

Three-dimensional mapping–guided permanent His bundle pacing in a patient with corrected transposition of great arteries



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Introduction

Congenitally corrected transposition of great arteries (CCTGA) is associated with increased risk for complete heart block. The morphologic right ventricle is at increased risk for pacing-induced cardiomyopathy and heart failure. In this report, we present a case of successful His bundle pacing (HBP) guided by 3-dimensional (3D) mapping in a patient with CGTGA.

Case report

A 16-year-old boy with CCTGA with preserved ventricular function developed progressive atrioventricular (AV) conduction disease with decreased exercise tolerance. His baseline electrocardiogram showed a QRS duration of 116 ms. Holter monitoring revealed average heart rate of 41 beats per minute with high-grade and complete AV block during exercise. Patients with CCTGA are at increased risk for morphologic right ventricular dilatation, tricuspid regurgitation, and heart failure.¹ He was referred for permanent HBP to reduce the risk for pacing-induced cardiomyopathy.² Preprocedural cardiac computed tomography angiogram was performed along with 3D reconstruction of the cardiac chambers. Three-dimensional electroanatomic mapping was created using the EnSite Precision (Abbott, Plymouth, MN) mapping system with HD Grid mapping catheter (Abbott) and the course of the His bundle and left bundle were tagged (Figure 1). Pacing was performed at both regions to assess QRS morphology. His ventricle interval was 41 ms. A Medtronic C304His deflectable sheath (Medtronic, Minneapolis, MN) was then used to deliver the SelectSecure pacing lead (Medtronic) to the distal His bundle region, live-tracking

KEY TEACHING POINTS

- Congenitally corrected transposition of great arteries (CCTGA) is associated with increased risk for complete atrioventricular block.
- Ventricular pacing is associated with increased risk for heart failure in patients with CCTGA.
- Permanent His bundle pacing prevents pacing-induced cardiomyopathy.
- Three-dimensional mapping along with cardiac imaging can be helpful in targeting the distal His bundle for pacing.

the lead in the 3D mapping system. Nonselective (1.5 V, QRS duration 132 ms) to selective HBP (0.5 V @ 1 ms) was achieved with R-wave amplitude of 8.5 mV and pacing impedance of 609 ohms. Pacing from HBP lead at 180 beats per minute confirmed 1:1 His capture.

Discussion

In patients with CCTGA, the His bundle is longer than normal and courses anterior to the pulmonary annulus and the left bundle courses subendocardially along the right-sided morphologic left ventricle.³ Both the cardiac computed tomography and 3D mapping helped to accurately locate the His bundle and facilitated the successful implantation of the HBP lead. Subsequent 2-dimensional echocardiogram confirmed the lead to be located below the right-sided mitral valve and anterior to the pulmonary annulus, as seen in Figure 2 (Supplemental Video). The patient's exercise capacity had significantly improved at 3-month follow-up with stable His bundle capture threshold at 0.5 V @ 1 ms. Short HV interval, large R-wave amplitude, nonselective His capture, and subvalvular lead placement confirmed the lead implantation in the distal His bundle, which is desirable in patients with potential for progression of conduction disease. This

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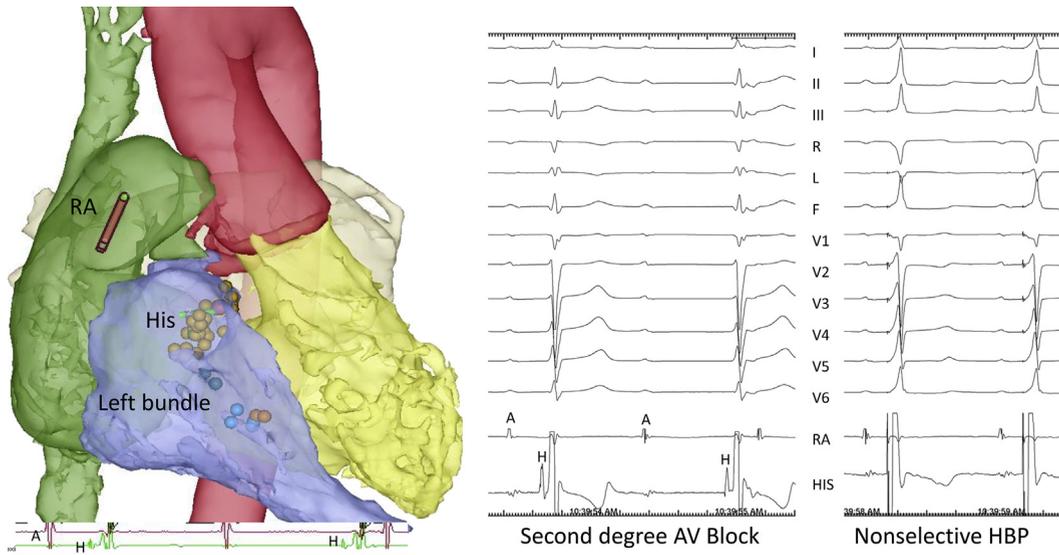


