Update on Conduction System Pacing: VCU Experience

Kenneth A. Ellenbogen, MD
Kimmerling Professor of Cardiology
VCU School of Medicine
DISCLOSURES

• Consultant, Research, DSMB, Honoraria: Medtronic, Boston Scientific
• Honoraria: Biotronik
• Honoraria and Consulting: Abbott
AGENDA

• VCU Left Bundle Branch Area (LBBA) Pacing Experience

• Tips and Tricks for Successful Implant

• Case Studies
These data shed some light on whom the target patient may be for HBP. The majority of patients undergoing HBP were treated for AV block (62% of patients from 16 papers), and patient age, sex, and comorbidities reflect that of a typical pacemaker population.
On-treatment comparison between corrective His bundle pacing and biventricular pacing for CRT: His-SYNC

41 patients enrolled and underwent randomization

(1:1)

21 assigned to His-CRT

10 crossed over to BiV
  - Failure to achieve QRS narrowing <130ms = 3
  - No correction due to IVCD = 5
  - Inability to map His = 2

11 Received His-CRT per-protocol

16 His-CRT as treatment-received

20 assigned to BiV

1 withdrawal after randomization

5 crossed over to His-CRT
  - Unable to cannulate = 2
  - Suboptimal CS target branch = 2
  - Vascular occlusion = 1

14 Received assigned intervention per-protocol

24 BiV-CRT as treatment-received
The Efficacy of His Bundle Pacing: Lessons Learned From Implementation for the First Time at an Experienced Electrophysiology Center

Advay G. Bhatt, MD, Dan L. Musat, MD, Nicolle Milstein, MS, Jacqueline Pimienta, BA, Laura Flynn, NP, Tina Sichrovsky, MD, Mark W. Preminger, MD, Suneet Mittal, MD

CONCLUSIONS HBP was feasible and readily learned with a high implant success in the hands of experienced electrophysiologists without prior exposure to the technique. BBB and atroventricular block pattern appears to affect success. The technique is limited by a high rate of rising thresholds and lead intervention. These data have important implications for patient selection. (J Am Coll Cardiol EP 2018;4:1397–406) © 2018 by the American College of Cardiology Foundation.
Case History

• 32 year old F with past medical history of congenital complete heart block who underwent His bundle pacemaker implantation 1 year ago.

• She presented to the ER with complaints of dizziness and presyncope while driving

• She is currently 28 weeks pregnant at presentation
Pre implant ECG : 1 year ago
Post pacemaker implantation: 1 year ago
Device interrogation on presentation

His bundle lead

- Capture threshold (bipolar) 3.25V at 0.5ms
- Programmed output (bipolar) 3V at 0.5 ms
- Impedance 304 ohms
- Measured R waves 3.1 mV
- Programed sensitivity 0.6 mV
His bundle capture threshold trends
VCU LBBA Pacing Experience

• February 2019-October 2019

• All consecutive patients referred for standard indications for PPM implantation

• LBBA pacing was attempted in 110 patients

• Indications:
  • Sinus node dysfunction : 33%
  • AV block : 45%
  • Cardiac resynchronization therapy : 7%
  • Refractory AF prior to AVJ ablation : 15%
<table>
<thead>
<tr>
<th>Variable</th>
<th>N (%)</th>
</tr>
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<tbody>
<tr>
<td>LBBA Pacing Attempted</td>
<td>110</td>
</tr>
<tr>
<td>LBAA Pacing Successful</td>
<td>88%</td>
</tr>
<tr>
<td>Age (years); Mean ± SD</td>
<td>72 ± 12</td>
</tr>
<tr>
<td>Females (%)</td>
<td>54%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>54%</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>28%</td>
</tr>
<tr>
<td>Coronary Artery Disease</td>
<td>32%</td>
</tr>
<tr>
<td>Valvular Heart Surgery</td>
<td>11%</td>
</tr>
<tr>
<td>Left Ventricular Dysfunction (EF&lt;50%)</td>
<td>23%</td>
</tr>
<tr>
<td>Atrial Fibrillation</td>
<td>42%</td>
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<table>
<thead>
<tr>
<th>Baseline ECG Characteristics</th>
<th></th>
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<tbody>
<tr>
<td>QRS Duration (ms); Mean ± SD</td>
<td>116 ± 29</td>
</tr>
<tr>
<td>QRS Duration &gt;130 ms</td>
<td>37 %</td>
</tr>
<tr>
<td>Right Bundle Branch Block</td>
<td>27%</td>
</tr>
<tr>
<td>Left Bundle Branch Block</td>
<td>14%</td>
</tr>
<tr>
<td>Intra Ventricular Conduction Delay</td>
<td>5 %</td>
</tr>
<tr>
<td>Procedural Characteristics</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Procedural Duration (mins)</td>
<td>107 ± 32</td>
</tr>
<tr>
<td>Notch or ‘W’ pattern in V1</td>
<td>54%</td>
</tr>
<tr>
<td>Paced QRSd (ms)</td>
<td>116 ± 11</td>
</tr>
<tr>
<td>Left Bundle Branch Potential (LBB)</td>
<td>51%</td>
</tr>
<tr>
<td>LBB Potential-QRS Duration (ms)</td>
<td>21 ± 5</td>
</tr>
<tr>
<td>LVAT at 5V</td>
<td>70 ± 10</td>
</tr>
<tr>
<td>LVAT at 1V</td>
<td>73 ± 11</td>
</tr>
<tr>
<td>C315 His Fixed Curve Sheath</td>
<td>85%</td>
</tr>
<tr>
<td>C304 His Deflectable Sheath</td>
<td>15%</td>
</tr>
</tbody>
</table>

