

Permanent His-bundle pacing for dextrocardia with situs inversus totalis using a combination of an electrode catheter and a deflectable sheath



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Introduction

Since Deshmukh and associates¹ reported the successful implementation of His-bundle pacing (HBP) in 2000, previous studies have reported that HBP can decrease heart failure admission and preserve left ventricular ejection fraction compared to right ventricular (RV) pacing.^{2,3}

We report a case of successful HBP using a deflectable sheath in a patient with complete atrioventricular block (AVB) with dextrocardia.

Case report

A 73-year-old man presented with dyspnea and was found to have complete AVB (Figure 1A). He had been diagnosed with dextrocardia with situs inversus totalis in his childhood (Figure 1B); however, he had no relevant medical history for over 70 years. Three months prior, he underwent percutaneous coronary intervention to the left circumflex coronary artery for angina pectoris. Although coronary arteries were also located on the right-side left, percutaneous coronary intervention could be performed by the conventional system. As shown in the magnetic resonance images (Figure 1C), the 4 cardiac chambers appeared normal but as mirror images. After referring the patient to guideline-directed therapy, we performed the pacemaker implantation.

A 9F and a 7F peel-away sheaths (MEDIKIT, Tokyo, Japan) were inserted into the right subclavian vein, and a 6F deflectable decapolar mapping catheter (2-mm interelectrode spacing, Biosense Webster, Diamond Bar, CA) was advanced to the right ventricle through the 7F sheath. Although His-bundle potential was not recognized, intracardiac electrocardiograms recorded at the electrode catheter made it possible to identify the anatomical structure. A deflectable lead delivery sheath (model C304, Medtronic,

KEY TEACHING POINTS

- The C304 deflectable lead delivery sheath (Medtronic, Minneapolis, MN) is feasible for His-bundle pacing even in dextrocardia.
- A decapolar electrode catheter can be used as an electrical and anatomical landmark of the His bundle.
- A combination of an electrode catheter and C304 deflectable sheath can be an effective and safe system for His-bundle pacing in challenging cases.

Minneapolis, MN) was inserted into the right ventricle through the 9F sheath, and an exposed helix pacing lead (SelectSecure, model 3830, Medtronic) was delivered through the C304 sheath. His-bundle potential was recorded at the lead in unipolar fashion, and nonselective HBP was achieved at the site (Figure 2). After the lead was fixed, the ventricular wave value was 6.5 mV; the HBP and RV pacing thresholds were 1.2 V and 0.5 V at 1 ms, respectively (Figure 3A). Thereafter, an atrial lead (model 5076, Medtronic) was implanted in the right atrium, and the atrial lead and SelectSecure lead were connected to the pacemaker generator (Azure XT DR MRI, Medtronic). An anterior-posterior projection radiographic image is shown in Figure 3B. At the 1-week follow-up, the HBP and RV pacing thresholds were 1.75 V and 0.5 V at 0.4 ms, respectively. Additionally, the HBP and RV pacing thresholds were maintained at 5-month follow-up (2.0 V and 0.5 V at 0.4 ms, respectively).

Discussion

Although HBP was shown to be technically challenging in early clinical reports,^{4,5} a high implant success rate, as well as long-term safety and feasibility of permanent HBP, were reported in recent studies.^{2,3,6,7} Among previous studies, the implant success rate tended to be better when using a sheath delivery system instead of a stylet delivery system.

KEYWORDS Complete atrioventricular block; Deflectable sheath; Dextrocardia; Electrode catheter; His-bundle pacing; Situs inversus (Heart Rhythm Case Reports 2019;5:549–551)

