

LBBB Cardiomyopathy and His- Bundle Pacing

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October 2018



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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

Atrioventricular node

HIS bundle

Right atrium

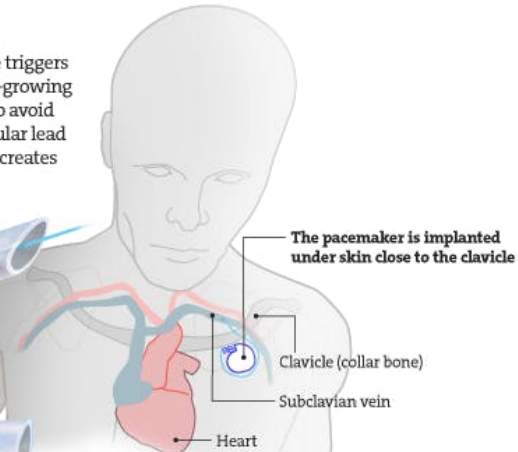
Right ventricle

Septum

Right bundle branch

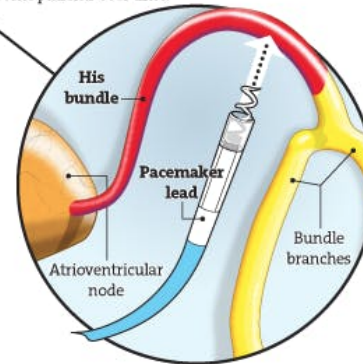
Source: Star Tribune reporting; University of Minnesota, Geisinger Health System; National Institute of Health

EDDIE THOMAS • Star Tribune



Approaching the His bundle

Named for discoverer Wilhelm His Jr. (1863-1934), 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.



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Carlson, Joe. "Making pacemakers easier on the heart may come down to connections." *Star Tribune*. May 27, 2017.

Background: LBBB Cardiomyopathy

Journal of the American College of Cardiology
© 2013 by the American College of Cardiology Foundation
Published by Elsevier Inc.

Vol. 61, No. 10, 2013
ISSN 0735-1097/\$36.00
<http://dx.doi.org/10.1016/j.jacc.2012.10.053>

Conduction Defects and Heart Failure

Resolution of Left Bundle Branch Block–Induced Cardiomyopathy by Cardiac Resynchronization Therapy

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Christophe Leclercq, MD, PhD,*† Christophe Thébault, MD,* Nathalie Behar, MD,*
Philippe Mabo, MD,*† Jean-Claude Daubert, MD*†

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First proposed in 2013; based on JACC article which retrospectively analyzed 375 patients from 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

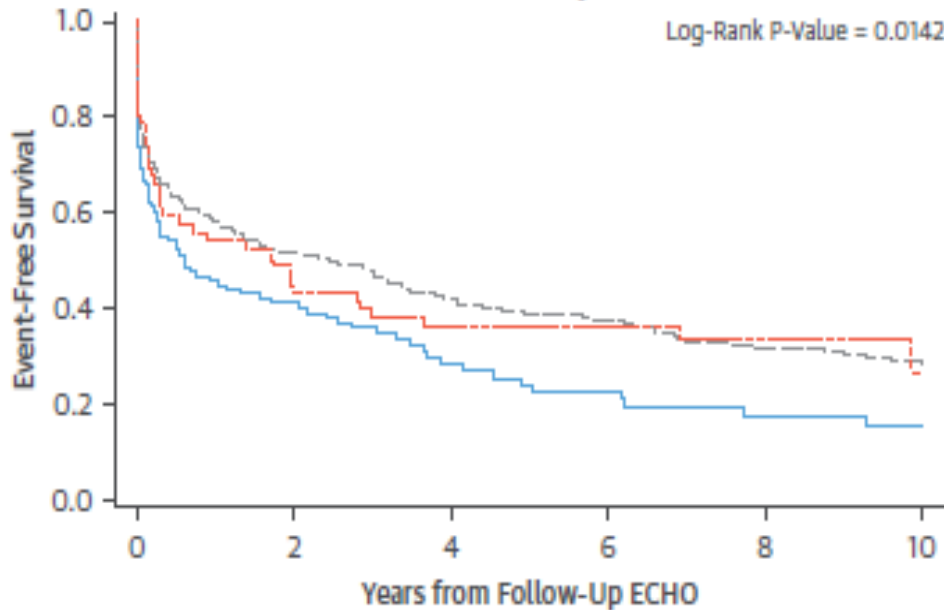


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Vaillant, Caroline, et al. "Resolution of left bundle branch block–induced cardiomyopathy by cardiac resynchronization therapy." *Journal of the American College of Cardiology* 61.10 (2013): 1089-1095.

