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## Selective left bundle branch pacing for pediatric complete heart block

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### ABSTRACT

Traditionally Right Ventricle has been the preferred site of pacing for the management of symptomatic brady-arrhythmias. The deleterious effect of chronic RV pacing has been shown by several studies. This has generated interest into a novel pacing strategy called physiological pacing wherein the His bundle or the left bundle is paced directly with 4.1 F pacing lead. Herewith we are reporting a case of congenital complete heart block in a 13-year-old child for whom selective left bundle branch pacing was done. This physiological pacing will ensure a synchronized contraction of the ventricles thereby avoiding the deleterious effect of RV pacing.

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### 1. Introduction

Congenital complete heart block can manifest at any age. As per ACC/AHA guidelines any symptomatic complete heart block needs permanent pacemaker implantation. Long term effects of chronic right ventricular pacing are well known which includes atrial arrhythmias, left ventricular dysfunction and recurrent heart failure [1]. Since these are young patients who need pacing for a long time it is good to look for alternative sites other than routine right ventricular apex. With recent developments in the field of physiological pacing it is better to consider this modality of pacing for young patients who need long term pacing. Several studies have confirmed the beneficial effect of permanent his bundle pacing (HBP). But there are certain limitations with HBP – high threshold, early battery depletion and risk of lead revision due to rise in threshold/dislodgement [2]. Selective left bundle pacing can overcome these limitation as it provides excellent threshold with good lead stability [3].

### 2. Case report

A 13 years old female child came to us for the management of bradycardia with recurrent presyncope. On examination she was

diagnosed to have congenital complete heart block. Electrocardiography showed atrio-ventricular (AV) dissociation with ventricular rate of 40 beats per minute (QRS duration 80 ms) (Fig. 1). Echocardiography showed mildly dilated Right atrium and ventricle with normal LV systolic function. 24 hours Holter monitoring showed minimum heart rate of around 35 beats per minute. Since she was symptomatic she was planned for permanent pacemaker implantation. In view of young age and requirement of long term pacing an option of physiological pacing was given.

After obtaining informed consent procedure was done under intravenous sedation. Twelve lead electrocardiography and intracardiac electrograms were continuously recorded using St Jude electrophysiology system. A quadripolar (St Jude Medical) catheter was placed via right femoral vein access to get His bundle signals. Baseline study showed AV dissociation with AH block. HV interval was 37 ms (Fig. 2A). After obtaining two separate extra thoracic left subclavian venous puncture C315 His Sheath (Medtronic, Minneapolis, MN) was used to map left bundle area. The lumen less 4.1 F 3830 Selectsecure lead (Medtronic, Minneapolis, MN) was introduced and unipolar mapping was done with the help of EP system. At a region 1 cm below the distal end of the His bundle catheter unipolar pacing showed “W” pattern. The lead was rotated rapidly for 4 turns to get deep into the septum. Pacing there showed typical right bundle branch delay with QRS duration of 97 ms. The paced left ventricular activation time (LVAT in lead V5) was 51 ms (Fig. 2B). Pacing from high output to low output showed non-selective to selective left bundle capture. Native rhythm showed sharp left bundle potential preceding local Ventricular electrogram

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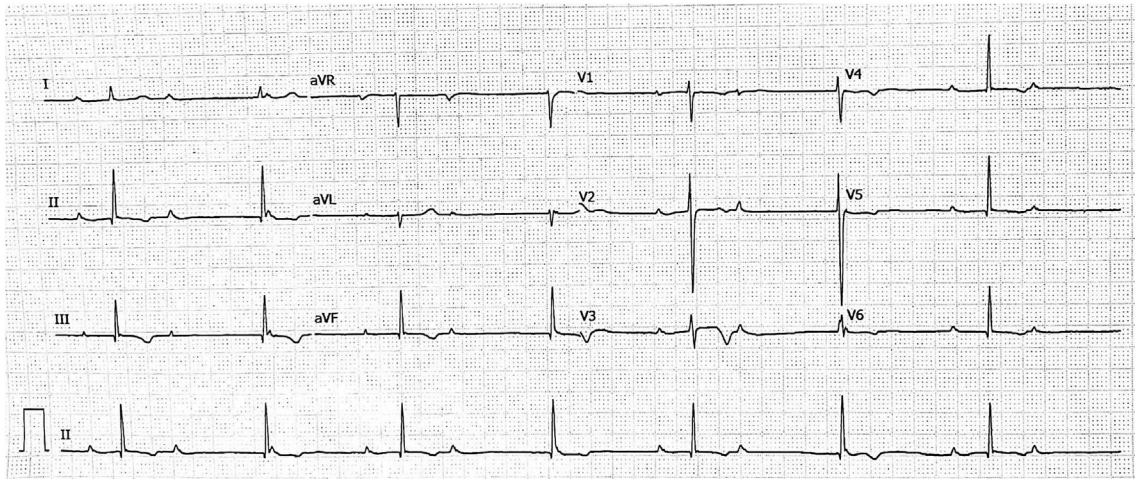


Fig. 1. Baseline ECG showing complete heart block with narrow QRS escape.

