

Cardiac Resynchronization Therapy Improves the Uptake of MIBI-^{99m}Tc and Cardiac Function

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This case shows the improvement promoted by cardiac resynchronization therapy (CRT) on myocardial perfusion and left ventricular (LV) performance assessed by gated myocardial perfusion scintigraphy. The patient had idiopathic dilated cardiomyopathy, left bundle branch block and severe heart failure despite optimized medical treatment. After CRT, clinical improvement, QRS reduction and improvement of previously hypoperfused anterior and septal walls were observed. There was also decrease in LV end-diastolic and systolic volumes and increase in LV ejection fraction.

Introduction

In recent years, the cardiac resynchronization therapy (CRT) has been considered an important adjunct therapy in heart failure (HF) refractory to optimized drug treatment and it has shown to be beneficial to many patients. In most patients with dilated cardiomyopathy, the increase of the QRS complex duration at the electrocardiogram (ECG) presents as a left bundle branch block (LBBB)^{1,2}. This is not only a marker of disease progression, but it can also lead to ventricular dyssynchrony^{3,4}.

Several studies have demonstrated the benefits of CRT on cardiovascular hemodynamics; however, little has been described on its effects on myocardial perfusion. In this case report, the behavior of myocardial perfusion and left ventricle (LV) function was evaluated by myocardial perfusion scintigraphy (MPS) with MIBI-^{99m}Tc at rest and after pharmacological stress with dipyridamole, gated to ECG (GS) pre- and three months after CRT.

Key words

Myocardial perfusion; ventricular function, left ventricular function and dilated cardiomyopathy.

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Case Report

A 64-year-old female patient, who presented idiopathic dilated cardiomyopathy and functional class III HF according to the New York Heart Association, despite optimized drug therapy for HF and LBBB at the ECG, was submitted to atrial-biventricular pacemaker implant. Pre-CRT, MPS images showed persistent low uptake of MIBI-^{99m}Tc, of moderate to severe degree, in the anterior and anteroseptal walls of the LV, Figure 1. At GS, the end-diastolic volume (EDV) was 257 mL; the end-systolic volume (ESV) was 186 mL; the LV ejection fraction (LVEF) at rest was 27%, Figure 1. Three months after the CRT, the patient presented Functional Class I, QRS duration decreased from 180 to 120 ms (Figure 2) and MPS showed a significant improvement in perfusion of the anterior and anteroseptal walls of the LV, Figure 1. At GS, a decrease in EDV to 150 mL and ESV to 86 mL was observed as well as LVEF at rest increase to 43%, Figure 1.

Discussion

The present case shows, through MPS images gated to ECG, the benefits provided by the CRT on myocardial perfusion and cardiac performance, with important LV reverse remodeling. The MPS is a valuable tool for the non-invasive evaluation of relative myocardial perfusion and of the regional and global LV function, when the images are gated to ECG. The physiological basis for the redistribution of the coronary blood flow after the change in the pattern of electrical activation of the LV is partially understood. Many patients with LBBB present areas of myocardial hypoperfusion, mainly in the septal wall, which are not related to obstructive coronary disease^{5,6}. The myocardial perfusion is a predominantly diastolic process. The cardiac dyssynchrony reduces diastole, prolonging the stress time during the cardiac cycle, decreasing the LV filling time⁶. This last phenomenon is even more prominent in patients with dilated cardiomyopathy⁷. Additionally, the myocardial blood flow supply can be interrupted at the asynchronous contraction, as in some regions the contraction starts or is continued at the diastole, when most of the coronary blood flow is occurring. However, this might not be the only explanation, since the delayed activated regions, which are still contracting in early diastole, have their blood flow increased⁸.

The degree of perfusion for a ventricular wall can be the reflex of its workload. The asynchronous activation leads to the decrease in the contractile force in the early activated myocardial regions and increase in the delayed activated ones^{5,6}. It is speculated that the abnormal relation