Background: LBBB HFREF Does Not Respond to Conventional Treatment

C KM Curves for Mortality and HF Hospitalization by QRS Morphology With Number of Subjects at Risk



	0	2	4	6	8	10
LBBB	111	42	21	15	9	7
WQRS	59	25	19	16	11	4
NQRS	489	219	142	98	60	39

LBBB Group — LBBB — WQRS - - - NQRS

- 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 His Bundle Pacing or Bi-Ventricular Pacing from 08/1/2015 – 08/2017

65 Patients who underwent His-Bundle Pacing

7 Patients who underwent Bi-V Pacing

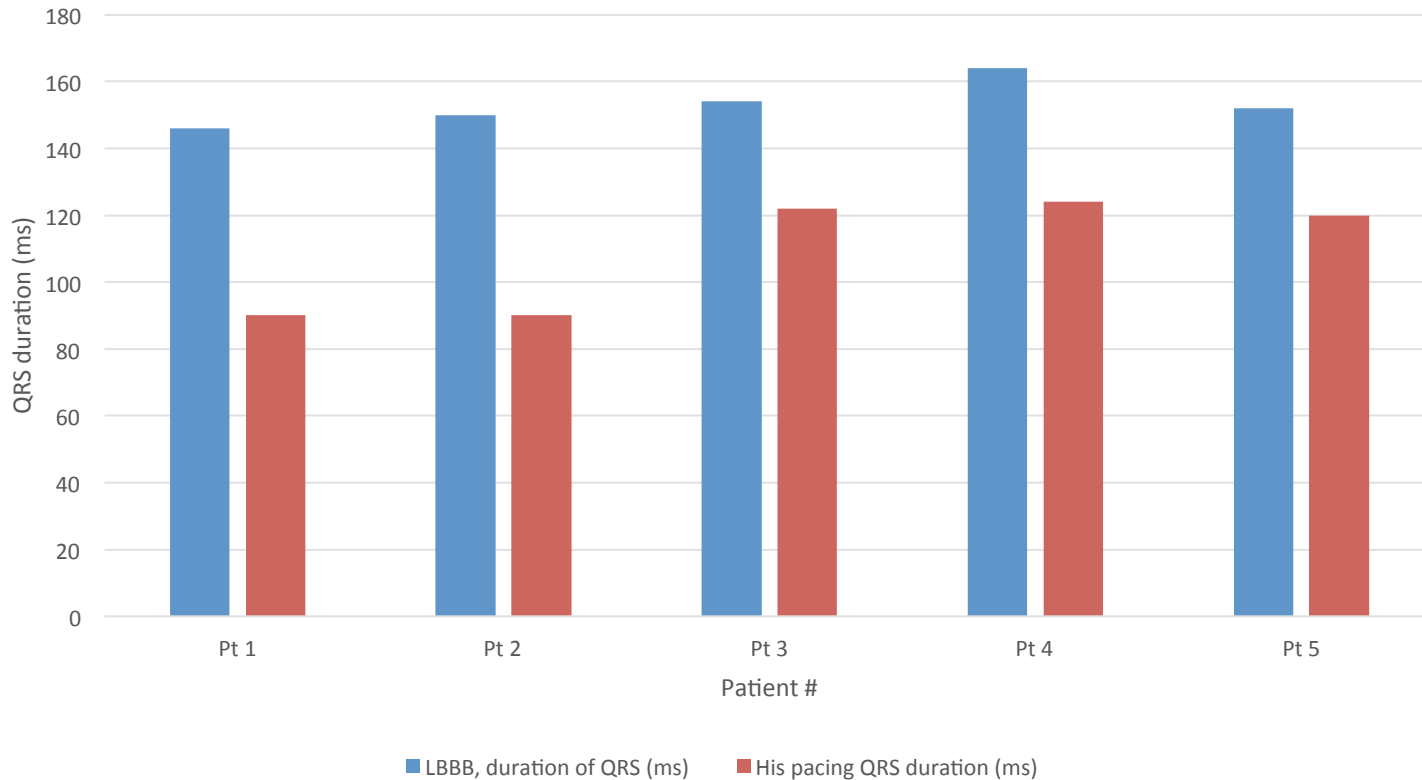
7 patients who underwent CRT with LBBB

5 patients who underwent CRT with LBBB*

