HEALTHY HEART

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His bundle pacing (HBP) results in physiological ventricular activation and has generated tremendous research interest and enthusiasm. By stimulating the His–Purkinje network directly, HBP results in synchronized ventricular activation, which might translate into improved clinical outcomes compared with dyssynchronous ventricular activation with RV apical pacing.

HBP can also overcome bundle branch block patterns, and data are accumulating on the benefit of HBP for cardiac resynchronization therapy (CRT).

Understanding of The anatomy of the His bundle and implantation technique is very critical.

In patients with significant RV pacing (>40%), heart failure hospitalization was significantly reduced in the HBP group compared with the RV pacing group.

Current data suggest that HBP is superior to traditional RV pacing, with improved clinical outcomes

Conduction System Pacing (Physiological Pacemaker)

Introduction

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Anatomy of the His bundle

- A detailed knowledge of the anatomy of the AV conduction system, including the HB and proximal bundle branches, is crucial for performing permanent HBP.
- The HB acts as a gateway for electrical conduction from the AV node to the ventricles via the bundle branches.
- Anatomical characterizations of the HB were first described in 1893 by Wilhelm His Jr, a Swiss anatomist and cardiologist.
- We now understand that the penetrating bundle of the HB originates from the distal AV node, runs through the inferior portion of the membranous interventricular septum and then, in most individuals, continues along the left side of the crest of the muscular interventricular septum.
- The proximal part of the HB rests on the right atrial–LV portion of the membranous septum, and the more distal part travels along the RV–LV portion of the membranous septum, immediately below the aortic root.

- Kawashima and colleagues described three anatomical variations in the course of the HB relative to the membranous part of the ventricular septum in an autopsy series of 105 human hearts.
- Type I anatomy (Most common type, 46.7%), the HB courses along the lower border of the membranous part of the interventricular septum and is covered with only a thin layer of myocardial fibres.
- Type II anatomy (32.4%), in which the HB runs within the interventricular muscle and is separated from the lower border of the membranous part of the interventricular septum.
- Type III anatomy (21%), also referred to as the naked AV bundle, the HB traverses immediately beneath the endocardium and courses onto the membranous part of the interventricular septum.
- These anatomical variations of the HB have clinical implications for permanent HBP and influence the ability to achieve selective or non-selective HB capture.

