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Research Article

Right Ventricular Infarction Following Inferior STEMI: A Case Report and Comprehensive Review of Management Challenges

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1. Introduction

Right ventricular infarction (RVI) is a life-threatening complication of inferior ST-elevation myocardial infarction (STEMI), occurring in approximately 30–50% of such cases—typically when the proximal right coronary artery (RCA) is occluded **[1,2].** While left ventricular (LV) infarction receives more clinical focus, RVI significantly worsens patient outcomes and is often underdiagnosed due to nonspecific signs **[3,4].** The right ventricle (RV) is anatomically distinct from the LV, with a thinner free wall, lower systolic pressure, and greater dependence on preload. These characteristics make the RV highly susceptible to ischemic damage and volume depletion. RV dysfunction can compromise left-sided output due to interventricular dependence, thereby leading to systemic hypotension and cardiogenic shock **[5,6].** Although timely revascularization is the cornerstone of STEMI therapy, standard management strategies may be inadequate in case of dominant RVI. In such cases, mechanical support such as right ventricular assist devices (RVADs) or extracorporeal membrane oxygenation (ECMO) can be lifesaving. Unfortunately, these are not universally accessible, particularly in resource-limited settings **[7]**. We present a case of inferior STEMI with RVI, highlighting the limitations of current management and the impact of unavailable mechanical RV support.

2. Aetiology and Pathophysiology

RVI typically results from acute occlusion of the proximal right coronary artery (RCA) before the branching of RV marginal arteries—most often in individuals with right dominant coronary anatomy, which occurs in approximately 80–85% of the population **[8].** The RCA supplies the RV free wall, inferior and posterior walls of the left ventricle (LV), and often the atrioventricular conduction system. Key pathophysiologic features include acute RV systolic dysfunction, RV dilation with interventricular septal shift impairing LV preload, systemic venous congestion, and reduced cardiac output leading to hypotension **[9].** Clinically, RVI is suggested by the classic triad of hypotension, elevated jugular venous pressure (JVP), and clear lungs—but this presentation is neither universal nor sensitive **[10].**

3. Epidemiology and Prognosis

RVI complicates nearly one third to one half of inferior STEMIs, with an in-hospital mortality rate that may exceed 30% in severe cases—particularly when diagnosis is delayed, or cardiogenic shock develops **[16]**. Outcomes depend strongly on the extent and duration of RV ischemia, timeliness and completeness of RCA reperfusion, coexistence of LV dysfunction, and access to mechanical circulatory support **[11,12].**

4. Case Presentation

Patient Information • Age: 70 years • Sex: Male • Ethnicity: Persian • Comorbidities: Hypertension, Type 2 Diabetes Mellitus • Medications: Metformin, Aspirin, Atorvastatin • Social history: Non-smoker, no alcohol or drug use

Clinical Presentation
The patient presented to the emergency department with acute chest pain radiating to the left shoulder, associated with diaphoresis and vomiting. The symptoms had begun three hours prior to arrival.

Initial Workup
Hemodynamically stable
• Electrocardiogram (ECG): ST-elevation in leads II, III, and aVF
• Troponin: Elevated
• Other labs: Electrolytes, renal function, and glucose within normal limits

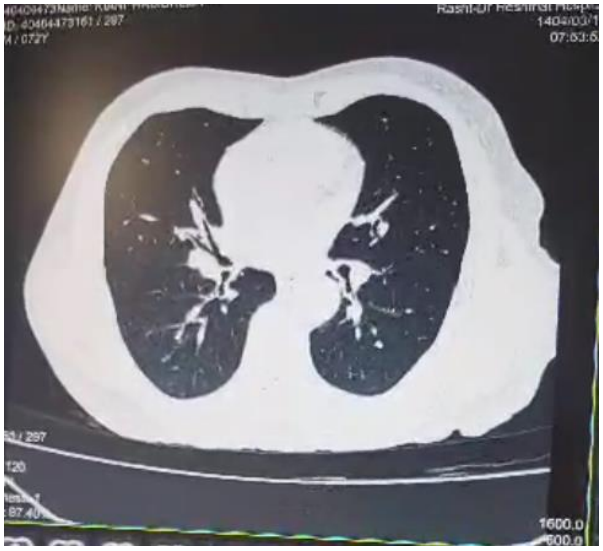
Echocardiography
Left ventricular ejection fraction (LVEF): 30–35 %
• Regional wall motion abnormalities: Akinetic inferobasal to mid-inferoseptal, posterior, and lateral walls
• RV function: Moderately reduced [tricuspid annular plane systolic excursion (TAPSE) 15 mm; RV systolic velocity (RV S') 6 cm/s]
• Valvular findings: Mild to moderate mitral regurgitation, mild aortic regurgitation
• Pulmonary artery pressure (PAP): 20 mmHg • Inferior vena cava (IVC): >50 % collapsibility

