

Permanent His-Bundle Pacing

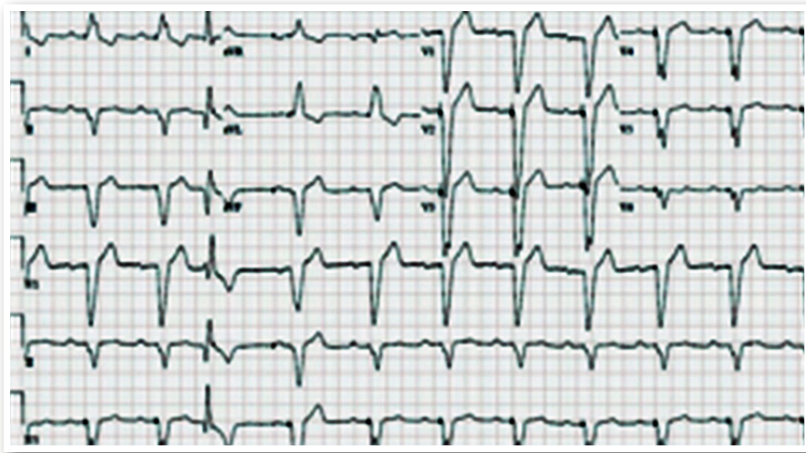
- The Electrophysiology Program at the Hospital of the University of Pennsylvania offers permanent His-bundle pacing for select patients with cardiac conduction disorders that require right ventricular pacing.

His-bundle pacing (HBP) represents a complete paradigm shift in ventricular pacing in an effort to maintain normal cardiac physiology despite chronic ventricular pacing. By utilizing a specially-designed 3830 lead and C315 sheath (Medtronic), the ventricular pacing lead that is normally placed in the right ventricular apex is now placed on the His-bundle itself, adjacent to the tricuspid valve annulus.

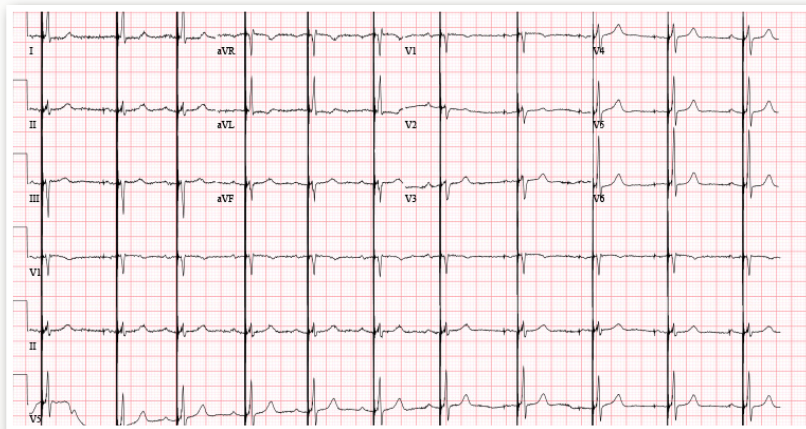
Traditional right ventricular (RV) apical pacing has been the standard for patients requiring permanent ventricular pacing for decades, largely because the approach is well tolerated and effective, and has the advantages of accessibility and lead stability. However, RV apical pacing is not physiologic because it does not engage the normal conduction system composed of rapidly-conducting His-purkinje fibers, leading to cell-to-cell conduction and a wide QRS complex (Figure 1). RV pacing has been linked to pacing-induced hemodynamic and structural abnormalities with progressive systolic dysfunction and the development of heart failure and atrial fibrillation.

By contrast, His-bundle pacing results in activation of the proximal conduction system and rapid spread of electrical activation throughout the myocardium resulting in a narrow QRS complex (Figure 2). Even in the face of chronic bundle branch blocks, it is frequently possible to inscribe a narrow QRS complex with HBP.

HBP has been shown to be similar in benefit to cardiac resynchronization therapy in improving cardiac function but without the requirement of an additional left ventricular lead. HBP can be used at both initial device implantation (to avoid potential detrimental effects of right ventricular pacing) and later if a patient develops an RV-pacing-induced cardiomyopathy. Moreover, HBP is simple in pacing from a single site and requires the same follow-up as a traditional pacemaker system.



► **Figure 1:** Wide QRS complex resulting from cell-to-cell conduction in a patient with traditional RV pacing.



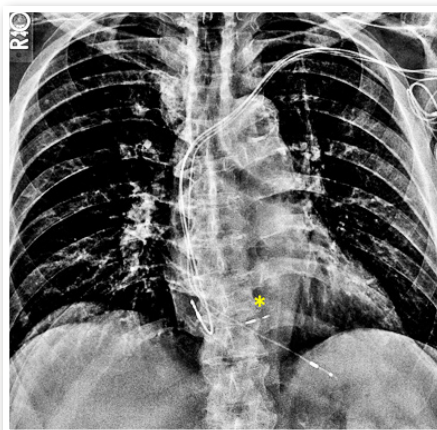
► **Figure 2:** His-Bundle pacing, resulting in narrow QRS complex of normal width.

CASE STUDY

Mr. K, a 65-year-old man was referred to Robert Schaller, MD at Penn Medicine's Electrophysiology Program for treatment of right-ventricular pacing-induced cardiomyopathy and depression of his left ventricular ejection fraction from 60 to 40%. This new finding was due to chronic right ventricular pacing via a traditional dual chamber pacemaker that was implanted 2 years prior for complete heart block. The RV pacing QRS complex measured 160 ms, consistent with cell-to-cell conduction. After discussing the pros and cons of traditional left ventricular cardiac resynchronization therapy and His-bundle pacing, Mr. K decided to opt for His-bundle pacing in order to maintain normal cardiac physiology.

(Continued on the back)

CASE STUDY *(Continued from cover)*



► **Figure 3:** Post-op CXR confirms proper placement of all leads.

For the procedure, which took about an hour, Mr. K was first placed under sedation and his original subcutaneous pocket was anesthetized and incised. Percutaneous access to the left axillary vein was acquired via fluoroscopic and ultrasound-guidance. The Medtronic 3830 lead was placed through the C315 sheath and guided to the His-bundle region (Figure 3*). A His-bundle electrogram seen on the recording system confirmed proper location and the screw was actively fixed to the cardiac tissue. Pacing here showed an extremely narrow QRS complex of 80 ms (Figure 2) with a very low threshold. The His-bundle lead was secured within the pocket and plugged into the left ventricular port of a biventricular generator. A post-op CXR confirmed proper placement of all leads (Figure 3).

Mr. K was discharged the day following implant after confirming stable HBP. In the ensuing weeks, he experienced no complications, and at his first follow-up visit at 6-weeks, Mr. K's ejection fraction had returned to normal. At this point, the right ventricular lead was turned off and pacing was performed strictly from the His-bundle lead. For new pacemaker implantations, pacing is only performed from the His-bundle region and an RV lead is not routinely required.

FACULTY TEAM

Penn Medicine has the largest electrophysiology program on the East Coast and one of the largest hospital-based programs in the U.S. Comprised of full-time, board-certified electrophysiologists, specialized nurse practitioners and physician assistants, the EP team is dedicated exclusively to treating and eliminating serious and potentially life-threatening heart rhythm disturbances. The team's leadership in ablative and arrhythmia device therapy at the Hospital of the University of Pennsylvania is evident in their continuing commitment to research and the large number of peer-reviewed scientific articles they have published, many of which have documented or changed the way arrhythmias are treated worldwide.

Performing Permanent His-Bundle Pacing Implantations at Penn Medicine

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