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希氏束起搏研究进展

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摘　要

希氏束起搏(His bundle pacing, HBP)是通过将起搏电极植入希氏束而实现的一种生理性起搏技术。它通过天然传导系统激动心室，可避免起搏器诱发的心肌病等并发症，是一种安全有效的起搏替代方式。HBP不仅适用于各种原因导致的心动过缓，还能实现心脏再同步及作为心力衰竭患者的替代疗法。现有数据表明，HBP在维持或恢复心室同步性方面具有明显优势。此外，与传统右心室起搏相比，HBP的心房颤动发生率降低。在需要高百分比起搏时，其临床益处尤其显著。近年来HBP的研究发展迅速，本文对国内外关于HBP的最新研究成果进行综述，以便掌握其最新的前沿动态。

关键词

希氏束起搏，生理性起搏，临床疗效，并发症

Research Progress of His Bundle Pacing

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Abstract

His bundle pacing (HBP) is a physiological pacing achieved by implanting pacing electrodes into his bundle. It stimulates the ventricle through the natural conduction system, which can avoid complications such as cardiomyopathy induced by the pacemaker, and is a safe and effective alternative to pacing. HBP is not only suitable for bradycardia caused by various reasons, but also can realize cardiac resynchronization and serve as an alternative therapy for patients with heart

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failure. Available data indicate that HBP has obvious advantages in maintaining or restoring ventricular synchronization. In addition, compared with conventional right ventricular pacing, the incidence of atrial fibrillation in HBP decreased. The clinical benefits are particularly significant when a high percentage of pacing is required. In recent years, the research on HBP has developed rapidly. This paper summarizes the latest research results of HBP at home and abroad in order to grasp its latest frontier trends.

Keywords

His Bundle Pacing, Physiological Pacing, Clinical Efficacy, Complication

1. 引言

随着人口老龄化的加重，对心脏起搏的需求越来越普遍。心脏起搏仍是不可逆缓慢性心律失常的最佳治疗方法。近些年来，大量研究发现由于诱发电和机械不同步，传统的右心室心尖起搏会对左心室功能产生不利的影响，如导致左室收缩和舒张功能障碍及心室重构等[1] [2]。由于这些原因，人们对直接激动自身传导系统的生理性起搏技术越来越感兴趣[3] [4] [5] [6]。在这方面，希氏束起搏(His bundle pacing, HBP)是最常用的方法[7] [8] [9]。由于产生正常的双心室电激动，HBP 可以维持心电和机械同步[10] [11]。多项研究证明了该技术的可行性和临床益处[12]-[17]。在发生束支传导阻滞的患者中，特别是那些有左束支传导阻滞和心力衰竭的患者，HBP 可以作为传统心脏再同步疗法(Cardiac resynchronization therapy, CRT)的替代方案[18]。作为一种生理性起搏方式，HBP 仍有一些局限性，包括难以识别希氏束的精确位置、植入过程中对希氏束的损伤、起搏远端的心脏传导阻滞以及长期性能的潜在限制等[10] [18] [19] [20] [21]。尽管存在这些局限性，但最近几项观察性研究表明，HBP 可在短期至中期随访中产生与传统双心室起搏相当的有益临床结局[10] [20]。然而，也有研究显示，几乎一半患者的 QRS 持续时间不能正常化，这表明在这部分患者中，HBP 不能克服传导阻滞[22] [23] [24] [25] [26]。本文将从 HBP 植入技术的特点、适应症、临床疗效等方面对 HBP 的最新研究进展进行综述。

2. 希氏束的解剖

希氏束作为从房室结经束支传导到心室的通道，详细了解希氏束及其近端束分支等房室传导系统的解剖结构，对于施行永久性 HBP 和理解该区域对起搏的各种反应至关重要[6]。

希氏束起源于房室结前端，穿过室间隔膜部的下缘，然后在大多数个体中沿着室间隔肌部上缘的左侧行走。希氏束的近端部分位于室间隔的右心房－左心室部分，较远端部分沿着室间隔的左心室－右心室部分移动，接近主动脉根部的正下方。永久性 HBP 起搏电极可置于希氏束的心房和心室部分，植入的最终位置取决于疾病的严重程度或房室传导阻滞程度[27]。

3. HBP 的植入特征

由于病变位置或解剖变异，HBP 也面临着诸多挑战。远端希氏－浦肯野系统病变可能会对阻滞部位远端的导线固定产生影响。解剖变异包括右侧植入和右心房或右心室明显扩大，可导致希氏束移位。使用外冠状窦输送鞘或其他冠状窦输送鞘和 C315 HIS 鞘的伸缩式鞘套可能有助于在重构和扩张的心脏中

