Society for Heart Failure and Transplantation

SOCIETY FOR HEART FAILURE AND TRANSPLANTATION'S

THE REVIVAL

Promoting Academics to Improve Clinical Outcomes.

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EDITOR'S NOTE

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Dear Readers of The Revival,

Greetings from the Editorial Desk. We bring to you a brilliant article by Dr Ashish Nabar and Dr Malav Jhala on Conduction System Pacing in Heart Failure. The article gives us a complete overview on the status of this modality and via case illustrations, the authors have walked us through the indications and the treatment strategies for each situation. The achievement of cardiac physiologic pacing is the target in each situation whether ischemic or non ischemic cardiomyopathy. The current strategies of LBBAP- LV (CS) referred to as Left Bundle optimised CRT (LOT-CRT) has been highlighted. I'm sure our dear Readers will benefit via this brief review article. Happy Reading!

Dr Manoj Durairaj
Editor "The Revival"

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Dr Talha Meeran

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Dear Colleagues,

This edition of REVIVAL features Dr Ashish Nabar and Dr Malav Jhala contributing with an excellent review on conduction system pacing and LBB area pacing. This particular topic has been the buzzword in the EP and heart failure academic meetings over the last 2-3 years. And this review from Dr Nabar and Dr Jhala delivers a brief yet succinct message to our readers backed with several fabulous case examples. We believe that there is still much to learn on the long term effects of CS pacing in our HF populations and hope to see many such successes in the future.

Sincerely,
Dr Talha Meeran
Sub Editor "The Revival"

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Special thanks to Dr Ashish Nabar and Dr Malav Jhala for authoring this month's article.

Designed by Maithili Kulkarni

PRESIDENTIAL MESSAGE

Dr Julius Punnen

Sr. Consultant Cardiothoracic Surgeon, Narayana Health, Bangalore

Dear Members and Colleagues,

In this edition of Revival we have two expert electrophysiologists Dr Ashish Nabar and Dr Malav Jhala giving us a comprehensive review about cardiac resynchronization therapy (CRT). The discussion focusses on the more technically advanced conduction system pacing methods such as His bundle pacing with emphasis on Left bundle pacing, specifically the relatively new technique of Left Bundle branch area pacing (LBBAP) which was introduced in 2019 as an alternative to His bundle pacing. In contrast to HBP, which targets a small zone in the membranous septum, the pacing lead in LBBAP is advanced through the septum well below the level of the tricuspid annulus, aiming at the bifurcation of His into the right and left bundle branches. This results in a larger target area, which is also less challenging to capture, seeing that the LBB is not encased in fibrous, non-conductive tissue as is the case with the bundle of His

Six cases with different indications are concisely presented illustrating the benefits of this technique. LBBAP is a safe and feasible alternative pacing strategy for CRT and has been associated with significant QRS narrowing and improvement of left ventricular ejection fraction (LVEF) in patients with CRT indications . Cases shown illustrate the superiority of this method of pacing even when conventional pacing has led to myocardial dysfunction from pacing induced cardiomyopathy, this has been reported in literature as well [1]

Another case illustrating its potential to prevent pacing induced cardiomyopathy by avoiding VV dyssynchrony. Though there are no prospective studies that have addressed this matter, it does seem to be a theoretically sound argument. This is particularly relevant in congenital complete heart block where the duration of pacing may be for a long period of time and therefore higher chances of pacing induced cardiomyopathy. Interestingly the other case shows development of pacing induced cardiomyopathy within six months. Although LBBAP has been suggested as an alternative to conventional right ventricular apex (RV) pacing, which increases the risk of pacing-induced cardiomyopathy (PICM), more research is needed to determine the effectiveness of single chamber LBBAP pacing in preventing PICM . In conclusion, left bundle area pacing is an emerging technique in cardiac pacing that offers an alternative to traditional right ventricular pacing in patients with left bundle branch block. Clinical evidence suggests that it can improve ventricular function and clinical outcomes. However, further research and long-term data are needed to fully evaluate its effectiveness, safety, and potential applications in different patient populations.

