

Reverse Remodeling After Myocardial Revascularization in Severe Ischemic Heart Disease

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Introduction

Heart failure with reduced ejection fraction (HFrEF), especially of ischemic etiology, is a challenging condition associated with high morbidity and mortality.¹ Patients with HFrEF frequently present with ventricular remodeling and progressive systolic dysfunction, making early identification of significant coronary artery disease (CAD) essential for defining therapy and optimizing prognosis.

Triple-vessel CAD involving the left main coronary artery (LMCA) constitutes a high-risk scenario. Guidelines recommend surgical revascularization in most cases, particularly in the presence of pronounced left ventricular dysfunction.² Evidence from studies such as STICH/STICHES has demonstrated that coronary artery bypass grafting (CABG) combined with optimized medical therapy in patients with ischemic cardiomyopathy and reduced left ventricular ejection fraction (LVEF) promotes improved long-term outcomes, although the perioperative risk remains high, with mortality up to 8.6% in patients with LVEF < 35%.³

Transthoracic echocardiography is essential for evaluating and monitoring reverse remodeling, according to specific Brazilian Society of Cardiology recommendations.⁴ Studies have indicated that high-risk patients undergoing CABG may achieve significant LVEF recovery and sustained clinical improvement.

We report a case of severe HFrEF with an initial LVEF of 10% and a critical 99% lesion in the LMCA, within the context of triple-vessel CAD. Following current guidelines, CABG was performed, highlighting the importance of early identification and structured, multidisciplinary outpatient follow-up.

Case report

A 62-year-old female patient was referred to the general cardiology outpatient clinic of a tertiary hospital due to decompensated heart failure. At the first consultation, without

prior examinations, she presented fatigue for 2 months, with a recent report of increased abdominal volume, lower limb edema, and episodic dyspnea, associated with fever 1 week before admission. Family members reported worsening of her general condition, decreased mobility, recent jaundice, and a weight loss of 8 kg in 1 month. Her personal history included hypothyroidism, dyslipidemia, asthma, and previous smoking (11 pack-years), which she had ceased 6 months prior. She had no history of acute myocardial infarction or prior valvular events.

Transthoracic echocardiography demonstrated a dilated left ventricle, eccentric hypertrophy, and severe systolic dysfunction with an LVEF of 10%, diffuse hypokinesia, grade III diastolic dysfunction, dilated right chambers and atria, right ventricular dysfunction (tricuspid annular plane systolic excursion of 7 mm), significant pulmonary hypertension (pulmonary artery systolic pressure of 50 mmHg), and mild to moderate valvular regurgitation. Serology tests for Chagas disease were negative. Initial management included beta-blocker adjustment; introduction of an SGLT2 inhibitor; maintenance of sacubitril-valsartan, spironolactone, and diuretic therapy; and laboratory reassessment.

Subsequently, diagnostic cardiac catheterization was requested, which revealed a 99% obstructive lesion in the LMCA, chronic total obstruction in the right coronary artery, and subtotal obstructions in the left anterior descending artery and proximal diagonal branch, confirming severe triple-vessel CAD. The patient remained hospitalized for discussion of proposed treatment, progressing stably, without chest pain or dyspnea at rest.

Given the complex anatomy (short and irregular LMCA), which would make angioplasty unfeasible, following discussion of risks with the family, CABG was chosen and successfully performed without cardiopulmonary bypass, via median sternotomy. The following grafts were performed: one from the left internal thoracic artery to the left anterior descending artery and one from the saphenous vein to the right coronary artery; no graft was placed to the circumflex artery due to technical infeasibility. There were no complications during the procedure. The patient was discharged from the intensive care unit in 2 days and discharged from the hospital on postoperative day 10.

During outpatient follow-up, the patient showed significant clinical improvement, remaining in functional class I throughout the follow-up. Serial echocardiograms showed progressive reverse cardiac remodeling, with an increase in LVEF to 16% at 3 months post-surgery, 36% after 6 months, and 47% after 1 year, as described in Table 1. A reduction in eccentric left ventricular hypertrophy, normalization of right ventricular function, mild diastolic dysfunction, and minimal valvular regurgitation were observed. The patient remained asymptomatic, with good tolerance of daily activities.

Keywords

Heart Failure; Myocardial Ischemia; Coronary Artery Disease; Myocardial Revascularization; Echocardiography

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The reported case highlights the importance of careful evaluation in patients with HFrEF and critical CAD, emphasizing the relevance of early identification of LMCA lesions, appropriate surgical intervention, and multidisciplinary follow-up, allowing for favorable outcomes, even in high-risk contexts.

