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Letter to the Editor
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# Leadless Pacemaker Implantation and Cavotricuspid Isthmus Ablation in Patients with Tachy-Brady Syndrome

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## INTRODUCTION

Tachycardia-bradycardia syndrome (TBS) is one of manifestations of sinus node dysfunction (SND). It consists of atrial tachyarrhythmia and subsequent sinoatrial block or sinus arrest. The sinus node automaticity and/or sinoatrial conduction are suppressed by the preceding atrial arrhythmia. Proper therapy usually requires both cardiac pacing and arrhythmia control.

Radiofrequency (RF) catheter ablation is the treatment of choice for drug-refractory atrial arrhythmia. However, it may result in dysfunction of intracardiac electronic devices. Transient or prolonged loss of output, under-sensing, over-sensing, asynchronous pacing, or reversion to "reset" mode has been reported in upto 53% of patients.[1] Although most of the devices regain normal function eventually, manually resetting is necessary in some cases.[1] Furthermore, the safety of RF catheter ablation in leadless pacemaker is rarely addressed.

## CASE

A 68-year-old female patient who had advanced esophageal malignancy receiving chemotherapy presented with palpitation and intermittent syncope for several months. A 24-hour Holter monitor revealed paroxysmal atrial fibrillation (AF) followed by a long sinus pause. Despite the consideration of transvenous pacemaker, both subclavian veins were unable to access due to venous occlusion and presence of chemo-port catheter (Figure 1A and 1B). A leadless pacemaker (Micra, Medtronic, MN, USA) was implanted and set as a backup pacing mode (VVI mode, base rate = 45 beats per minute) (Figure 1C). Flecainide was used for AF rhythm control.

Five days later, incessant atrial flutter (AFL) occurred and electrophysiological study confirmed the diagnosis of cavo-tricuspid isthmus (CTI) dependent AFL. Linear RF catheter ablation interrupted the CTI and successfully terminated the arrhythmia (Figure 1C, 1D and Figure 2). Bidirectional conduction block through CTI was achieved

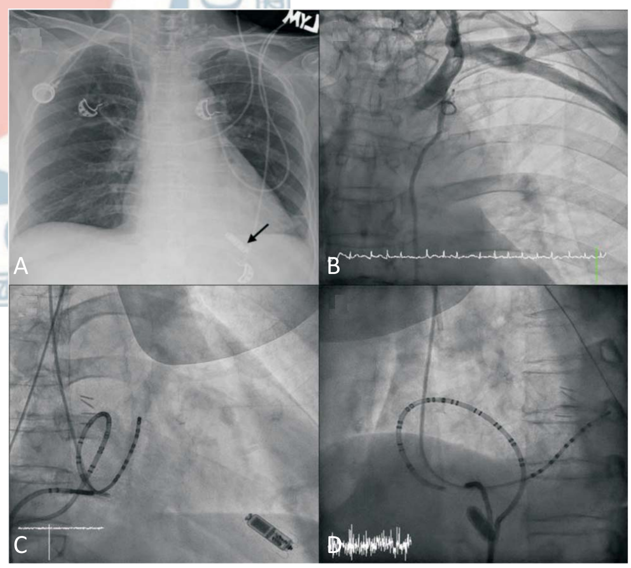


***Figure 1.*** *(A) Chest X ray after Micra implantation. Presence of a chemo port catheter in the right subclavian vein. Micra was located at RV apex (arrow). (B) Venogram showed a chronic occlusion of left subclavian vein with collateral circulation. Fluoroscopy during atrial flutter ablation procedure in (C) right anterior oblique (RAO) view and (D) left anterior oblique (LAO) view. Micra was at right ventricle apex. Halo catheter located in right atrium and 10 poles catheter located in coronary sinus. The ablation catheter was at middle cavo-tricuspid isthmus.*