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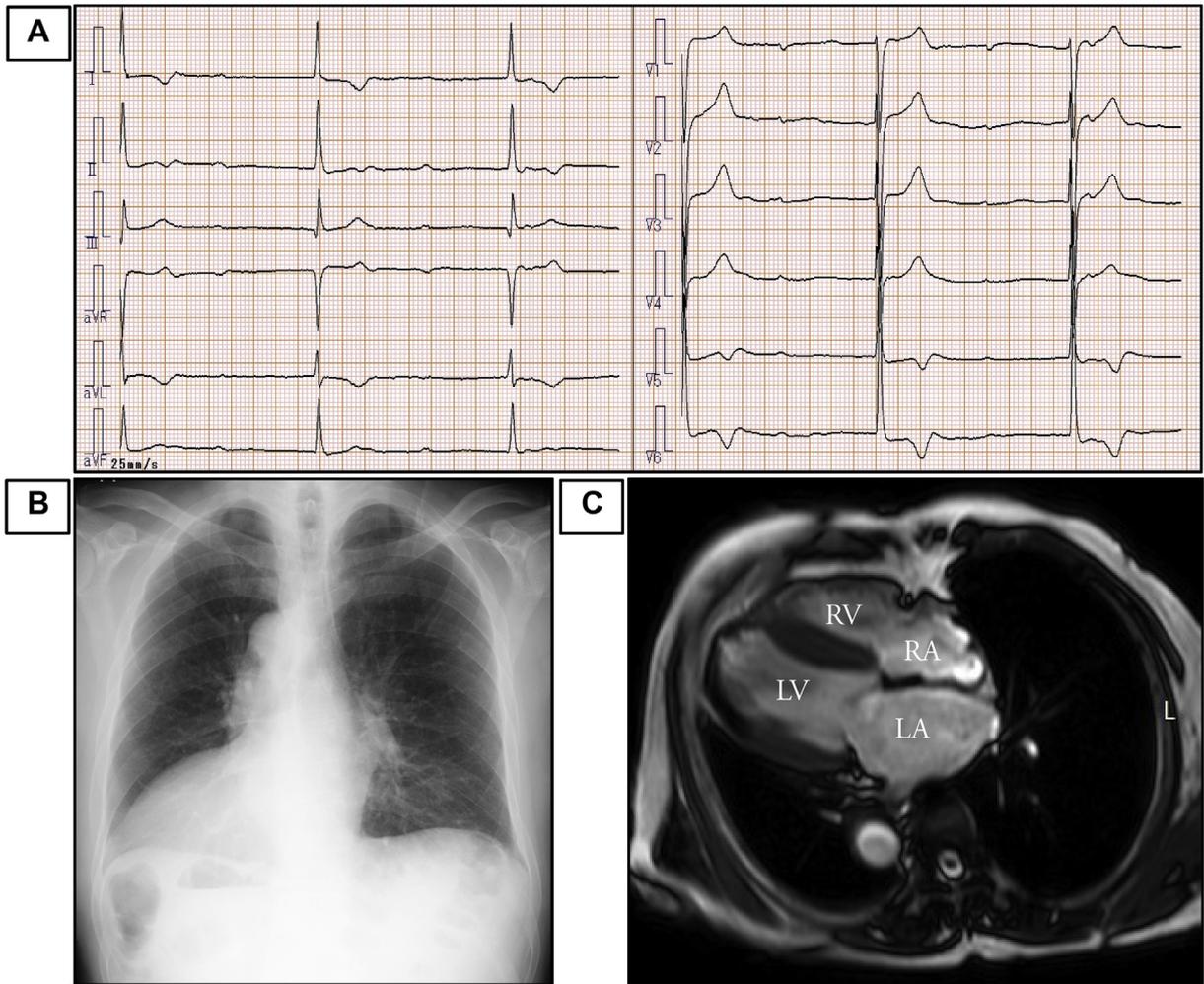


Figure 1 Baseline. **A:** A 12-lead electrocardiogram showing complete atrioventricular block by reversing both the arm and leg leads as well as right-side chest leads. **B:** Chest radiograph image showing dextrocardia. **C:** Cardiac magnetic resonance imaging showing the heart with the right and left sides reversed. LA = left atrium; LV = left ventricle; RA = right atrium; RV = right ventricle.

The fixed-curve lead delivery sheath (C315HIS, Medtronic) and SelectSecure lead are the mainstream devices used in HBP. The C315HIS sheath has a primary and secondary curve, which allows the lead to be easily directed toward

the His-bundle region. Although this device is available in both right-sided and left-sided implantation in the normal heart, it is difficult to use it in cases of complete situs inversus because it becomes oriented to the opposite direction of the