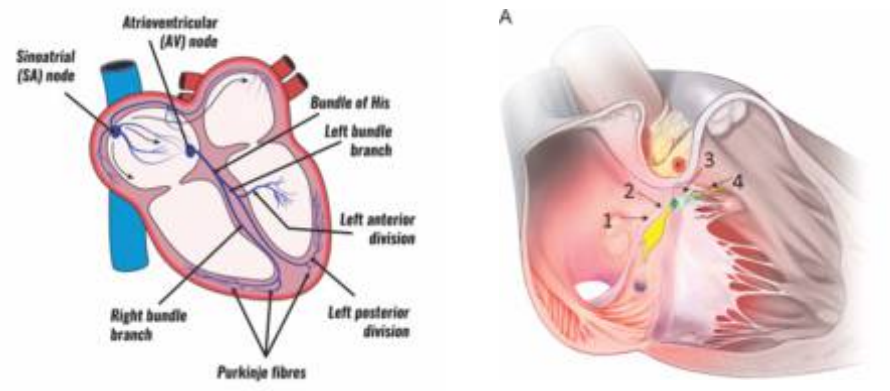

Figure 1: Conduction System of Heart

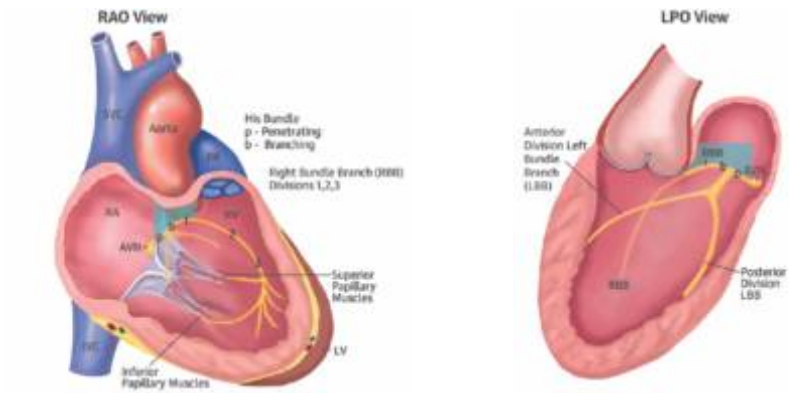

Figure 2: Targets of Conduction System Pacing

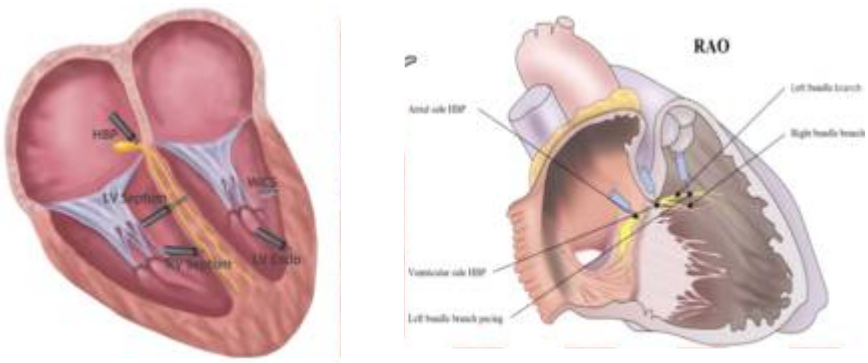

Figure 3: Possible pacing sites

Early descriptions of permanent HBP

- In 2000, Deshmukh and colleagues were the first to report permanent HBP in clinical practice. They demonstrated successful permanent HBP in 67% of 18 patients with chronic AF.
- Subsequently, several European groups described the success of permanent HBP. These studies routinely used an electro-physiology multielectrode mapping catheter to localize the HB (often using femoral venous access).

Implantation technique and success rate

- In the early experience with permanent HBP, lead implantation at the HB was performed using standard pacing leads and by reshaping various stylets with the hope of positioning the lead at a site near the electrophysiology mapping catheter using fluoroscopic views.
- As expected, this technique required additional steps, was very time consuming and was associated with low overall success rates.
- With the advent of newer tools (such as new delivery systems), mapping the HB using the lead itself became feasible, followed by more stable lead fixation, and resulted in a substantial improvement in implantation success rates.
- Currently, the HBP system that has been most studied comprises the SelectSecure 3830 Medtronic lead implanted via delivery heaths.

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- The 3830 lead is 4.1 F in diameter with a 1.8 mm exposed helix and is lumenless in design.
- The C315 HIS delivery sheath has an outer diameter of 7.0 F with an inner diameter of 5.4 F and has a primary (distal) septal curve and a secondary (proximal) curve that directs it towards the tricuspid annulus.
- After obtaining venous access, the C315 HIS sheath is advanced over a long guidewire towards the tricuspid annulus, generally through an

