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Reversal of left bundle branch block and recovery of left ventricular dysfunction by left bundle branch *area* pacing in a patient with left bundle branch block-induced cardiomyopathy

Reversão do bloqueio do ramo esquerdo e recuperação da disfunção ventricular esquerda por estimulação da área do ramo esquerdo em doente com cardiomiopatia induzida por bloqueio do ramo esquerdo

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A 70-year-old man presented to our department on 19 August 2023 after experiencing seven days of shortness of breath and fatigue. He had a history of coronary artery disease with a stent implanted in the right coronary artery seven years previously, hypertension for seven years and type 2 diabetes for two years. Medication included aspirin, atorvastatin, beta-blocker, sacubitril/valsartan, metformin and dapagliflozin.

An electrocardiogram (ECG) showed complete left bundle branch block (LBBB) with a QRS duration of 162 ms (Figure 1A). Echocardiography revealed a left ventricular end-diastolic diameter (LVEDD) of 63 mm, a low left ventricular ejection fraction (LVEF of 38%) and left ventricular diffuse hypokinesis. There was no LBBB on the ECG (Figure 1B) and LVEDD (45 mm) and LVEF (62%) were normal one year ago.

A cardiac resynchronization therapy-defibrillator pacemaker (SJM Unify, CD3231-40) was implanted (Figure 1C), with a pacing lead (SJM Tendril 2088) in the right atrium and a right ventricular defibrillation lead (SJM Durata 7122) in the right ventricular apex. A 2088 TC lead was placed in the left bundle branch area (LBBA) following the method described by Huang et al.[1] Briefly, a stylet-driven pacing lead was advanced to the right ventricular septum. When the paced QRS morphology showed a ''W'' pattern in lead V_1, the site was considered suitable for performing left bundle branch area pacing (LBBAP). The lead was then screwed into the septum until a qR pattern in lead V_1 was obtained. Different outputs were performed to confirm left bundle branch capture.[1] LBBB was corrected by pacing with a capture threshold 0.8 V/0.4 ms. Pacing stimulus to left ventricular activation time in lead V_6 was 80 ms and QRS duration is 82 ms. After CRT-D pacemaker implantation, DDD pacing mode was programmed with an AV delay of 80 ms for LBBAP. The pacing lead configuration was set to bipolar mode, and the output of pacing lead in the right atrium and LBBA were programmed to 1.5 V/0.5 ms.

Left bundle branch area pacing refers to capturing the subendocardial area on the left side of the interventricular septum and includes LBBP, left fascicular pacing, and left

