

His Bundle Pacing

Getting on the Learning Curve



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KEYWORDS

- His bundle pacing • Training • Expertise • Competence • Physiologic pacing

KEY POINTS

- His bundle pacing procedure requires higher level of expertise compared with standard pacing techniques.
- It is important for the implanter to have a solid understanding of electrophysiological (EP) mapping.
- Given our current level of understanding regarding electrical dyssynchrony, it is important for implanters to have expertise in all forms of cardiac pacing.
- Mastering His bundle pacing can be readily achieved with good foundations in implant techniques and EP anatomy and mapping.

INTRODUCTION

In order to provide perspective on the skill sets required to become facile with His bundle pacing (HBP), it is useful to consider it more broadly in the context of cardiac pacing, which developed from a surgical procedure to an invasive vascular one, with the skill sets transitioning from the surgical operating room to the cardiac catheterization and electrophysiology (EP) laboratories.^{1–3} Minor surgical skills had to be developed early in this transition by cardiologists and subsequently electrophysiologists advantaged relative to the surgeon with a working knowledge of relational fluoroscopic anatomy and the disease processes being treated by pacemakers. Coupling those procedural skills with a more focused understanding of subsequent clinical management of chronically implanted devices placed implantable cardiac devices even more squarely in the realms of cardiology and EP. In this context, HBP can be thought of as the next step in the evolving field of cardiac pacing, requiring all of the prior skill sets but adding to that a thorough understanding of the EP anatomy of the atrioventricular (AV) junction and the patterns of activation that are consequent to

implantation of a permanent pacing lead into the AV junction. A deep knowledge of EP anatomy and His Purkinje disease is necessary to perform this procedure well and to maximize the probability of excellent long-term care of the patient. In this article, the author delineates some of the critical aspects of HBP that differentiate it from its device therapy antecedents, thereby providing the reader a sense of what tools they will need to develop or acquire in order to do this procedure well. We will first consider technical aspects and then look at the EP foundational knowledge that should be developed by the operator. Finally, the author provides a perspective on the numbers of procedures that may be required to become competent as a His bundle system implanter.

TECHNICAL CONSIDERATIONS

HBP is distinguished from standard pacing by the need for an electrogram acquisition system that permits identification of the His potential, which in most instances will be evident on the pacing electrode when sensing a conducted or junctional escape beat. One must therefore have familiarity with real-time observation and interpretation of

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intracardiac electrograms. Although it is possible to use a standard pacing system analyzer, a multichannel system allows attachment of 12 lead surface electrodes and provides better electrogram resolution and more flexible options for sweep speeds and filtering. In addition, a multichannel mapping system allows for the addition of a multipolar His mapping EP catheter, which can be very helpful, especially for one who is just learning the technique, to map the His along most of its length and provide a fluoroscopically obvious demonstration as to where the His lead delivery sheath needs to be manipulated in order to secure it at or very near the His bundle.⁴ As one becomes more familiar with the behavior of the delivery sheath, the need for an EP catheter becomes less critical, although it can be helpful in cases where for one reason or another mapping the His is challenging. In addition, a multichannel system permits 12-lead surface electrocardiogram acquisition: the 12 lead helps define clearly the pacing response for different outputs and/or polarities at any given site along the length of the His bundle. This is particularly important when mapping and pacing into diseased His Purkinje tissue, wherein subtle morphology shifts can be readily detected and may be meaningful in terms of anticipated clinical response. As will be discussed later, this latter point is one of the most substantive distinguishing characteristics of HBP relative to right ventricle pacing, where QRS morphology is not a consideration, or left ventricle (LV) lead placement, which is constrained by available anatomic targets.

Pacing lead delivery options are currently limited and described in detail in Faiz A. Subzposh and Pugazhendhi Vijayaraman's article, "[Long-Term Results of His Bundle Pacing](#)," in this issue. Although lead delivery can be performed by hand shaping stylets, lead delivery sheaths allow greater control and precision and mastering their use is central to performing this procedure successfully. Although experience with slit-able LV lead delivery sheaths is helpful, the purpose of the sheath is subtly but importantly different. In the case of LV leads the sheaths serve as support, whereas the His bundle sheaths provide control for precise targeting and mapping. There are specific hand motions that determine motion and positioning: understanding and internalizing these motions represent the critical technical aspects of the procedure that conscribe most of the HBP learning curve. Specifically, with the 6-Fr stiff preshaped C315 His sheath very small motions can cause dramatic position changes, with clockwise rotation sending the system anteriorly and toward the ventricle, with counterclockwise rotation rotating the sheath posteriorly and toward the

atrium. These motions provide critical feedback to the operator regarding the reach required to adequately map along the length of the AV junction from its atrio-posterior extent (closer to the AV node) to its most anterior-ventricular aspect adjacent or within the membranous septum. Difficulties encountered may be addressed either by hand shaping the sheath for more anterior reach or by choosing to switch to a deflectable sheath. The advantage of the deflectable sheath is that it can help provide more anterior reach and the curve can be modified to target more distally or proximally. The disadvantage is the absence of a septal plane of deflection, making it more difficult at times to get the lead screw to catch: often a fair amount of counterclockwise torque is needed to try to catch the endocardium. At times, however, the tip of the sheath will seat well at the nexus between Todaro tendon and the tricuspid valve (TV) annulus, where often an excellent His pacing response and threshold can be obtained. Typically, if there is no further advantage noted using this sheath within 10 to 15 minutes it is reasonable to consider an alternative pacing strategy. If the issue is finding a His potential, before giving up it can sometimes be helpful to place an octapolar His mapping catheter from an adjacent axillary sheath and use that to target electrode bipoles recording a distinct His potential.

Contending with HBP thresholds represents another novel aspect of the procedure in that pacing thresholds tend to be higher relative to standard pacing sites, and there can be uniquely rapid and dramatic changes in thresholds—usually for the better, but not always—at a given pacing site. There are at least 2 factors to take into account that need to be understood: one is learning to record and recognize His injury current, the presence of which is reassuring for long-term stable capture.⁵ The second is to be aware of how the lead moves at the implant site; although not proved yet in this author's personal experience, significant motion of the lead tip likely indicates the implant site is very close to or potentially through the base of the septal TV leaflet and is at higher risk for microdislodgement. Others have observed that wide differences in capture threshold between unipolar and bipolar vectors may also predict future threshold increases and probably warrants repositioning.

ELECTROPHYSIOLOGICAL FOUNDATIONAL KNOWLEDGE

The fact that there is a specific EP target distinguishes HBP from any other form of permanent

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