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## Halo-shape technique for leadless pacemaker implantations: A case report

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### ABSTRACT

A 92-year-old woman underwent an implantation of a leadless pacemaker (Micra; Medtronic, Inc, Minneapolis, MN) for complete atrioventricular block after a transvenous lead extraction due to a pocket infection of a dual chamber pacemaker. Marked scoliosis and a humpback due to an advanced age made it impossible to direct the tip of the pacemaker delivery catheter towards the right ventricular septum or apex and shape the catheter into a gooseneck-shape. Thus, by attaining a halo-catheter shape of the delivery catheter, the catheter tip could be directed toward the infero-basal portion of the right ventricular septum. The pacemaker was successfully deployed at that site without any complications, and good device parameters were achieved. The halo-shape technique may be also an alternative method for delivering a leadless pacemaker in patients with an unsuccessful delivery of a leadless pacemaker to the right ventricular septum using the conventional gooseneck-shape technique.

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### 1. Introduction

A Micra leadless pacemaker (Medtronic, Inc, Minneapolis, MN) has been recently used as an alternative to conventional transvenous pacemakers in selected patients. However, Micra implantations using a conventional gooseneck-shape technique via the femoral vein are sometimes challenging in patients with marked skeletal deformities, complex cardiac anatomies, and limited venous access to the heart [1–4]. We present a successful implantation of a leadless pacemaker using a halo-shape technique in an extremely elderly patient with marked scoliosis and a humpback, in whom a leadless pacemaker implantation was impossible using the conventional gooseneck-shape technique.

#### 1.1. Case report

A 92-year-old woman presented with a pacemaker pocket infection two years after an implantation of a dual chamber pacemaker due to complete atrioventricular block. After a transvenous extraction of the pacemaker leads, a Micra leadless pacemaker was

implanted. A 27-Fr sheath was advanced into the right atrium via the right femoral vein. Right ventriculography revealed a narrowing of the tricuspid annulus and alteration of the orientation of the right atrium and ventricle due to marked scoliosis and a humpback with aging (Fig. 1A). The delivery catheter of the leadless pacemaker could be introduced into the right atrium through the sheath, but the tip of the delivery catheter could not be directed towards either the right ventricular septum or apex. Thus, by slowly deflecting, gently pushing, and clockwise rotation of the delivery catheter, a halo-catheter shape of the delivery catheter was attained and the catheter tip could be directed toward the infero-basal portion of the right ventricular septum (Fig. 1B and C). The pacemaker was successfully deployed at that site without any complications (Fig. 2), and good device parameters were achieved (sensing, 20 mV; pacing threshold, 0.5 V/0.25 ms; impedance, 1300 ohms).

### 2. Discussion

This case report described a halo-shape technique for delivering a leadless pacemaker in an extremely elderly patient with a skeletal deformity, which altered the orientation of the right-sided cardiac chambers and the tricuspid valve. Several alternative techniques for Micra implantations have been reported in some cases where the Micra implantations were difficult using the conventional gooseneck-shape technique [3,4]. The halo-

Abbreviations: PA, pulmonary artery; RA, right atrium; RV, right ventricle; TA, tricuspid annulus.