Coronary Angiography

Right coronary artery (RCA): Proximal total occlusion
• Left circumflex artery (LCx): Moderate to severe stenosis
• Left anterior descending artery (LAD): Involvement not specified but presumed severe (confirmed 3-vessel disease)

Imaging Review
Supplementary cardiac imaging was performed:

• Supplementary Video 1 (Computed Tomography [CT]) demonstrated normal aortic anatomy and absence of pericardial effusion. https://www.youtube.com/shorts/PsogGyFDWzg



• Supplementary Video 2 (Coronary Angiography) confirmed total occlusion of the proximal RCA with no distal flow, and moderate to severe stenosis in the LCx.
https://www.youtube.com/shorts/9grENqF_FrE

Management

Given complex coronary disease and ineligibility for percutaneous coronary intervention (PCI), urgent coronary artery bypass grafting (CABG) was performed.

Postoperative Course

CABG was technically successful
• Postoperative LVEF declined to 25–30 %
• Persistent RV dysfunction was observed
• On Day 3, the patient suffered two cardiac arrests, initially resuscitated
• Transferred to intensive care unit (ICU), intubated, and placed on inotropes
• A third cardiac arrest on the same day was fatal

Outcome

Date of death: Postoperative Day 3
• Cause: Cardiogenic shock secondary to persistent RV failure

5. Discussion

This case highlights the severity and therapeutic challenges posed by dominant right ventricular infarction (RVI). Despite guideline-directed revascularization with CABG, the patient's RV function deteriorated, leading to refractory cardiogenic shock and death. While reperfusion of the RCA is essential

for RV recovery, extensive or irreversible infarction may limit the effectiveness of even successful surgical intervention. Standard pharmacologic therapies—such as fluid resuscitation and inotropes—often fail to restore hemodynamic stability in severe RV failure. Notably, intra-aortic balloon pump (IABP) support, which proves beneficial in LV failure, has limited efficacy in isolated RVI and may not improve survival outcomes **[13].** In contrast, mechanical circulatory support (MCS)—including devices such as RVADs and ECMO—offers temporary circulatory rescue, potentially bridging patients to myocardial recovery or further advanced therapies. Recent data show variable survival outcomes among ECMO-treated patients, depending on patient characteristics and care settings, although mortality remains high **[17].** However, such technologies are often unavailable in many centres, particularly in low-resource settings, underscoring the urgent need for improved referral networks and infrastructure **[14,15].**

6. Conclusion

Right ventricular infarction complicating inferior STEMI poses a substantial risk to survival, especially in the presence of three-vessel disease and reduced LV function. Although CABG is guideline-directed in such patients, it may be insufficient in the absence of RV-specific support. This case highlights the urgency of enhancing diagnostic awareness and expanding access to mechanical RV support devices to improve patient outcomes in resource-limited settings.

7. Declarations Patient Consent:

Written informed consent for publication was obtained from the patient's legal next of kin.
Ethics Approval: Not required for single-patient case reports under local guidelines.
Conflict of Interest: All authors declare no conflict of interest
Authors Contribution: Siyamak Jalal Hoseini: Patient management, clinical diagnosis Data retrieval; Reza Shoghli: Drafted the initial manuscript, organized case data, interpretation and analysis; Hermon Eyob: Provided critical review, clinical commentary, and major revisions; Yosan Eyob: revision, analysis and review manuscript

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- **Conflict of Interest Statement**

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- **Additional Information**

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