2 patients with ischemic cardiomyopathy

5 patients who met criteria for LBBB Cardiomyopathy

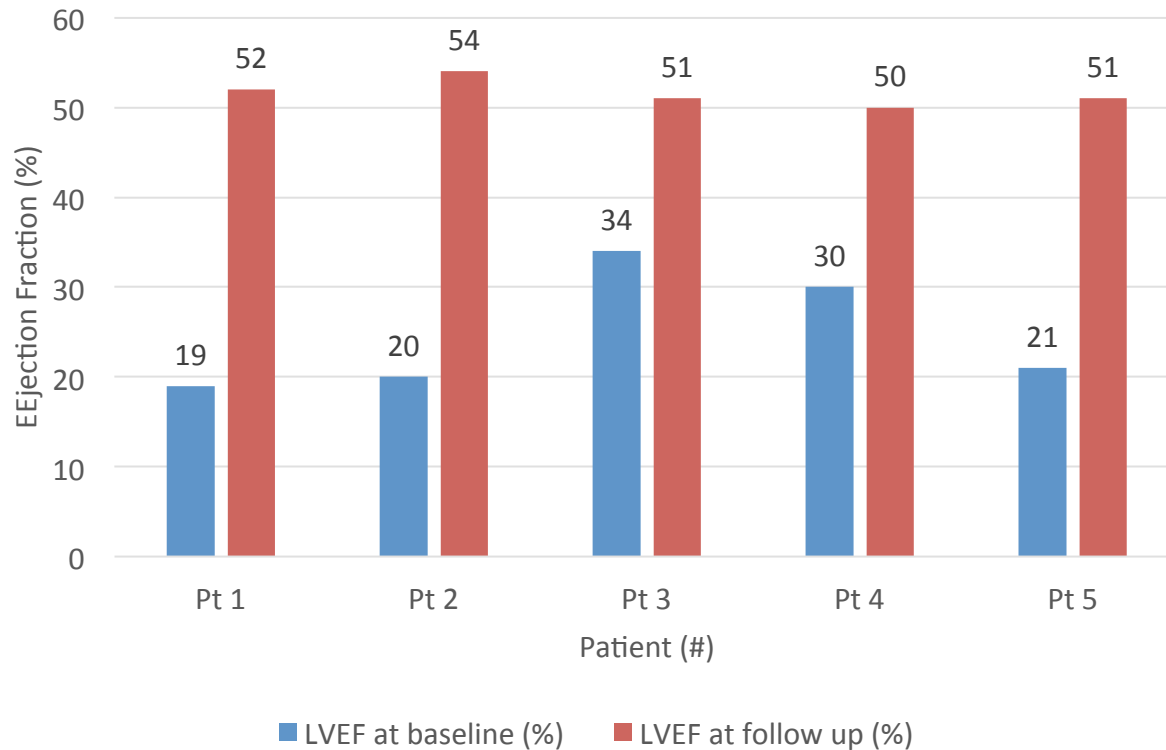
QRS Duration Decrease



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



EF Improvement



- Average improvement in EF by 52% from 24% → 52%
- 100% patients were hyper-responders (EF > 50%)



Patient Characteristics

	Pt 1	Pt 2	Pt 3	Pt 4	Pt 5	
Age/Gender	59/F	51/F	71/F	61/F	50/M	
LBBB, duration (months)		16	36	6	72	24
LVEDD at baseline (mm)		52	53	59	58	64
LVEDD at follow up (mm)		40	45	42	50	54
Hyper-response noted on follow up duration (months)		13	3	5	5	3
Nature of His bundle pacing	S	S	NS	NS	S	

