Original Article

Status of In-Hospital Mortality in Patients with Acute ST-Elevation Myocardial Infarction Complicated with Ventricular Septal Rupture

Sadam Hussain, Sahrish, Sartaj Uddin and Syed Danish Habib

ABSTRACT

Objective: To determine the frequency of in-hospital mortality in patients with acute ST-Elevation Myocardial Infarction complicated with ventricular septal rupture.

Study Design: Descriptive Cross sectional study

Place and Duration of Study: This study was conducted at the Cardiology department, NICVD, Karachi, Pakistan from March 26, 2021 to September 25, 2021.

Methods: All patients who visited the NICVD Karachi and met the eligibility requirements were included in the study. All the patients were assessed for ventricular septal rupture secondary to STEMI. Post STEMI patients were followed for one week to assess in hospital mortality. All data collected were entered into the attached form and used electronically for research purposes.

Results: Mean ± SD of age was 57.2±11.5 years. In distribution of gender, 39 (68.4%) were male while 18 (31.6%) were female. In-hospital mortality was found to be in 16(28.1%) patients.

Conclusion: In conclusion, VSR, a condition affecting patients, requires accurate clinical judgment and ECG to quickly diagnose and determine the most suitable treatment at the appropriate time, depending on the patient's condition.

Key Words: Acute Coronary Syndrome, In-Hospital Mortality, ST-Elevation Myocardial Infarction, PCI.

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INTRODUCTION

Ventricular septal defect is a complication that occurs sporadically but can be lethal after an acute myocardial infarction (MI).[1] Full-thick (transmural) infarction of the ventricular septum can cause rupture and can occur anywhere anatomically. Infarctions that involve the left anterior descending, dominant right coronary, or dominant left-circumflex arteries can all result in septal branches.

Similar rates of ventricular septal rupture have been reported in anterior and inferior/lateral infarctions [2]. Anterior infarctions at the septum-porous wall intersection often lead to apical defects, while inferior infarctions result in basal defects. Oxygenated blood is shunted from the high-pressure left ventricle to the lower-pressure right ventricle, ranging from full hemodynamic stability to outright collapse. Hemodynamic degradation is unpredictable, and survival is rare without intervention. [3]. Septal rupture, a traditional surgical procedure, is caused by coagulation necrosis of ischemic tissue with neutrophilic invasion, resulting in progressive thinning and weakness of the septum, taking 3-5 days.[4] The likelihood of rupture is higher within 24 h of presentation when an intramural hematoma or hemorrhage is dissectioned into ischemic myocardium.[5] This typically happens as a result of hypercontractile, distant myocardium segments mixed with physical shear stresses near the edge of an infarct zone. The VSR is often detected in the basal inferior septum, next to the hyperdynamic mid-septum that is perfused by the LAD, in the context of an inferior infarction. In addition, various mechanical problems such ventricular aneurysm, free wall rupture, or papillary muscle rupture may potentially coexist with ventricular septal rupture [6,7].

Although ventricular septal defects have become increasingly rare with the advent of reperfusion strategies (such as thrombolytic therapy and percutaneous coronary intervention), their consequences continue to negatively impact the clinical prognosis of these patients. Transcatheter closure of PI-VSR has been used with promising results, allowing

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for rapid shunt decrease to stop hemodynamic deterioration[8]. As a result, transcatheter closure, which has a high percentage of procedural success, has emerged as a useful alternative to surgical repair [9]. Current revascularization methods have shown to reduce the incidence of ventricular septal defect from 1%–2% to 0.17%–0.31% in acute Mis. Despite a general decline in occurrence, ventricular septal defect continues to be a highly unfavorable clinical predictor. The mortality rate for these patients is still rather high; it varies between 40% and 80% depending on the series, population under study, or reperfusion technique. [10] Death is the most alarming consequence of this MI dilemma.. According to a US research, which covered the whole study period, the total death rate was 30.5% [11] Heart failure, cardiogenic shock, and technical difficulties in corrective interventions contribute to left-to-right shunting, which can't be treated with medical management [12].

