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When two hearts do not beat as one – An unusual cause of pacemaker related tachycardia

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ABSTRACT

We describe an unusual cause of intermittent rapid ventricular paced rhythm in a patient implanted with a dual chamber pacemaker due to sinus node dysfunction after heart transplantation. During implantation of the pacemaker lead measurements were reported normal, atrial sensing was not documented because of sinus arrest. After implantation the patient complained about intermittent palpitations. Via pacemaker interrogation we could demonstrate electrical isolation of the atrial lead, which was implanted in the donor's atrial myocardium. This led to intermittent pacemaker related tachycardia and AV-dissociation. This case report highlights the difficulty of atrial lead placement in heart transplanted patients using the biatrial surgical technique.

Introduction

Patients undergoing heart transplantation are susceptible to symptomatic sinus node dysfunctions with a reported risk of 2–24% depending on the surgical approaches [1,2]. Using the biatrial surgical approach the risk for sinus node dysfunction is slightly higher compared to the bicaval approach [3–5]. In the biatrial surgical technique, parts of the recipient's right and left atrium is retained for the implantation of the donor's heart. Thus, the implantation of a pacemaker can be challenging, since differentiation of the recipient's and donor's atrial myocardium during pacemaker implantation can be difficult. We report on a 55 year-old male with sinus node dysfunction following heart transplantation undergoing DDD pacemaker implantation presenting with an unusual cause of intermittent rapid ventricular paced rhythm.

Case report

A 55-year-old male patient presented himself in our outpatient clinic for interrogation of his dual chamber pacemaker due to intermittent palpitations. In the course of ischemic cardiomyopathy, the patient suffered from progressive heart failure and underwent orthotopic heart transplantation (biatrial surgical technique) one year ago. Postoperatively persistent sinus arrest was diagnosed and consecutively a dual chamber pacemaker was implanted. The intraoperative measurements of the atrial and ventricular leads were reported as normal; the sensed atrial electrical signal was 3.1 mV and pacing threshold was 0.7 V/0.4 ms.

During pacemaker interrogation, the patient reported intermittent palpitations but no symptoms of heart failure; especially no history of syncope or fatigue. The pacemaker was programmed in DDD mode 50–130 bpm, paced AV delay 150 ms, sensed AV delay 130 ms, post ventricular atrial refractory period 275 ms and post ventricular atrial blanking of 150 ms. Surface ECG (Fig. 1A) showed sinus rhythm with intrinsic AV conduction at 96 bpm. However, the last 5 beats showed ventricular stimulation without recognizable p waves before ventricular pacing indicating potential oversensing on the atrial lead. The atrial lead measurements revealed a sensed atrial electrical signal of 4.4 mV, a pacing threshold of 0.25 V/0.5 ms and normal impedances; paced atrial beats were not conducted to the ventricle showing AV dissociation (Fig. 2). In the intracardiac electrocardiogram (IEGM) (Fig. 1B), p waves visible in the surface ECG were not sensed. However, an alternative atrial rhythm was annotated as atrial sensing (AS) or sensing within the refractory period (AR) dissociated from the R waves. In chest X-ray (Fig. 3), we could observe the atrial lead placed in the posterior aspect of the right atrium, typically the part of the recipient's atrial myocardium, which is preserved during heart transplantation using the biatrial surgical approach.