1. Kwon, S., Lee, SR., Choi, EK. et al. Reversal of pacing-induced cardiomyopathy after left bundle branch area pacing: a case report. Int J Arrhythm 24, 5 (2023). https://doi.org/10.1186/s42444-023-00087-1

With warm regards,

Dr Julius Punnen

President, Society for Heart Failure and Transplantation

CONDUCTION SYSTEM PACING IN HEART FAILURE

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Current Position:

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- Visiting Consultant at Department of Cardiology KEM Hospital, Mumbai
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- EC member Indian Society of Electrocardiology (Treasurer)

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- 25 years of Enrich experience in field of Cardiology.
- Proficiency in Routine and Complex RF ablations and Cardiac Implantable Electrical device mplants and re-do procedures.
- Published and presented extensively in International (American, European, Asia- Pacific) and National Journals and meetings.
- More than 50 articles published in International (Circulation, JACC, Journal of Cardiovascular Electrophysiology etc) and National Journals.

Dr Malav Jhala

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Cardiac Resynchronization therapy (CRT), involving biventricular pacing, using the right ventricular (RV) endocardial lead and quadripolar coronary sinus lead (CS), is a trial-proven contemporary therapy for patients with advanced symptomatic heart failure (HF) with left ventricular ejection fraction (LVEF) <35% and QRS width ≥130 ms, preferably with a left bundle branch block (LBBB) – type QRS morphology. Following a shared decision-making, patients with nonischemic cardiomyopathy (NICM) and multiple limiting comorbid conditions may receive CRT-pacemaker, vis-à-vis patients with ischemic cardiomyopathy (ICM) are more likely to be recommended a CRT-defibrillator. While narrowing the QRS by ensuring >95% biventricular capture may accrue responder status in patients with CRT therapy, the ultimate QRS narrowing achieved is influenced by the pathology causing the wide QRS. The latter may be due to bundle branch block, myocardial scar, hypertrophy or LV dilatation. Consequently, for different reasons, 1/3rd of patients receiving CRT are non-responders. Conduction system pacing (CSP), involving pacing the His bundle (HB) or left bundle (LB), could as well result in a narrow paced-QRS complex and prevent, reverse or treat HFrEF (HF with reduced ejection fraction). LB pacing involves drilling the lumenless or stylet-drive lead, using a proprietary delivery sheath, from the RV endocardial site and through the interventricular septum (IVS) to reach the LV subendocardium (See Figure 1). From this site there may be a selective / non-selective capture of the LB or deep septal (myocardial) pacing, any of which may achieve a similar clinical result. Hence this method of pacing is best referred to as LB-area pacing (LBBAP). We describe exemplary cases of HFrEF where LBBAP could help to better clinical status.

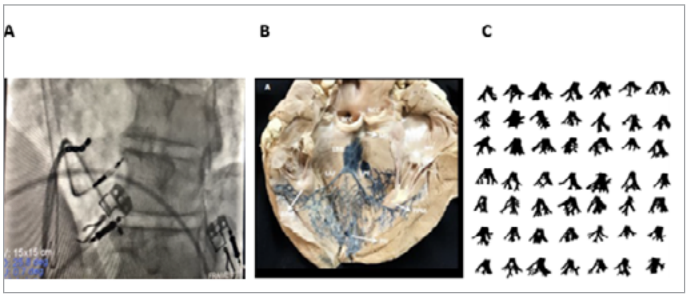

Figure 1. A. Screw- in lead is drilled with sheath-support from the RV endocardial site to reach LV subendocardium to achieve LBBAP. B. LBBAP can best achieved by pacing the trunk of LB which is anatomically below the right and non-coronary cusp junction. C. Multiple attempts at lead positioning may be required due to variations in the anatomy of the LB system.

Case 1:

A 65-year man, hypertensive and diabetic, had recurrent presyncope with ECG showing RBBB with right QRS axis. His echocardiogram showed inferior wall motion abnormalities and LVEF 40%. His external loop recorder showed intermittent advanced AV block. Coronary angiography showed significant lesions in obtuse marginal and proximal right coronary artery. An electrophysiological study done prior to device implant revealed a prolonged HV (90 ms) and no inducible ventricular tachycardia. He was counselled for dual chamber pacemaker with LBBAP. A selective LBBAP was achieved (See Figure 2).