Preliminary data
Success Rates and Electrophysiological Parameters with Left Bundle Branch Area Pacing

Preliminary data
Conduction System Pacemaker Implantation

**C315 HIS Sheath**
- Outer diameter 7F
- Inner Diameter 5.4F

**SelectSecure® 3830 Pacing Lead**
- 4.1 F, exposed helix
- Isodiametric lead body
- Lumenless design

**New C304 His Deflectable Sheath**
- Outer diameter 8.4F
- Inner diameter 5.7F
Conduction System Pacing

LBAP: Technically easier and higher success rates

Criteria for LBB Capture

1. Paced morphology of RBBB pattern: Qr or rSr’
2. Identification of the LBB potential
3. Pacing stimulus to left ventricular activation time (Stim-LVAT)
4. Determination of Selective (S) and nonselective (NS) LBBP
5. Evidence for direct LBB capture

Huang W, Vijayaraman P. Heart Rhythm. 2019
Tips and Tricks

#1: Ideal site for lead fixation

Recall Para-Hisian PVC morphology: Inferior lead and avR/avL Discordance
#2: Sheath position: difference between HBP and LBBAP

Apply at least 45 deg counter clockwise torque (so that the lead tip faces 1-2 0’ clock position in RAO)
#3 Lead fixation technique

Avoid bloody/sticky gloves
Clean or get a new pair

Two hands, Rapid 4-5 turns
#4 What to do if lead buckles or back spins?

Before repositioning lead, take it out and clean the helix.
#5. Recognize interventricular trans-septal perforation

2290 Analyzer  
09/03/19 8:46:37 AM  
CHART SPEED 25.0 mm/s  

IMPEDANCE Δ from 710 Ω to 329 Ω with HEUX TURN

ECG LEAD II 0.2 mV/mm

MARKER CHANNEL

V EGM 5 mV/mm
LBBA Pacing Cases
Case 1: Difficult to reach basal septum with C315 His sheath.
MDT C315 Fixed Curve Sheath

MDT C304 Deflectable His Sheath

Outflow Tract Morphology

Para-Hisian Morphology
Case 2: CHB post AVR. Mid-septal LBP lead fixation
Final QRS 110 ms with rSr’ pattern in V1
ECG Rhythm Strip: VVI Bipolar Pacing. Threshold Testing

Note: LAD due to LPF Capture
Case 3: 64 yo F w. ICMP EF 20%, on home milrinone, LBBB w. QRSd 160 ms, ambulatory NYHA class IV symps referred for CRT-D implant
Bail out LBBA pacing lead

Initial Site

After 6 turns

Retro LB potential
LAO: Septogram

TTE
Final ECG

Discharged home off Milrinone next day
Case 4: HBP lead exit block 6 months after implant. Referred for LBBA pacemaker. Note HIS and LB signals on respective leads.
Thresholds ($V @ 1.0 \text{ ms}$)

- Implant: 0.7
- 1 month: 0.5
- 6 months: 4.0
- 8 months: 4.5
Evidence for direct LBB capture: $V$-$\text{His}_R$ time
Unipolar ring

V-Retro His 70 ms
Evidence for direct LBB capture: $V$-$\text{His}_R$ time
Unipolar tip

V-Retro His 17 ms