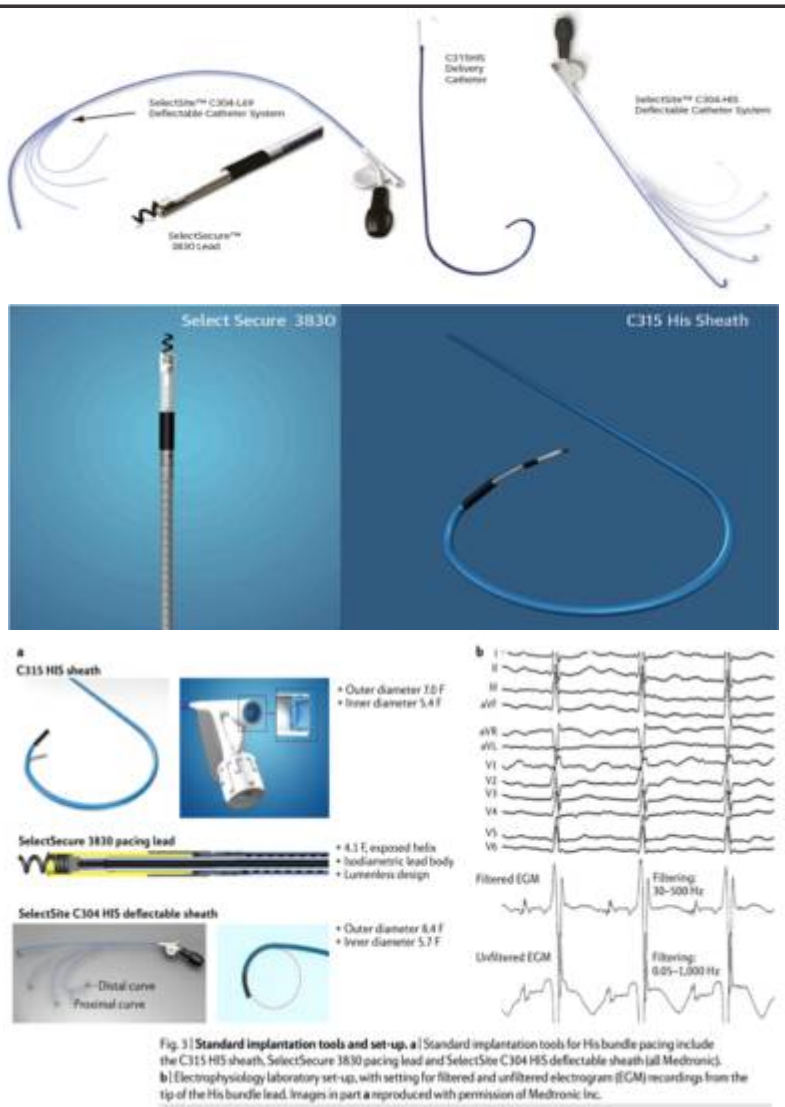

Fig. 3 | **Standard implantation tools and set-up. a** | Standard implantation tools for His bundle pacing include the C315 HIS sheath, SelectSecure 3830 pacing lead and SelectSite C304 HIS deflectable sheath (all Medtronic). **b** | Electrophysiology laboratory set-up, with setting for filtered and unfiltered electrogram (EGM) recordings from the tip of the His bundle lead. Images in part a reproduced with permission of Medtronic Inc.

Figure 4: Implantation tools used for Conduction System Pacing

Figure 6: Normal ECG

Figure 7: Conventional RV apical pacing (Wide paced QRS)

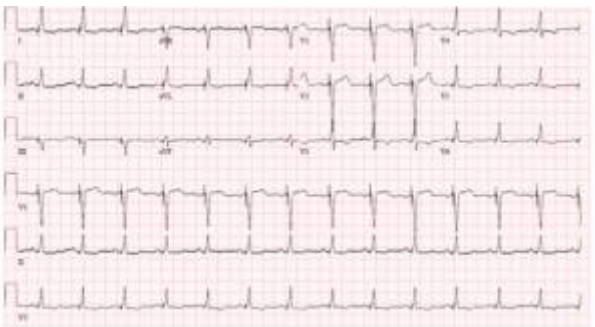

Figure 8: Conduction System Pacing (Narrow paced QRS)

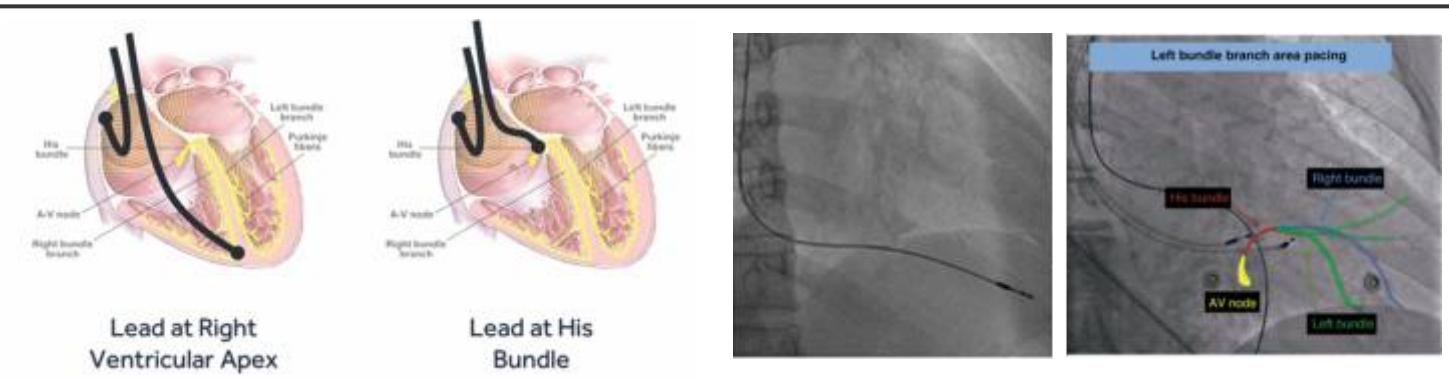

Figure 5: Schematic showing Conventional RV apical Pacing vs Conduction System Pacing