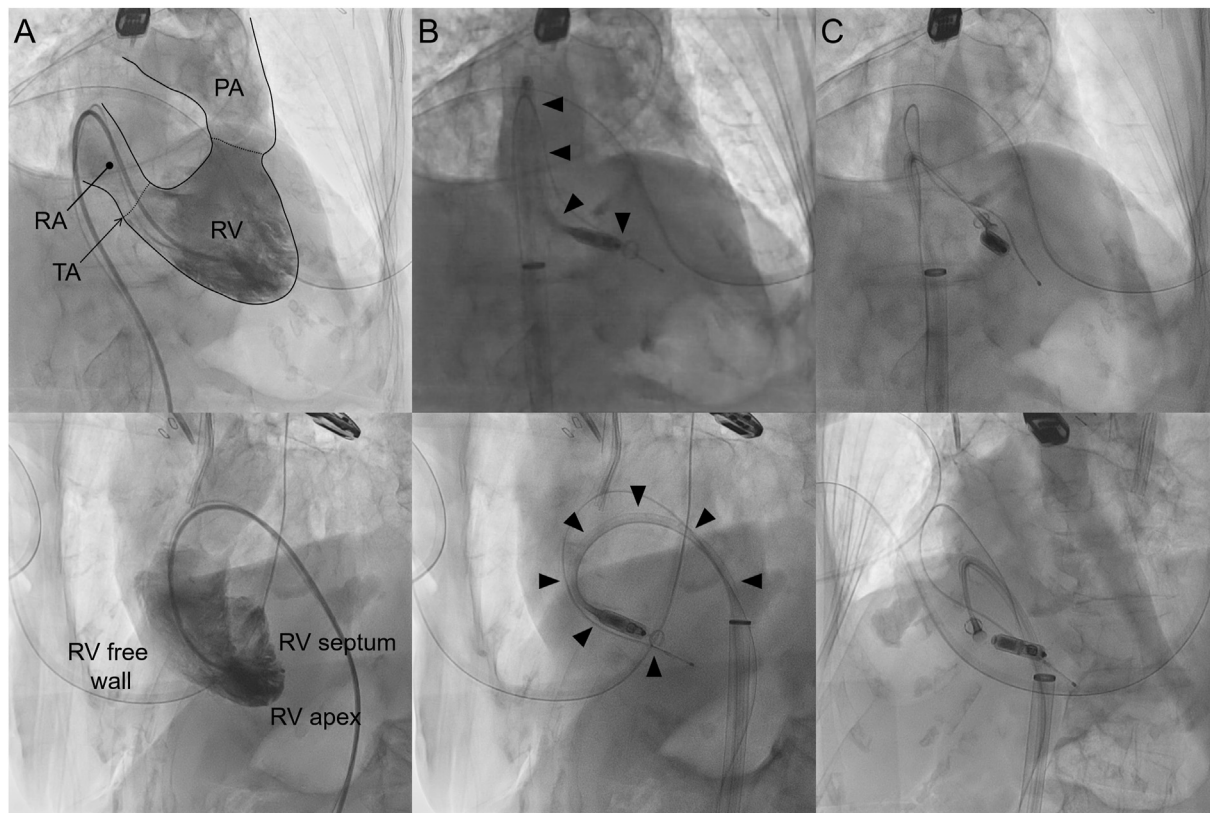
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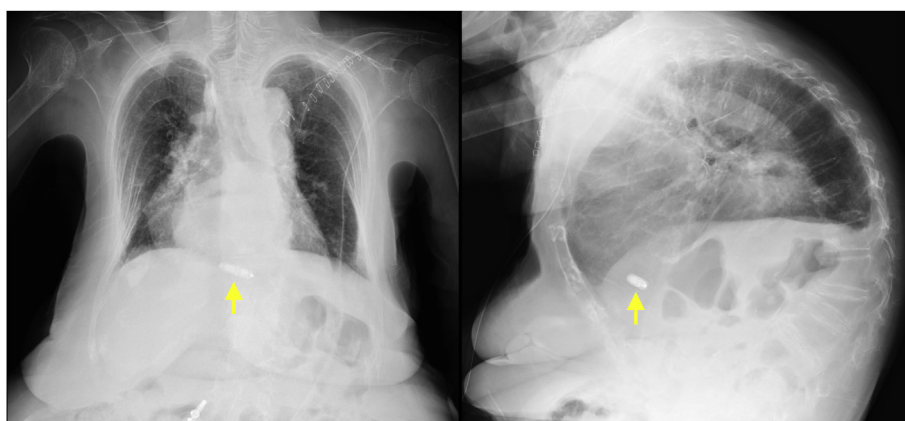
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**Fig. 1.** (A) Right ventriculography, (B) attaining a halo-catheter shape of the delivery catheter (arrowheads), and (C) deployment of the leadless pacemaker in the right anterior oblique 35-degree and left anterior oblique 45-degree views (upper and lower panels).



**Fig. 2.** Chest X-rays after the leadless pacemaker implantation in the anteroposterior and lateral views. The yellow arrows indicate the leadless pacemaker implanted on the infero-basal RV septum.

shape technique may also be an alternative method for leadless pacemaker implantations in those cases. Further investigation will be necessary in order to understanding the success rate and safety of this leadless pacemaker implantation technique in a large series of cases.

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