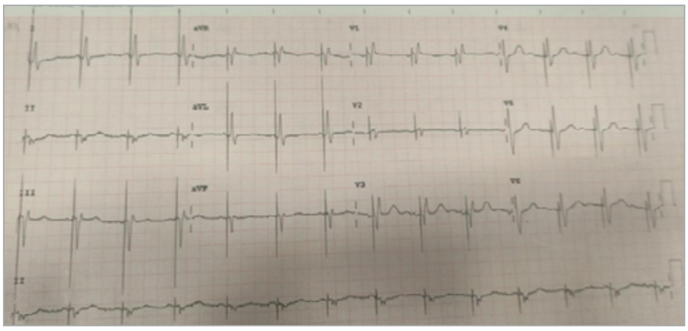

Figure 2. Patient described in case 1. Selective LBBAP was achieved with QRS width 110 ms and paced QRS morphology suggestive of left posterior fascicular capture.

Comment: LBBAP in patients with mild LV systolic dysfunction requiring bradypacing may prevent further deterioration of LVEF by providing electrical synchrony (narrow paced QRS).

Case 2:

A 10 year-old child who had previously undergone balloon pulmonary valvotomy (BPV) followed by atrial septal defect (ASD) closure has a congenital complete heart block (CHB). We are often restricted to single chamber VVI pacing due to both, short-term and long-term considerations, associated with dual chamber pacing in pediatric population. Single chamber LBBAP could possibly prevent pacing-induced cardiomyopathy (PICM) by avoiding VV dyssynchrony. (See figure 3)

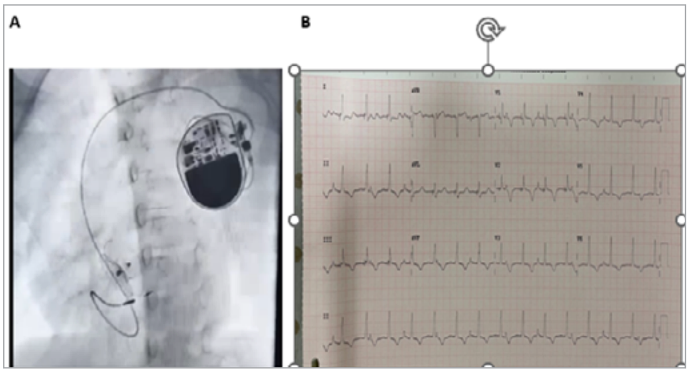

Figure 3. Patient described in case 2. A. SelectSecure 3830 fixed helix lead is used to achieve LBBAP in a child status post ASD device closure and BPV. Note the alpha loop of the lead. The ASD closure device is seen. B. Selective LBBAP was achieved. Note the qR pattern in lead V1. The paced QRS width is 100 ms and morphology (positive in all inferior leads) is suggestive of left anterior fascicular capture.

Comment: The 4.1F lumenless-lead 3830 (Medtronic Inc) is more suited for a long-term freedom from lead malfunction and the lead length (≥59 cm) allows an alpha-loop. It is FDA approved for LBBAP.

Case 3:

A 56 year-old man with diabetes and hypertension underwent dual chamber pacemaker for CHB in June 2021. Active fixation lead was placed at RV apex. 3 months later he presented with new LV systolic dysfunction. Coronary angiogram showed nonincriminatory single-vessel circumflex stenosis. PICM was diagnosed and RV lead explanted followed by LBBAP (see Figures 4 and 5). 3 months later the LVEF had recovered.

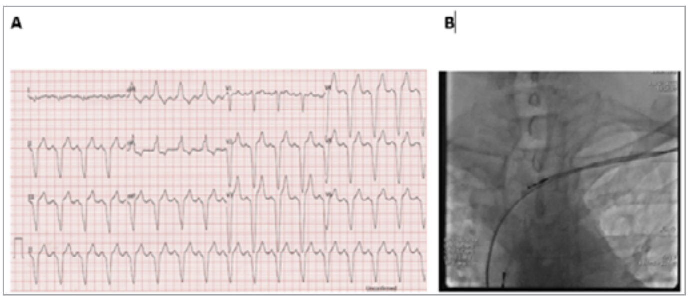

Figure 4. Patient described in case 3. A. Following a dual chamber pacemaker implant for CHB, the RV apical pacing results in a wide QRS = 160 ms. B. 3 months post implant, the RV lead was easily explanted.

