

A Case Report of Permanent His Bundle Pacing in A Patient with LVEF Worsened after CRT

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Abstract

Deleterious effects from chronic RV pacing have been well documented. Physiologic pacing-induced by cardiac resynchronization therapy (CRT) and His bundle pacing (HBP) appears to mitigate the deleterious structural and functional effects of RV pacing. Based on the above-mentioned evidence, in patients with atrioventricular block who have an indication for permanent pacing with a left ventricular ejection fraction (LVEF) between 36% and 50% and are expected to require ventricular pacing more than 40% of the time, it is reasonable to choose pacing methods that maintain physiologic ventricular activation (e.g., CRT or HBP) over right ventricular pacing according to current guidelines; however, it is not clear when to prefer CRT over HBP and vice versa. We report a case of a patient with ischemic dilated cardiomyopathy, low ejection fraction, and narrow QRS who had a further worsening of LVEF after CRT-D therapy for advanced atrioventricular block and sudden death prevention, in whom His bundle pacing was a reasonable solution.

Keywords: His bundle pacing; CRT; Pacing-induced cardiomyopathy; Physiologic ventricular activation

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Citation: Marinaccio L, Patrassi LA, Marchese D (2020) A Case Report of Permanent his Bundle Pacing in A Patient with LVEF Worsened after CRT. *Int J Integr Cardiol*, Volume 2:1. 112. DOI: <https://doi.org/10.47275/2690-862X-112>.

Received: October 06, 2020; **Accepted:** October 19, 2020; **Published:** October 26, 2020

Introduction

Right ventricular (RV) apical pacing has been routinely used for the treatment of patients with atrioventricular (AV) block; however, deleterious effects from chronic RV pacing have been well documented. RV apical pacing may have adverse effects on myocardial metabolism and perfusion, remodeling, hemodynamics, and mechanical function through electrical and mechanical dyssynchrony [1,2]; moreover, the incidence of these effects is higher if preimplant ejection fraction (EF) is reduced [3]. Current evidence against RV apical pacing has led to a vigorous search for a more physiological pacing mode that might avoid the adverse consequences delineated above. Physiologic pacing-induced by cardiac resynchronization therapy (CRT) and His bundle pacing (HBP) appears to mitigate the deleterious structural and functional effects of RV pacing, also it seems to improve left ventricular remodeling and function in patients affected by pacing-induced cardiomyopathy (PICM) [4-13]. Based on the above-mentioned evidence, in patients with atrioventricular block who have an indication for permanent pacing with a left ventricular ejection fraction (LVEF) between 36% and 50% and are expected to require ventricular pacing more than 40% of the time, it is reasonable to choose pacing methods that maintain physiologic ventricular activation (e.g., CRT or HBP) over right ventricular pacing regardless of the QRS complex width, according to current guidelines [14]; however, it is not clear when to prefer CRT over HBP and vice versa. We report a case of a patient with

ischemic dilated cardiomyopathy, low ejection fraction, and narrow QRS who had a further worsening of LVEF after CRT-D therapy for advanced atrioventricular block and sudden death prevention, in whom His bundle pacing was a reasonable solution.

Case Report

We present the case of a 76-year old man, Caucasian, suffering from hypertension, obesity (body mass index 34 Kg/m²), ischemic dilated cardiomyopathy, and low ejection fraction (LVEF) 35%, treated with percutaneous transluminal coronary angioplasty in 2015 and with coronary artery bypass grafting in 2017. In the same year, the patient underwent successful CRT-D (Claria MRI™ Quad CRT-D SureScan, Medtronic, St. Paul, MN) implantation due to advanced atrioventricular block and sudden death prevention. A quadripolar left ventricular (LV) lead (Attain Stability, Medtronic) was positioned in an anterior vein of the coronary sinus, the only available branch; not ideal, but acceptable lead position, considering the high risk for an epicardial implant. In November 2019, the patient came to our attention for acute worsening heart failure. Medical therapy included acetylsalicylic acid, bisoprolol, amiodarone, furosemide, sacubitril/valsartan. At hospital admission, he presented dyspnoic, with peripheral edemas, lung congestion at thoracic X-Ray, and an LVEF of 28%. The electrocardiogram (ECG) showed sinus rhythm and biventricular (BiV) pacing with a very wide paced QRS complex (>180 ms) (Figure 1a). During a previous device follow-up, the LV



pacing was set in the most distal configuration (apical region) due to increased capture thresholds (greater than 5V@1ms) in all the other configurations causing a prolongation of the QRS complex, compared to its immediate post-implantation width (Figure 1b).

