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External electrical cardioversion of persistent atrial fibrillation in a patient with a Micra™ Transcatheter Pacing System

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ABSTRACT

We report a case of a 85-year old woman with a preexisting Transcatheter Pacing System (TPS) (Micra™ VR, Fa. Medtronic, Inc., Minneapolis, MN, USA) undergoing several external electrical cardioversions (CV) for symptomatic persistent atrial fibrillation (persAF). Due to bradycardia in the setting of atrial fibrillation a right apical TPS implantation was performed earlier. Four weeks prior to presentation at our facility an unsuccessful CV with a maximum biphasic energy level of 360J was performed, after which amiodarone was initiated. At the time of presentation three shocks with 100 J, 200 J and 360 J were delivered without sustained restoration of a stable sinus rhythm. Patches were in an anterior-posterior position. No complications and no significant changes in device parameters in comparison to the pre-acquired values were observed.

To our knowledge, this is the first case report of an external CV in a patient with a TPS. External CV in patients with a preexisting TPS seems to be safe and feasible.

1. Case report

1.1. History

We report a case of a 85-year old woman undergoing external electrical cardioversion (CV) for persistent atrial fibrillation (persAF) with a preexisting Transcatheter Pacing System (TPS) (Micra™ VR, Fa. Medtronic, Inc., Minneapolis, MN, USA). The leadless pacemaker was implanted three months prior to presentation for bradycardia in the setting of persistent atrial fibrillation (persAF) (Fig. 1). Four weeks prior to presentation at our facility an unsuccessful CV with a maximum biphasic energy level of 360J was performed, after which amiodarone was initiated.

Relevant pre-existing conditions were coronary heart disease, arterial hypertension and clipping of the mitral and tricuspid valves for significant regurgitation. A recent transthoracic echocardiography showed a concentric myocardial hypertrophy with preserved left ventricular ejection function and severe biatrial dilatation. The case relevant medication consisted of β-blocker, amiodarone and an oral anticoagulation with apixaban.

1.2. Treatment and course

Prior to CV a 12-lead-electrocardiography (ECG) showed AF with intermittent ventricular pacing. Before CV a device interrogation revealed a sensing of 6.4 mV, a pacing threshold of 0.50 V at 0.24 ms, an impedance of 570 Ohm, and a battery voltage of 3,13 V. Under deep sedation three unsuccessful attempts of biphasic electrical cardioversion shocks with 100 J, 200 J and 360 J respectively were conducted using an external cardioverter-defibrillator device (Lifepak 12 AED defibrillator, Medtronic, Inc., Minneapolis, MN, USA). Standard self-adhesive electrode pads in an anterior-posterior position were used. The patient was monitored until full recovery, and remained clinically stable during the entire observation period.

After CV, a device interrogation and a 12-lead-ECG were repeated (Fig. 2a–d). The interrogation values showed a stable sensing of 6.4 mV and an unchanged threshold of 0.50 V at 0.24 ms. No alterations in impedance (570 Ohm) and battery voltage (3,13 V) were notable. In conclusion, no significant changes in device parameters in comparison to the pre-acquired values were observed

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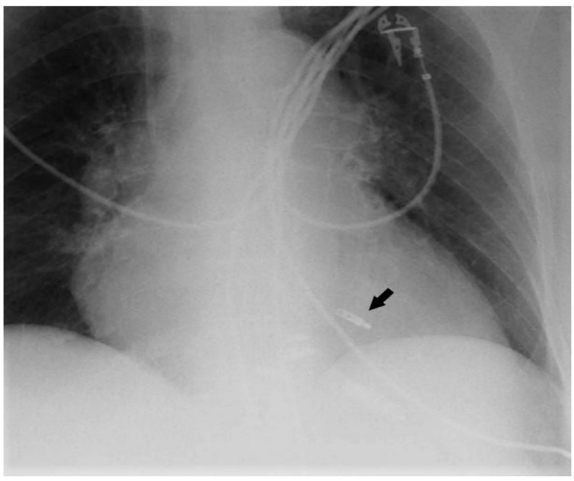

Fig. 1. Fig. 1 shows the position of the intracardiac pacemaker device in the right ventricle on a standard chest X-ray one day after implantation of the device.

(Table 1). Amiodarone therapy was discontinued and a rate-control strategy with a β-blocker was pursued. The patient was discharged on the same day. A follow-up at 2 weeks revealed again stable device parameters: a sensing of 7.30 mV, a pacing threshold of 0.50 V at 0.20 ms, an impedance of 590 Ohm, and a battery voltage of 3,11 V.