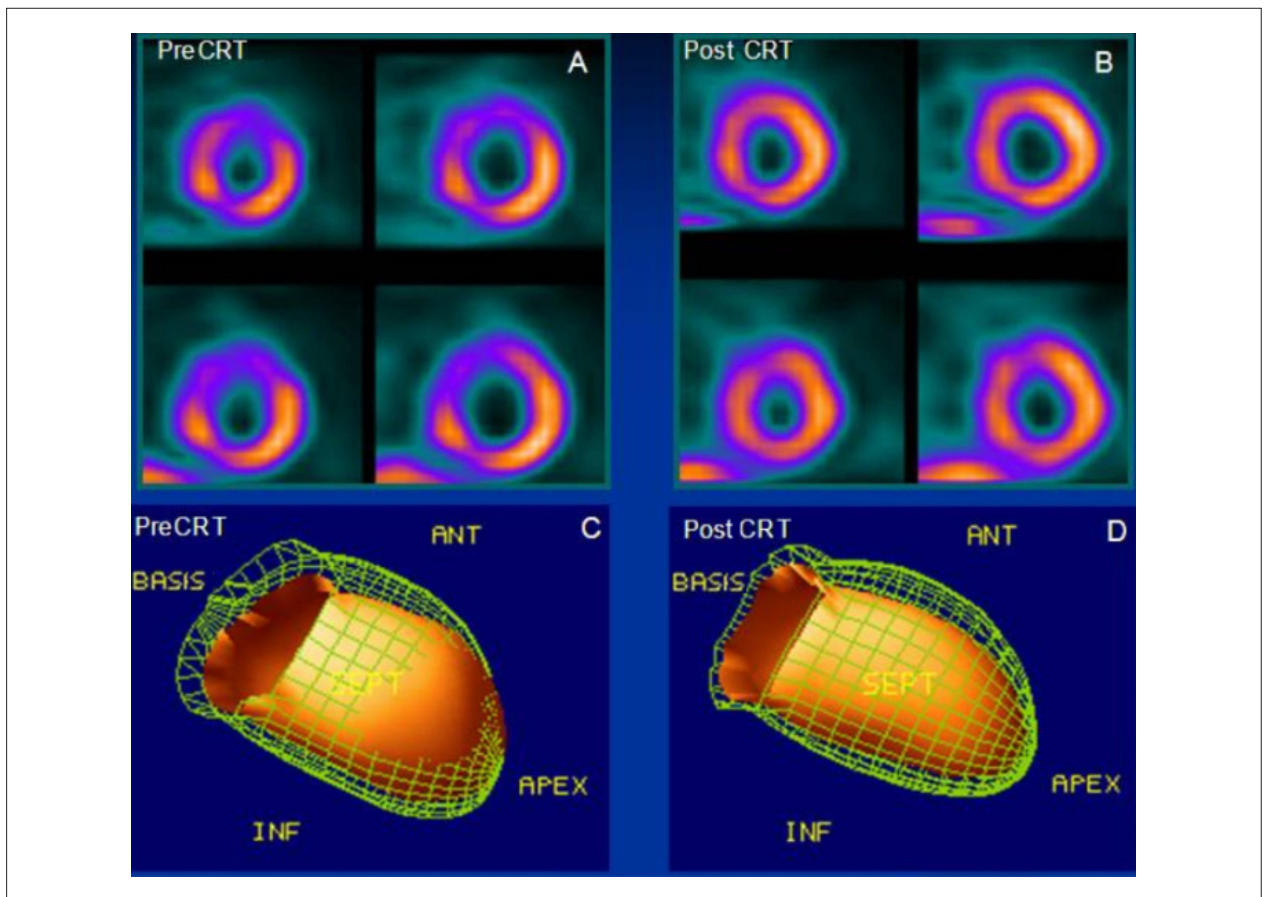


Figure 1 - A - Short axis views of the single photon emission computed tomography (SPECT) of the left ventricle (LV) with MIBI-^{99m}Tc pre-cardiac resynchronization therapy (CRT); Upper rows: images obtained after pharmacological stress with dipyridamole; lower rows: images at rest. Persistent hypoperfusion can be observed, of moderate to severe degree, in the anterior and anteroseptal walls; B - Images obtained three months after the CRT; an important improvement in the perfusion of the anterior and anteroseptal walls can be observed; C - Three-dimensional images of the gated SPECT showing diffuse hypomotility of the LV walls and dyskinesia of the septal wall with left ventricle ejection fraction (LVEF) of 27%. D: Post-CRT, the reversion of the dyskinesia of the septal wall can be observed as well as the increase in the LVEF to 43%.

between regional contraction/relaxation in patients with ventricular dyssynchrony causes abnormalities in wall stress with an altered local distribution of blood flow due to a metabolic adaptation of the flow to the regional differences in the workload⁵. The endothelial dysfunction with impairment of the coronary flow reserve can be another mechanism involved in the flow alteration caused by the electromechanical cardiac dyssynchrony⁶.

The decrease in myocardial blood flow reserve in HF, regardless of its cause, can generate intermittent periods of ischemia, leading to a chronic LV dysfunction, which is associated with a poor prognosis⁹. Thus, the perfusion improvement, especially in the anterior and septal walls of the LV through CRT can induce the recovery of the function and improve the prognosis¹⁰.

