually enabled by the physician using the Medtronic programmer.

The patient was unwilling to take antiarrhythmic drugs again to avoid 1:1 AV conduction during atrial tachycardia, which prompted us to use a special software application that allows the delivery of atrial ATP therapy without regard to the AV conduction status (temporary patient activated therapy: Medtronic TPARxTM). The activation of this algorithm is either patient or clinician controllable using a patient activator (Medtronic InCheckTM AT Patient Assistant). The risk that pacing the atrium at high rates may be, in the worst case, pro-arrhythmic in the ventricles, if the ATP should be tracked with 1:1 conduction, was thoroughly discussed with the patient and informed written consent was given by the patient before implementing the new software application. Using the TPARx algorithm, the
detection criteria for atrial tachycardia remain active and therapy delivery depends on the fulfilment of physician programmed criteria (i.e. AT: 410–270 ms, A-Ramp: A-S1-interval: 91%; interval decrement: 10 ms; initial number of pulses: 10) except for the AV conduction status. During a follow-up of 9 months, the patient developed 11 atrial tachycardias recorded by the AT500 electrogram storage, 10 of which were terminated by single overdrive stimulation using the TP ARx in spite of sustained 1:1 AV conduction. One tachycardia was terminated without the necessity for TP ARx activation because of intermittent 2:1 AV conduction. Tachycardia termination was achieved with the first attempt at overdrive pacing in all episodes (Figure 1B). As a result of early and successful treatment of atrial tachycardias, the patient reported an improved quality of life. No further episodes of cardiac decompensation occurred and no pro-arrhythmic effect regarding acceleration of atrial tachycardia or induction of ventricular tachycardia by ATP was documented during follow-up. With the activation of the TPARx algorithm, there was no inappropriate therapy delivery during follow-up.

Discussion

The treatment of cardiac arrhythmias occurring after cardiac surgery is sometimes very time consuming and difficult. This case demonstrates a hybrid approach of electrophysiological ablation procedure and pacemaker therapy. The use of pacemaker systems with atrial tachycardia management has its drawbacks and limitations especially in younger patients with normal AV-conduction status. Before implantation, it should always be considered that atrial tachycardias with persistent 1:1 AV conduction may not be treated by the AT500 with the standard software application. Thus, the existence of atrial tachycardia with 1:1 AV conduction should be at least a relative contraindication to standard implantation. A therapeutic option for these atrial tachycardias can be the use of the TPARx software in combination with a patient activator. This case demonstrates successful use in a patient with atrial tachycardias and AV 1:1 conduction. During the follow-up, all tachycardias were treated successfully when the TPARx algorithm was activated by the patient and thus the AV conduction status was no longer considered by the detection algorithm for AT evaluation. There were no pro-arrhythmic effects in the ventricles caused by the atrial ATP; but it should be considered that this is a potential hazard by means of persistent 1:1 AV conduction if the atrial ATP is tracked by the ventricles.

The applicability of this treatment strategy depends on the possibility of tachycardia-termination by right atrial overdrive stimulation as well as the compliance of the

Figure 1 (A) Surface ECG showing a sustained atrial tachycardia with 1:1 AV conduction and leads I, II, III, V2, V5, and V6. (B) Corresponding intracardiac electrogram (Atip/Arring, atrial lead position: antero-lateral wall of the right atrium) showing the atrial tachycardia (cycle length: CL = 370 ms) and tachycardia termination by atrial overdrive stimulation (A-Ramp). The marker channel and the cycle length of RR-/PP-intervals are shown. (Marker channel annotations: TD, tachycardia detection; AS, atrial sense; AP, atrial pace; VS, ventricular sense; VP, ventricular pace).
patient. However, it should be kept in mind that the use of this treatment strategy must be determined individually for each patient.

References