Comment: RV apical pacing causing PICM is under-recognized unless symptomatic and with significant reduction in LVEF. LBBAP for every bradypacing indication, are we there yet? Await a randomized trial.

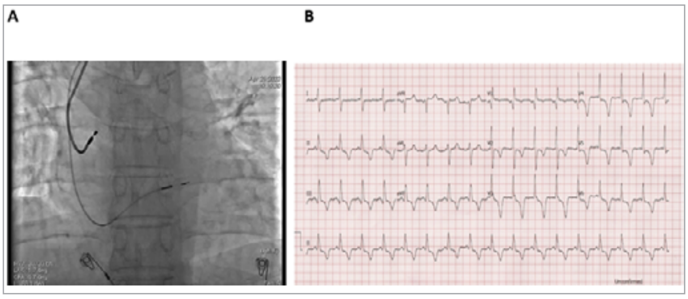

Figure 5. Patient described in case 3. A. Note that the dual chamber pacemaker is now done by implanting the RV lead using LBBAP technique. B. 12-lead QRS morphology confirms LBBAP, the QRS width is 100 ms.

Case 4:

A 43 year-old lady presented with HF. She had sinus rhythm with LBBB-type QRS with QRS width = 150 ms. Echocardiogram suggested NICM with LVEF 25% and a moderate mitral regurgitation. She was planned for a conventional CRT. Quadripolar CS lead was easily introduced in the posterolateral CS branch. However, the CS lead was displaced 5 times due to the wide caliber of the CS branch. We switched to LBBAP as a bail out strategy. A deep septal pacing was achieved; however, the NYHA class, LVEF and MR grade improved in the early follow up. See figure 6.

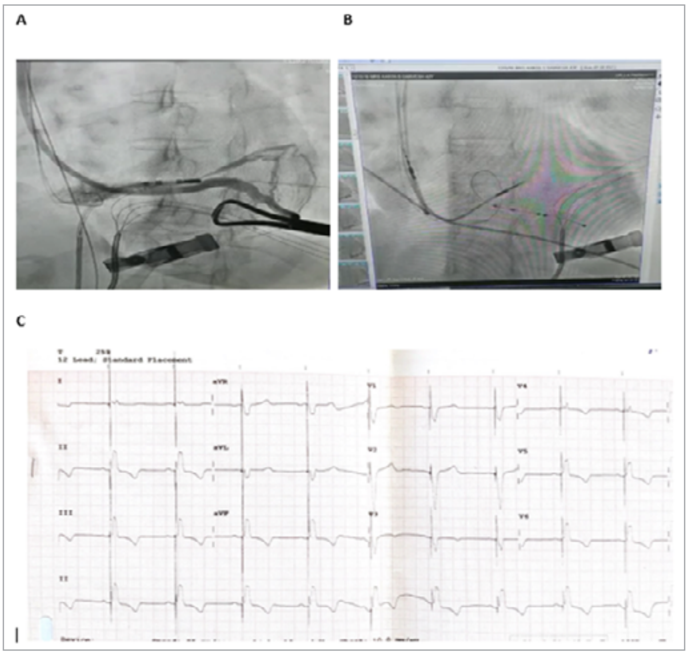

Figure 6. A. Note the large and roomy posterolateral CS branch. B. The quadripolar CS lead, despite introducing deep into the vein, would repeatedly slip out while withdrawing the sheath. C. Deep septal pacing was achieved.

Comment: Planning the conventional CRT procedure should include the possibility to switch to LBBAP, if required. Suitable hardware should be kept standby even if conventional CRT is primarily planned.

Case 5:

A 63 year-old gentleman had HF NYHA III with NICM (LVEF 30%) and ECG with LBBB-type QRS. He was planned for CRT-D implantation. Despite easy CS cannulation with a CRD-1 catheter, the CPS 1150 CS sheath dissected the CS endocardium and the previously visible target branch was no longer seen to pass the guidewire. After ruling out pericardial effusion, the plan was changed to do LBBAP. This was achieved using the Agilis HisPro steerable sheath and the stylet driven Tendril STS Model 2088TC lead (Abbott Inc) (see figure 7). DF4 lead and RA were implanted as usual. All 3 leads connected to the CRT-D device with bipolar LV port. Patient was responder at the intermediate 6-month follow up.

