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A Clinical Case of Left Bundle Branch-Optimized Cardiac Resynchronization Therapy

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Abstract

This paper presents a clinical case of left bundle branch-optimized cardiac resynchronization therapy (LOT-CRT). It included targeting left ventricular lead implantation close to the late activation zone in the left ventricle (LV) and implantation lead in left bundle branch (LBB). Leads were implanted to the right atrium, to the lateral vein of the coronary sinus (CS) (the target one), to the interventricular septum from the right ventricle in the area of LBB and to right ventricular apex for defibrillation. The patient is a responder for cardiac resynchronization therapy (CRT) according to clinical and echocardiographic parameters. Left ventricular pacing (LVP) through the vein of CS combined with left bundle branch area pacing (LBBAP) resulted in greater narrowing of QRS then isolated LVP or LBBAP.

Introduction

Recently, there has been a tendency to perform His-optimized cardiac resynchronization therapy (HOT-CRT) or LOT-CRT to provide the most physiological excitation and coverage of a larger area of the myocardium [1]. In the ESC 2021 guidelines, these types of pacing have a level of IC, but specific indications are based on single clinical studies, according to individual selection [1, 2, 3]. There are studies that note a more successful correction of extremely wide QRS complexes with HOT-CRT and LOT-CRT than with other types of pacing [4, 5, 6]. The location of leads may vary depending on the required pacing mode, the presence and type of intraventricular conduction block and the width of the QRS complex [3].

Clinical case description

A 69-year-old patient with a long history of hypertension and coronary heart disease was admitted for CRT due to LBBB and symptomatic heart failure (HF) with reduced ejection fraction (EF) (17%) despite optimal drug therapy and optimal revascularization. Patient appeared to have a dilatation of all heart chambers (index of the end-diastolic volume (iEDV) of the left ventricle (LV) was 149 ml/m², index of the end-systolic volume (iESV) of the LV was 103 ml/m², left atrium was 54 mm) with severe mitral, aortic, tricuspid regurgitation (MR, AR, TR). Also he had permanent atrial fibrillation (AF) with complete left bundle branch block (LBBB), QRS duration 195 ms, nonsustained ventricular tachycardia. Due to severe heart failure with EF 17% patient was refused in valves repair surgery and even in MitraClip procedure. The patient underwent non-invasive electroanatomical mapping combined with multispiral computed tomography of the heart with contrasting to determine the latest activation

area of the of the LV myocardium in order to choose the target vein for LV lead implantation.

The patient was implanted with the CRT-D device, the atrial electrode was implanted in the appendage of the right atrium, the LV lead was positioned in the lateral vein in the projection of the inferolateral segment, the SelectSecure 3830 lead was implanted into the lower part of the interventricular septum, screwed until signs of selective capture of LBB had appeared, lead for defibrillation was implanted to right ventricular apex. In 30 days radiofrequency ablation of AV node was performed. The VVIR pacing mode was installed, the optimal parameters have been selected: LBBAP firstly and LVP in 40 ms secondly. Modest narrowing of QRS was reached (127 ms). Class of chronic HF (NYHA) decreased from 3 to 2, LV EF grew up to 27,7%, iEDV LV became 153 ml/m², iESV LV decreased to 110 ml/m², MR, TR, AR reduced to the 2nd degree. LVP resulted in QRS of 234 ms, LBBAP resulted in QRS of 144 ms.

Results

Initially QRS duration was 195 ms. LVP even with LV lead implanted in the target vein gave 234 ms of QRS duration, isolated LBBAP resulted in 144 ms of QRS duration and the combination of both resulted in 127 ms of QRS duration (Picture 1).

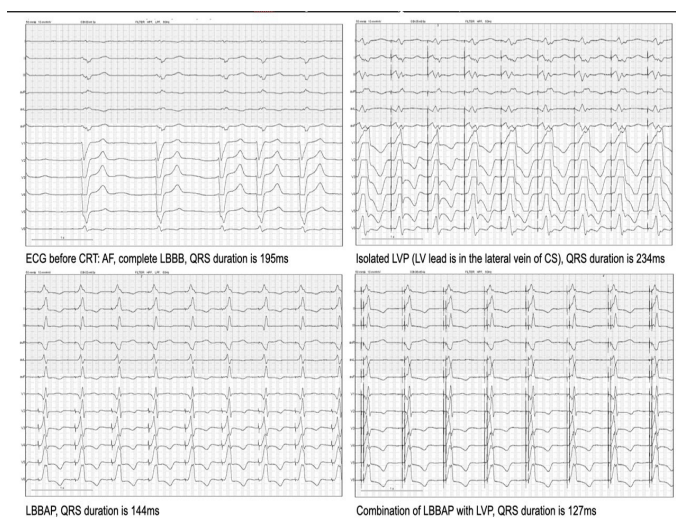


Figure 1: Patient ECG in different types of pacing

Discussion

The choice of the LOT-CRT technique in this clinical case is due to the presence of a complete LBBB with extremely wide QRS complexes (195 ms) in order to increase coverage area of the myocardium by pacing. Information on a similar choice of resynchronization method is widely presented in clinical studies [4,5,6]. According to the results of implantations of CRT systems with the LBBAP, patients show both a more significant narrowing of QRS complexes and clinical and echocardiographic parameters than with classical biventricular pacing and isolated LBBAP. Venous anatomy

determined by multispiral computed tomography with contrast, and the LV myocardial activation pattern provided the possibility of target implantation of the left ventricular lead, which further corrected dyssynchrony. The patient is a responder according to clinical and echocardiographic parameters. Also, earlier the patient was denied on both valvuloplasty and open cardiac surgery for valve insufficiency. Currently, the lack of indications for surgical treatment of valvular defects due to the improvement of the situation after correction of myocardial dyssynchrony is being discussed. Patient monitoring continues, evaluation will be carried out after 6 months.

Conclusions

The LOT-CRT technique showed high clinical and echocardiographic effectiveness in the treatment of a patient with stagnant HF with a wide QRS, and also adjusted MR, TR and AR.

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