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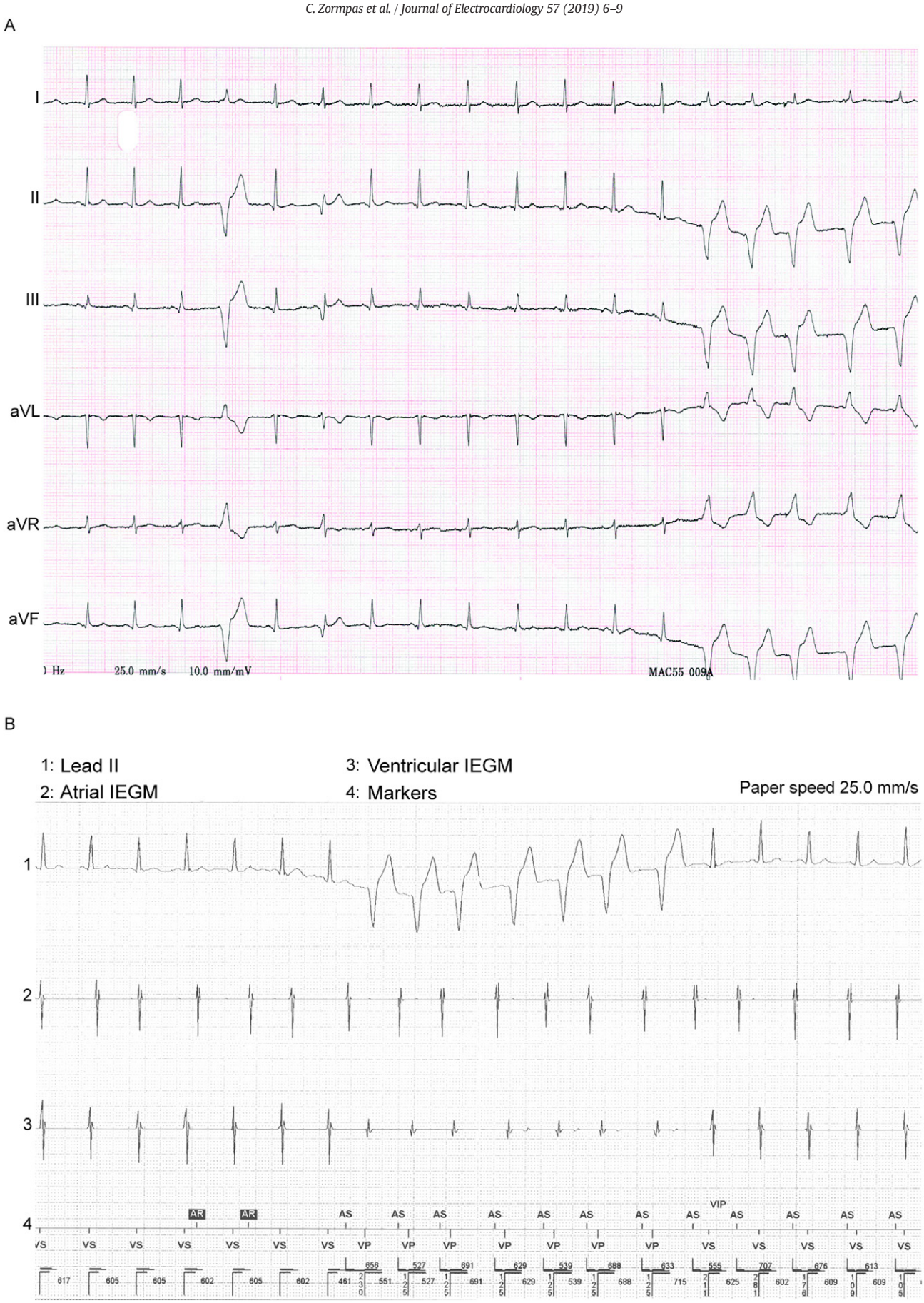

Fig. 1. A: Surface ECG demonstrating the initial rhythm observed during pacemaker interrogation; before the paced ventricular beats no p wave can be observed. B: Device tracing during interrogation; 1 represents lead II, 2 atrial intracardiac electrocardiogram (IEGM), 3 ventricular IEGM and 4 the markers. Atrial rhythm is dissociated from the ventricles. If atrial rhythm is sensed, ventricular stimulation is triggered (VAT-mode).