提供更长的作用距离[28]。植入希氏束区域的导线的特性与植入心房或心室心肌组织的导线的特性具有较大差异。植入希氏束区域电极的感知 R 波通常低于传统右心室位置，报告的平均 R 波介于 3.4 mV 和 6.8 mV 之间[29] [30] [31]。使用 SelectSecure 3830 导联报告的平均希氏束夺获阈值约为 1.4 V @ 1 ms，而束支传导阻滞时校正阈值通常更高，约为 2 V @ 1 ms [32]。随着工具的改进和术者经验的增加，永久性 HBP 的成功率从 2000 年的 65%大幅提高到 2018 年的 92% [19] [31]。

4. HBP 的适应症及禁忌症

与右心室起搏相比，HBP 已被一致证明具有更好的临床结果，尤其是在房室传导阻滞的患者中[30] [31] [33] [34]。在一项前瞻性、随机、双盲、交叉试验中，对 38 例房室传导阻滞、窄 QRS 波和左心室射血分数 > 40%的患者进行了 HBP 与右心室间隔起搏的比较，在起搏术后的第 12 个月，室间隔起搏组患者的左室射血分数(Left ventricular ejection fraction, LVEF) (50% ± 11%)明显低于 HBP 组(55% ± 10%；p = 0.005) [35]。

但在某些特殊的疾病状态下，应谨慎考虑施行 HBP，甚至可能是禁忌证。这些情况包括但不限于为避免损伤瓣膜而行三尖瓣置换术的患者，经导管主动脉瓣置换术的患者，以及患有室间隔疾病的患者。对于有其他瓣膜疾病的患者，如三尖瓣成形术、主动脉瓣置换术、二尖瓣疾病或置换术等，HBP 通常是成功的[36]。

5. HBP 与心脏再同步治疗

传统的心脏再同步治疗(cardiac resynchronization therapy, CRT)是通过双心室起搏实现的，通过控制心室融合起搏以改善心室收缩同步[37]。近年来，使用 HBP 实现 CRT (His-CRT)越来越受欢迎[20] [32] [38] [39] [40] [41] [42]。多组数据已经证明 HBP 可以实现心室再同步，HBP 被认为是实现 CRT 的一种主要策略[43]。

永久性 HBP 在需要 CRT 的患者中成功率很高。在一项关于 His-CRT 多中心研究中，8 名患者成功升级为 HBP，其中 6 名患者有超声心动图参数的改善(75%)，平均 LVEF 从 30% ± 10%提高至 38% ± 13% (P = 0.07)，这表明 HBP 可能是部分对传统 CRT 无应答患者的不错选择[32]。然而，仍需要进一步的研究以证明上述结论的准确性。

6. HBP 面临的挑战

首先是 HBP 的成功率。近些年来，HBP 的手术成功率显著提高(高达 92%)，但这样的成功率是在经验丰富的临床中心实现的，是术者经验提高和使用先进工具的结果[44]。Bhatt 及其同事的一项研究显示，在所有患者中 HBP 的成功率为 75%，但在房室传导阻滞患者中仅为 56%，而无房室传导阻滞患者为 83% [45]。目前需要改进现有的输送工具，以提高解剖变异和远端传导系统病变患者的 HBP 成功率。

夺获阈值增加是 HBP 面临的另一个挑战。尽管在记录到希氏束损伤电流的患者中，夺获阈值可以在最初的几个小时内得到改善，但在一定比例的患者中观察到希氏束夺获阈值的长期增加[31]。一项对 332 名患者进行的研究发现，约 14%的患者在术后 12 个月时其希氏束夺获阈值 > 2.5 V，而在平均 2 年的随访期间，4.2%的患者出现了阈值的显著增加并需要修复导线[31]。希氏束起搏阈值延迟增加的机制尚不确定，但可能是由于固定不当、导线松弛、局部纤维化或微移位所致。

电池寿命也是影响 HBP 性能的重要方面。考虑到与传统的右心室起搏导联位置相比，希氏束夺获需要更高的起搏输出，因此存在 HBP 缩短电池寿命的问题。目前随着 HBP 特定设备算法的优化，较低的输出便可确保希氏束夺获，从而提高了电池寿命。一项对 74 名 HBP 患者进行的研究表明，脉冲发生器的 5 年生存率为 91%，在一些患者中可以成功进行双腔系统 CRT，从而降低了与植入相关的总成本[46]。

此外还存在感知问题。HBP 导线通常植入希氏束区域，其感知 R 波振幅通常较低。这种情况可能会导致心房过度感知、希氏束过度感知而心室感知不足。所以必须在植入过程中评估这些特征，以避免这方面的影响。

7. 展望

HBP 代表了最生理的心室激动形式。目前的数据表明，HBP 优于传统的右心室起搏，具有更好的临床结果。此外，HBP 是 CRT 适应症患者的一种有前景的替代选择。当然，HBP 技术的广泛应用还取决于其在大型随机临床试验中的有效性的进一步验证以及导线设计、输送工具等的进一步改进。

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