Research Brief

Feasibility, safety and outcomes of left bundle branch pacing in octogenarians

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ABSTRACT

Objectives: Left bundle branch pacing (LBBP) provides physiological pacing at low and stable threshold. The safety and efficacy of LBBP in elderly population is unknown. Our study was designed to assess the safety, efficacy and electrophysiological parameters of LBBP in octogenarian (≥80 years) population.

Results: LBBP was successful in 10 out of 11 patients. Mean age 82.1 ± 2.5 yrs. Follow up duration 7.7 months (range 4–10). Indication for pacing included atrioventricular (AV) block 5 patients, Left bundle branch block (LBBB) with low ejection fraction (EF) 4 patients, sinus node dysfunction in 1. QRS duration reduced from 145.9 ± 27.7 ms to 107.1 ± 9.5 ms (p value 0.00001) LV ejection fraction increased from 47.6% to 58.4% after LBBP (p value 0.017). Pacing threshold was 0.58 ± 0.22 V and sensed R wave 17.35 ± 6.5 mV and it remained stable during follow up. LBBB with low EF patients also showed similar reduction in QRS duration along with improvement in LVEF.

Conclusion: LBBP is a safe and effective strategy (91% acute success) of physiological pacing in elderly patients. LBBP also provided effective resynchronization therapy in our small group of elderly patients. The pacing parameters remained stable over a period of 10 months follow up.

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1. Introduction

Physiological pacing offers the advantage of capturing His-purkinje system directly thereby achieving synchronized ventricular contraction. Although His bundle pacing (HBP) offers the most physiological form of pacing, it has some inherent limitations. Huang et al. reported direct capture of left bundle (LB) by deep septal pacing as an alternative to overcome the limitations of HBP. Though the safety of left bundle branch pacing (LBBP) has been established by several studies, the data for elderly population is lacking. This paper describes the feasibility, safety and electrophysiological properties of LBBP in octogenarians.

2. Methods

This is a retrospective, observational study conducted in our institute from March 2019 to March 2020 after getting institutional ethical committee approval. Patients provided written informed consent regarding LBBP as a non-standard approach. All patients aged between 80 and 89 years who were planned for permanent pacemaker implantation and those requiring cardiac resynchronization therapy (CRT) were included in the study. Patients who refused for the therapy were excluded.

The procedure was done as described by Huang et al. using C315 sheath and 3830 SelectSecure™ lead (Medtronic, Minneapolis, MN). In brief, the pacing lead was placed deep inside the septum at a site 1–1.5 cm below the His bundle (Fig. 1A). LB capture was confirmed by presence of right bundle branch delay pattern (qR in lead V1) along with any one of the following criteria (a) presence of LB potential (b) non-selective to selective LB capture during unipolar threshold measurement (Fig. 1B) (c) short and constant peak left ventricular activation time (pLVAT) < 80 ms. (d) programmed stimulation from the pacing lead to show change in QRS morphology, duration and axis. Patients baseline characteristics and indications for pacing were documented. LVEF was measured by modified simpson's method.

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3. Results

11 patients satisfied the inclusion criteria. Successful LBBP could be performed in 10 out of 11 patients (91% acute success rate). In one patient with AV block, lead could not be penetrated deep and conventional RV lead was placed. Baseline and procedural characteristics are shown in Table 1. Mean age of the study population was 82.1 ± 2.5 years. The indication for pacemaker implantation was AV block in 5 patients, LBBB with low EF in 4 patients and sinus node dysfunction in one patient. The baseline QRS duration was 145.9 ± 27.7 ms. Pre-procedural echocardiography showed mean EF of 47.6 ± 11.2% and septal thickness of 11.1 ± 0.7 mm. The fluoroscopic time for LB lead placement was 17.9 ± 8.2 min. Non-selective to selective LB capture could be demonstrated in all patients (Fig. 1B). LB potential was noted in one patient. QRS duration was reduced to 107.1 ± 9.5 ms (measured from the onset to the end; p value 0.00001). The pLVAT as measured in lead V5 (from pacing spike to peak of R wave) was 72.2 ± 5.3 ms. The unipolar pacing threshold was 0.58 ± 0.22 V at 0.5 ms pulse-width. The mean R wave amplitude was 17.35 ± 6.6 mV. The unipolar pacing impedance was 773.6 ± 112.9 Ω. All 4 patients with LBBB and low EF had complete correction of LBBB at low and stable threshold (Fig. 1C and D). No acute procedural complications noted.

