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Case Report

Urgent cardiac resynchronization therapy is useful in patients with decompensated heart failure requiring inotropes and mechanical circulatory support

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ABSTRACT

Although cardiac resynchronization therapy (CRT) is beneficial in patients with heart failure (HF) and left ventricular dyssynchrony, its effectiveness has not been established in patients with decompensated HF on mechanical support. Here, we report two patients with decompensated HF depending on inotropes and intra-aortic balloon pumping (IABP), who were rescued by urgent CRT implantations. Both patients had non-ischemic cardiomyopathy with wide QRS of left bundle brunch block. IABP could be weaned just after introducing CRT. CRT can dramatically improve hemodynamics even in severely decompensated HF, and thus could be considered when left ventricular dyssynchrony is present.

<**Learning objective:** The efficacy of cardiac resynchronization therapy (CRT) for acutely decompensated heart failure (HF) is controversial. However, the patients with wide QRS complex with left bundle brunch block and non-ischemic etiology can be the candidates of CRT implantation in order to wean inotrope and mechanical circulatory support.>

Introduction

Cardiac resynchronization therapy (CRT) has been established as a non-pharmacological therapy for selected patients with chronic heart failure (HF) with wide QRS complex of left bundle branch block (LBBB) [1]. On the other hand, the effectiveness of CRT for severely decompensated HF under mechanical support remains unclear.

Case reports

We introduced CRT to seriously decompensated HF patients with LBBB requiring inotropes and mechanical circulatory support. Baseline demographics and clinical outcomes are shown in Table 1. The electrocardiogram (ECG) and chest X-ray (CXR) in both cases are shown in Figs. 1 and 2.

Case 1

A 47-year-old man was admitted to an emergency hospital due to HF. After admission, he developed cardiogenic shock due to severe left ventricular (LV) pump failure. Thus intra-aortic balloon pumping (IABP) and veno-arterial extracorporeal membrane oxygenation (ECMO) were emergently started. Since he could be weaned from the ECMO but still needed continuous support by inotropes and IABP, he was referred to our hospital in consideration of a treatment by the LV assist device and heart transplantation. The ECG showed LBBB type QRS with duration of 226 ms (Fig. 1a). An echocardiography showed left ventricular ejection fraction (LVEF) of 21.5% due to significant LV mechanical dyssynchrony and severe mitral regurgitation (MR). Plasma brain natriuretic peptide (BNP) level was 1204.9 pg/ml. Despite intensive care with

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Table 1 Patients' characteristics at baseline and discharge.

	Patient 1		Patient 2	
Age (years)	47		77	
Sex	Male		Male	
Etiology of HF	Sarcoidosis		DCM	
Rhythm	Sinus		Sinus and PAF	
QRS morphology	LBBB		LBBB	
Periprocedural inotropes	Dobutamine 2 ν		Dopamine 3 ν	
	Milrinone 0.125 ν		Dobutamine 2.5 ν	
	Noradrenaline 0.03 ν		Milrinone 0.125 ν	
Duration of inotrope usage at CRT implantation (days)	8		39	
Duration of IABP usage at CRT implantation (days)	9		5	
Duration of inotrope usage after CRT implantation (days)	54		20	
Duration of IABP usage after CRT implantation (days)	1		2	
	Baseline	At discharge	Baseline	At discharge
NYHA	IV	I	IV	II
Blood pressure (mmHg)	83/68	95/52	99/72	126/80
Cardiothoracic ratio in chest X-ray (%)	69	51	56	47
Laboratory parameters				
Total protein (mg/dl)	6.5	6.9	6.4	7.9
Hemoglobin (g/dl)	12.8	12.5	15.2	13.1
Sodium (mEq/l)	127	138	133	140
Creatinine (mg/dl)	1.07	0.98	1.67	1.17
Total bilirubin (mg/dl)	3.0	0.5	2.6	0.8
Plasma BNP (pg/ml)	1204.2	58	1591.7	312.6
Electrocardiogram parameters				
Heart rate (beats per minutes)	102	65	82	66
Duration of QRS complex (ms)	226	123	174	132
Echocardiography parameters				
Ejection fraction (%)	21.5	40.5	22.4	19
LV diameter in diastole (mm)	84	52	68	63
LV diameter in systole (mm)	75	35	58	59
Severity of MR	Severe	Moderate	Severe	Mild

