

Surviving the triple threat: Left main and triple vessel coronary disease treated with coronary artery bypass grafting: A case report

Aditya Shrivastav¹, Priyansh Kumar Sahu², Suhas Tiwaskar³, Anurag Luharia⁴, Saurabh Somankar², Sarthak Das⁵, Sunil Thitame⁶

From ¹Undergraduate Scholar, Department of Cardiovascular Technology, ²Postgraduate Scholar, ³Professor, ⁴Professor and Head Radiation Physicist, ⁵Undergraduate Scholar, Department of Radiodiagnosis, Datta Meghe Institute of Medical Sciences, ⁶Professor and Dean, Department of Allied Health Sciences, Datta Meghe Institute of Higher Education and Research (Deemed to be University), Wardha, Maharashtra, India

ABSTRACT

Left main coronary artery – Triple vessel disease is a critical cardiovascular condition requiring urgent intervention. Early diagnosis and timely revascularization play a vital role in determining patient outcomes. We present a 58-year-old male with a history of myocardial infarction who was discharged but returned with worsening dyspnea and chest pain. Coronary angiography revealed severe stenosis of the left main, left anterior descending, and left circumflex arteries, along with total occlusion of the right coronary artery. The patient underwent coronary artery bypass grafting and was later found to have left ventricular dysfunction with an ejection fraction of 44% on follow-up echocardiography. Heart failure therapy was optimized according to the clinical situation. Exclusion of alternative causes through laboratory and radiological investigations supported the diagnosis. A structured strategy involving hemodynamic stabilization, early mobilization, and cardiac rehabilitation was implemented. At 1-year follow-up, although the ejection fraction remained low, the patient showed improved functional capacity. This case highlights the importance of early identification, coordinated multidisciplinary care, and rehabilitation in managing complex coronary artery disease. It also underlines the disconnect between anatomical severity and biomarker levels, emphasizing the need for further investigation into similar clinical paradoxes and their therapeutic implications.

Keywords: Coronary artery bypass grafting, Cardiac rehabilitation, Coronary angiography, Coronary artery disease, Ejection fraction, Left ventricular dysfunction, Left main coronary artery - Triple vessel disease, Myocardial infarction

Triple vessel disease (TVD) is a severe form of coronary artery disease (CAD) characterized by critical stenosis in all three major coronary arteries. CAD typically arises from cholesterol deposition and inflammation in the coronary vessels, which can severely restrict myocardial blood flow. In advanced cases, revascularization through coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI) is often required to improve prognosis and relieve symptoms [1]. The left main coronary artery (LMCA) poses a particular therapeutic challenge due to its high-risk nature. LMCA disease often coexists with other coronary artery involvement and is rarely isolated. It carries a significant risk of ischemic complications and is generally managed with CABG, especially when associated with multivessel disease [2,3]. Post-operative LMCA occlusion, particularly following procedures such as aortic valve replacement, is a known complication [3]. While CABG with


cardiopulmonary bypass and cardioplegic arrest is the standard approach, inadequate myocardial protection or perioperative factors such as transfusions can lead to post-operative myocardial dysfunction [4,5]. The use of an intra-aortic balloon pump may support hemodynamics in such cases [6].

We report a rare case of LMCA-TVD with paradoxically low troponin levels and persistent left ventricular dysfunction post-CABG, which raises questions about biomarker reliability and highlights the importance of individualized recovery strategies.

CASE PRESENTATION

A 58-year-old male with a history of hypertension and prior myocardial infarction presented with progressively worsening exertional dyspnea and intermittent chest discomfort over 6 months, despite adherence to his prescribed medical regimen.

On general physical examination, he appeared hemodynamically stable with a blood pressure of 128/84 mmHg,

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Correspondence to: Aditya Shrivastav, Undergraduate Scholar, Department of Cardiovascular Technology, Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra - 442001, India. E-mail: aaditya.6361@gmail.com

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a heart rate of 78 bpm, a respiratory rate of 18 breaths per minute, and an oxygen saturation of 96% on room air. No peripheral edema or jugular venous distension was noted, and heart sounds were normal.

