

Cardiac Resynchronization Therapy in Anomalous Coronary Sinus: A Case Report

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Abstract:

A 37-year-old man, a known case of Dilated Cardiomyopathy (DCM) with Post PPM (Permanent Pacemaker) status for last 3 years underwent upgrading of PPM to Cardiac Resynchronization Therapy Pacemaker (CRT-P) in a specialized cardiac center. During the implantation procedure, there was anomalous branching of coronary sinus with absence of lateral

branch & presence of a highly tortuous posterior branch causing difficulty in lead placement. Finally left ventricular (LV) lead was placed in the tortuous branch using Judkin's right catheter. Lead position was stable with excellent threshold. The patient has been followed up with improvement of symptoms.

Key words: CRT-P, PPM, Coronary Sinus, DCM

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Introduction:

Cardiac resynchronization therapy (CRT), via atrial-synchronous biventricular pacing, is an effective treatment for moderate to severe heart failure (HF) patients having ventricular dyssynchrony. Following CRT implantation, patients have been observed to have significant improvement of symptom, exercise capacity, along with quality of life.¹ CRT is shown to improve ventricular systolic function, decrease functional mitral regurgitation, and induce favorable remodeling with reduction of cardiac chamber dimensions by modification of ventricular electromechanical delay.^(2, 3 & 4) Meta-analyses of clinical experiences and larger subsequent trials of CRT confirmed an approximately 30% decrease in hospitalizations and a mortality rate benefit of 24% to 36%.⁵ To maximize the benefit of CRT, careful patient selection is mandatory along with proper positioning of the implanted leads. The LV lead in coronary sinus should be placed in a location so that it can stimulate the entire left ventricle. The posterolateral region of left ventricle

shows the maximum contractile delay. Thus studies have shown the posterolateral region as the ideal position for stimulation. Problems may be encountered during LV lead placement in a small number of patients e.g., absence of suitable vein, venous tortuosity, unfavorable angle of the vein or a small vein/ atretic vein.⁶ We report a case of anomalous coronary sinus with absence of lateral vein. Thus left ventricular lead implantation was done in highly tortuous posterior branch.

Case presentation:

A 37-year-old male presented with DCM with implantation of PPM 3 years back. Permanent pacemaker was implanted due to complete heart block. He was on maximally tolerated medical treatment for heart failure with partial improvement of symptoms. ECG showed pacing ECG with a wide QRS complex (184 milliseconds) associated with left bundle branch block and extreme left axis deviation. His echocardiography revealed

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moderate left ventricular dysfunction with ejection fraction of 35%. His coronary angiogram (CAG) revealed normal coronary arteries. Based on his ECG findings, refractory heart failure on optimal medical treatment and moderate left ventricular dysfunction with recurrent hospitalization, he was advised upgrading of his PPM to CRT-P.

Clinical Status during PPM Implantation

NYHA class	II
ECG	CHB, Ventricular escape
Echocardiography	Mild LV systolic dysfunction with EF: 45%
Indication of PPM	Class I

Clinical Status during CRT Implantation

NYHA class	IV
ECG	Dual chamber paced rhythm, LBBB morphology
Echocardiography	EF: 35%, LVIDD: 58mm
CAG	Normal Coronaries
Indication of CRT	Class I

In this case, RA & RV lead was already placed. Only LV lead implantation was required for bi-ventricular (Bi-V)

pacing. Coronary sinus was engaged with 5F EP catheter and subsequently a 7F MB2 delivery sheath was advanced deep into the body of the coronary sinus. Venography was done in LAO 30° and RAO 30° views which revealed absence of lateral vein. A 0.014 inch extra support BMW coronary guide wire with LV lead was attempted to be negotiated over this wire. However, due to extreme tortuosity and multiple angulations of the vein, the lead could not be advanced to the posterolateral site despite several attempts. Then 5F guide catheter was passed over the wire into posterior vein but LV lead negotiation into the vein was not possible. Finally, 5F Judkin's Right catheter over the PTCA wire was introduced in the tortuous posterior vein which crossed the angulation & LV lead was placed at the desired location with good lead stability and pacing parameters (Figure 2). ECG after CRT-P showed narrow QRS. In-hospital stay of the patient was uneventful and he was discharged after five days. On follow-up after 3 months, the patient showed functional improvement to NYHA Class II and an improved LVEF of around 40% on Echocardiography. Three months after the procedure, chest X-Ray P/A view showed stable LV lead position with excellent parameters.



