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CASE REPORT

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One stage atrioventricular nodal ablation and leadless pacemaker implantation for refractory atrial fibrillation

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Abstract

Atrioventricular nodal (AVN) ablation and right ventricular (RV) pacing is recommended for refractory atrial fibrillation (AF) and tachycardia-bradycardia syndrome. Three AF patients (mean age 83, range 79-89 years) underwent AVN ablation and transvenous leadless pacemaker Micra™ implantations using the same venous access without anticoagulation interruption. Satisfactory pacing 0.59 (0.50-0.63) V at 0.24 ms and sensing 11.2 (6.3-15.6) mV were achieved within 1-3 deployments. There were no vascular complications nor device dislodgment. Durable pacemaker parameters and VVIR pacing were achieved. Combined AVN ablation and leadless pacemaker implantation is feasible and safe, and avoids pacemaker pocket hematoma and bleeding complications in patients on uninterrupted anticoagulation.

KEYWORDS

ablation, atrial fibrillation, leadless pacemaker, rate adaptation, sick sinus syndrome

1 | INTRODUCTION

Atrioventricular nodal (AVN) ablation followed by right ventricular (RV) pacing is a recommended rate control therapy for medically refractory atrial fibrillation (AF) and tachycardia-bradycardia syndrome. Traditional pacing in patients after AVN ablation on continued anticoagulants has an increase in venous access bleeding risk and pocket hematoma. Leadless pacemakers[1] are now available that obviate transvenous lead(s) and a pacemaker pocket, with highly successful implantation rate, durable pacing and sensing functions and a very low risk of dislodgment.[2] This form of pacing therapy may be ideal in conjunction with AVN ablation, as neither additional venous access nor pacemaker pocket will be necessary.

2 | CASE REPORT

In this case series, three consecutive patients with a mean age of 83 years (range 79-89 years) were included (Table 1). Patient 1 had a previous transcatheter atrial septal defect closure and in permanent rapid AF despite medications. The remaining two patients had tachycardia-bradycardia syndrome with fast AF rate and sinus bradycardia after rate control drugs. Both requested a leadless device and understood the potential risk of pacemaker syndrome in VVI mode. In all patients, the pros and cons of leadless pacemakers over traditional pacemakers were discussed. All patients understood and accepted the possible risk of pericardial effusion/tamponade, dislodgement, retrieval, and the implication of end of service management, including cremation.[3]

The procedures were performed under local anesthesia in a cardiac catheterization laboratory without interruption of oral anticoagulation. A figure of eight subcutaneous suture was placed around a guidewire in the right femoral vein for subsequent hemostasis. Through this wire, an 8.5F sheath was inserted for an 8.5F saline irrigation ablation catheter (Webster C, Thermocool, Johnson & Johnson). A 5F quadripolar temporary pacing electrode catheter was also placed in the RV. AVN block was achieved in all patients within three radiofrequency applications (20-30 W for up to 90 minutes).

After permanent AV block, the venous site for the ablation catheter was dilated to admit a 27F Medtronic Micra™ introducer sheath.

TABLE 1 Demographic, procedural details, and device parameters of patients undergoing one stage radiofrequency (RF) atrioventricular nodal ablation and leadless pacemaker implantation procedure. R wave was not available (NA) after the procedure as all patients were pacemaker dependent

Patients	Gender	Age (y)	LVEF (%)	Rhythm	Anticoagulation	No. of RF Applications	No. of implant site (s) attempted	Total procedural duration (min)	Ventricular threshold at 0.24 ms (V)		R Wave (mV)		Impedance (Ω)	
									Implant	6 m	Implant	6 m	Implant	6 m
1	F	79	84	AF	Warfarin	2	1	66	0.63	0.50	15.6	NA	640	540
2	F	80	55	TBS	Edoxaban	2	2	92	0.63	0.38	6.3	NA	820	700
3	M	89	66	TBS	Edoxaban	5	3	96	0.50	0.50	11.7	NA	1160	640
Mean/ Median	—	83	68	—	—	2	2	85	0.59	0.46	11.2	NA	873	626

AF, atrial fibrillation, LVEF, left ventricular ejection fraction; TBS, tachycardia-bradycardia syndrome.

A Micra™ delivery catheter (23F) was introduced through the sheath into the RV. All Micra™ TCP pacemakers were implanted in the lower third of RV septum within three attempts (median 2, range 1-3). The mean pacing and sensing thresholds were 0.59 V at 0.25 milliseconds and 11.2 mV respectively. Hemostasis was achieved in all patients with figure of eight subcutaneous suture followed by brief manual compression. All patients were discharged the next day. Figure 1 shows the cineangiogram of AVN ablation and leadless pacemaker implantation in patient 3. The mean total procedure time was 85 (range 66-96) minutes. Rate adaptive pacing was initiated at 3 months, achieving a pacing rate of 90/minute during walking. At 6 months, all patients were in permanent AF and not on antiarrhythmic drugs. Pacemaker parameters remained stable, and estimated device longevity was ≥8 years.