Electrocardiography (ECG) revealed ST-segment depression across leads V1–V6, suggestive of myocardial ischemia (Fig. 1). Transthoracic echocardiography showed significant left ventricular dysfunction with an estimated ejection fraction between 22% and 25% (Fig. 2). Given the symptoms and non-invasive findings, coronary angiography was advised and performed. The results revealed a complex and high-risk coronary anatomy with severe LMCA disease and triple-vessel involvement. Specifically, the LMCA showed 80–90% stenosis at the ostium (Fig. 3); the proximal left anterior descending artery (LAD) and the diagonal branch (D1) were both critically narrowed at 99%.

The proximal left circumflex artery also had 99% stenosis, whereas the obtuse marginal (OM) and the posterior descending artery (PDA)/posterolateral ventricular branches were normal. The dominant right coronary artery was completely occluded proximally.

These findings indicated severe LMCA-TVD, necessitating urgent CABG. Pre-operative management included initiation

of beta-blockers, statins, and dual antiplatelet therapy. Under general anesthesia, the patient underwent CABG using the left internal mammary artery to graft the LAD and saphenous vein grafts for the OM and PDA. The post-operative course was stable. He was extubated within 24 h, supported hemodynamically with fluids and vasopressors, and engaged in early physiotherapy and mobilization. The patient was discharged with guideline-directed medical therapy, including anticoagulants, angiotensin-converting enzyme inhibitors, and beta-blockers. At 1 month, he reported mild breathlessness on exertion (New York Heart Association Class II) but no chest pain. By the 3-month mark, his 6-min walk test performance had improved, although his ejection fraction remained unchanged at 22–25%. Over a year of follow-up, he remained functionally stable, benefiting from ongoing cardiac rehabilitation and lifestyle modifications.

DISCUSSION

This case is notable for a type 1 myocardial infarction involving the LMCA, with critical 90% ostial stenosis compromising perfusion to a large portion of the left ventricle. Interestingly, despite the anatomical severity, peak troponin-I levels remained unexpectedly low, drawing attention to the complexities of relying solely on biomarkers to assess myocardial damage. While several studies confirm the strong correlation between peak troponin-I levels and infarct size, this case illustrates the exceptions where structural compromise may outpace biomarker elevation, especially in chronic ischemia or multivessel disease with collateralization [7].

The differential diagnoses initially considered included stable angina, non-cardiac causes of chest pain such as gastroesophageal reflux disease, myocarditis, and microvascular angina.

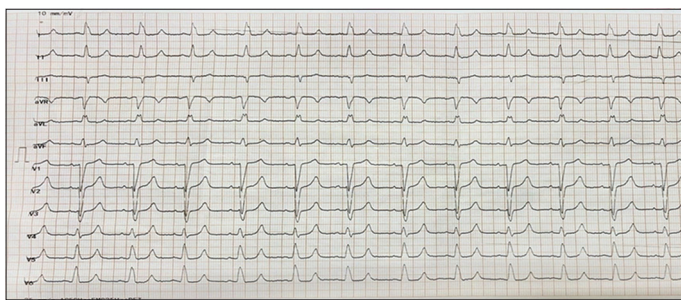


Figure 1: Electrocardiogram shows pre-operative ST-segment depression in leads V1–V6, suggestive of anterior wall ischemia

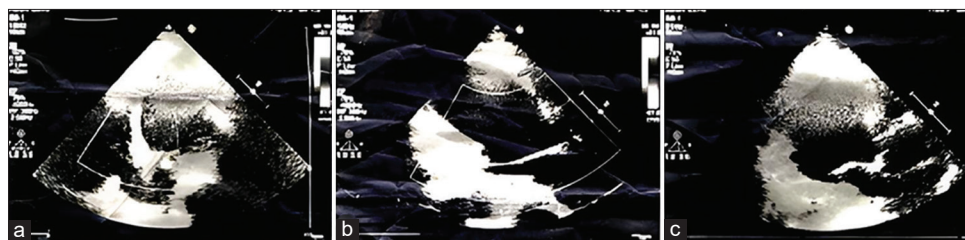


Figure 2: Echocardiography images (a) and (b) show significant left ventricular dysfunction, while image (c) demonstrates an ejection fraction of 22–25%