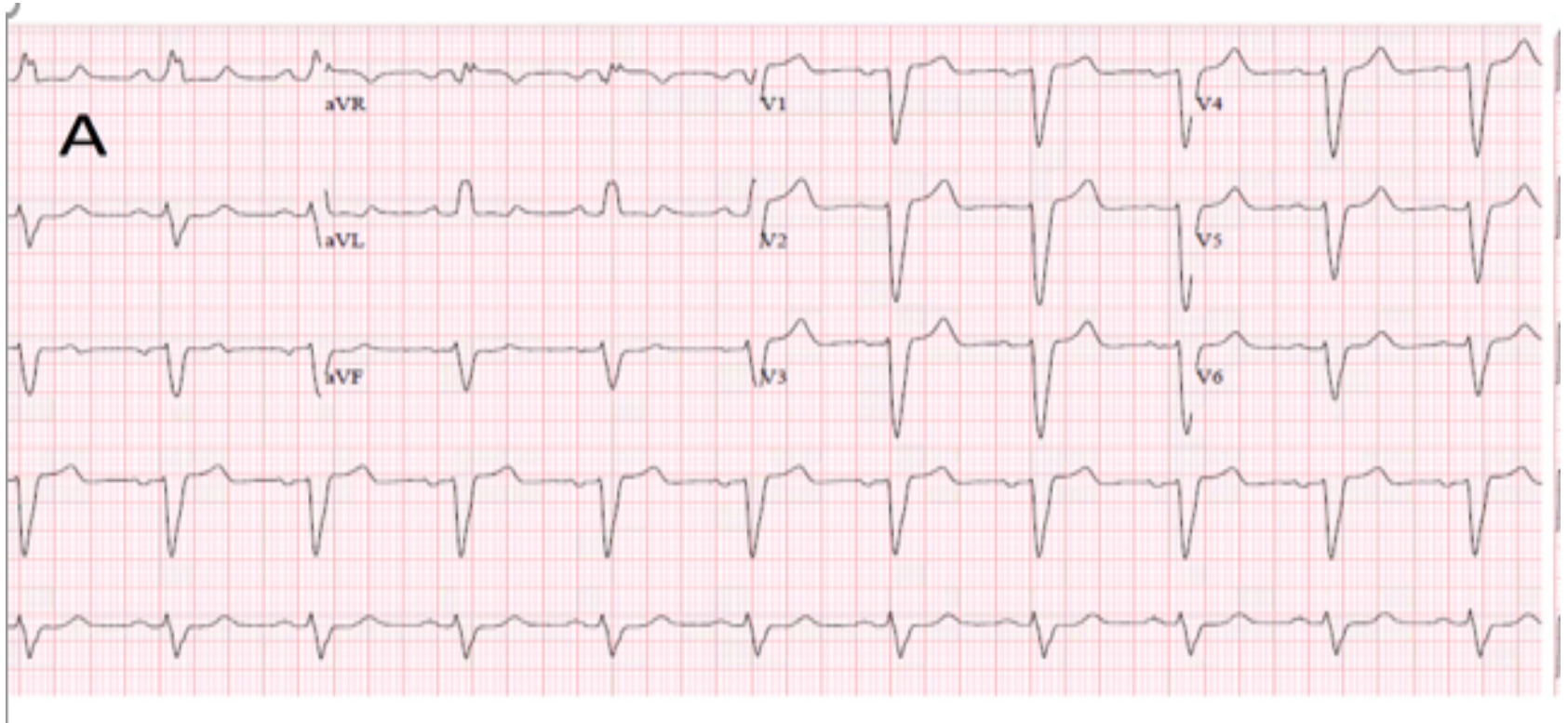


Electrical Remodeling via HBP?

