The Effect of His-Purkinje system pacing in patients with chronic heart failure

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Abstract

Background:
His-Purkinje system pacing mainly refers to His bundle pacing (HBP) and left branch bundle pacing (LBBP). His-Purkinje system pacing is characterized by activating ventricle via the intrinsic conduction system, thus carrying out the ventricular synchronous contraction, improving cardiac function and reversing ventricular remodeling.

Objectives: We aimed to analyze the effect of His-Purkinje system pacing in chronic heart failure patients, and compare the efficacy and parameters between HBP and LBBP.

Methods:
The chronic heart failure patients (LVEF<50%) who needed pacemaker therapy from September 2014 to December 2018 in the First Affiliated Hospital of Nanjing Medical University were included. They received HBP or LBBP. The data of two-dimensional echocardiography and electrocardiogram in the process of preoperative and postoperative follow-up were obtained, including left ventricular ejection fraction (LVEF), left ventricular end-diastolic dimension (LVDd), left ventricular end-systolic dimension (LVDs), and QRS duration (QRSd). The parameters of the pacemaker during and after the operation were recorded, including threshold and impedance. Preoperative and postoperative parameters of all patients were compared to analyze the effect of His-Purkinje system pacing on chronic heart failure. The parameters between HBP group and LBBP group were also compared.

Results:
According to the 6-month follow-up results after device implantation, some
parameters changed significantly: LVDd decreased from 65.72±9.76 mm to 59.76±10.88 mm (P<0.0001), LVDs decreased from 55.08±11.21 mm to 46.44±12.73 mm (P<0.0001), NYHA decreased from 3.00±0.71 to 2.09±0.67 (P<0.001), QRSd decreased from 150.20±34.14 ms to 118.50±20.18 ms (P<0.0001), and LVEF increased from 33.96±10.58 % to 45.46±13.36 % (P<0.0001).

In HBP group, some parameters changed significantly after 6-month follow-up: LVDd decreased from 65.75 ± 10.11 mm to 61.08 ± 12.27 mm (P=0.02), LVDs decreased from 55.00 ± 11.32 mm to 48.00 ± 13.99 mm (P<0.01), NYHA decreased from 3.17 ± 0.72 to 2.20 ± 0.63 (P=0.02), QRSd decreased from 138.70±25.99 ms to 115.30±24.12 ms (P<0.01), and LVEF increased from 34.28 ± 9.90 % to 44.06 ± 13.78 % (P<0.01). In LBBP group, these parameters changed significantly after 6-month follow-up: LVDd decreased from 65.69 ± 9.83 mm to 58.54 ± 9.78 mm (P<0.001), LVDs decreased from 55.15 ± 11.57 mm to 45.00 ± 11.83 mm (P<0.0001), NYHA decreased from 2.85 ± 0.69 to 2.00±0.71 (P<0.01), QRSd decreased from 160.80±38.18 ms to 121.5±16.15 ms (P<0.001), and LVEF increased from 33.65±11.56 % to 46.75 ± 13.39% (P<0.001).

The lead threshold of HBP and LBBP was 1.28±0.64 V and 0.53±0.083 V (P<0.01) before discharge, and was 1.53±0.71 V and 0.61±0.14 V (P<0.01) during the 6-month follow-up. The mean of absolute value of change of lead threshold was 0.54 ± 0.48 V in HBP group and 0.16±0.14 V in LBBP group (P=0.04).

**Conclusions:**

His-Purkinje system pacing could reverse left ventricular remodeling, and improve cardiac electrical synchrony in chronic heart failure patients. Both HBP and LBBP could improve cardiac function in chronic heart failure, and LBBP had an edge of lower and more stable lead threshold.

**Keywords:**
Heart failure; His-Purkinje system; cardiac resynchronization therapy (CRT); His bundle pacing (HBP); Left bundle branch pacing (LBBP)