A case report of Left bundle branch area pacing (LBBAP)-optimized cardiac resynchronization therapy (CRT)

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**Introduction**: This report demonstrates a case on left bundle branch area pacing (LBBAP)-optimized cardiac resynchronization therapy (CRT) in a heart failure patient with atrial fibrillation and atypical complete left bundle branch block (LBBB).

**Methods**: A 54-year-old male had symptoms of shortness of breath for 3 years. Four months ago, he was diagnosed as severe aortic valve stenosis with heart failure, and trans-thoracic echocardiography showed enlarged left ventricular end-diastolic diameter (LVEDD) of 70mm and reduced left ventricular ejection fraction (LVEF) less than 40%. Because the baseline ECG showed atrial fibrillation and complete LBBB with a QRS duration of 186ms (Figure 1), the ventricular dyssynchronization caused by LBBB might contribute to the impaired LV function. During the procedure of aortic valve replacement, an epicardial lead was implanted on lateral wall of left ventricle in case of the requirement of implant of cardiac resynchronization therapy (CRT). After 4 months of optimal medical therapy, no significant improvement was observed in cardiac function, with further reduced LVEF of 29% and enlarged LVEDD of 75mm. The patient was indicated for implantation of CRT. During the procedure, LBBAP was attempted by using trans-septal protocol after placement of defibrillation lead. Although LBBAP did not completely correct LBBB, a relatively narrow paced QRS was achieved. The LBBAP lead was plugged into the atrial port since the patient had chronic atrial fibrillation, and the AV delay was set as 30 ms. Two-dimensional mechanical dispersion (defined as time to peak strain delay, PSD) was analyzed on three different pacing modes (LBBAP optimized BiV, LBBAP only, and BiV) for evaluating LV synchrony. ECG and echocardiography were evaluated 6-month follow-up.

**Result**: Post-procedure ECG and echocardiography evaluation had shown that LBBAP-optimized BiV pacing was presented with the narrowest QRSd (QRSd: 124 ms vs. 150 ms vs. 158 ms for LBBAP-optimized BiV, LBBAP only, and BiV mode, respectively, Figure 2D,E,F) and the most improved LV synchrony (PSD: 50 ms vs. 63ms vs. 101 ms for LBBAP-optimized BiV, LBBAP only, and BiV mode, respectively, Figure 2A,B,C). At 6 months’ follow-up, the narrowed QRSd persisted stable (QRSd 125ms) and improved LV synchrony still remained (PSD 49ms). LVEF increased from baseline 29% to 40%, and LVEDD decreased from 75mm to 62 mm. The serum B-type natriuretic peptide decreased from 2688.0 pg/ml to 431.8 pg/ml and cardiothoracic ratio reduced from baseline 0.59 to 0.51 (Figure 3), and the NYHA classification was improved from class III to class I. The patient had not suffered heart failure episodes after CRT implantation and the pacing threshold of LBBAP remained to be
Conclusion: LBBAP-optimized BiV pacing may result in improved electrical and mechanical resynchronization for heart failure patients with atrial fibrillation and atypical LBBB.