Operational Definition St-Elevation Myocardial Infarction (Stemi): It was determined that the patient had it if they met any two of the following criteria:

- Typical chest pain lasting more than 20 minutes (radiating discomfort down the left arm or shoulder, increased by effort or mental stress, alleviated by rest or nitroglycerin);
- A new ST elevation in at least two contiguous leads that is >2mm in males or >1mm in women, leads V2 to V3, and/or additional contiguous chest leads or limb leads that is >1mm.

Ventricular Septal Rupture: It was defined as rupture of the interventricular septum of the heart with left to right shunting of blood confirmed by transthoracic echocardiography.

METHODS

Sample Size: W.H.O sample size calculator was applied to analyze the frequency of in hospital mortality (30.5%)[11] in patients with acute STEMI complicated with ventricular septal rupture. Confidence Level (C.I)=95%, margin of error (d)=12%, then the estimated sample size was n=57. Due to low prevalence of ventricular septal rupture and considering the time constraints, margin of error was kept 12%.

Inclusion Criteria:

- Age (35-70 years.)
- Both gender.
- According to the operational criteria, patients had ST-elevated myocardial infarction at the time of presentation.
- Time from symptom-onset to presentation > 24 hours.

Exclusion Criteria:

- Patients who received thrombolytic therapy within 24 hours of hospital admission.
- Patients who were diagnosed as Non-ST elevation Myocardial Infarction (NSTEMI).
- Patients diagnosed with any other complication of STEMI (Atrial Fibrillation, Cardiogenic Shock, Left Ventricular Aneurysm etc.) except Ventricular Septal Rupture.
- Patients who presented beyond 24 hours with resolved symptoms.

Data Collection: The study involved all diagnosed cases, obtained informed consent, and collected data on gender, age, risk factors, and clinical features, including diabetes, smoking, hypertension, and heart disease family history. Weight was determined using a weight machine, while height was measured in cm. BMI was calculated by dividing weight by the squared height in meters after management of STEMI. All the patients were assessed for ventricular septal rupture secondary to STEMI (as mentioned in operational definition) by consultant > 5 years of experience assist by researcher himself. Post-STEMI patients were monitored for a week to evaluate hospital mortality, controlling for confounding variables and biases through exclusion criteria and stratification, and maintaining secure patient information.

RESULTS

In this study, 57 patients were included the mean ± SD of age was 57.2±11.5 years. In distribution of gender, 39 (68.4%) were male while 18 (31.6%) were female. Furthermore the frequency distribution of diabetes mellitus, hypertension and smoker were shown as 20 (35.1%), 32 (56.1%) and 25 (43.9%) respectively. Positive family history of ischemic heart disease was found in 12 (21.1%) patients while interventions were noted as coronary artery bypass graft with VSR closure in 23 40.4%) patients, only coronary artery bypass graft in 11 (19.3%), percutaneous coronary intervention with VSR (closure 21 (36.8%) while none of the intervention was noted in 2 (3.5%) patients as shown in Table 1. In-hospital mortality was found to be in 16(28.1%) patients. Figure 1

In this study, to assess the in-hospital mortality in patients with acute ST-Elevation Myocardial Infarction complicated with ventricular septal rupture and the results were analyzed as: the mean ± SD of age was 57.2±11.5 with C.I (54.14…….60.25) years whereas Mean ± SD of height, weight and body mass index was 1.62±0.91 with C.I (1.37…….1.86) meters, 59.5±8.8 with C.I (57.16…….61.83) kg and26.2±5.7 with C.I (24.68…….27.71) kg/m^2 respectively. shown in Table 2.

Stratification of age group, gender, body mass index, hypertension, diabetic mellitus, family history of ischemic heart disease, smoking status and interventions were done with respect to in hospital mortality in order to assess statistical difference from Table 3.

