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Case Report

Direct His-Bundle Pacing Improved Left Ventricular Function and Remodelling in a Biventricular Pacing Nonresponder

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ABSTRACT

The optimal pacing modality after atrioventricular junction (AVJ) ablation remains unclear. Herein, we describe the case of a heart failure patient who had AVJ ablation for chronic atrial fibrillation and received a cardiac resynchronization therapy defibrillator device. Because of the lack of clinical response to biventricular pacing, the device was revised with the addition of direct His bundle pacing, which resulted in significant improvement in functional status and left ventricular indices. This case illustrated direct His bundle pacing as an alternative for conventional biventricular pacing in some cardiac resynchronization therapy nonresponders who undergo AVJ ablation for atrial fibrillation and have an intact distal conduction system.

RÉSUMÉ

Le type de resynchronisation cardiaque optimale suivant l'ablation de la jonction atrio-ventriculaire reste encore à déterminer. Le présent article décrit le cas d'un patient souffrant d'insuffisance cardiaque et ayant subi une ablation de la jonction atrio-ventriculaire en raison d'une fibrillation auriculaire chronique chez qui on avait implanté un défibrillateur et un appareil de resynchronisation cardiaque (ou stimulateur biventriculaire). Le patient n'ayant obtenu aucune réponse clinique à la stimulation biventriculaire, on lui a par la suite ajouté un dispositif assurant une stimulation directe du faisceau de His qui a amélioré considérablement son état fonctionnel et sa fonction ventriculaire gauche. Ce cas illustre bien l'intérêt de la stimulation directe du faisceau de His comme solution de rechange à l'habituelle stimulation biventriculaire chez les sujets qui ne répondent pas au traitement de resynchronisation cardiaque après l'ablation de la jonction atrio-ventriculaire en raison d'une fibrillation auriculaire, mais chez qui le système de conduction distal est toujours intact.

Cardiac resynchronization therapy (CRT) clinical trials have shown that biventricular (BiV) pacing significantly improves clinical outcomes in patients with ventricular systolic dysfunction and dyssynchrony compared with right ventricular (RV) apex (RVA) pacing. Implantation of a CRT device after atrioventricular junction (AVJ) ablation is a well established treatment for patients with drug-refractory chronic heart failure (CHF) and permanent atrial fibrillation (AF). However, approximately one-third of eligible patients fail to benefit from this treatment. Direct His bundle pacing (DHBP) can generate truly physiologic ventricular activation, and is an alternative to BiV pacing.[1-3]

Case Description

A 46-year-old man presented with symptomatic CHF from dilated cardiomyopathy and chronic AF with a rapid ventricular response and narrow QRS complex (Fig. 1). In March of 2009, he underwent AVJ ablation and implantation of a CRT defibrillator (CRT-D; Model V-350; St Jude Medical, Inc, St Paul, MN) with a left ventricular (LV) pacing lead in the lateral vein region. After AVJ ablation, the electrocardiogram showed a ventricular escape rhythm with left bundle branch block (LBBB)-like QRS morphology and QRS duration of 166 ms (Supplemental Fig. S1). After echocardiography-guided optimization, the QRS width during BiV pacing was 145 ms (Fig. 1). Over a 4-year follow-up, the patient responded poorly to CRT and was repeatedly hospitalized for heart failure. In July 2013, he underwent CRT-D generator replacement for battery deletion, at which time he was classified as New York Heart Association class III with LV end-diastolic diameter of 66 mm, and LV ejection fraction of 26% (Supplemental Table S1).

During the CRT-D replacement, an additional pacing lead (Model 3830; Medtronic, Inc, Minneapolis, MN) was placed at the His bundle region and connected to the right atrial port

