

Clinical Comparison of Cardiac Function between Dual Chamber Pacing and Left Bundle Branch Regional Pacing

Fubao Zhang^{1,a}, Yiling Li^{1,b,*}

¹Department of Cardiovascular Diseases, The Third Affiliated Hospital of Gansu University of Traditional Chinese Medicine, The First People's Hospital of Baiyin, No. 222 Silong Road, Baiyin District, Baiyin, Gansu, 730999, China

^a2186099474@qq.com, ^blyl1302652979@163.com.

*Corresponding author

Keywords: Left bundle branch regional pacing; dual chamber pacing; cardiac function

Abstract: To observe the changes of heart-related indexes after left bundle branch pacemaker implantation and traditional pacemaker implantation, and to explore the advantages and disadvantages of both. In this study, 47 patients were selected by inclusion and exclusion criteria, including 19 patients in the left bundle branch pacing group and 28 patients in the biventricular pacing group. Cardiac function indexes were compared between the two groups for half a year before and after pacemaker implantation. There was no significant difference in the related indicators between the two groups before pacemaker implantation ($P > 0.05$). However, half a year after implantation, the results of fractional shortening, ejection fraction, LEDV (left ventricular end-diastolic volume) and NT-ProBNP were significantly different between the two groups ($P < 0.05$). Left bundle branch area pacing has a better cardiac function recovery than conventional pacing.

1. Introduction

Cardiac conduction system disorders are not rare in cardiovascular diseases ^[1]. According to relevant statistics, tens of thousands of such patients receive pacemaker implantation every year. In many countries, the number of pacemakers implanted is not known due to the limited conditions. Compared with China, it is reported that the implantation rate of pacemakers in different regions of Europe is also different, ranging from less than 25 pacemakers per million people in economically underdeveloped regions to more than 1000 pacemakers per million people in economically developed regions ^[2]. This is probably because there are some countries with under and overtreatment of pacemakers, but there are also differences in sociodemographic and geographic characteristics. With the constantly changing of human living and medical conditions, the gradual extension of life expectancy leads to the continuous aging of the population, and the use of pacemakers continues to increase ^[3].

Cardiac synchronization therapy is the optimal choice for cardiac insufficiency patients, especially for those with intermediate and advanced cardiac function and prolonged QRS duration. Moreover,

randomized studies have shown that patients with left bundle branch conduction disorder, improved quality of life and prognosis after pacemaker implantation, and reduced hospitalization for heart failure.^[4-5] In a recent multicenter observational study, His bundle pacing was more effective than conventional biventricular pacing in improving outcomes in patients with right bundle branch conduction disorder^[6]. HBP started relatively late in China, and there is still a lack of technology, especially the high threshold of corrected pacing for right bundle branch block, so the overall success rate of surgery is low^[7,8]. However, after years of efforts by domestic experts, left bundle branch pacing has gradually replaced physiological cardiac electrical activity^[9-11], which is technically easier to implement, has been shown to prolong the quality survival time of patients^[12-14]. The aim of this study is to compare the changes of cardiac function before and 6 months after dual chamber pacing and Left His bundle pacing, and to analyze whether Left His bundle pacing has better clinical prognosis.

2. Materials and Methods

2.1 General Data

47 patients with permanent cardiac pacemaker implanted for the first time in the Department of Cardiovascular Diseases of The First People's Hospital of BeiYin (June 2021-October 2022) were selected as subjects, including 19 patients with left bundle branch conduction disorder pacing and 28 patients with dual-chamber pacing. Inclusion criteria: meet the indications for permanent pacemaker implantation in the 2018 American Heart Association (ACC)/American Heart Association (AHA)/American Heart Association (HRS) guidelines for the Evaluation and Management of patients with bradycardia and Cardiac conduction delay^[15]. Exclusion criteria: (1) contraindications of permanent cardiac pacemaker implantation; (2) incomplete data of research indicators.

2.2 Methods

The height and weight of the subjects were measured on the day of admission, and the basic disease history of the subjects was asked by medical professionals. The SBP and DBP of the subjects in the first 3 days after admission were measured. All the subjects were examined by NT-ProBNP test and cardiac color ultrasound. According to the different implantation of permanent pacemakers: left bundle branch pacemaker group and dual chamber pacemaker group.