However, in spite of the results observed in the present clinical case and the previously reported studies in the literature, more evidence is needed to confirm whether the

modifications triggered by the CRT in the uptake of MIBI-^{99m}Tc are in fact associated with a significant increase in LVEF and decrease in the LV remodeling, which occur in many patients submitted to this therapy.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

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Case Report

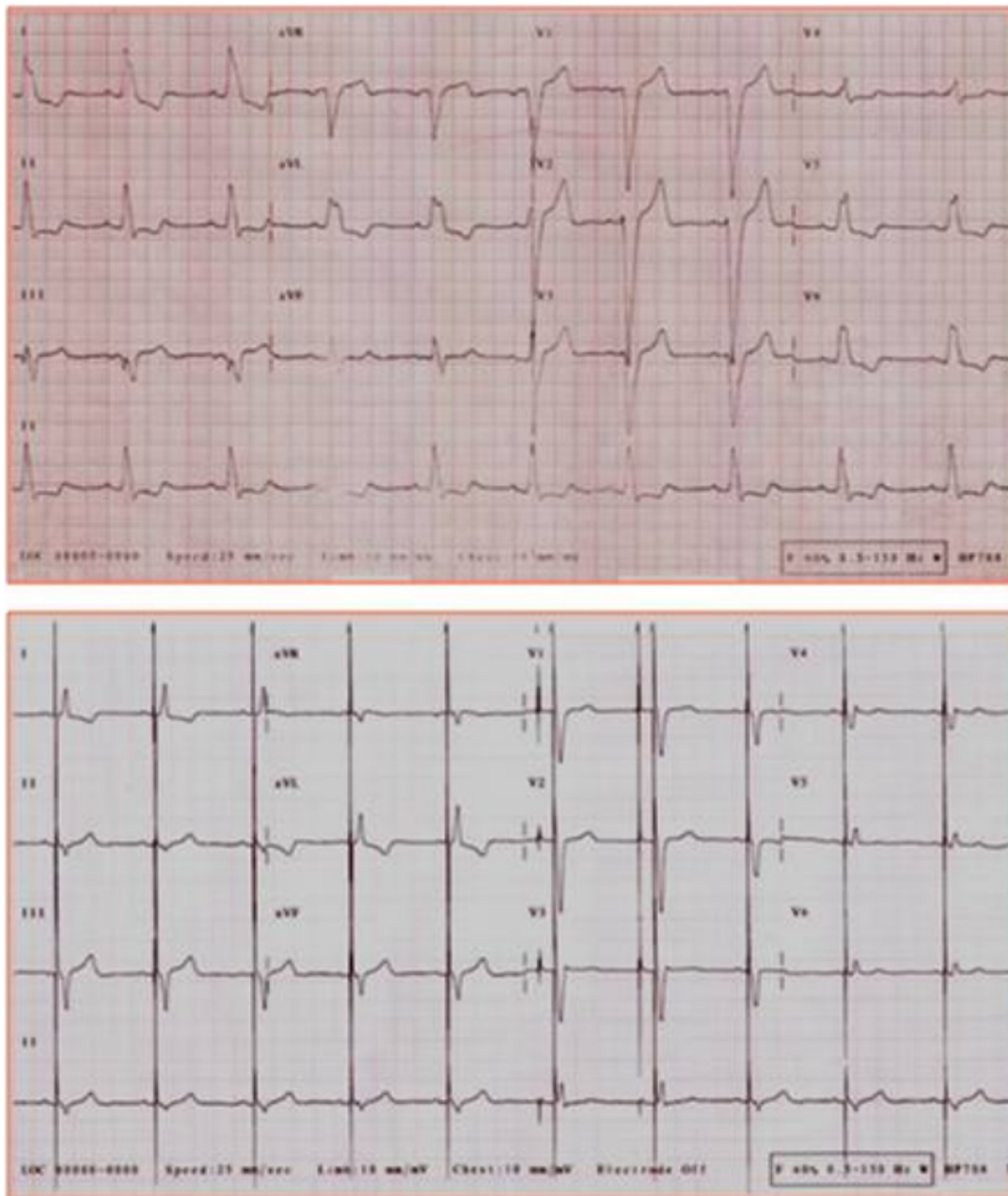


Figure 2 -Above, 12-derivation electrocardiogram (ECG) with left bundle branch block morphology and QRS complex duration of 180 ms, pre-CRT; Below, ECG after CRT, with pacemaker operating regularly and showing a decrease in the QRS duration to 120 ms.

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