3.1. Follow-up

The mean follow-up duration was 7.7 ± 1.9 months (range 4–10 months). The pacing threshold remained stable at 0.525 ± 0.07 V at 0.5 ms pulse width and sensed R wave amplitude 15.6 ± 7.3 mV during follow-up (Table 1B). The unipolar pacing impedance decreased to 663.1 ± 57.9 Ω (p value 0.002). Echocardiography showed significant improvement in LV ejection fraction from 47.6 ± 11.2% to 58.4 ± 3.7% (p value 0.017). The length of the lead inside the septum was 10.3 ± 0.82 mm. There was no acute or late lead dislodgement. There were no episodes of thrombo-embolism, pocket infection or mortality.

The findings are comparable to the general data on LBBP in Indian patients by our group where we showed 94% acute success rate with threshold of 0.59 ± 0.22 V and R wave of 14 ± 7 mV which remained stable over 12 months follow-up.7 QRS duration was reduced from 144 ± 34 ms to 110 ± 12 ms along with improvement in LVEF from 44% to 53%.

3.2. Cardiac re-synchronization therapy

Four patients had undergone LBBP done for LBBB with low LVEF and normal epicardial coronaries. Three patients were symptomatic for the last four years and one had heart failure symptoms for two years. The age of onset of LBBB in these four patients were not known as serial ECGs were not available. The QRS duration was reduced from 169.7 ± 13.3 ms to 111.5 ± 13.4 ms and LVEF improved from 37.5 ± 8.8% to 57.7 ± 3.8% along with improvement in the NYHA functional class.

4. Discussion

Though multiple studies are available on feasibility and efficacy of LBBP,5,6 there is no published data on safety of LBBP in elderly
In this paper we have shown that LBBP could be successfully done in 10 out of 11 patients without any procedural complication. LBBP could reduce the QRS duration from 145.9 ± 27.7ms to 107.1 ± 9.5ms (p value 0.00001). LV ejection fraction improved from 47.6 ± 11.2% to 58.4 ± 3.7% (p value 0.017) during follow up. The lead parameters remained stable during follow up (Table 1B). All these findings are comparable to the published studies by other authors on LBBP5,7,8

Generally, CRT trials have excluded very old patients (>80 years old) and little data exist on outcomes of CRT in elderly.9 Rigot et al,10 in a retrospective study showed that the response to CRT was not compromised in patients aged >75 years with 14% mortality at the end of one year. Achilli et al11 showed 2.4% LV lead dislodgement in patients aged >80 years undergoing CRT. Though similar clinical efficacy was noted as compared to those under 80 years, 17.3% mortality occurred during follow up of 12 months. LBBP could be safely done as an alternative for cardiac re-synchronization therapy in our small cohort aged >80 years. We could also show significant reduction in QRS duration along with improvement in LVEF in these patients. With the stable lead parameters and less procedural complication rate, LBBP has the potential to be an excellent alternative to CRT in elderly patients.

5. Conclusion

Left bundle branch pacing is a safe strategy of physiological pacing in octogenarians and we could show significant reduction in QRS duration and improvement in LV ejection fraction. Since it is a single center, retrospective observational study involving small numbers data cannot be extrapolated to general population. Further prospective, multicenter, randomized controlled trials will be required to assess the long safety of LBBP.

Key messages

1. Left bundle branch pacing is a novel strategy of physiological pacing with promising results
2. Safety and efficacy of LBBP in octogenarians are not well studied
3. This is the first study showing the feasibility and safety of LBBP with excellent mid-term outcomes
4. Cardiac resynchronization therapy by LBBP is feasible with promising results

Financial source

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Declaration of competing interest

We have no conflicts of interest to disclose.

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