2.3 Observation Index

FS%, EF%, LVIDS (mm), LVESV (ml) and LVEDV(ml) were measured by color doppler echocardiography before and 6 months after operation. (2) The levels of NT-proBNP were compared between the two groups before and 6 months after operation: fasting peripheral venous blood was taken before and half a year after operation, and the level of serum NT-proBNP was detected by electrochemiluminescence immunoassay.

2.4 Statistical Methods

SPSS 23.0 statistical software was used for data processing. The measurement data are expressed by ($\bar{x} \pm s$), using *t*-test; the counting data are expressed by relative number (%), and the comparison is done by χ^2 test. The difference was statistically significant ($P < 0.05$).

3. Research results

3.1 Comparison of baseline data

19 patients in the left bundle branch conduction disorder pacing pacemaker group and 28 patients in the dual-chamber pacemaker group. After comparative analysis, it is concluded that the baseline data of the two groups have no statistical significance, as detailed in Table 1.

Table 1: Baseline data of subjects.

Project	Left bundle branch area pacemaker group (19 cases)	Double cavity group (28 cases)	<i>P</i>
Age (year)	82.50±3.98	83.72±9.23	0.627
Gender (male%)	42.70	38.60	0.597
Height (cm)	159.33±5.15	160.83±6.93	0.712
Weight (kg)	66.08±5.45	63.28±9.87	0.486
Smoking (%)	30.80	33.30	0.693
SBP(mmHg)	117.83±10.62	135.28±21.81	0.741
SDP(mmHg)	67.67±8.96	76.56±13.85	0.398
Basic disease history			
Hypertension (%)	76.90	66.70	0.471
DM (%)	7.70	20.80	0.580
CHD(%)	15.40	8.30	0.418
Atrial fibrillation (%)	46.20	12.50	0.366
Days of hospitalization (days)	7.83±2.21	7.33±3.05	0.784

3.2 Comparison of heart, function indexes between the two groups before and 6 months after operation

The left ventricular short-axis shortening rate, ejection fraction, LVEDV and NT-ProBNP analysis results were statistically significant between the two groups after operation. As detailed in Table 2.

Table 2: Comparison of cardiac function between the two groups

Groups	FS%		EF%		NT-proBNP	
	Before operation	After operation	Before operation	After operation	Before operation	After operation
Left bundle branch area pacemaker group	29.17±3.97	34.20±5.88 ^b	55.33±5.59	61.91±8.85 ^b	2909.33±85.96	129.89±60.04 ^b
Double cavity group	32.60±2.88	35.04±1.69 ^{ab}	53.79±3.67	60.09±4.12 ^{ab}	3846.54±17.45	143.76±40.23 ^{ab}
<i>t</i>	10.019	2.873	3.691	2.893	0.927	0.238
<i>P</i>	0.193	0.041	0.236	0.015	0.672	0.031

Continuation of Table 2

Groups	Left ventricular end-diastolic diameter (mm)		Left ventricular end-systolic volume(ml)		Left ventricular end-diastolic volume(ml)	
	Before operation	After operation	Before operation	After operation	Before operation	After operation
Left bundle branch area pacemaker group	57.12±5.03	45.89±6.47	51.33±16.97	46.29±12.51	106.17±3.20	85.33±3.55 ^b
Double cavity group	58.67±3.89	50.01±7.22	50.00±14.99	45.91±10.67	100.66±4.50	84.96±1.39 ^{ab}
<i>t</i>	7.944	1.098	9.461	3.864	0.739	0.213
<i>P</i>	0.109	0.060	0.494	0.362	0.441	0.009

Note: ^aP<0.05 for inter-group comparison and ^bP<0.05 for intra-group comparison.

4. Discussion

There are two types of His bundle pacing, one of is left bundle branch pacing, which is more similar to the physiological activation pattern of the heart. Left bundle branch pacing can stabilize the pacing threshold, fully perceive R wave amplitude, and correct left bundle branch block^[16]. In the later stage, more sample size is needed for further study, and long-term follow-up results are lacking. In the future, large-scale multi-center randomized controlled studies are needed to study the long-term clinical effects and practicability of left bundle branch pacing.

Acknowledgement

This work was supported by capital source: Science and Technology Program of Baiyin City (Program No. : City Kefa [2021]43, Project No. : 2021-214Y.)

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