EDUCATIONAL FORUM

Braz J Cardiovasc Surg 2025;40(5):e20240249
https://doi.org/10.21470/1678-9741-2024-0249

Therapeutic Considerations of Post-Myocardial Infarction Ventricular Septal Defect in the Elderly – An Educational Presentation

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This study was carried out at the Cardiac Critical Care Department, Fundación Clínica Shaio, Bogotá D.C., Colombia.

ABSTRACT

Post-myocardial infarction ventricular septal defect is an infrequent complication associated with low survival rates in the absence of surgical management. An 80-year-old woman presents to the emergency department with an inferior wall ST-segment elevation myocardial infarction with complete occlusion of the right coronary artery and a rupture of the interventricular septum with rapid deterioration to cardiogenic shock. Advanced age, female sex, and cardiogenic shock are associated with high mortality. The use of intra-aortic balloon pump improves hemodynamic status, allowing stabilization in the preoperative period.
Keywords: Heart Septal Defects, Ventricular. Myocardial Infarction. Cardiogenic Shock. Hospital Emergency Service. Preoperative Period.

Abbreviations, Acronyms & Symbols	
AMI	= Acute myocardial infarction
IABP	= Intra-aortic balloon pump
VSD	= Ventricular septal defect

INTRODUCTION

An 80-year-old woman with a history of primary hypertension, dyslipidemia, and obesity presented to the emergency department with retrosternal chest pain the past three days. Upon admission to the emergency department, she was tachycardic without other abnormal findings on physical examination. An electrocardiogram was performed, which showed ST-segment elevation and necrosis in the inferior wall (Figure 1).

The patient underwent coronary angiography, revealing total thrombotic occlusion of the right coronary artery (Figure 2) without obstructive lesions in the anterior descending and circumflex arteries. Thrombus aspiration and angioplasty with placement of two drug-eluting stents in the proximal right coronary artery were performed. Additionally, contrast medium passage into the right ventricle with filling of the pulmonary artery was observed, indicating a 7 mm interventricular communication. Following the procedure, the patient was transferred to the cardiac intensive care unit, where she received management with dual antiplatelet therapy, statin, and beta-blocker. On the day following the intervention, she developed hypotension, oliguria, coolness of the distal extremities, and slow capillary refill time, needing the initiation of vasopressor and inotropic support with noradrenaline and dobutamine.

A transesophageal echocardiogram was performed, confirming the interventricular communication of 10 mm located at the mid-segment of the inferior interventricular septum (Figure 3). Additionally, it revealed a left ventricular ejection fraction of 30% and right ventricular dysfunction with a fractional area change of 12% and mild mitral regurgitation. In the presence of cardiogenic shock with persistent signs of hypoperfusion, it was decided to place an intra-aortic balloon pump (IABP) on the fourth day of hospitalization, which led to the withdrawal of vasopressor support, a reduction in dobutamine dosage, and a notable improvement in perfusion variables.

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Article received on July 20th, 2024.
Article accepted on August 31st, 2024.