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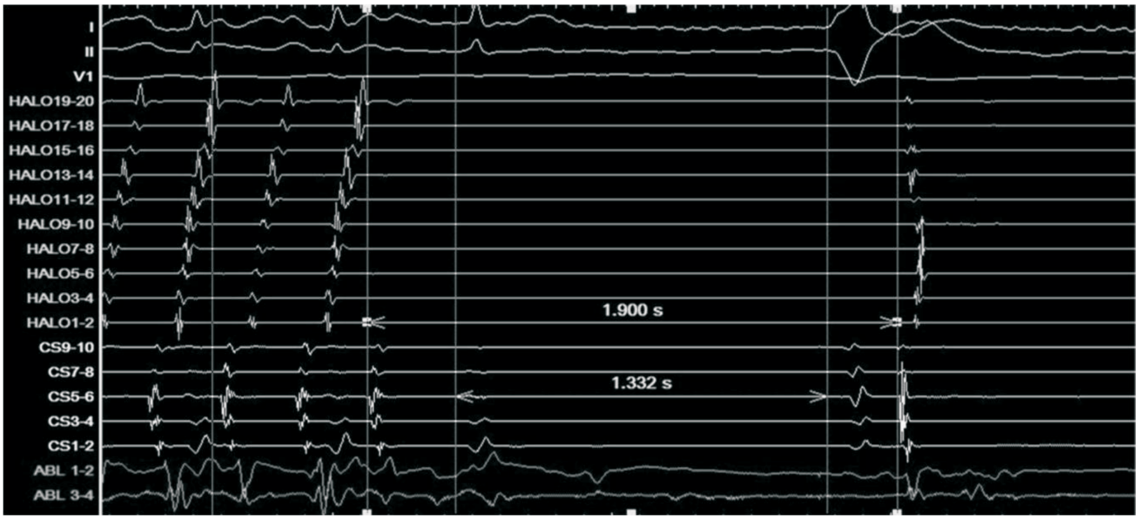


***Figure 2.*** *Intracardiac tracing at the time of atrial flutter termination during the ablation procedure. The atrial activation is consistent with clockwise cavo-tricuspid isthmus-dependent flutter. Micra (VVI-45 bpm) paced after a low rate interval of 1.33 secs. The first recovery atrial signal is from the left atrium. Sinus node did not fire until 1900 ms after flutter termination. This finding was compatible with sinus node dysfunction.*

at the end of the procedure. The leadless pacemaker worked normally during the procedure. It paced after a lower rate interval = 1332 ms (rate = 45 beats per minute) at the time of AFL termination. Sinus node firing did not occur until 1900 ms after the last atrial activation (Figure 2), which was compatible with SND.

She was free from rhythm-related symptoms for the rest of her life. There was no AF or AFL during the follow-up. She died of cancer progression 6 months later.

## DISCUSSION

In spite of the strong pacing indication,[2] lack of vascular access precluded the use of transvenous pacemaker. Surgical pacemaker implantation carried an unacceptable high risk in this patient. Leadless pacemaker seemed to be an optimal pacing strategy; however, AF, heart failure and pacemaker syndrome remained the major concerns in VVI pacing. Those adverse events were reported largely related to percentage of ventricular pacing.[3] In current guideline recommendations, VVI pacing is a reasonable alternative of dual chamber pacing for SND with infrequent pacing demand.[2] We set the pacemaker at the back-up rate of 45 bpm to minimize the ventricular pacing and adverse events.

In addition to cardiac pacing, atrial tachyarrhythmia control is another issue in TBS management. In this case, we attempted medical AF rhythm control with flecainide and applied CTI ablation for the drug-refractory AFL. Although ablation is a more effective strategy in AF rhythm control,[4] the procedure is too risky in this patient with terminal condition. In case of long-lasting persistent AF with uncontrolled ventricular rate, atrioventricular nodal (AVN) ablation would be a reasonable treatment consideration for rate control but not for rhythm control. Besides, AVN ablation results in complete AV block and 100% dependence on ventricular pacing with a current leadless pacemaker. In our case with paroxysmal atrial tachyarrhythmias and sinus arrest, the combination of anti-arrhythmic drug, CTI ablation and leadless pacemaker appears to be a better symptom-free approach for both rhythm and rate control.

In addition to heating effect and the risk of device dislodgement, high frequency electromagnetic fields, such as RF energy, raise the concern of functional undersensing, temporary reversion to noise mode, inappropriate reset to recommended replacement time or elective replacement indicator, power on reset, and long-term malfunction of a pacemaker.[5] With similar mechanism, two studies have emphasized the risk of leadless pacemaker dysfunction during AVN ablation. In the 2 studies, no sign of long-term detrimental electrical effect can be found in leadless pacemakers, including pacing threshold, impedance and R wave amplitude during 12-month follow-up.[6,7] In addition, after leadless pacemaker implantation, neither the immediate nor the later (14-days after implantation) AVN ablation procedures, showed electromagnetic interference or pacing inhibition during the procedure.[8] To date, the impact of RF energy delivery during AFL CTI ablation on leadless pacemaker is still unclear. Our case provides an experience of safe CTI ablation early after leadless pacemaker implantation. The device worked well during 6 months of follow-up until the patient passed away.

## LEARNING POINTS

1. In comparison to surgical pacemaker implantation, leadless pacemaker provides an alternative and safer choice in patient lacks of vascular access for traditional transvenous pacemaker.
2. This case provides the rare experience regarding the safety of leadless pacemaker during AFL CTI ablation. No meaningful interaction between RF energy and leadless pacemaker can be seen.

## CONFLICT OF INTEREST

All the authors declare no conflicts of interest.

## DISCLOSURE

None.

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