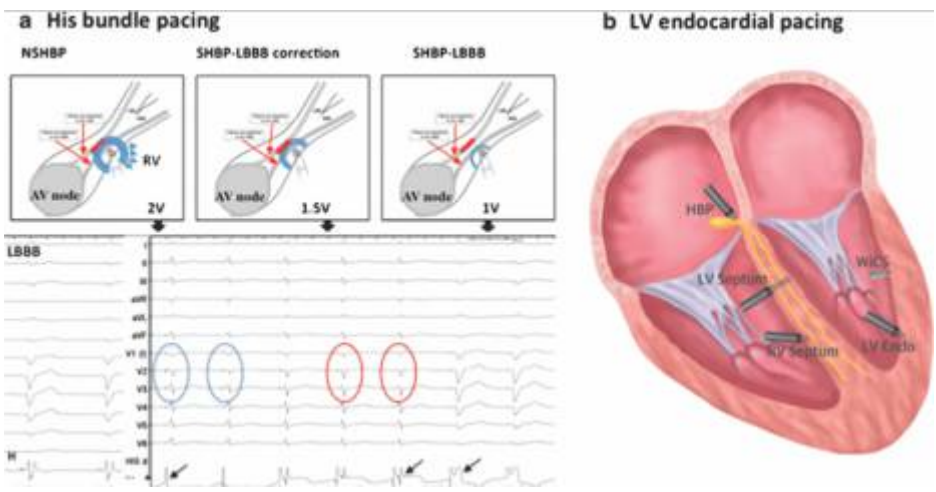

Figure 9: LBBB correction with Conduction System Pacing (Cardiac Resynchronization)