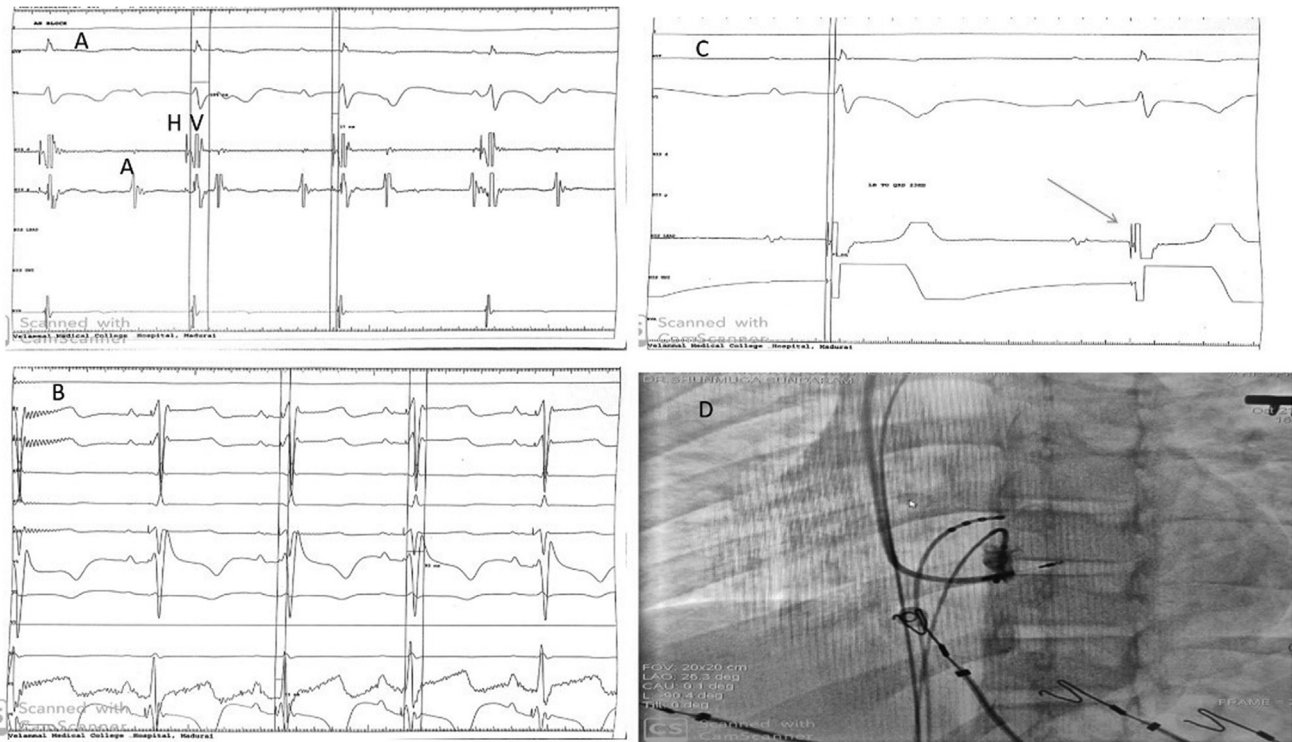


Fig. 2. A) Baseline intracardiac electrogram showing AH block with normal HV interval. B) Left bundle branch paced QRS duration of 97 ms and LVAT of 51 ms. C) 3830 Selectsecure lead electrogram showing giant left bundle potential with LBP to QRS duration of 23 ms. D) Sheath angiography in LAO view showing the depth of the lead (~9mm).

