Left Bundle Branch Pacing in a Patient with Dextroposed Heart: A Case Report

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Abstract

The Right Ventricular (RV) apex has been the standard site for pacing in symptomatic bradyarrhythmias, but chronic RV pacing can cause adverse effects such as atrial arrhythmias and left ventricular dysfunction. Physiological pacing, including His bundle and left bundle pacing, offers alternatives with fewer complications. We present a 66-year-old male with

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The Right Ventricular (RV) apex has been the standard site for pacing in symptomatic bradyarrhythmias, but chronic RV pacing can cause adverse effects such as atrial arrhythmias and left ventricular dysfunction. Physiological pacing, including His bundle and left bundle pacing, offers alternatives with fewer complications. We present a 66-year-old male with a dextroposed heart and fibrotic right lung requiring left bundle branch pacing due to a high RV pacing burden. The procedure involved modified lead placement and a medial subclavian vein puncture, successfully achieving good electrical parameters and post-procedural device function, highlighting left bundle branch pacing's feasibility in complex anatomical conditions.

Keywords: His bundle pacing, Left bundle pacing, dextroposed heart.

Introduction :

The right ventricular (RV) apex has long been preferred site for pacing for management of symptomatic bradyarrhythmia. However, chronic RV pacing can cause various adverse effects in the form of atrial arrhythmias, left ventricular dysfunction, higher hospitalization and has been documented in numerous literatures [1]. This has generated a lot of interest in a new pacing strategy where left His bundle or the left bundle branch is paced using pacing lead. This strategy is known as physiological pacing. Although clinical benefits of pacing His bundle permanently have been demonstrated in various studies, concerns remain in various issues such as higher pacing thresholds, smaller R-wave amplitude, early battery depletion and risk of developing distal conduction block [2]. These challenges can be addressed by selectively pacing left bundle branch which provides excellent threshold, and good lead stability [3]. The proximal left bundle branches travel through the left ventricular septum and then fan out, offering a larger area for pacing compared to the His bundle. During the procedure, radiographic landmarks and intracardiac signals are crucial. Here, we report a case involving dextroposition and altered radiographic landmarks where left bundle pacing was successfully performed

Case history :

A 66 years old non-diabetic, non-hypertensive male came to us with recurrent episodes of syncope. He had past history of pulmonary tuberculosis in childhood. On examination, apex beat was found to be in right 5th intercostal space just medial to midclavicular line.

Methods :

The blood reports were unremarkable. His baseline electrocardiogram (ECG) was suggestive of bifascicular heart block (Figure 1). High resolution computed tomography (HRCT) thorax was suggestive of fibrotic right lung with shifting of mediastinum towards right (dextroposed). Echocardiogram revealed a case of situs solitus and levocardia; with normal cardiac chamber sizes and biventricular function grossly rightwards shifted apex. 24 hour Holter showed multiple 2:1 episodes and he was likely to get more than 40% RV pacing, so conduction system pacing was considered in his case. Coventional Venogram of bilateral upper limbs revealed shifted drainage of left and right subclavian veins and superior vena cava. As this was not truly situs inversus dextrocardia, ECG electrode placement was the key step to success of the procedure. Measurement of left ventricular activation time (LVAT) and ECG morphology in V1 is essential for successful left bundle branch (LBB) capture, besides narrowing of QRS duration. Therefore, modified placement of chest leads was done with echocardiographic as well as fluoroscopic guidance as depicted in (Figure 2). As there was anatomical displacement of innominate vein and SVC more towards right, we contemplated the length of C 315 sheath might be insufficient to reach the upper IVS. Hence puncture for the subclavian vein was done more medially so that the C 315 sheath could reach the septum. There was additional curve given to the sheath as there was sharp angulation at the junction of left innominate with superior vena cava. At first, atrial lead was positioned in right ventricle for pacing back up during right ventricular lead placement. It also provided idea about right ventricle and location of tricuspid valve. The 315 sheath was then guided towards the interventricular septum. After a few attempts, site with good electrical parameters showing upright QRS in lead II and QRS discordance in aVL and aVR on electrocardiogram was selected (Figure 3). Ventricular lead was then screwed and the paced left ventricular activation time (LVAT) was 58 mSec with QRS duration of 96 mSec. Pacing threshold was found to be 0.9 V. Later, atrial lead was positioned into right atrium. Since the anatomy of the patient was distorted, after multiple efforts with site with acceptable threshold and sensing was selected on the lateral wall of right atrium and right atrial lead was fixed. Post procedural pacing check, done on next day demonstrated normal device function with atrial lead\RL's threshold of 0.875V, ventricular lead\RL's threshold 0.25V with 88.1% atrial pacing and 99.9% ventricular pacing. Post-procedure period was uneventful and the patient was discharged in haemodynamically stable condition. (Figure 4)