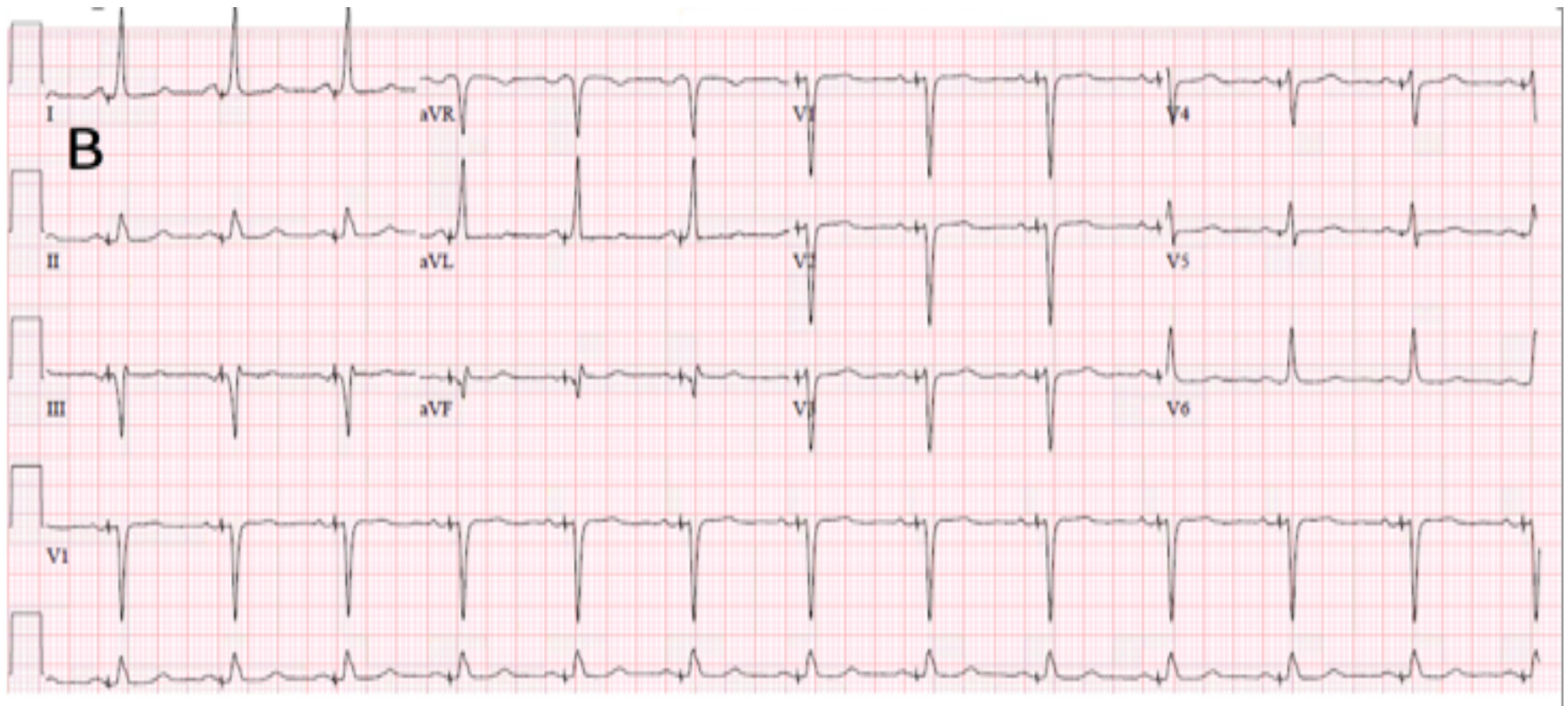
- One patient with resolution of LBBB on follow-up