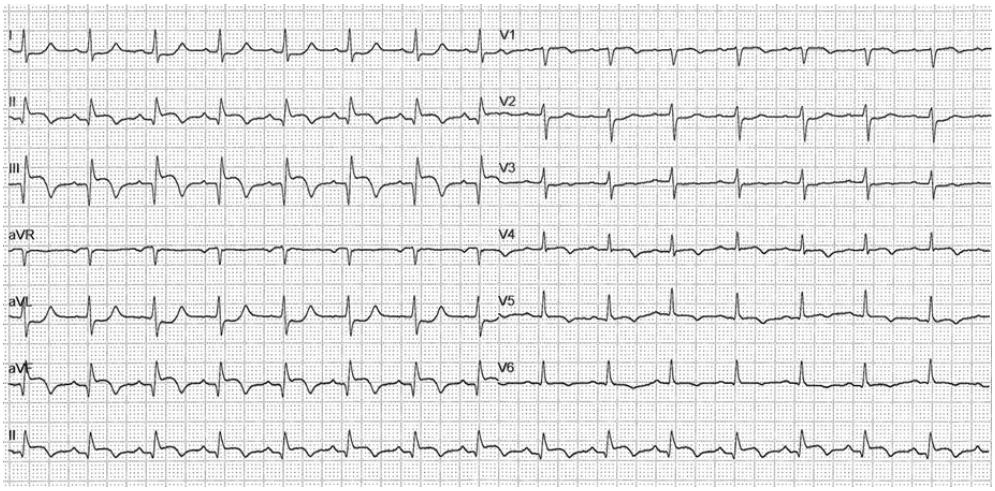

Fig. 1 – *ST-segment elevation in leads II, III, and aVF accompanied by Q waves of necrosis.*

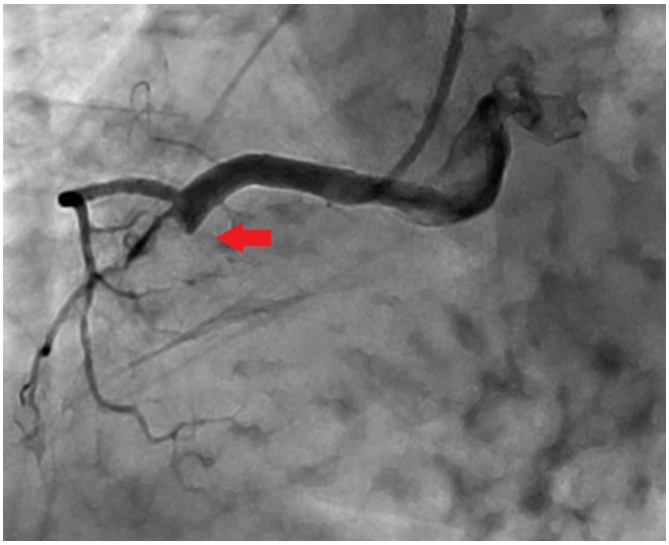

Fig. 2 - *Complete occlusion of the right coronary artery with thrombolysis in myocardial infarction flow grade 0.*

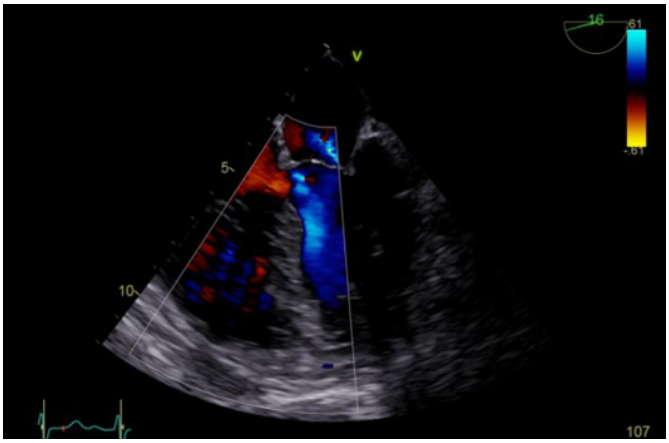

Fig. 3 - *Mid-esophageal four-chamber view with color Doppler demonstrating left-to-right shunt at the basal level of the interventricular septum.*

The European System for Cardiac Operative Risk Evaluation II score predicted a mortality of 13.59%, and there was a morbidity-mortality rate probability of 73.3% according to the Society of Thoracic Surgeons. Therefore, on the seventh day of hospitalization, the patient underwent endovascular closure of the interventricular communication. However, a second defect was identified superior to the previously known defect, and despite multiple attempts to place the device for defect correction, anchoring was not possible due to tissue friability. Following the unsuccessful procedure, the patient was readmitted to the intensive care unit with high-dose dual vasopressor support, inotropic support with dobutamine, and signs of hypoperfusion. Within a few hours, she progressed to severe bradycardia, leading to asystole and subsequent death.