During the same hospitalization, after obtaining a good clinical compensation with intravenous diuretics, the patient underwent coronary angiography with evidence of unchanged coronary situation compared to 2017; considering the lack of coronary sinus side branches, the patient's advanced age, and the absence of lead infection, we excluded the hypothesis of LV lead extraction, so we decided to implant a new pacing ventricular lead (3830 SelectSecure; Medtronic, St. Paul, MN) on the His bundle to achieve more physiologic pacing [11] (Figure 2). The new lead was connected to the LV port of the device. The surface ECG showed a selective His bundle pacing (HBP) with a capture threshold value of 1.25 V@1 ms (Figure 3a,b). The device was set in DDDR BiV pacing mode at 60 bpm with VV interval 80 ms (VV max of the device) 3,7. His bundle capture remained stable after 1 month and 4 months post-procedure; improvement of dyspnea was observed from NYHA 3 to NYHA 2, as well as an improvement of LVEF, 46%.

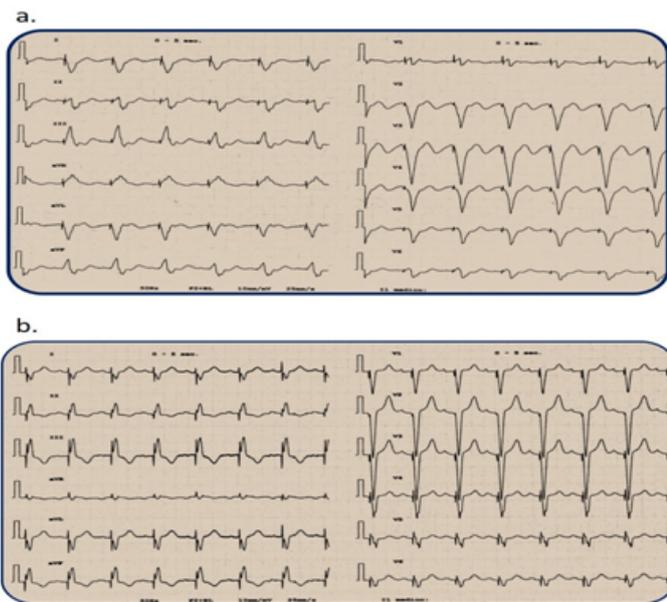


Figure 1: Surface ECG showing CRT pacing. (a). On admission, QRS complex length > 180 ms. (b). Immediately post-CRT, QRS complex length 145 ms.



Figure 2: Antero-posterior fluoroscopic projection, showing sub-valvular His Bundle lead Position.

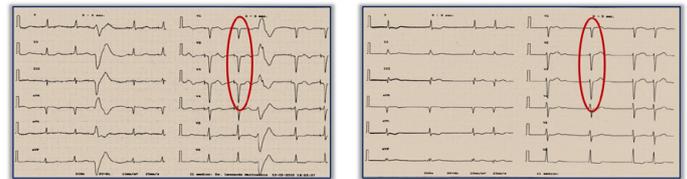


Figure 3: Surface ECG 12 leads showing the same QRS morphology both pre-implant (a) and during His bundle pacing (b), red oval.

Discussion

In this 76-years old patient with high-degree AV block, LV lead malfunction, poor availability of target vessels, and high risk for lead extraction, His bundle pacing represented a reasonable solution to achieve more physiological pacing with good electrical parameters, narrower QRS, and improvement of LVEF compared to CRT. Based on the evidence of the BLOCK HF Trial our patient underwent implantation of CRT [15], but his coronary sinus anatomy dictated the placement of LV lead in the anterior branch of the coronary sinus, the only one available. However, a likely micro dislodgment of the LV lead resulted in the loss of capture of the proximal bipoles, so that the apical bipole was the only valid one, resulting in iatrogenic dyssynchrony with QRS complex widening from 145 ms to > 180 ms. MADIT-CRT trial showed how although there was no difference in outcome among patients with anterior, posterior, and lateral LV lead positions, the apical lead position was associated with a significantly worse clinical outcome compared with non-apical lead [16]. Jastrzebski et al. investigated the effect of implantation-related paced QRS morphology on long-term mortality and morbidity in cardiac resynchronization therapy (CRT) patients, showing that apical or paraseptal LV lead position and the Antero-apical pattern of LV-paced QRS complexes were independent predictors of mortality and morbidity [17]. Although the benefits of cardiac resynchronization therapy are well established in patients with low ejection fraction and a prolonged QRS duration, in patients with narrow QRS complexes BiV pacing was associated with potential harm, consequent to iatrogenic dyssynchrony [18], even in the case of narrow QRS complexes and mechanical dyssynchrony [19]. Therefore, in the above-mentioned category of patients His bundle pacing has the advantage that it may allow AV delay to be optimized while normal intrinsic ventricular activation is maintained; Sohaib et al. have previously demonstrated that acute hemodynamic function is improved with AV-optimised His bundle pacing in patients with heart failure and PR prolongation with either a normal QRS or RBBB [20]. In conclusion, despite current guidelines recommend physiologic ventricular activation (e.g., CRT or HBP) in patients with atrioventricular block who indicate permanent pacing with an LVEF between 36% and 50% and high expectance of ventricular pacing, regardless of QRS duration, maybe in case of narrow QRS, HBP should be the first choice.

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