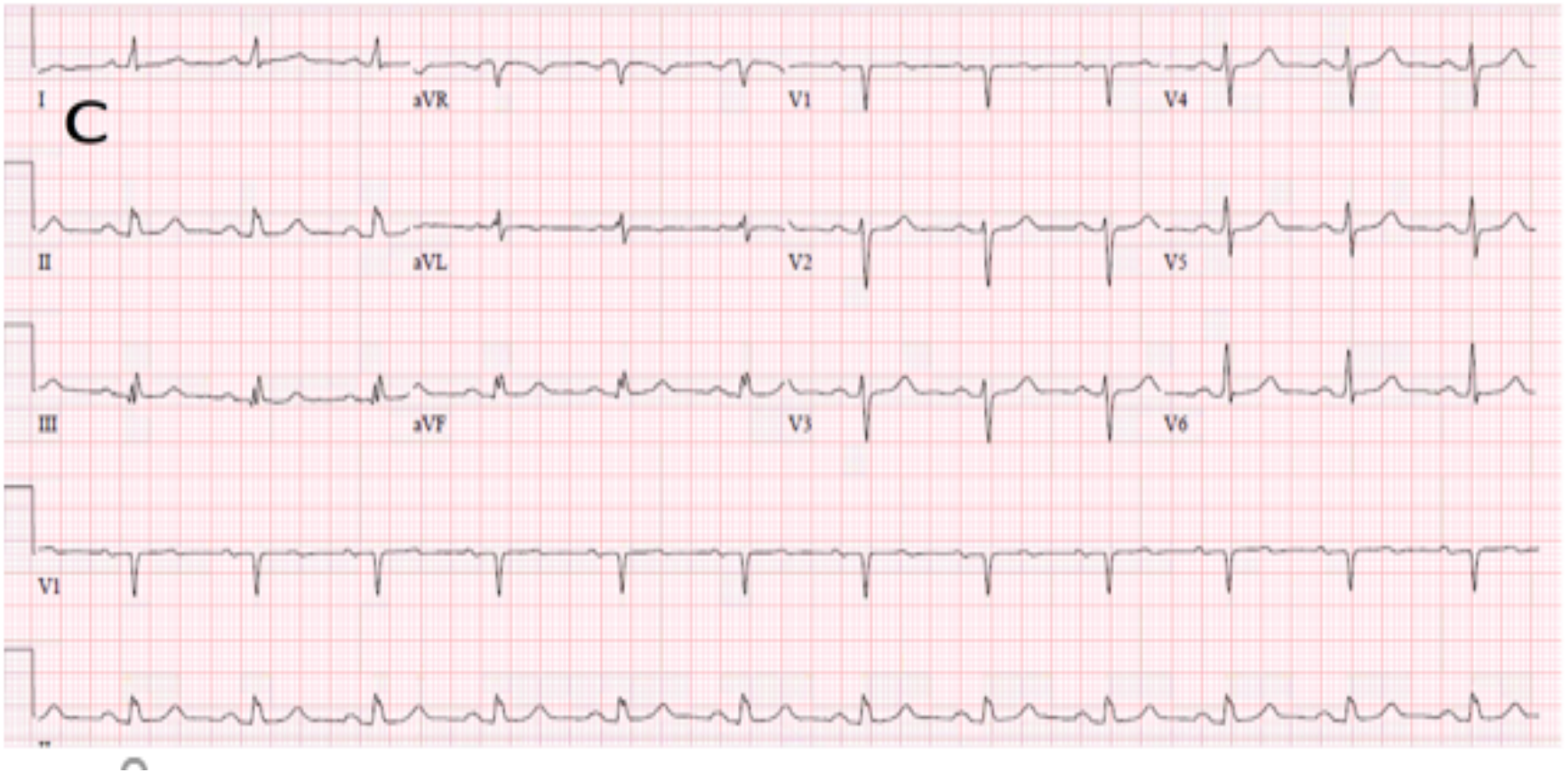
Baseline ECG with LBBB



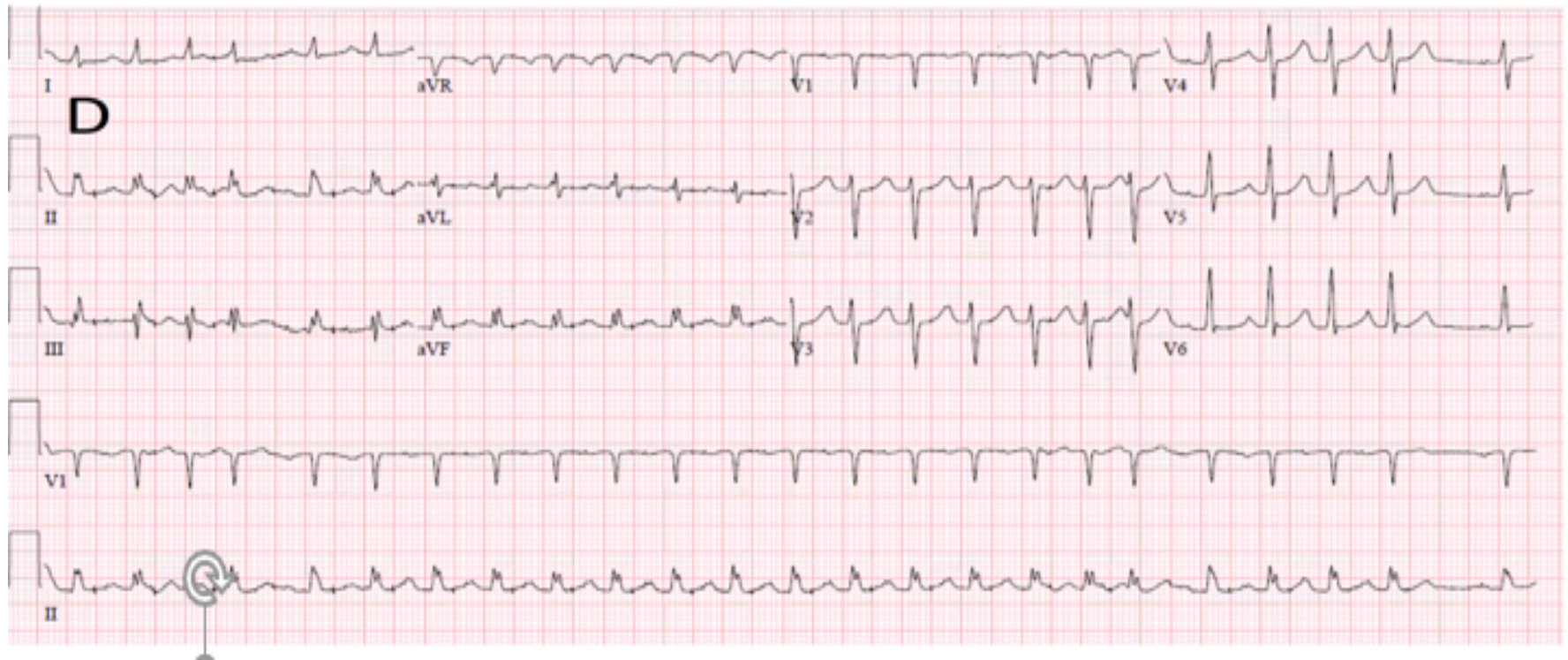
His bundle pacing with recruitment of LBBB fibers