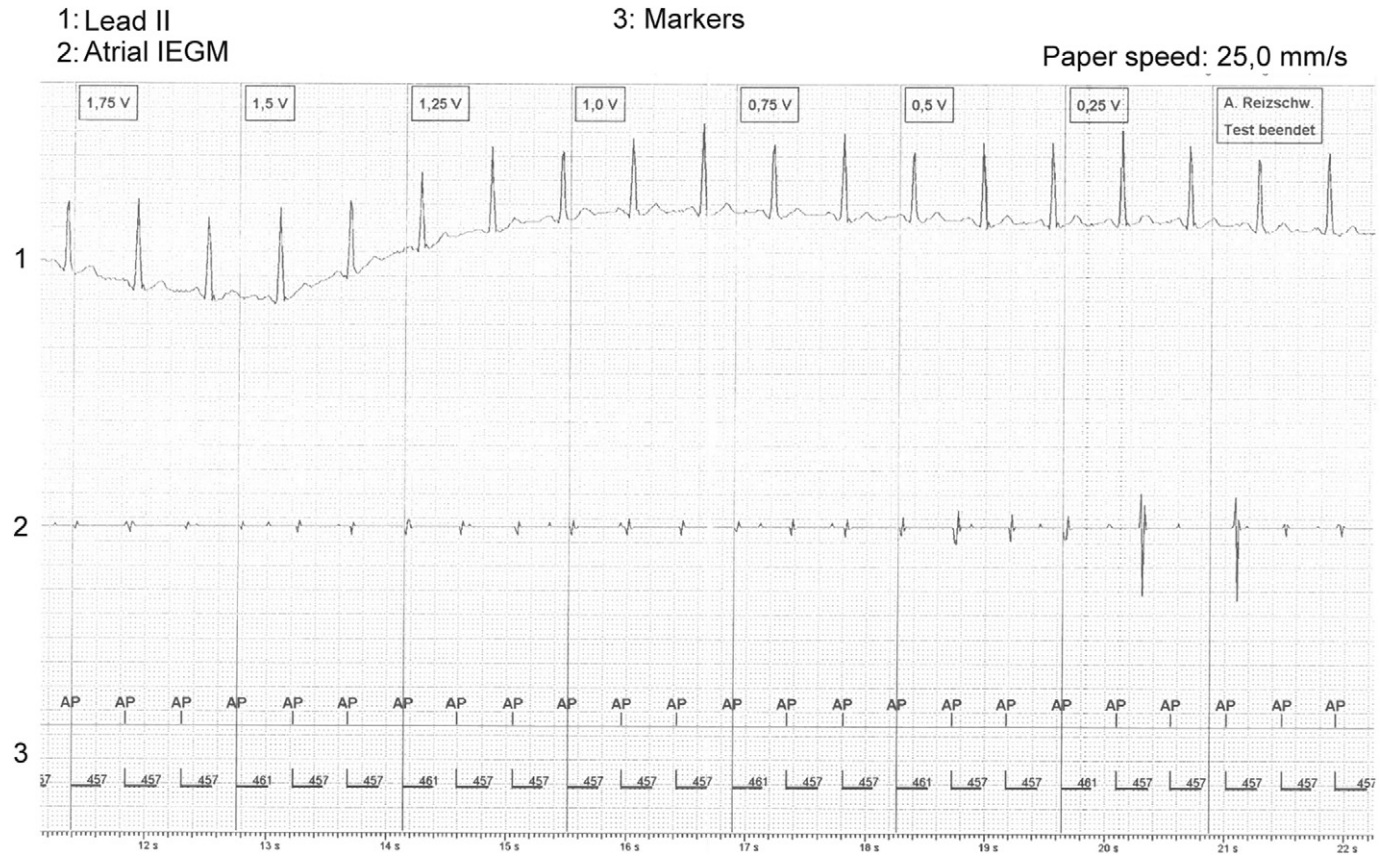

Fig. 2. Atrial threshold test in A00 mode. Atrial paced beats are not conducted to the ventricle in the absence of AV block. At a threshold of 0.25 V/0.5 ms intrinsic atrial rhythm breaks through. 1 represents lead II, 2 the atrial IEGM and 3 the annotations of the pacemaker.

The atrial lead was electrically and mechanically intact, although not functional due to its placement in the posterior atrial wall of the recipient's right atrium electrically isolated from the donor's heart. In surface ECG, the atrial rhythm arising from the donor's right atrium with an adequate AV conduction is observed. The intrinsic rhythm of the recipient's rudimentary atrium cannot be seen in surface ECG, however was triggered to the donor's ventricle causing PMT. Since no AV block or sinus node dysfunction was present at time of interrogation, the dual chamber pacemaker was programmed to a VVI backup mode at 40 bpm.

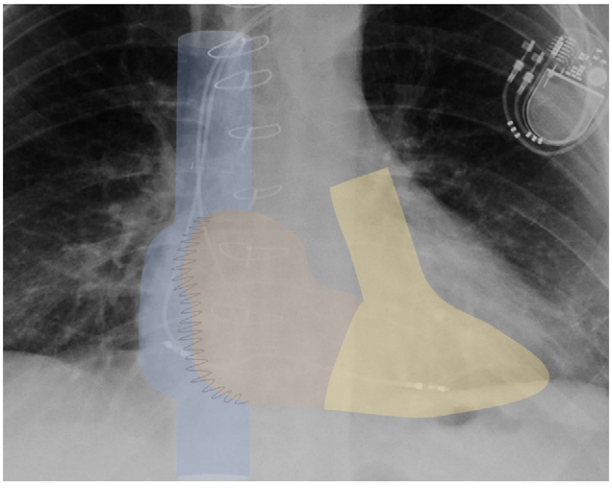

Fig. 3. Chest X-ray. The atrial lead is implanted in the posterior area of the right atrium, i.e. the recipient's part of the right atrium. Blue represents the recipient's right atrium as well as vena cava superior und inferior, orange represents the donor's right atrium and yellow thee donor's right ventricle.

Discussion

To our knowledge, we here first describe an unusual cause of intermittent rapid ventricular paced rhythm. Patients undergoing orthotopic heart transplantation may demonstrate sinus node dysfunction postoperatively. If sinus node dysfunction persists, implantation of a permanent pacemaker is required. Implantation of the atrial lead in this context requires knowledge of the transplantation technique used. In case of the biatrial technique, the implantation of an atrial lead can be challenging and should be based on IEGM as well as on fluoroscopy. Especially, if AV conduction is preserved as in most cases after heart transplantation, atrial threshold test should be performed in a pacing mode able to unmask atrial lead position in the electrically isolated right atrium of the recipient, i.e. AAI mode. Fluoroscopically, the posterior atrial area should be avoided, since it usually represents the preserved part of the recipient's right atrium. In the present case, the atrial lead is implanted in the recipient's rudimentary atrium, the ventricular lead in the donor's right ventricle. Consequently, the pacemaker senses activity of the electrically isolated atrial myocardium and stimulates the donor's ventricle. This leads to AV dissociation and a symptomatic intermittent rapid ventricular paced rhythm.

Conclusion

Implanting physicians should be aware of the biatrial surgical technique in cardiac transplantation in order to avoid atrial lead implantation in the electrically isolated recipient's right atrium.

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