(Fig. 2C). The left bundle to local ventricular electrogram interval was 23 ms. All features favored selective left bundle capture. The local R wave was 10 mV and pacing threshold was 0.3V at 0.6 ms pulse width. Sheath angiography was taken in Left anterior oblique (LAO) view which showed a lead depth of around 9 mm (Fig. 2D). Subsequently atrial lead was placed at right atrial appendage. Both the leads were connected to a dual chamber Medtronic pulse generator. Final paced ECG showed right bundle branch delay pattern with QRS duration of 96ms (Fig. 3). Patient recovered well and discharged on the 4th post procedure day.

### 3. Discussion

Cardiac pacing remains the definitive therapy for symptomatic

bradyarrhythmias. Since chronic RV pacing has produced significant hemodynamic problems alternative pacing sites were considered which includes right ventricular septum, Right ventricular outflow tract and left ventricle. Eventually the concept of permanent his bundle pacing was described by Desmukh et al. [4]. Subsequently with further insights into the anatomy of the conduction system selective pacing of the left bundle branch was attempted by Huang et al. [3]. Since the lead is placed deep into the interventricular septum the pacing parameters are good with good lead stability.

Selective left bundle pacing can be done to treat any symptomatic brady-arrhythmia. 3830 Medtronic selectsecure MRI lead is used and it is guided deep into the septum with the help of C315 sheath. The paced QRS morphology and pacing impedance should

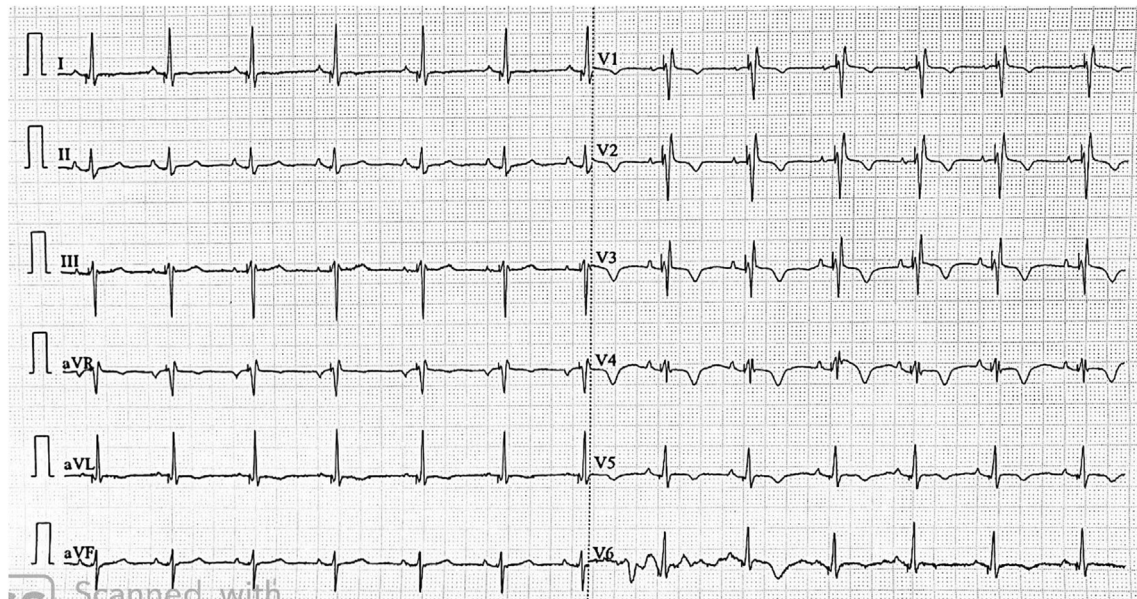


Fig. 3. Final selective left bundle branch paced QRS showing right bundle branch delay pattern with duration of 96 ms.

be monitored as the lead goes into the septum to avoid perforation. With excellent pacing parameters, this modality is considered as an alternative to cardiac resynchronization therapy for patients with dilated cardiomyopathy with left bundle branch block and LV dysfunction. Studies have shown promising results with significant improvement in NYHA functional class and LV ejection fraction [5].

Any patient requiring pacing for more than 40% are at risk of developing chronic RV pacing related complication. Congenital complete heart block is a specific subset of patients who require long term pacing from the early part of their life. Hence physiological pacing must be considered in this subset, it can be either His bundle pacing or left bundle branch pacing. This is going to activate normal cardiac conduction system and provide synchronized contraction of ventricles. With further insights from randomized controlled trials, physiological pacing (His bundle/Left bundle) might come as an effective alternative to cardiac resynchronization therapy in non-ischemic dilated cardiomyopathy patients.

#### Declaration of competing interest

We have no conflicts of interest to disclose.

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