Discussion :

Cardiac pacing is the only therapy for symptomatic bradyarrhythmia. Chronic right ventricular pacing has various hemodynamic problems, because of which other alternative pacing sites are being considered. These include right ventricular septum, right ventricular outflow tract, left ventricle, His bundle and left bundle branch pacing. His bundle pacing, developed by Desmukh et al [4] has some inherent problems like low sensed R wave amplitude which can result in atrial over sensing and ventricular undersensing. Also it has high pacing thresholds either during implantation or during follow-up which can cause early battery depletion in 5%-10% of cases [3]. Left bundle branch area pacing may be a viable solution for patients experiencing His bundle pacing failure. Advantage of left bundle branch pacing is that it can correct the distal conduction system disease and the pacing lead effectively bypasses the diseased proximal segment [5]. It is also considered to be an alternative to cardiac resynchronization therapy in patients with dilated cardiomyopathy with left ventricular dysfunction and left bundle branch block pattern [6].

Position of heart may be different either in congenital heart diseases or in diseases of mediastinum or lung. In our case, the patient is having dextroposition of heart due to fibrosis of right lung. We considered CSP ahead of RV pacing in this case, as it was better option especially when the patient had compromised lung (so he is not going to tolerate any deterioration of LV function) in the background of expected pacing burden

of more than 40%. But, mere thinking was not sufficient in this case as the anatomical hurdles of left bundle branch pacing in this patient needed to be addressed. More medial puncture than usual, positioning atrial lead first in the right ventricle, giving additional curve to the sheath were done to overcome the anatomical complexities in this patient. Finally, the atrial lead was secured to the lateral wall of the right atrium. There are very few reporting on left bundle branch area pacing in literature but they were done in situs inversus dextrocardia [7-9] and to our knowledge this is the first reporting of case of left bundle branch area pacing in dextroposed heart.

Conclusion :

In conclusion, the case presented highlights the challenges and considerations in opting for left bundle branch area pacing as an alternative to traditional right ventricular pacing in patients with anatomical variations like dextroposition of the heart. Despite anatomical complexities such as mediastinal shift and altered venous drainage, careful procedural planning and modification of conventional techniques enabled successful implantation of the pacing system. This case underscores the importance of tailored approaches in pacing strategies, particularly in patients at risk of adverse effects from chronic right ventricular pacing. Further studies and case reports are warranted to explore the efficacy and long-term outcomes of left bundle branch area pacing in diverse anatomical settings, ensuring optimal management of symptomatic bradyarrhythmias while minimizing potential complications associated with traditional pacing techniques.

Key clinical message :

Chronic right ventricular pacing can cause complications such as atrial arrhythmias and left ventricular dysfunction. Left bundle branch area pacing offers a physiological alternative, especially for patients with anatomical variations like dextroposition. This case demonstrates successful pacing despite anatomical challenges, highlighting the need for tailored pacing strategies in complex cases.

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Figure legends:

Figure 1: Pre-procedure baseline ECG showing bifascicular heart block with wide QRS (duration 144 msec)

Figure 2: Modified position of placement of precordial leads of ECG on right hemithorax

Figure 3: Post procedure baseline ECG showing narrowed QRS

Figure 4: Post procedure chest X-Ray of the patient showing dextroposed heart with pacemaker in situ.

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