

EP CASE REPORT

Non-invasive electrocardiographic imaging of His-bundle and peri-left bundle pacing in left bundle branch block

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Case presentation

A 77-year-old lady with atrial fibrillation and left bundle branch block (LBBB) suffering from symptomatic bradycardia underwent His-bundle pacing (HBP). Electrocardiographic imaging (ECGi) (CardioInsight™ Noninvasive 3D Mapping System, Medtronic Inc., Minneapolis, MN, USA) was used to study the effect of pacing on electrical activation. His-bundle pacing was achieved by fixing a pacing lead (3830, Medtronic Inc., Minneapolis, MN, USA) delivered over a sheath dedicated to HBP (C315His, Medtronic Inc., Minneapolis, MN, USA) in the His-bundle region (HBR). Selective HBP (SHBP) was achieved with a threshold of 1.8 V at 0.5 ms and sensing of 3.2 mV. Correction of the LBBB was observed, and the QRS width decreased from baseline of 196 to 100 ms. Non-selective HBP (NSHBP) was observed when the pacing output was increased to 4.0 V at 0.5 ms. Peri-left bundle pacing (PLBP) was achieved by fixing another 3830 lead to a point at the high right ventricular (RV) septum overlying the left bundle using the method described by Huang *et al.*¹ Fluoroscopically, this point was located at approximately 1 to 1.5 cm below the HBR on the line between the HBR and the RV apex (Figure 1). Multiple clockwise turns on the 3830 lead were made and unipolar pacing was performed intermittently until narrowing of the QRS width and emergence of qR pattern in lead V₁ indicating capturing of the left bundle. The pacing threshold was 0.8 mV at 1.0 ms; sensing was 4.5 mV; impedance was 600 Ω, and the resultant QRS width was 144 ms.

Electrocardiographic imaging recording of the intrinsic rhythm showed a line of conduction block in the left ventricle (LV) with the latest activation in posterolateral LV. Both SHBP and PLBP demonstrated synchronous activation of the LV without a line of conduction block. The LV total activation time for intrinsic rhythm, SHBP, and PLBP were 110 ms, 36 ms, and 42 ms, respectively. The total global activation time for intrinsic rhythm, SHBP, and PLBP were 117 ms, 38 ms, and 48 ms, respectively (Figure 1).

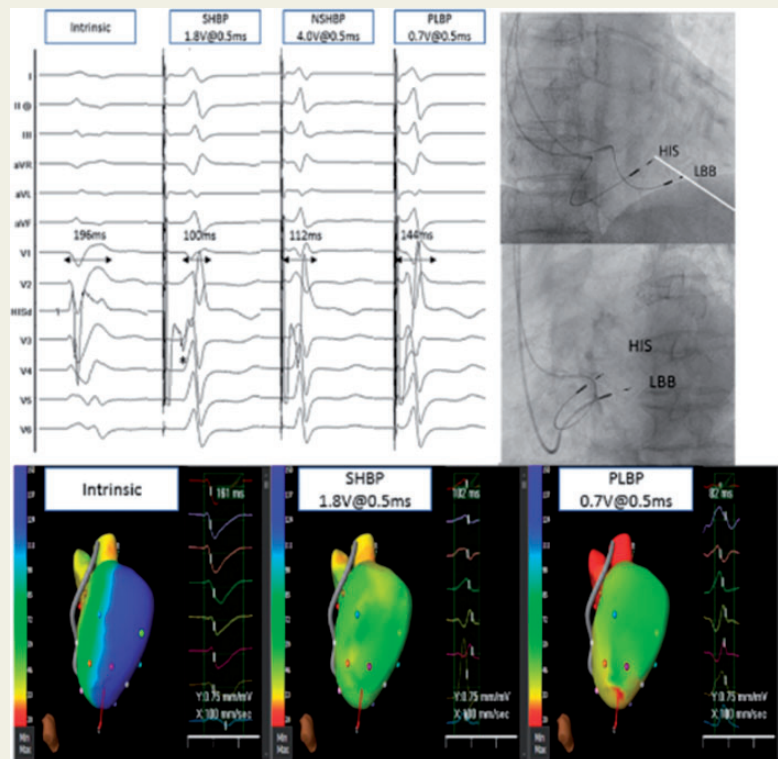


Figure 1 The top left panel are the surface and pacemaker lead local electrograms during intrinsic rhythm; selective His-bundle pacing (SHBP); non-selective His-bundle pacing (NSHBP); and peri-left bundle pacing (PLBP) with the corresponding pacing output and QRS duration. The top right and middle right panel is the fluoroscopic image in right anterior oblique and left anterior oblique projection, respectively, showing the SHBP and PLBP pacing sites. The lower panel is the activation map of non-invasive global epicardial electrogram (ECGi) for intrinsic rhythm; SHBP; and PLBP in the left lateral projection. ECGi, electrocardiographic imaging; LBB, left bundle branch.

Discussion

This is the first case report demonstrating that PLBP is similarly effective as SHBP in synchronizing LV activation in a patient with LBBB. Previous studies have shown Purkinje system conduction disorders like LBBB can be corrected by HBP.² However, there are practical problems with HBP including 10–15% of implantation failure, subacute increase in threshold, atrial oversensing, ventricular undersensing, and inability to correct LBBB.³ Comparing to SHBP, the PLBP site had a lower threshold and increased R-wave sensing and was still able to improve activation in this reported case. The 3830 lead helix was too short (1.8 mm) to reach the left bundle branch but the unique fixed helix screw design and small lead body diameter (1.4 mm) of the 3830 lead allowed it to be driven deep into the RV system by multiple turns on the lead body. The long-term performance, safety, and clinical benefit of PLBP comparing to HBP or RV pacing need to be evaluated by future studies.

Conflict of interest: J.Y.S.C. and W.J.H. have received consultancy fee from Medtronic Inc. B.Y.: none declared.

References

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