Fig.-1: CS venogram

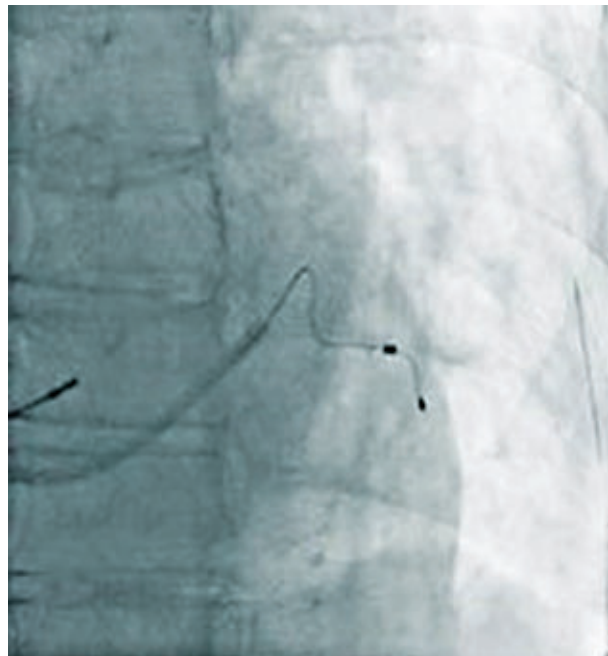


Fig.-2: LV lead

Discussion:

Heart failure (HF) is associated with substantial mortality and morbidity and remains the most common hospital discharge diagnosis in patients ≥ 65 years of age.⁷ Development of HF is characterized by progressive left ventricular (LV) remodeling and deteriorating function. Cardiac resynchronization therapy (CRT) is now established as an effective treatment for moderate-to-severe HF patients having ventricular dyssynchrony. Still some of the patients do not show expected response following CRT implantation. One of the major determinants of CRT response is implantation of the left ventricular (LV) pacing lead in coronary sinus.⁸ The final positioning of LV pacing lead is crucial for proper activation of left ventricle in order to obtain effective resynchronization. Due to the highly variable anatomy of the coronary sinus and its tributaries, LV lead placement has several challenging technical issues. Thus the observed heterogeneity of response even among those who would appear to be excellent candidates for CRT may result from suboptimal lead location.⁹

The abnormal anatomy of coronary sinus includes congenital presence of Thebesian, Vieussens valves, acute angle of the vein, excessive tortuosity, small size of the vein, epicardial course of the vein or coronary sinus stenosis.¹⁰

Successful lead placements using various modified techniques are described. The buddy wire technique is one of them. Yoshimitsu Soga et al. have described a case of an obstructed coronary sinus where LV lead placement was done through a collateral pathway.¹¹ William G. De Voogt et al have also reported a case using a collateral branch for LV lead re-implantation.¹² Another case report described use of the double-wire technique (a second parallel guidewire) as effective way of implanting left ventricular electrodes in patients with anatomical difficulties.¹³ Harinder K. Bali et al described a case of CRT implantation where left ventricular lead implantation was done using anterolateral vein where middle cardiac vein was functionally occluded.¹⁴

In our case, multiple attempts & techniques were required to place LV lead in the highly tortuous posterior vein for optimum lead position, stability & pacing thresholds.

Conclusion:

We report this case as there are few case reports regarding abnormal anatomy of coronary sinus & technique required to place LV leads. We also recommend for further studies regarding this topic.

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