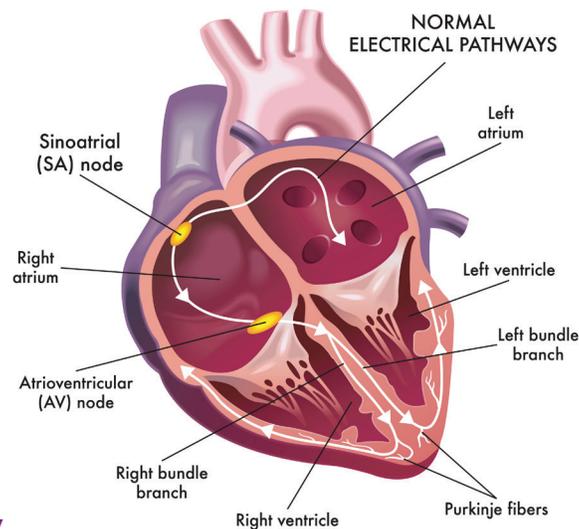


# Permanent His Bundle Pacing

## What happens during a normal heartbeat?

To better understand a problem with the rate or rhythm of your heartbeat, it is important to know how the heart works.

- The heart is made up of four chambers: two atria (upper chambers) and two ventricles (lower chambers).
- Electrical impulses from your heart muscle (the myocardium) cause your heart to beat (contract).
- This electrical signal begins in the sinus node.
- A group of cardiac cells with a property termed automaticity, called the sinus node, is located at the top of the right atrium.
- The sinus node is responsible for starting a heartbeat—it is the body's natural pacemaker.
- When an electrical impulse is released from this natural pacemaker, it causes the atria to contract.
- The signal then passes through the atrioventricular (AV) node, through the bundle of His, and down the bundle branches (which are like the trunk of a tree).
- And then through the Purkinje fibers (which are like branches on a tree) through the muscle fibers of the ventricles, causing them to contract.



## Normal Conduction Analogy

- Imagine a picture made up of dominoes.
- One domino is pushed over causing a wave of collapsing dominoes spreading out across the picture until all dominoes are down
- And imagine the bundle branches as motorways, with the Purkinje fibers as A and B roads that spread widely across the ventricles. In this way all the cells in the ventricles receive an electrical stimulus causing them to contract.

## His Bundle Pacing Background

- First and foremost, it replicates human physiology.
- Traditionally, pacemakers are implanted with a lead (wire) positioned to deliver the electrical impulses to the heart's right ventricle (RV) to regulate a slow or irregular heart rhythm.
- However, long-term RV pacing creates a non-physiologic activation pattern and may lead to worse systolic (contraction) and diastolic (relaxation) function

- His bundle pacing (HBP) directly engages the His-Purkinje system (HPS), utilizing your normal and natural pacing physiology to maintain synchronous ventricular activation
- By stimulating the His-Purkinje network, HBP engages electrical activation of both ventricles and may avoid marked dyssynchrony (the difference in the timing, or lack of synchrony, of contractions in different ventricles in the heart).
- His-bundle pacing preserves synchronous ventricular activation, which could lessen ventricular dysfunction relative to RV pacing.
- **Experience does matter.** Although His Bundle pacing is relatively new (2016), **I have performed over 150 implants** implanting approximately **five pacemakers per month** using HBP technique. I am encouraged by the results seen in my patients using His-bundle pacing.

### Lead Placement

- The lead that would be intended for ventricular pacing, which would normally be placed in the right ventricle, will be placed on the lower septal part of the right atrium or in the upper septal part of the right ventricle to pace the bundle of His.
- Limitations: Permanent HBP can be challenging due to the limited availability of delivery tools, particularly in patients with an enlarged right atrium and a displaced tricuspid annular region or right pectoral implants.

### 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

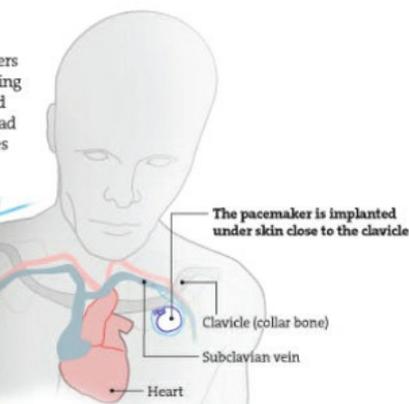
Right ventricle

Septum

Right bundle branch

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

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#### 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.