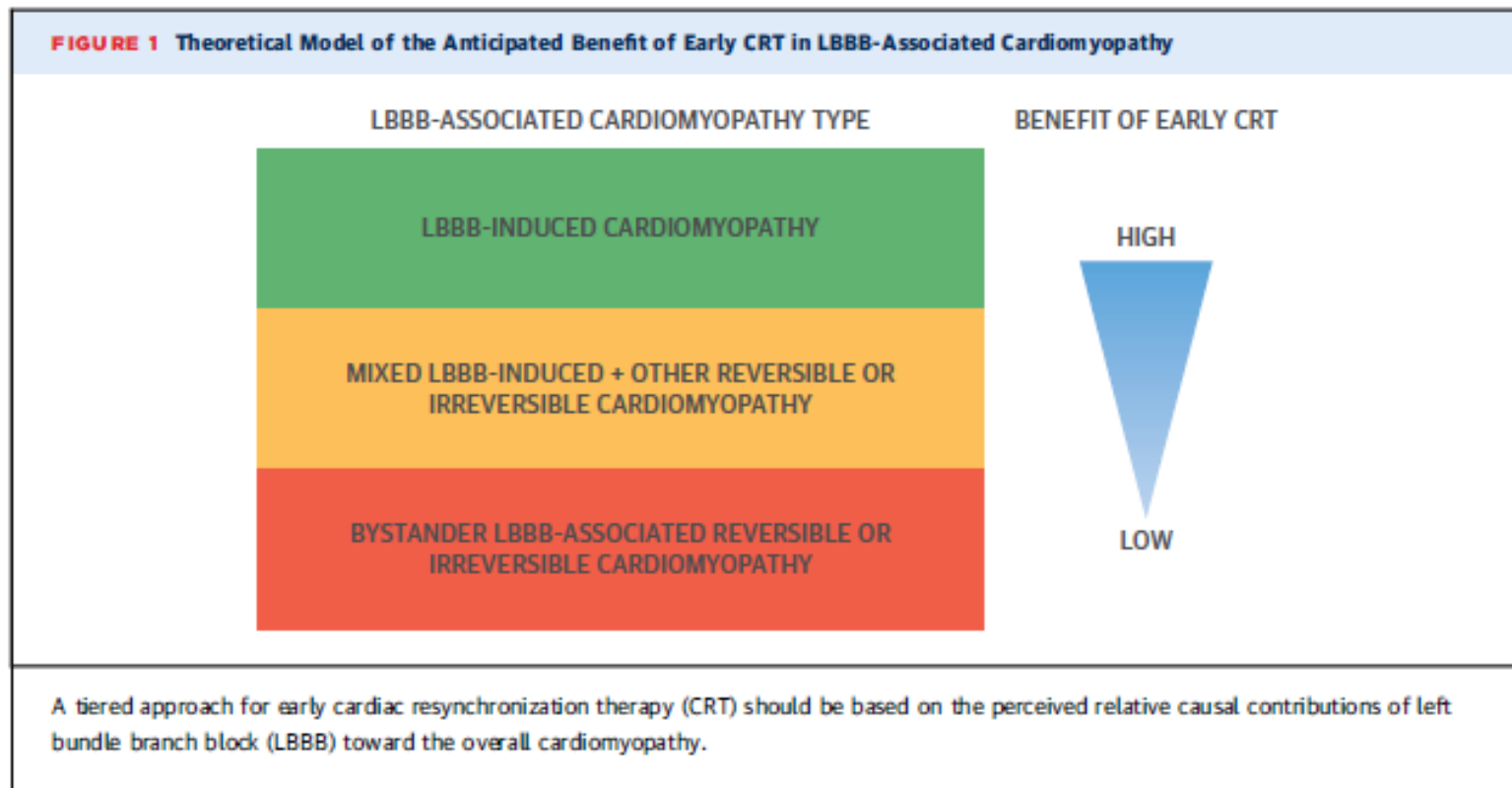
Sinus rhythm with LBBB reverse remodeling after 3 months