Table No. 1: Descriptive Statistics of Demographic and Other Variables

Gender	**Male**	**39**	**68.4%**
	Female	18	31.6%
History of D.M	Yes	20	35.1%
	No	37	64.9%
History of Hypertension	Yes	32	56.1%
	No	25	45.9%
Family history of IHD	Yes	12	12.21%
	No	45	78.9%
History of Smoking	Yes	25	43.9%
	No	32	56.1%
Intervention Outcome	Coronary Artery Bypass Graft with VSR Closure	23	40.4%
	Only Coronary Artery Bypass Graft	11	19.3%
	Percutaneous Coronary Intervention with VSR Closure	21	36.8%
	None	02	3.5%

Table No. 2: Descriptive Statistics of Different Variable

Variable	Mean ±S.D	95% C.I	Max	Min	Range
AGE	57.2±11.5 Years	54.14……60.25	35	70	35
Height	1.62±0.91		1.38	1.86	0.48
Weight	59.5 ±8.8	57.16…….61.83	40	95	55
BMI	26.2±5.7 (kg/m^2)	24.68…….27.71	16	34	18

Table No.3: Variables

Variables		In Hospital Mortality		P-Value
		Yes	No	
Age group [in years]	35 – 60	6(10.5%)	26(45.6%)	0.076
	>60	10(17.5%)	15(26.3%)	
Gender	Male	8(14.0%)	31(54.4%)	0.062
	Female	8(14.0%)	10(17.%)	
Bmi [kg/m^2]	16 – 24	4(7.0%)	24(42.1%)	0.023
	>24	12(21.1%)	17(29.8%)	
Hypertension	Hypetention	5(8.8%)	27(47.4%)	0.019
	Non-Hypertensive	11(19.3%)	4(24.6%)	
Diabetes mellitus	Dibetic	11(19.3%)	9(15.8%)	0.001
	Non-Diabetic	5(8.8%)	32(56.1%)	
Family history	Positive	8(14.0%)	4(7.0%)	0.001
	Negative	8(14.0%)	37(64.%)	
Smoking status	Smoker	13(22.8%)	12(21.1%)	0.0001
	Non-Smoker	3(5.3%)	29(50.9%)	
Intervenation	Coronary Artery Bypass Graft with VSR Closure	9(15.8%)	14(24.6%)	0.021
	Only Coronary Art: Bypass Graft	5(8.8%)	6(10.5%)	
	Percutaneous Coro:Intervention with VSR Closure	1(1.8%)	20(35.1%)	
	None	0(0.0%)	2(3.5%)	

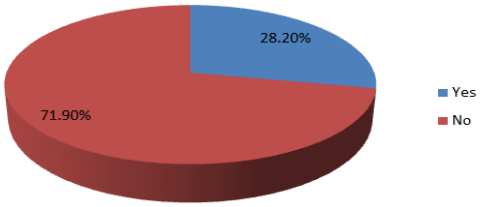

Figure No. 1: Frequency of In Hospital Mortality (n=57)

DISCUSSION

Ventricular septal defects, a rare but fatal consequence of acute myocardial infarction, have decreased in frequency with the development of reperfusion methods like thrombolysis and percutaneous coronary intervention, but still impact clinical prognosis.

Vessel septal defect is a significant negative factor, with mortality rates ranging from 40-80%. Left-to-right

shunting is common in heart failure patients, cardiogenic shock, and technical difficulties.

VSR-aggravating acute myocardial infarction (AMI) occurred 1% to 3% of the time before reperfusion treatment was introduced and it was linked to a very poor prognosis, with in-hospital death rates of roughly 45% for patients receiving surgical treatment and 90% for those receiving medicinal treatment. The incidence of VSR significantly dropped to between 0.2% and 0.4% with the introduction of thrombolytic treatment. Similar to this, the reported incidence of VSR when employing primary percutaneous coronary intervention as the reperfusion approach ranged from 0.2% [13] to 0.5% [14]. The mortality rate of VSR-induced AMI remains high compared to AMI without VSR, despite hopeful decreases. Research aims to improve VSR therapy choices, but results are limited by small patient numbers.