2. Discussion

Electrical cardioversion is a well-established treatment option to convert patients with persAF into sinus rhythm [1]. To our knowledge so far no data exist on external CV in patients with a TPS. Venier et al. reported a single direct shock treatment for ventricular fibrillation in a patient with a leadless pacer of another type (Nanostim™, St. Jude Medical), during heart surgery [2]. A shock of 20 J was directly applied to the fibrillating heart using internal paddles. Recent case reports showed cases of defibrillation threshold testing [3], and defibrillation of ventricular tachycardia [4] in combinations of a leadless pacemaker and a subcutaneous internal cardioverter-defibrillator, without observed adverse events. Previous case reports on standard pacemaker devices revealed that external CV may temporarily or permanently alter device parameters [5] or cause battery discharge [6]. In comparison to conventional device positions, possible effects of CV on the TPS device are potentially increased by the intracardiac position of the device, being directly in the path of the electrical current. For transvenous pacemakers, the AHA recommends an external patch distance of at least 2.5 cm from the device [7]. However, in CV of TPS patients the latter is not possible. Therefore, this case report may shed some light on feasibility and safety of the external CV

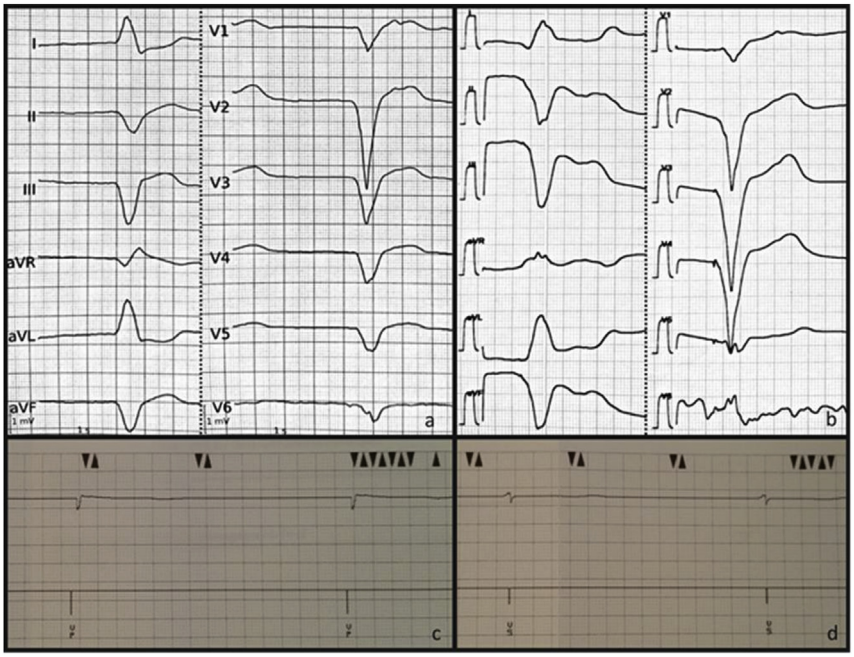

Fig. 2. 12-lead-ECG recordings prior to (a) and immediately after (b) external CV as well as intracardiac electrograms during testing of pacing (c) and sensing (d) functions immediately after CV are shown.

Table 1
Table 1 presents the measurements of the TPS before and after the current CV. The initial parameters after device implantation, as well as parameters after the first CV four weeks prior were added for comparison. The pacemaker was programmed to VVIR mode with a lower limiting frequency of 55 beats per minute. The ventricular pacing percentage was 77.9%.

	Post-Implantation	Index CV 4 weeks earlier	Before CV	After CV	2 weeks follow-up
Battery voltage (V)	3.15	3.17	3.13	3.13	3.11
Sensing (mV)	5.6	6.1	6.4	6.4	7.3
Impedance (Ohm)	510	560	570	570	590
Stimulation threshold	0.88V/0.24	0.50V/0.24 ms	0.50V/0.24 ms	0.50V/0.24 ms	0.50V/0.20 ms

procedure in patients with a TPS, even in cases of repeated shocks up to 360 J. These findings warrant confirmation in propective trials and larger cohorts.

3. Conclusion

Electrical cardioversion in patients with a TPS seems to be safe and feasible. These findings warrant confirmation in prospective trials and larger cohorts.

Conflicts of interest

None, stated by all authors.

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