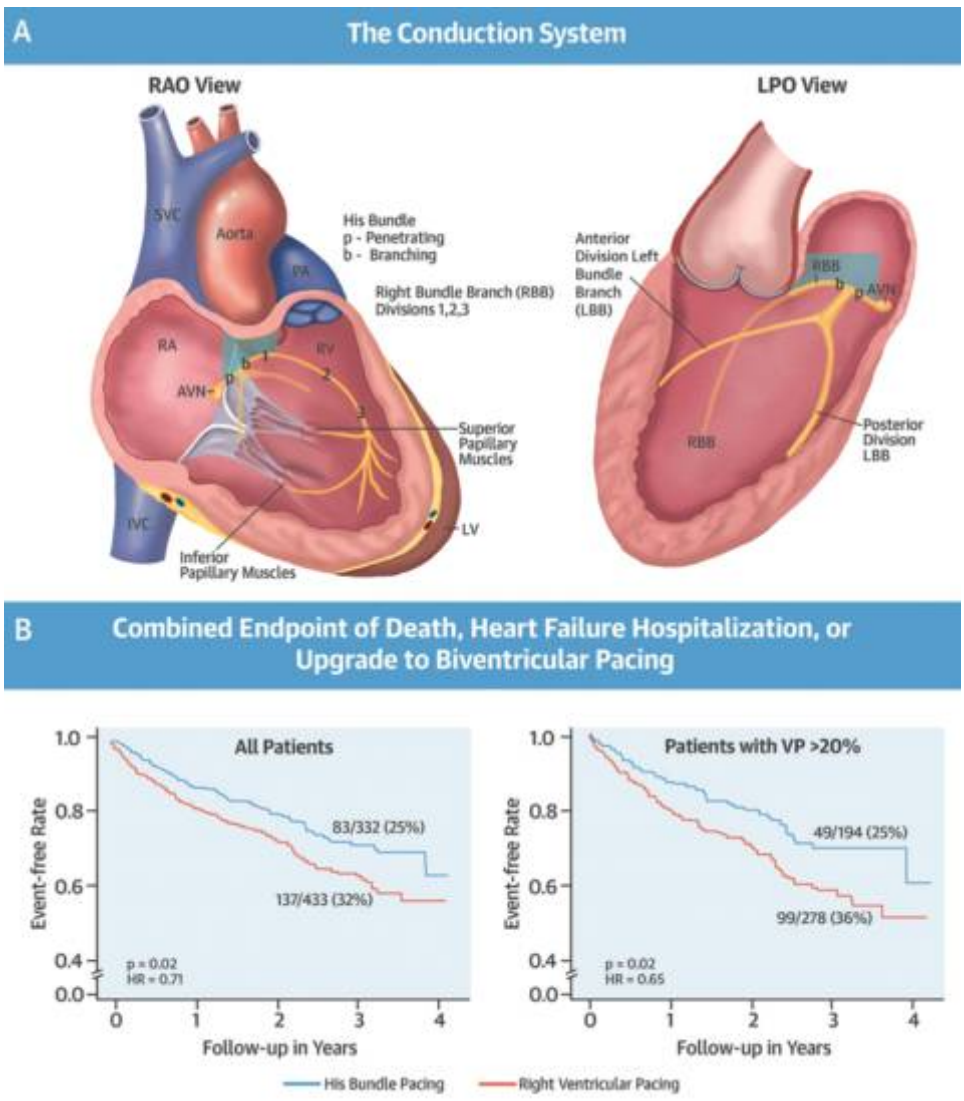

Figure 10: Clinical outcomes of RV apical pacing vs Conduction System Pacing

outer peel away sheath. The 3830 lead is then advanced to the tip of the sheath, and the HB region is mapped in the unipolar configuration.

- The electrogram recordings are displayed on the Pacing System Analyser (PSA) alone or on an electrophysiology recording system.
- When satisfied with the sensing and paced morphology at the HB region, the lead is fixed at this location by rotating the lead body four or five turns in a clockwise fashion.
- Lead parameters (R wave sensing and HB capture morphologies and thresholds) are then assessed.

Clinical Outcomes of Physiological Pacing

- It is well established that chronic RV pacing is detrimental to left ventricular function and is associated with heart failure and increased mortality.
- Depolarization of the ventricles through the His–Purkinje system prevents dyssynchrony because activation is physiological. Catanzariti et al demonstrated that HBP is associated with a reduction in the indices of LV dyssynchrony and mitral regurgitation together with improved LV function compared to RVP.
- In 2014, Kronborg et al reported data from 38 patients who underwent HBP and RV septal pacing in a 12-month crossover study. HBP preserved LVEF and mechanical synchrony compared with RV septal pacing.
- The incidence of Pacing induced Cardiomyopathy was significantly higher in the RV pacing compared to the HBP group (22% vs 2%).

- Despite 5 years of V pace, HBP did not result in ventricular dyssynchrony or cardiomyopathy. In this population of patients, HBP prevents pacing-induced heart failure.
- In patients with more than 40% V pace, the combined endpoint of death or Heart Failure Hospitalization was significantly reduced in the HBP group compared to the RV pacing group.
- The mechanism by which HBP reduces mortality may partly be explained by elimination of ventricular dyssynchrony and reduction in heart failure.

TAKE HOME MESSAGE

- Permanent His-bundle pacing (HBP) is a physiological alternative to right ventricular pacing (RVP). HBP has been considered to be technically challenging.
- Permanent HBP can be achieved by unipolar mapping of the His bundle using a dedicated pacing lead (Select Secure, model 3830, Medtronic Inc, Minneapolis, MN) and a fixed curve delivery sheath (C315 HIS, Medtronic).
- In patients with significant RV pacing (>40%), heart failure hospitalization was significantly reduced (2% vs 15%) in the HBP group compared with the RV pacing group.
- By using the His-Purkinje conduction system, HBP maintains normal ventricular synchrony and avoids the deleterious effects of RVP.
- Current data suggest that HBP is superior to traditional RV pacing, with improved clinical outcomes.
- HBP is a promising alternative option in patients with CRT indications.

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CENTRE OF EXCELLENCE FOR TKR AND JOINT REVISION

MODERN DAY REVISION KNEE REPLACEMENT

TKR HAS A 97% SUCCESS RATE,

However one of the dreaded complication of TKR is Postoperative Infection.

CASE HISTORY IN A PREVIOUSLY INFECTED PRIMARY TKR

A 63 year female patient mother of a pediatrician underwent TKR 3 years back, developed gram negative post-op infection with resistance to most antibiotics, underwent debridement twice elsewhere along with long duration of Iv antibiotics.

1 ST STAGE SURGERY ON 14/03/2021

- Underwent removal of TKR implants
- Extensive clearance of soft tissue
- Moulded antibiotic cement spacer implants put in

ADVANTAGES OF ARTICULATED SPACER:

- Weight bearing on 1st post-operative day
- Activity of daily living
- Good knee flexion upto 110 degrees
- Multidisciplinary approach with Orthopaedic Surgeon, Infectious Disease Specialist, Microbiologist and Physiotherapist
- Return to normal life.

2ND STAGE REVISION TOTAL KNEE REPLACEMENT ON 06/07/2021

- Patient mobilized first post-op day
- Antibiotics regime as per primary TKR

INFECTION CONTROLLED AND PATIENT BACK TO ROUTINE LIFE

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