Figure 1 Three-dimensional (3D) mapping and His bundle pacing (HBP). 3D reconstruction of the right atrium (RA), right ventricle, left ventricle, and aorta in patient with corrected transposition of great arteries are shown. Yellow dots represent sites where His electrograms were recorded and blue dots represent sites where left bundle potentials were observed. Final lead position is also depicted on the map. Twelve-lead electrocardiogram along with right atrial (A) and His (H) electrograms at baseline (atrioventricular [AV] nodal block) and during nonselective HBP are shown.

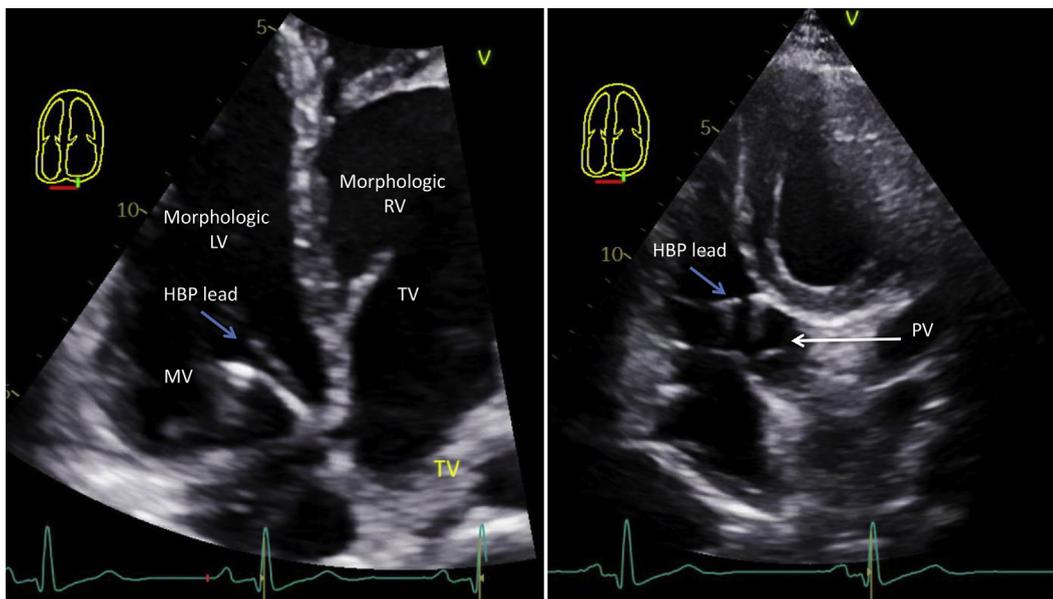


Figure 2 Echocardiographic localization of His bundle pacing (HBP) lead. Left panel shows the HBP lead location under mitral valve (MV) in the morphologic left ventricle (LV). The tricuspid valve (TV) leaflet is displaced apically in the morphologic right ventricle (RV). The right panel demonstrates the location of the HBP lead tip anterior to the pulmonic valve (PV).

is the first report of 3D mapping–guided permanent HBP in a patient with CCTGA and complex cardiac anatomy.

Appendix

Supplementary data

Supplementary data Supplementary data associated with this article can be found in the online version at <https://doi.org/10.1016/j.hrcr.2019.09.012>.

References

1. Graham TP, Bernard YD, Mellen BG, et al. Long-term outcome in congenitally corrected transposition of the great arteries: a multiinstitutional study. *J Am Coll Cardiol* 2000;36:255–261.
2. Vijayaraman P, Naperkowski A, Subzposh FA, et al. Permanent His bundle pacing: long-term lead performance and clinical outcomes. *Heart Rhythm* 2018; 15:696–702.
3. Anderson RH, Becker AE, Arnold R, Wilkinson JL. The conducting tissues in congenitally corrected transposition. *Circulation* 1974;50:911–923.