3 | DISCUSSION

This study documents the feasibility of one stage AVN ablation and leadless VVIR pacing. As ejection fraction was normal, RV pacing was considered appropriate. A DDD(R) pacemaker for the two patients with intermittent sinus rhythm may avoid potential risk of pacemaker syndrome. However, a VVI (R) pacemaker is a Class IIa alternative given that permanent AF will develop in 16%-31% within 6 months despite DDD pacing in these patients. Depending on associated thromboembolic risk, many patients undergoing AVN ablation will be on anticoagulation due to AF. Uninterrupted oral anticoagulation without heparin bridging during pacemaker implantation is recommended, but increases venous access bleeding risk and packet hematoma. Leadless pacing in this setting is particularly appealing as mechanical hemostasis using subcutaneous sutures or closure devices are usually effective for venous hemostasis without anticoagulation interruption. While we had not encountered pericardial effusion or tamponade in our patients, it is worth noting that perforation/pericardial effusion is one of the most common complications of leadless pacing (1.5%).[2] Whether the combined procedure increases this risk will require prospective comparative evaluation. Anticoagulation reversal agent's availability may help.

An important attribute of all pacing therapy after AVN ablation is stable pacing and sensing function and no dislodgement, as all patients are in complete AV block and pacemaker dependent. In one study[4] using the Nanostim Leadless Cardiac Pacemaker, the investigators performed AVN ablation 2 weeks after leadless pacing to ensure stable pacemaker fixation and electrical parameters. They demonstrated similar safety and efficacy endpoints with leadless pacing compared to traditional pacing with dislodgement rates at 1.7% vs 3.0% respectively. No dislodgement was reported in the IDE Micra™ trial.[1] A subgroup of patients in Micra™ IDE trial had combined AVN ablation and Micra™ implantation.[5] These investigators implanted the Micra™ before AVN ablation, and used the Micra™ as temporary RV pacing backup. A smaller sheath inside the Micra™ introducer sheath was used for the ablation catheter in AVN ablation. Again, they documented no device dislodgement nor malfunction although follow-up was available in only 67% of their patients. We preferred our approach

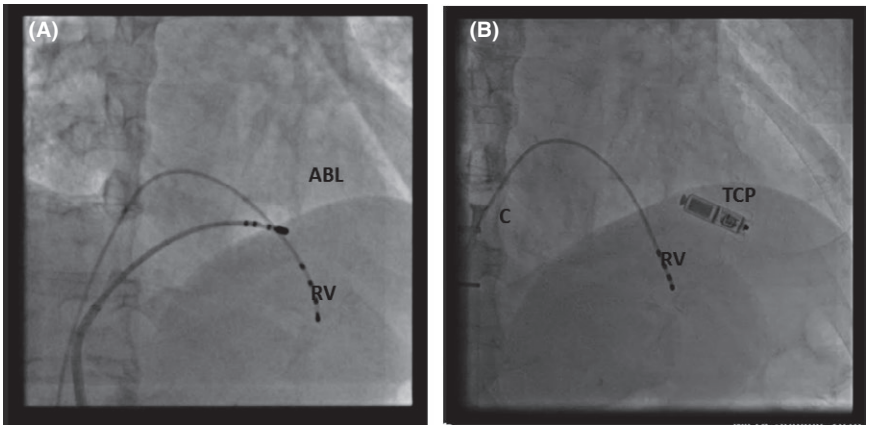

FIGURE 1 One stage antrioventricular nodal (AVN) ablation and implantation of leadless pacemaker in patient 3 with tachycardia-bradycardia syndrome and fast atrial fibrillation. Right anterior oblique cineangiogram views during AVN ablation (A), and implantation of the leadless pacemaker Micra™ TCP prior to its complete detachment from the delivery sheath (B). ABL = ablation catheter, C = Micra™ delivery catheter, RV = RV temporary pacing catheter, TCP = Micra™ transcatheter pacemaker

to avoid interference of the Micra™ during radiofrequency application and potential catheter induced dislodgement of leadless pacemaker. Furthermore, the effect of radiofrequency energy on longevity of Micra™ battery is an additional concern.

In conclusion, a one stage AVN ablation and leadless pacemaker implantation is effective and safe in patients with refractory AF or tachycardia-bradycardia syndrome, with stable pacing and sensing function and rate adaptation at 6 months. This combined procedure utilizes the same venous access, and avoids the acute problem of bleeding and pocket hematoma in patients on uninterrupted anticoagulation.

CONFLICT OF INTERESTS

Authors declare no conflict of interests for this article.

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