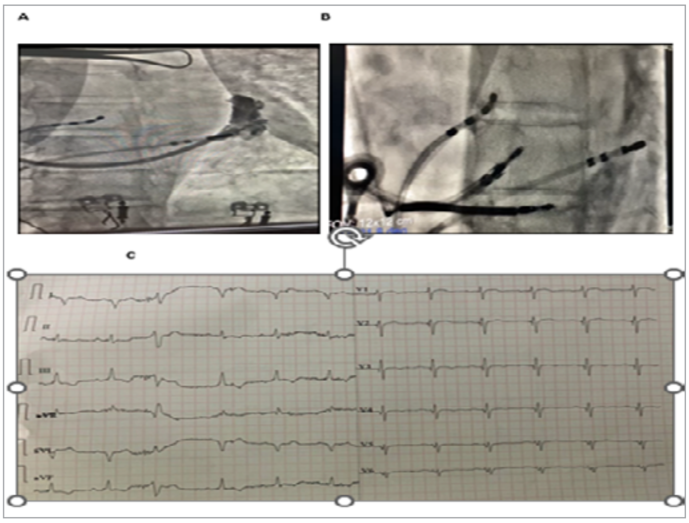

Figure 7. A. CS dissection occurred while introducing the sheath over the CRD-1 catheter, following which the previously noted target branch was occluded at the ostium by the dissection flap and no longer visible. B. RV pacing lead was implanted by LBBAP technique. C. Electrical synchrony was achieved, note that the paced QRS width was <120 ms.

Comment: CS dissection is a rare complication during implantation of the LV lead. If the dissection involves the ostium of the target CS branch, it would no longer be possible to pass the guide wire into this branch. Instead of abandoning the procedure to a later date, LBBAP can be done for resynchronization. LBBAP can be considered even for non-LBBB wide QRS.

Case 6:

A 51 year-old lady with NICM and LBBB QRS with NYHA III HF was planned to receive a CRT-P implantation. A quadripolar CS lead was implanted into the posterolateral vein and demonstrated acceptable thresholds without diaphragmatic pacing through all the tested bipoles. RV endocardial lead was implanted in mid-septal site. The best biventricular paced QRS width was 140 ms and deemed unacceptable for a future responder status.

Hence it was decided to implant the RV lead by LBBAP technique. The biventricular pacing, combining LBBAP (bipolar) with LV3-4 bipoles of the quadripolar lead resulted in the narrowest QRS = 100 ms. See Figure 8.

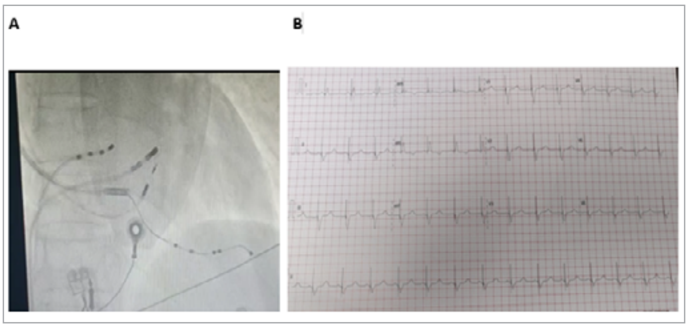

Figure 8. A. Shows biventricular pacing achieved by RV pacing through LBBAP lead and LV pacing through quadripolar CS lead. B. Note the narrowest biventricular paced QRS = 100 ms.

Comment: Achieving narrowest biventricular paced QRS is considered equivalent to reversing electrical dyssynchrony and equated with improvement in mechanical synchrony with subsequent responder status. Every attempt should be made during the implant to achieve the narrowest QRS. In our case "Cardiac Physiologic Pacing" was obtained by LBBAP-LV (CS) pacing. This is referred to as LB optimized CRT (LOT-CRT).

The advantages of LBBAP over HBP are that a larger target area is available to position the lead with correction of distal conduction disease, low capture thresholds and good sensing parameters and a consistent back-up myocardial capture is possible. The biggest worry is that these leads are not primarily designed for penetration into the myocardium and whether they disrupt at the insertion site in the long-term? Although in HF, conventional CRT is preferred, LBBAP has been given a class IIA indication. For bradypacing, LBBAP may be selectively used.

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