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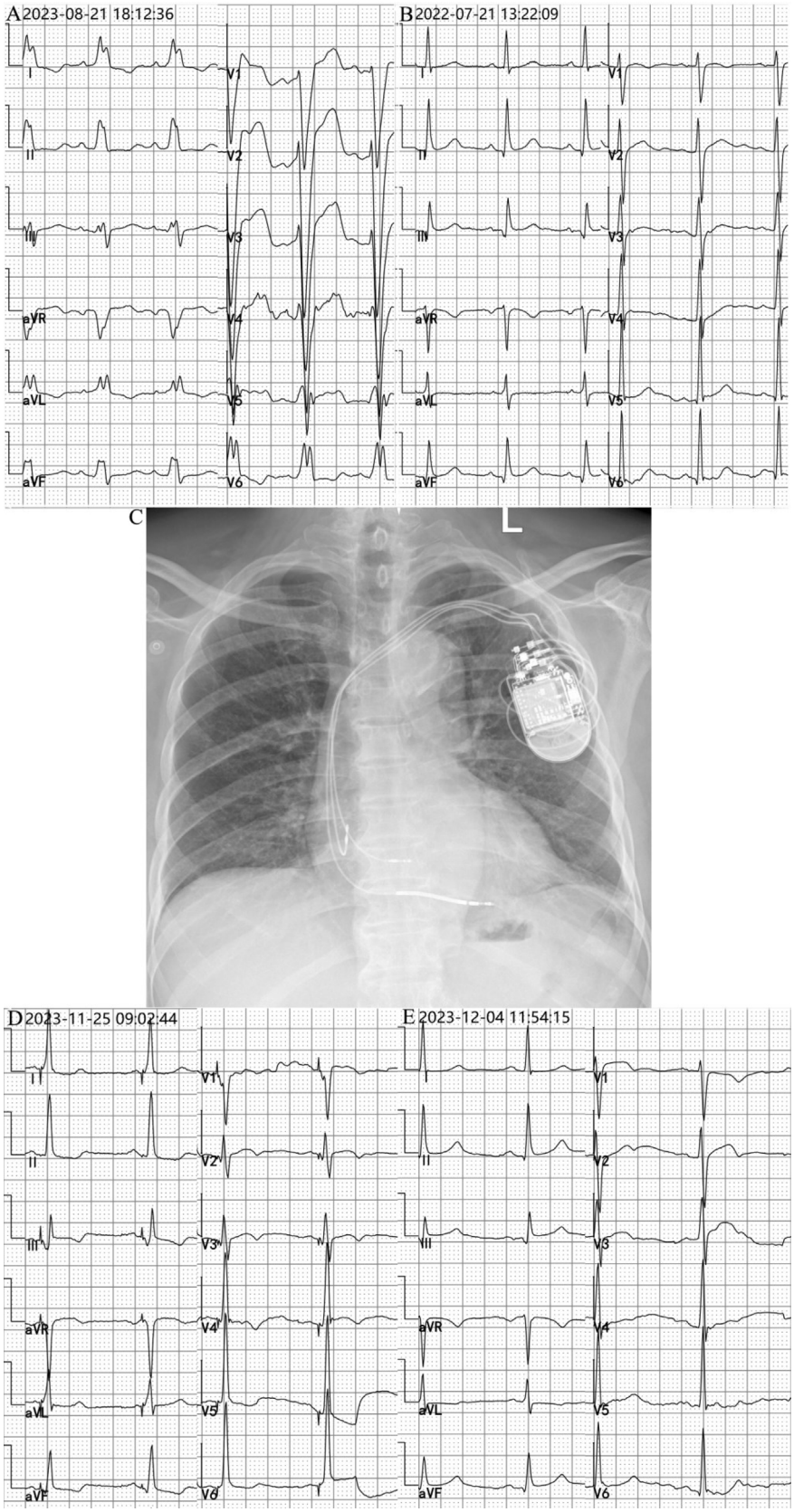

Figure 1 Electrocardiograms before and after left bundle branch *area* pacing. (A) The electrocardiogram (ECG) showed left bundle branch block after admission on August 19th, 2023. (B) No LBBB on ECG one year before admission. (C) CRT-D pacemaker was performed. (D) QRS duration was 108 ms after LBBAP. (E) The ECG revealed sinus rhythm with a QRS duration of 102 ms without pacing at 100-day follow-up after implantation of a CRT-D pacemaker.

ventricular septal pacing (LVSP).[2] Although LBBB was corrected after LBBAP, right bundle branch block morphology in lead V_1 was not observed in this patient. Terminal r′/R′ in V_1 may be absent in some cases,[2] which can be caused by rapid transseptal activation, rapid retrograde conduction to the His bundle (HB) and down the right bundle branch (RBB), and fusion with intrinsic conduction.[3]

The ECG showed a QRS duration of 82 ms one day after CRT-D pacemaker implantation. At three-month follow-up, there was LBBAP with a QRS duration of 108 ms (Figure 1D) in ECG. Echocardiography showed that LVEDD decreased from 63 mm to 51 mm, and LVEF increased from 38% to 57%. At 100-day follow-up, the ECG revealed sinus rhythm and a QRS duration of 102 ms without pacing (Figure 1E).

Left bundle branch block refers to conduction delay or block in any of several sites in the left intraventricular conduction system, which may be transient, persistent or permanent. It develops in as many as 25% of patients with heart failure (HF) and is associated with poor prognosis in patients with dilated cardiomyopathy. Even with guideline-directed medical therapy without CRT, patients with LBBB have less LV functional recovery.[4] An early CRT strategy is important for patients with LBBB and HF.

CRT includes biventricular pacing (BiVP), his bundle pacing and LBBAP. There is greater LVEF improvement in patients with LBBAP than with BiVP. Furthermore, LBBAP can resolve LBBB.[5] In this case, LBBB reversed and LV dysfunction recovered only three months after LBBAP, which suggesting that intermittent LBBB may be a cause for HF and LBBAP may be an optimal CRT strategy for patients with LBBB-induced cardiomyopathy.

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Conflicts of interest

The authors declare that they have no competing interests.

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