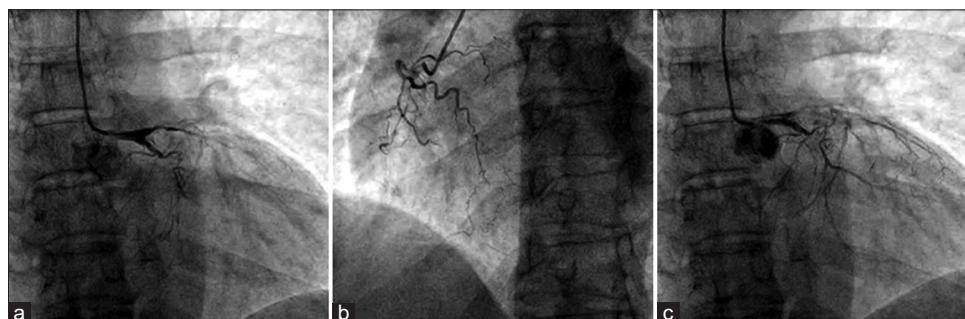


Figure 3: Coronary angiography revealing critical left main coronary artery – triple vessel disease: (a) Contrast media in left main coronary artery (LMCA), (b) complete right coronary artery occlusion, (c) 80–90% ostial LMCA stenosis

However, the patient's progressive symptoms, ECG changes, echocardiographic findings of reduced ejection fraction, and angiographic evidence of critical stenosis supported a definitive diagnosis of LMCA-TVD.

Patients with LMCA disease generally carry a poor prognosis due to the extensive myocardial territory at risk. Revascularization through PCI or CABG has consistently shown superior outcomes compared to medical therapy alone. While PCI is associated with increased re-intervention rates, studies have demonstrated that long-term outcomes related to mortality, myocardial infarction, and stroke are similar between PCI and CABG after 5 years. Differences in all-cause mortality appear to be influenced by baseline patient characteristics and revascularization strategy selection [8]. An observational, non-randomized study of LMCA patients found that CABG to be associated with reduced mortality and lower rates of major adverse cardiovascular or cerebrovascular events compared to PCI, even after adjustment for confounding variables [9]. Nonetheless, interpreting such data is complicated by challenges such as patient heterogeneity, unequal baseline profiles, and selection bias, all of which influence procedural outcomes. Moreover, higher rates of non-cardiac hospitalizations are often reported in the PCI group [9].

Non-invasive modalities, including stress echocardiography and computed tomography angiography, play a pivotal role in the early detection of LMCA disease and stratifying patients for appropriate intervention [10]. CABG remains the preferred strategy for patients with complex coronary anatomy and multivessel involvement, offering superior long-term survival. However, the difference in cardiac-specific mortality between PCI and CABG in LMCA disease appears modest, with a relatively higher proportion of non-cardiac deaths seen post-PCI [11].

Comparable cases in the literature have documented LMCA disease with unusual presentations, such as minimal enzyme elevation or preserved functional capacity despite anatomical severity. Our case aligns with such reports, underscoring the importance of a holistic diagnostic and therapeutic approach. It further highlights the necessity of multidisciplinary decision-making and the potential for meaningful recovery even in patients with persistent low ejection fractions, provided that rehabilitation and follow-up are rigorously pursued.

CONCLUSION

This case of serious left main disease, together with severe multivessel disease, serves to underline the great value of surgical

revascularization (CABG) in lengthening life and lowering cardiac events. Even though the two therapies may produce much the same short-term results, CABG provides better long-term advantages over PCI for advanced CAD. The patient's increased functional stability following CABG, despite the low ejection fraction, emphasizes the significance of prompt intervention and comprehensive cardiac rehabilitation for positive results.

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