QUESTIONS

A. What is post-infarction ventricular septal defect (VSD)?
B. What are the clinical outcomes of this entity?
C. What are the strategies for managing post-infarction VSD?

Discussion of Questions

Question A. Post-myocardial infarction VSD is a rare but potentially lethal mechanical complication of acute myocardial infarction (AMI)[1]. In the pre-fibrinolytic era, it occurred as a complication in 1-3% of AMI cases and in the present, with the implementation of reperfusion strategies, the incidence varies between 0.17 and 0.32%[2,3].

Question B. Despite the low frequency of post-myocardial infarction VSD, it is still associated with a high rate of in-hospital mortality, with a survival rate < 10% at 30 days without surgical treatment[4]. Risk factors associated with higher mortality previously identified include the presence of cardiogenic shock, female sex, tachycardia, advanced age[5-7], posterior septal rupture, and the need for mechanical support such as IABP and extracorporeal membrane oxygenation, conditions that combined with the ongoing controversy over the timing of intervention and repair of VSD have resulted in no improvement in outcomes for this complication over the past decade[8,9].

Question C. Current guidelines for the management of AMI and its complications recommend addressing post-infarction VSD with urgent surgical or percutaneous intervention[10,11]. However, the results of these procedures are still unsatisfactory mainly due to poor healing of the previously injured and edematous myocardium; the optimal timing and type of intervention continue to be controversial[4]. The United Kingdom registry published by Giblett et al.[12] found that 16.1% of patients undergoing percutaneous intervention required subsequent surgical intervention, while 7.8% of patients initially treated with surgery required subsequent percutaneous management. On the other hand, patients treated percutaneously were older (72 [64-77] *vs.* 67 [61-73] years) with higher in-hospital mortality (55% *vs.* 44.2%, *P*=0.048) although without differences in short-term mortality (61.1% *vs.* 53.7%, *P*=0.17).

In a large series of 116 patients, only 12% of them had undergone surgical management. Among the survivors, the surgically treated group had lower one-year mortality than those who received conservative management (18% *vs.* 84%, *P*=0.05) with a five- and 10-year survival rate of 72% and 43%, respectively[4]. Ronco et al.[9] in a series of 475 patients from the CAUTION study found lower mortality in patients who underwent surgical repair after seven days of septal rupture detection, which is likely related to poor tissue quality for repair in the early stage of the disease.

BRIEF CONSIDERATION OF THE CASE REPORTED

In our case, the female patient with early presentation of acute heart failure progressing to mild to moderate cardiogenic shock coincides with findings in the literature indicating that the main cause of death is pump failure despite early myocardial revascularization. Additionally, the patient has a basal location of the defect, which is a factor associated with percutaneous closure of VSD failure, as Hua et al.[4] have previously identified, because the distorted anatomy complicates the technical aspects of device placement for VSD closure, and in the case of basal location, it may be accompanied by worsened valve insufficiency due to a mechanical effect of the device. In the other hand, the use of IABP in the preoperative period increases cardiac output, improves interventricular shunting and coronary circulation, and reduces myocardial oxygen consumption[3], making it an ideal strategy for stabilizing patients before surgery correction, a strategy that remains current in the literature[1,10].

LEARNING POINTS

- Post-infarction VSD is a rare but potentially lethal mechanical complication of AMI.
- Advanced age is a major risk factor for unfavorable outcomes in post-infarction VSD.
- Cardiac critical care team should pursue hemodynamic optimization prior to interventions with the intention of closing the defect using mechanical support such as IABP early in the process.

No financial support.
No conflict of interest.

Authors' Roles & Responsibilities

OJCA	Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; final approval of the version to be published
RRD	Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; final approval of the version to be published
EAG	Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; final approval of the version to be published

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