VSR rarely necessitates medical treatment, but definitive surgery may improve survival and surgical outcomes, while full mechanical assistance may reduce mortality rates after AMI. [20] In the pre thrombolytic phase, there was an accumulation of 1 2% and fatalities totaling 70 80% [16].

In our study, mean age was noted to be 57.2±11.5 years. Moreyra AE, et al found mean age as 71±10 years. Another study reported as 61±9.7 years [19]. In this study, 39 (68.4%) were male while 18 (31.6%) were female. Singh V, et al noted to have 55% males and 45% females [11]. There were 198 (48%) men and 210 (52%) women [2]. Shah SF, et al found to have 54.4% males and 45.6% females [19].

In current study, diabetes mellitus was documented in 20 (35.1%) patients. Diabetes was found in 73 (18%) patients. The study of Shah SF, et al reported diabetes in 35% cases [19]. In recent study, hypertension was noted in 32 (56.1%) patients. Moreyra AE, et al noted hypertensive cases as 116 (28%) [2]. There were 14% hypertensive cases noted in the study of Shah SF, et al [24]. In this study, 25 (43.9%) patients were smoker while 32 (56.1%) were non-smoker. Shah SF, et al found to have 21% smokers [19].

In our study, positive family history of ischemic heart disease was found in 12 (21.1%) patients while Shah SF, et al reported positive history in 32% cases [19].

In present study, interventions were noted as coronary artery bypass graft with VSR closure in 23 (40.4%) patients, only coronary artery bypass graft in 11 (19.3%), percutaneous coronary intervention with VSR closure 21 (36.8%) while none of the intervention was noted in 2 (3.5%) patients. Moreyra AE, et al reported coronary artery bypass in 133 (33%), percutaneous coronary intervention in 50 (12%) patients [14].

Present study reported in-hospital mortality was noted in 16 (28.1%) patients. Singh V, et al reported in-hospital mortality in 30.5% cases while in-hospital mortality was reported in 17.4% in the study done by Shah SF, et al [19]. Prompt interventional methods like thrombolytics and PCI have reduced life-threatening mechanical consequences after acute myocardial infarction (AMI), with ventricular septum rupture and acute mitral regurgitation most likely appearing between days 2 and 5. Free wall rupture (FWR) often appears around day 5 in 50% of instances, and 90% of patients will have it by two weeks following an AMI. The study revealed a 30.5% decrease in total mortality rate due to myocardial infarction, a concerning trend over the past three decades[11]. Our results show a rate that takes into account patients who had surgery, interventional treatments, and the usage of supporting equipment. In-hospital associated mortality has decreased with the introduction of revascularization, from early highs of 90% to 41% in the GRACE study [20]. However, many series describe variations from 50 to 70%. Mortality in surgical procedures is influenced by aggressive strategies, procedural techniques, supportive devices, and improved techniques. Percutaneous procedures and structural cardiac interventions have grown, leading to minimally invasive procedures. In our study, stratification of confounders / effect modifiers with respect to in-hospital mortality, insignificant difference was noted in age group (P=0.076), gender (P=0.062), whereas significant difference was reported in body mass index (P=0.023), hypertension (P=0.019), diabetes mellitus (P=0.001), family history of IHD (P=0.001), smoking status (P=0.0001) and interventions (P=0.021)

CONCLUSION

We may draw the conclusion that acute ST- elevation myocardial infarction complicated by ventricular septal rupture is probably related to mortility. Prospective studies with strict controls are required to validate the results so far.

Author's Contribution:

Concept & Design of Study:	Sadam Hussain
Drafting:	Sahrish, Sartaj Uddin
Data Analysis:	Syed Danish Habib
Revisiting Critically:	Sadam Hussain, Sahrish
Final Approval of version:	Sadam Hussain

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