Left Bundle Branch Pacing

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What we will be discussing

- How does the hearts wiring work?
- Why would someone need a pacemaker?
- How does a traditional pacemaker work?
- What is the problem with a traditional pacemaker?
- What is a bi-ventricular (3-wire) pacemaker?
- What is conduction system pacing and how is it beneficial?
- How does left bundle branch pacing work?
- How do we know left bundle branch pacing works?

Cardiac Conduction System: The Hearts "Wiring"



Cardiac Conduction System: The Heart's "Wiring"



Ronald A. Bergman, Ph.D., Adel K. Afifi, M.D., Paul M. Heidger, Jr., Ph.D; https://www.anatomvatlases.org/MicroscopicAnatomv/Section08/Plate08151.shtml

Why Would Someone Need a Pacemaker?

IF THE HEART BEATS TOO SLOW
TO TREAT CONDUCTION DISEASE
(Mainly Left Bundle Branch Disease)

Reasons to have an pathologically slow heart rate



- Sinus Node dysfunction
 - Sometimes the heart's "natural pacemaker" stops working right
 - By far the most common reason to implant a pacemaker
 - Normal HR is 55-100 beats per minute
 - Bradycardia: HR < 55 bpm
 - Tachycardia: HR >100 bpm
 - We rarely implant a pacemaker based on a number alone (<40bpm) since the vast majority of pathological bradycardia will cause symptoms (i.e. dizziness, lightheadedness, fatigue, syncope, exercise intolerance)

Reasons to have a pathologically slow heart rate





How Does a Traditional Pacemaker Work?

Components of a Traditional Pacemaker



How Does a Traditional Pacemaker Work?



The Leads:

- Conduct impulses from the pulse generator to the heart
- Relay information from the heart to the pulse generator
- The Pulse Generator:
 - Generates the electrical impulse using the integrated battery
 - Receives information from the leads and serves as the CPU

A Pacemaker Does NOT.....

- Treat fast heart rates!!!!
 - What about AFIB??
 - What about Ventricular tachycardia??







Left

atrium

Left ventricle

Purkinje fibers

Left bundle

branch

The Problem With Traditional Pacemakers

Pacemaker Induced Heart Failure



- Traditional pacemaker leads are placed within the myocardium where conduction is slow.
- This causes the left ventricle (the strongest chamber which pumps blood to the whole body) to beat out of sync. One half of the ventricle contracts and relaxes before the other half start to contract.
- After a while this causes the left ventricle to weaken

What is a Biventricular (3 wire) Pacemaker?



CRT STANDS FOR "CARDIAC RESYNCHRONIZATION THERAPY"

- In addition to the two traditional wires, a third wire is implanted into the outside vein of the heart called the coronary sinus
- In patient with any kind of heart failure (especially pacemaker induced heart failure), CRT improved heart function and allowed patients to live longer. This was a great advancement in pacemaker technology.
- Unfortunately, 30% of these people don't get better

What is Conduction System Pacing?

What is Conduction System Pacing?



- Conduction system pacing refers to use of an artificial pacemaker to directly stimulate, directly or indirectly, the hearts innate insulated specialized electrical circuit. There are two types:
 - **1. HIS** bundle pacing
 - 1. Direct (selective) or indirect (nonselective) capture of the HIS bundle.
 - 2. Left bundle branch pacing
 - **1.** Direct or indirect capture of the left bundle branch

How Does Left Bundle Branch Pacing Work?

Implantation Technique





How Do We Know Left Bundle Branch Pacing Works?





How Does Conduction System Pacing Compare to Bi-Ventricular Pacing?

Myocardial architecture consists of complex folds of muscle that contract with multi directional deformation





Evidence For Improved Clinical Outcomes



Wu et. al. Canadian Journal of Cardiology 37 (2021) 319e328

Sharma et. al. Heart Rhythm; Volume 19, Issue 1, January 2022, Pages 3-11

Continued Research

/ OCT. 11, 2022

Multi-institutional project awarded \$31M to study promising heart failure therapy

The study will assess a new method for pacing the heart that could potentially improve health outcomes for patients diagnosed with heart failure and conduction system disease.



Continued Research

BIOTRONIK Enrolls First Patient Into BIO-CONDUCT, First IDE Trial to Study Use of Stylet-Driven Leads for Conduction System Pacing



Summary:

- PACEMAKERS ARE COMMONLY IMPLANTED FOR SLOW HEART RATES AND CONDUCTION DISEASES SUCH AS LEFT BUNDLE BRANCH BLOCK
- TRADITIONAL PACEMAKERS ARE ASSOCIATED WITH A RISK FOR PACEMAKER INDUCED HEART FAILURE
- BI-VENTRICULAR PACEMAKERS CAN REVERSE HEART FAILURE IN MANY PATIENTS, BUT NOT ALL....
- CONDUCTION SYSTEM PACING RECRUITS THE HEARTS NATURAL ELECTRICAL WIRING TO RESTORE VENTRICULAR SYNCHRONY
- LEFT BUNDLE BRANCH PACING HAS EMERGED AS A NEW, SAFE, VIABLE AND EFFECTIVE ALTERNATIVE TO NOT ONLY REVERSE CERTAIN TYPES HEART FAILURE BUT PREVENT THEM FROM OCCURRING
- CURRENT EVIDENCE HAS ESTABLISHED THIS BUT EXCITING NEW TRIALS ARE ON THE HORIZON TO EXPAND OUR TOOLS AND, MORE IMPORTANTLY, ESTABLISH A MORTALITY BENEFIT



THANK YOU!!!