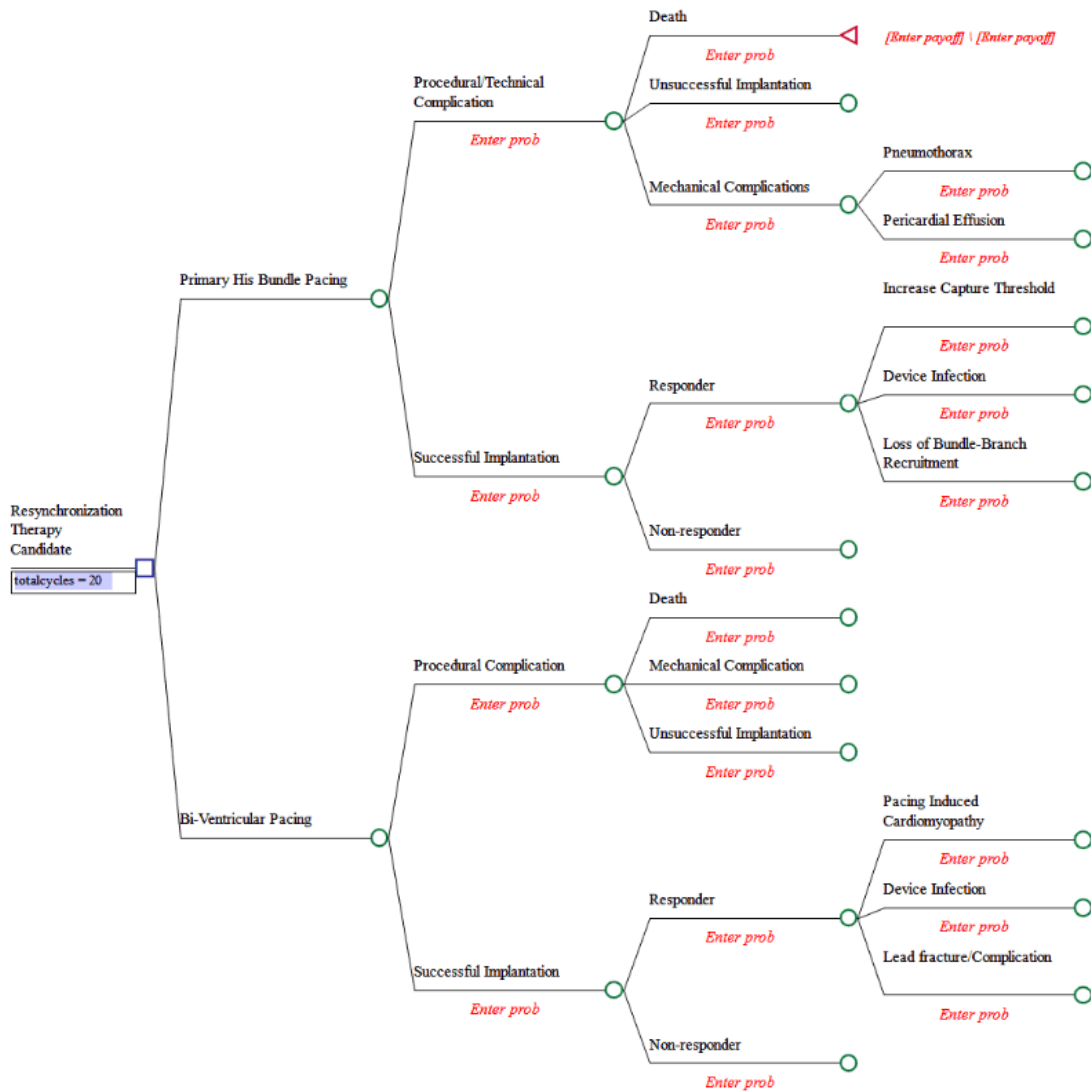


Atrial pacing with faster ventricular rates and no evidence of LBBB



LBBB Cardiomyopathy: A New Paradigm?





- 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 dyssynchrony 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