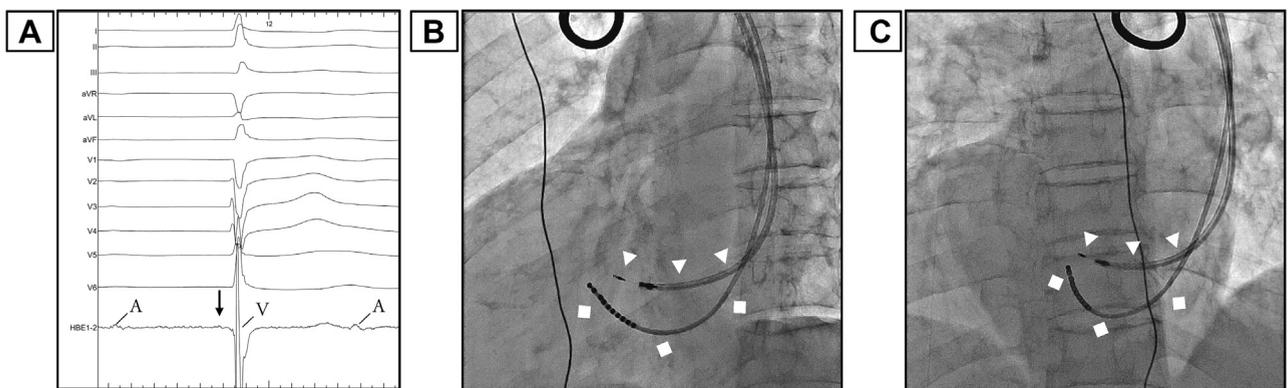


Figure 2 Successful site of His-bundle pacing. **A:** Local electrogram of the SelectSecure lead (Medtronic, Minneapolis, MN) in unipolar fashion at the His-bundle pacing site showing a minute His-bundle potential (arrow) and a large ventricular electrogram. **B, C:** Left anterior oblique (**B**) and right anterior oblique view (**C**) showing the SelectSecure lead located at the His-bundle pacing site through the C304 deflectable lead delivery sheath (Medtronic; triangles) and a deflectable decapolar mapping catheter (squares) at the para-Hisian site.

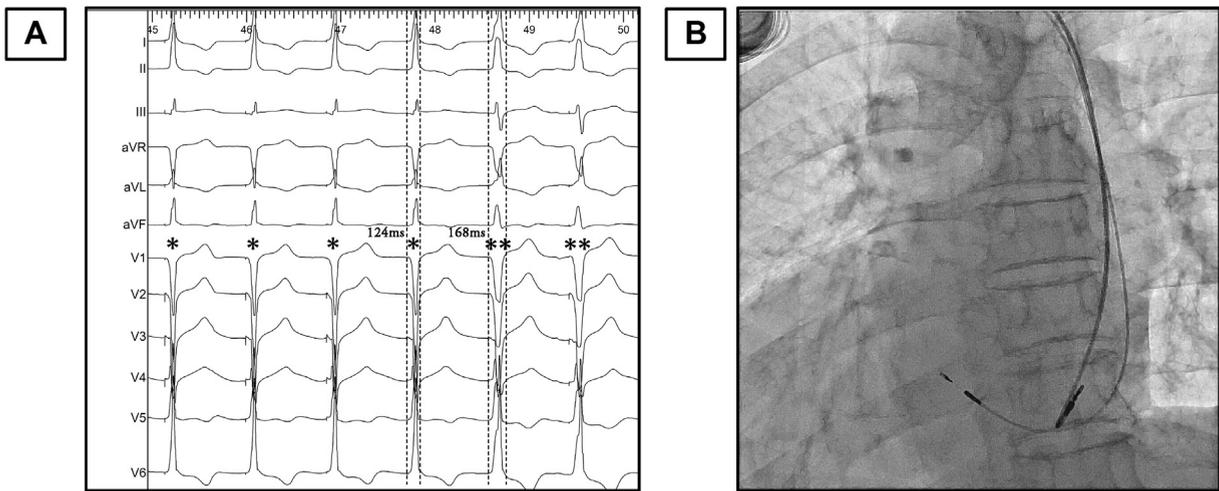


Figure 3 Implantation and results of His-bundle pacing. **A:** Continuous 12-lead electrocardiogram showing nonselective His-bundle pacing with narrow QRS (single asterisk) changing to right ventricular pacing with wide QRS (double asterisk) by decreasing the pacing output. **B:** Anterior-posterior projection radiographic image showing the atrial lead and His-bundle pacing lead.

His-bundle region. Therefore, we used the C304 deflectable sheath for His-bundle mapping in this patient. Unlike the C315HIS sheath, which has a 7.0F size and fixed-curve soft tip, the C304 sheath has a size of 8.5F and a deflectable hard tip. Owing to these features, the C304 sheath has a potential increased risk of cardiac tamponade. In this case, to avoid that risk, we used the decapolar electrode catheter through the same venous access as the C304 sheath for electrical and anatomical mapping first, which was effective for safe His-bundle mapping and successful HBP. In addition, to make the implanting procedure simpler, it might be useful to invert the original fluoroscopic image right-to-left to simulate a normal heart.

Conclusion

We achieved permanent HBP in a patient with complete AVB and dextrocardia with situs inversus totalis using a

combination of an electrode catheter and C304 deflectable delivery sheath.

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