Discussion

HFrEF is a condition with high morbidity and mortality, especially when associated with critical CAD.¹ In the case reported, the patient presented with an LVEF of 10% and

a critical 99% lesion in the LMCA (Figure 1), a condition associated with high mortality without early intervention.² The literature highlights that LMCA involvement is a predictor of adverse effects and sudden death.

Optimized management of heart failure includes evidence-based pharmacological therapy, such as the use of beta-blockers, neprilysin inhibitors, spironolactone, and SGLT2 inhibitors.^{1,4} However, persistence of the etiological factor, especially ischemia, can compromise the patient’s therapeutic response. In the reported case, the association of early CABG with pharmacological adjustment contributed to

Table 1 – Echocardiographic and clinical progress after coronary artery bypass grafting

Date	LVEF (%)	LVDD (mm)	LVSD (mm)	LA	RV	PASP	NYHA FC	MR
December 8, 2023	10	61	58	46	33	65	IV	Moderate
February 29, 2024	16	61	57	44	22	50	II	Mild
May 29, 2024	38	63	51	42	26	44	II	Mild
October 2, 2025	47	53	40	35	24	NPE	I	Minimal

LA: left atrium; LVDD: left ventricular diastolic diameter; LVEF: left ventricular ejection fraction; LVSD: left ventricular systolic diameter; MR: mitral regurgitation; NPE: not possible to estimate; NYHA FC: New York Heart Association functional class; PASP: pulmonary artery systolic pressure; RV: right ventricle. Values obtained from transthoracic echocardiography.



Figure 1 – Pre-treatment coronary angiography showing critical stenosis of approximately 99% in the left main coronary artery, with a significant reduction in flow to the anterior descending and circumflex branches. Examination used to define the revascularization strategy.

Case Report

reverse ventricular remodeling, as reflected in the increase in LVEF to 47% over 1 year. This finding is consistent with studies demonstrating that myocardial revascularization in high-risk patients can promote significant functional improvement and reduce mortality.³

In the reported case, no formal myocardial viability test was performed, reflecting the real-world practice of Brazilian public services, where advanced methods (such as magnetic resonance imaging with late enhancement, positron emission tomography, or stress echocardiography) are not universally available in the Unified Health System (SUS). It is important to emphasize that, unlike elective scenarios, the therapeutic decision did not depend exclusively on demonstrating viability, but rather on the extremely critical coronary anatomy, namely, a 99% lesion in the LMCA associated with extensive triple-vessel disease. According to the European Society of Cardiology and European Association for Cardiothoracic Surgery (ESC/EACTS) Guidelines on Myocardial Revascularization (2018) and the American College of Cardiology, American Heart Association, and Society for Cardiovascular Angiography and Interventions (ACC/AHA/SCAI) Guideline for Coronary Artery Revascularization (2021), in the presence of significant LMCA and high-risk anatomy, the indication for CABG may take precedence over formal assessment of myocardial viability, given the immediate threat to global left ventricular perfusion.⁵⁻⁸

In this context, even though challenging, the joint decision to proceed with surgery, combined with structured outpatient follow-up, was fundamental to improving cardiac function. We observed regression of eccentric hypertrophy and normalization of the right ventricle, which showed significant reverse remodeling, with direct impacts on the patient's prognosis. These results reinforce the importance of multidisciplinary and individualized strategies, combining surgical intervention and optimized clinical management for patients with severe CAD and HFrEF.

Conclusion

Early CABG, indicated in accordance with guidelines for critical LMCA lesions in the context of triple-vessel CAD,

combined with optimized medical therapy and structured outpatient follow-up, was crucial for reverse ventricular remodeling and sustained functional recovery in this patient with severe HFrEF, thus demonstrating that appropriately indicated therapeutic strategies can significantly modify prognosis, even in high-risk scenarios.^{3,4} As this is a case report, the findings should be interpreted within the context of available evidence, reinforcing the importance of early identification of critical CAD, appropriate definition of the revascularization strategy, and multidisciplinary follow-up.

Author Contributions

Conception and design of the research and Acquisition of data: Freitas AKE; Analysis and interpretation of the data and Writing of the manuscript: Trento BME, Medeiros DG, Bizinelli MES, Barão MM, Freitas AKE; Critical revision of the manuscript for content: Trento BME, Medeiros DG, Bizinelli MES, Barão MM, Freitas AKE.

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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Ethics approval and consent to participate

All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

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