LBBB Cardiomyopathy and His-Bundle Pacing

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Disclosures

• No relevant disclosures
Goals of this Presentation

• I. Background: Introduce the audience to the concept of LBBB Cardiomyopathy

• II. IU Experience with His Bundle Pacing and Left Bundle Branch Cardiomyopathy

• III. Novel Concepts and Future Work
Background: His Bundle Pacing

A BETTER WAY TO PACE HEART

Pacemakers restore normal heartbeats in millions of people, but the widely used technique of connecting the pacemaker wire to a spot in the lower right ventricle triggers heart failure in a surprising number of patients, recent studies show. A small but growing number of doctors are using a new implant technique called His bundle pacing to avoid pacing-induced problems. In His bundle pacing, the doctor puts the right-ventricular lead in the right atrium, millimeters from the heart’s natural conduction system. This creates a natural heartbeat, avoiding the dyssynchrony in heart chambers that leads to pacing-induced heart failure.

New His bundle pacemaker lead placement

Traditional right-ventricular pacemaker lead placement

Pacemaker leads come into heart through the subclavian vein

Sinoatrial node

Atioventricular node

HIS bundle

Right atrium

Right ventricle

Septum

Right bundle branch

The pacemaker is implanted under skin close to the clavicle

Clavicle (collar bone)

Subclavian vein

Heart

Approaching the His bundle

Named for discoverer Wilhelm His Jr. (1869-1924), the His bundle is a collection of highly conductive muscle cells that transmit electric impulses to make the heart’s lower ventricles beat. The His bundle can be stimulated directly, recreating a natural heart rhythm instead of the “elongated” heartbeat that causes problems in some patients over time.

Source: Star Tribune reporting;
University of Minnesota, Grepenger Health System, National Institute of Health

EDDIE THOMAS • Star Tribune

Background: LBBB Cardiomyopathy

First proposed in 2013; based on JACC article which retrospectively analyzed 375 patients form 2007-2010

Six Patients were identified that fit pre-existing criteria which included

1) History of typical LBBB > 5 years
2) LVEF > 50%
3) Decrease LVEF < 40% and development of HF to NYHA II-IV
4) Major mechanical dyssynchrony
4) Idiopathic etiology of cardiomyopathy
Background: LBBB HFREF Does Not Respond to Conventional Treatment

- January 2018 Duke study; QRS duration, EF, and OMT studied on 659 patients
- Highest HF hospitalization, mortality for LBBB, worst response to OMT (3.5% improvement in EF vs 10%)

72 Patients who underwent CRT with LBBB

65 Patients who underwent His-Bundle Pacing

- 7 patients who underwent CRT with LBBB

- 2 patients with ischemic cardiomyopathy

5 patients who met criteria for LBBB Cardiomyopathy

7 Patients who underwent Bi-V Pacing

- 5 patients who underwent CRT with LBBB*

2 Patients with ischemic cardiomyopathy
QRS Duration Decrease

- 28% decrease in QRS duration from 153 ms → 110 ms
EF Improvement

- Average improvement in EF by 52% from 24% \(\rightarrow\) 52%
- 100% patients were hyper-responders (EF> 50%)
# Patient Characteristics

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<th>Pt 1</th>
<th>Pt 2</th>
<th>Pt 3</th>
<th>Pt 4</th>
<th>Pt 5</th>
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<tbody>
<tr>
<td>Age/Gender</td>
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<td>51/F</td>
<td>71/F</td>
<td>61/F</td>
<td>50/M</td>
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<td>LBBB, duration (months)</td>
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<td>36</td>
<td>6</td>
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<td>LVEDD at baseline (mm)</td>
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<td>LVEDD at follow up (mm)</td>
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<td>54</td>
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<td>Hyper-response noted on follow up duration (months)</td>
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<td>3</td>
<td>5</td>
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<td>Nature of His bundle pacing</td>
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**SCHOOL OF MEDICINE**
Electrical Remodeling via HBP?

• One patient with resolution of LBBB on follow-up
His bundle pacing with recruitment of LBB fibers
Sinus rhythm with LBB reverse remodeling after 3 months
Atrial pacing with faster ventricular rates and no evidence of LBBB
LBBB Cardiomyopathy: A New Paradigm?

A tiered approach for early cardiac resynchronization therapy (CRT) should be based on the perceived relative causal contributions of left bundle branch block (LBBB) toward the overall cardiomyopathy.

• Markov Model: Cost Effectiveness/Value Based Care

• Improved response with HBP vs BiV CRT

• No PIM with HBP vs RVP

• Higher thresholds lead to decreased generator longevity
Conclusions

• LBBB NICM does not respond to GDMT in same manner as other cardiomyopathies. Why should it be treated as such?

• PHBP appears to be a viable strategy in treating LBBB-induced cardiomyopathy, addressing the underlying physiology rather than mechanical manifestations of LBBB

• Our case demonstrates electrical reverse remodeling of chronic and persistent LBBB with HBP.
Future Work

- Future randomized trials: HIS-SYNC II: 8000 pt randomizing CRT to HBP

- LBBB Cardiomyopathy group undergoing strain and dysynchrony analysis for a more complete LV systolic function assessment rather than just Ejection Fraction
Questions and Thanks

• Special thanks: Dr. Dandamudi; Dr. Devahaktuni, Dr. Simon, Dr. Ezzedine
LBBB Recruitment by HBP

1) Longitudinal disassociation of His Bundle (some fibers in His bundle are pre‐destined to go into left bundle or right bundle)

2) VEP: Virtual Electrode Polarization: Electrical stimulation can decrease threshold

3) Source‐sink: Overcoming diseased tissue through higher output

4) Bypassing block through distal pacing
Recruitment