HF, heart failure; DCM, dilated cardiomyopathy; PAF, paroxysmal atrial fibrillation; LBBB, left bundle branch block; CRT, cardiac resynchronization therapy; IABP, intra-aortic balloon pumping; NYHA, New York Heart Association; MR, mitral regurgitation; BNP, brain natriuretic peptide; LV, left ventricle.

inotropes and IABP, multiple organ failure became apparent. CRT (Allure Quadra™, Abbott Laboratories, Abbott Park, IL, USA) was urgently applied to him 7 days after admission. A LV lead could be positioned in the mid portion of the anterolateral vein. Pacing parameters were set as DDD of 60–150 ppm, sensed AV delay of 100 ms, and LV to RV pacing delay (VV delay) of 20 ms, respectively. Then, the IABP could be weaned on the following day. After 2 months, the LVEF recovered from 21.5% to 40.5% and the New York Heart Association (NYHA) functional class improved from class IV to class II, and then he could be discharged from our hospital. The patient case was diagnosed with cardiac sarcoidosis by endomyocardial biopsy and positron emission tomography. Then immunosuppressive therapy with corticosteroids was started after discharge. He survived 26 months without other admissions of HF exacerbation after implantation of CRT, and is presently visiting the outpatient clinic.

Case 2

A 77-year-old man was admitted to our hospital due to HF based on dilated cardiomyopathy (DCM). His ECG showed sinus rhythm with LBBB, and the QRS duration was 174 ms (Fig. 2a). An echocardiography showed LVEF of 22.4% due to significant mechanical dyssynchrony with severe MR. His low cardiac output state resulted in multiple organ failure with onset of pneumonia and paroxysmal atrial fibrillation. With monitoring hemodynamic state by catheter, we started IABP support and his cardiac output increased from 1.8 to 2.5 l/min. Since the IABP could not be weaned, CRT (Frontier II™, Abbott Laboratories) was implanted. An LV lead could be positioned in the mid portion of the lateral vein. Pacing parameters were set as DDD of 70–130 ppm, sensed AV delay of 120 ms, and LV to RV pacing delay (VV delay) of 80 ms, respectively. After that, cardiac output increased from 2.2 to 2.7 l/min and then IABP was removed 2 days after the CRT implantation. EF did not change but the severity of MR was reduced to mild degree at discharge. The patient had one admission for HF and died of bacterial pneumonia 41 months after the CRT implantation.

Discussion

CRT has been indicated for the patients with chronic compensated HF with LV dyssynchrony. Previous reports also suggested that CRT was likely to be more effective in non-ischemic cardiomyopathy [2] accompanied by LBBB and QRS duration of 150 ms or greater [3], as our presented cases. However, many investigators reported that role of CRT is limited for NYHA IV patients [2]. Eventually, a large CRT trial excluded the non-ambulatory patients with inotrope and mechanical circulatory support, and the efficacy of CRT in those patient groups has not been elucidated [4]. There are only limited reports suggesting the effects of CRT in inotrope-dependent, acutely decompensated HF patients. Cowburn et al. [5] suggested that CRT was useful for acutely decompensated HF with QRS widths of 180 ms or greater. Yamashita et al. [6] also reported the efficacy of CRT in inotrope-dependent patients and compared the responder group with the non-responder group. The responder group had significantly larger LV dyssynchrony represented by time interval difference between the anteroseptal and posterior wall segmental peak strain compared with those of the non-responders (341 ± 49 ms vs. 206 ± 80 ms, $p = 0.02$) although the QRS widths were not significantly different between the two groups (181 ± 22 ms and 160 ± 41 ms).

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