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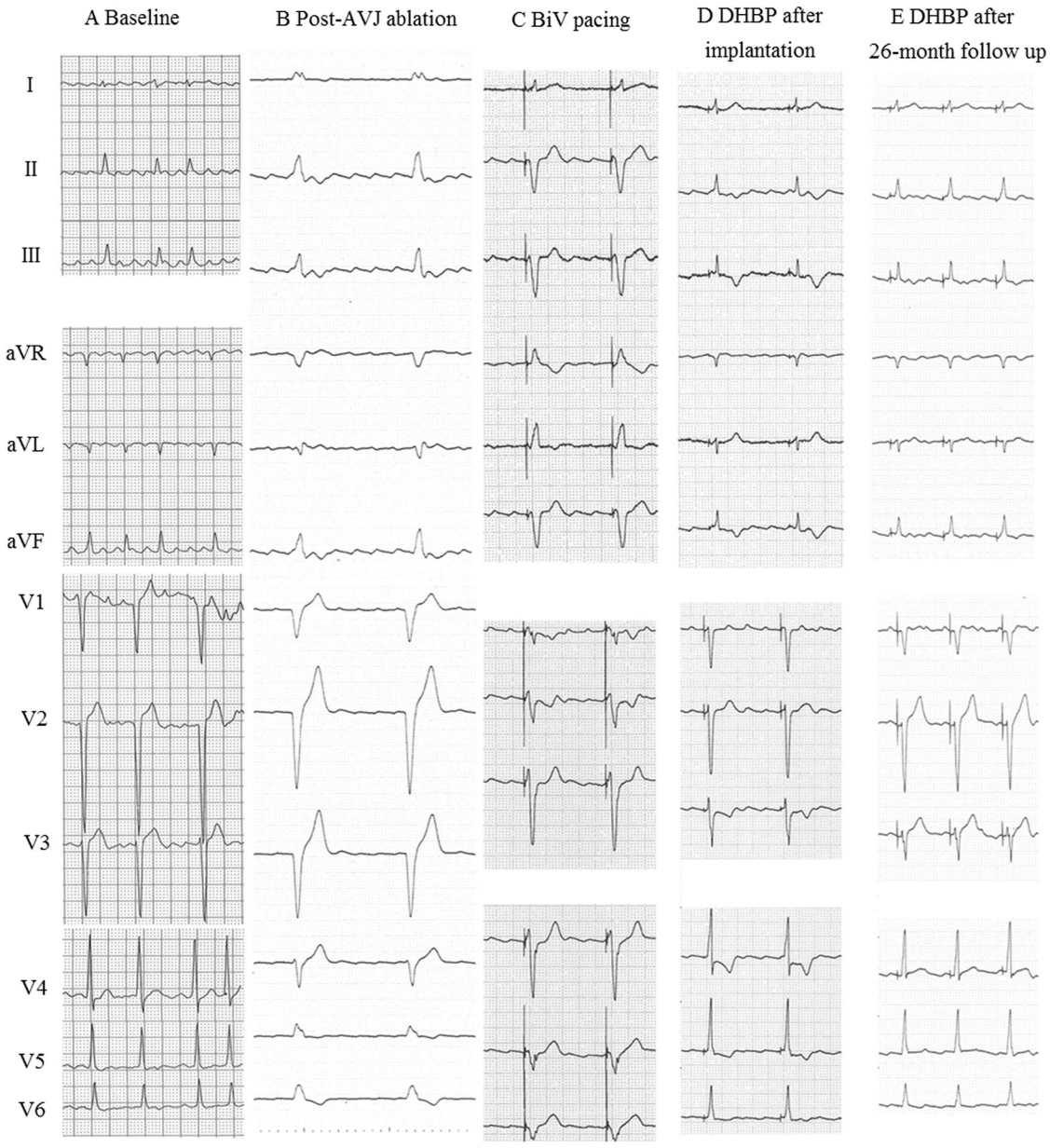

Figure 1. Twelve-lead electrocardiogram recordings. (**A**) Atrial fibrillation baseline before atrioventricular junction (AVJ) ablation. (**B**) Intrinsic escape ventricular beat after AVJ ablation. (**C**) Biventricular (BiV) pacing. (**D**) Direct His bundle pacing (DHBP) immediately after 3830 lead implantation. (**E**) DHBP at 26-month follow-up.

of the CRT-D device (Model 3231-40; St Jude Medical, Inc) for DHBP. The original right atrial lead was capped and abandoned; the original RV and LV leads were connected to the RV and LV ports, respectively. The pacing output (1.9-2.2 V, 0.5 ms pulse width) produced His bundle capture with QRS that resembled the native ventricular escape rhythm. Higher output pacing ($\geq$ 2.3 V) resulted in a narrow QRS complex that resembled QRS before AVJ ablation (QRS width 103 ms; Supplemental Fig. S1). The device output for DHBP was set at 3.0 V. The device was programmed to dual chamber pacing (DDD) mode with 200 ms atrioventricular delay to allow DHBP with BiV as backup pacing. During the 26-month follow-up, the patient was 99.9% DHBP-paced.

After DHBP, the patient became asymptomatic with no further CHF-related hospitalizations, and his New York Heart Association class improved from III to I (Supplemental Table S1). Brain natriuretic peptide level, LV end-diastolic diameter, and cardiothoracic ratio decreased (Fig. 2), correlating with significant LV reverse remodelling and increased LV ejection fraction (Videos 1-6; view videos online). Tissue-Doppler imaging 1 year later showed that DHBP greatly improved systolic synchrony vs BiV or RVA pacing (eg, shorter time from earliest to latest peak systolic velocity in different LV wall segments; 10 ms during DHBP vs 100 ms BiV, 140 ms RVA pacing). Speckle tracking echocardiography showed greater global longitudinal peak strain with DHBP