ORIGINAL ARTICLE

# FREQUENCY OF VENTRICULAR SEPTAL RUPTURE AS A COMPLICATION OF ACUTE ST-ELEVATION MYOCARDIAL INFARCTION IN PATIENTS PRESENTING TO A TERTIARY CARE HOSPITAL

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**Background:** Nearly one-third of the world's population dies from cardiovascular disorders, the majority of which are caused by stroke and coronary artery problems and 80 percent of these fatalities occur in impoverished countries. This study was conducted to determine the frequency of ventricular septal rupture in patients with acute ST-elevation myocardial infarction presenting to cardiology unit Hayatabad Medical Complex Peshawar. **Methods:** This was descriptive cross sectional research study at the Department of Cardiology, MTI-Hayatabad Medical Complex, Peshawar, from January to July 2020. Detailed history was obtained including duration of symptoms, co-morbidities present and occupation. A thorough clinical examination was done for signs of heart failure and ventricular septal rupture. Patients' demographics, clinical and laboratory parameters were recorded on a pro forma. All the data was analyzed statistically by using SPSS version 24.0. **Results:** A total of 179 patients were included in our study. Ventricular Septal Rupture (VSR), was recorded in 7 (3.9%) patients having Acute ST elevation of MI. In our study age, obesity, reperfusion therapy, location of MI and history of previous shock were observed to be non-significantly ($p$<0.05) associated with high incidence of Ventricular Septal Rupture in patients having Acute ST elevation of MI. **Conclusion:** According to our findings, individuals with PI-VSR have a significant risk of acute-phase death. Furthermore, a significant incidence of acute-phase fatalities has been related to female gender and severe cardiac failure upon admission.

**Keywords**: Ventricular Septal Rupture; Acute ST elevation; Myocardial Infection

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## INTRODUCTION

Nearly one-third of the world's population dies from cardiovascular disorders, the majority of which are caused by stroke and coronary artery problems and 80 percent of these fatalities happen in impoverished countries.[1] The larger percentage of fatalities is caused by heart disease, particularly coronary artery disease, which is mostly attributable to myocardial infarction. Ventricular septal rupture is one of the most fatal consequences of acute myocardial infarction. In the pre-thrombolytic period, 1–3 percent of patients of acute myocardial infarctions had this deadly consequence.[2] With the development of acute reperfusion methods for AMI, VSR is becoming more uncommon and is detected earlier on in the post-MI stage.

Because of advancements in thrombolytic therapy, the incidence of VSR has decreased to 0.4%, according to the GUSTO-I study, which examined 41,021 patients at 1081 centers in 15 different states over a period of five years. VSR is a serious medical condition that may be fatal if not treated promptly.[3] Its incidence was 0.17 percent in the APEX-AMI registry, with improvements in pharmaco-invasive treatment being the cause for this significant decrease.[3] The prognosis of patients who acquire VSR remains dismal despite substantial improvements in overall death rates for patients with AMI over the past two decades, with death rates ranging from 45–80% in patients who develop VSR. An MI-related rupture of the ventricular septum typically happens during the first week, with a mean duration of 3–5 days between the start of symptoms and the rupture. As observed by researchers at the GUSTO study, old age, anterior infarction, female gender, and no prior smoking were the risk variables most linked with this condition.[4] Despite improvements and promising results in non-surgical managements of VSR such as transcatheter closure devices, surgical repair of septal defects remains the cornerstone of treatment. Anterior left ventricular wall AMI is complicated in 60% of cases by septal rupture. In most cases, ruptures occur in the septum's apical section, and they are very simple. Septal rupture worsens AMI of the left ventricle's inferior wall in 40% of patients.[5] Medically, the rupture manifests as hypotension, bilateral cardiac insufficiency and dyspnea, with the right side being the most severely affected. Additionally, a freshly developed holosystolic rough murmur may be heard, most prominently in the lower sternum. A palpable thrill is present in half of the patients, but in individuals with poor cardiac output it is difficult to detect both murmurs and thrills. Patients with acute ST elevation myocardial infarction were shown to be at higher risk of having their ventricular septum ruptured, according to a research by Muhammad Adil *et al.*[6] In

another research by Areeba Riaz, ventricular septal rupture was seen in 3% of acute ST elevation myocardial infarctions.[7] Irrespective of hemodynamic balance at the diagnosis time, the American College of Cardiology Foundation and the American Heart Association (ACCF/AHA) advocate urgent surgical correction. The goal of this research is to determine the incidence of ventricular septal rupture in our community after an acute myocardial infarction in the present era of intensive reperfusion treatment with pharmacological drugs or primary percutaneous coronary intervention. Through the determination of this information, we will be able to identify instances that need early intervention for correction, which will undoubtedly decrease the mortality rate associated with acquired ventricular septal rupture in the case of acute ST elevation MI.

## MATERIAL AND METHODS

This was a cross-sectional study piloted in Cardiology Unit of Hayatabad Medical Complex Peshawar. The study duration was six months from January to July 2020. Sample size was 179 using 3% as proportion of patients with acute ST elevation MI developing ventricular septal rupture, with 95% confidence interval and 2.5% margin of error using WHO sample size calculator.[7] Consecutive non-probability sampling technique was used. The inclusion criteria for our study included patients aged 50 years and above irrespective of gender, patients presenting with acute ST elevation myocardial infarction as per definition while the exclusion criteria includes patients with history of congenital heart defects, patients with past history of ventricular septal rupture or having free wall rupture, patients with non-ST elevation myocardial infarction and patients who underwent cardiac surgery in the previous one year The study was carried out after ethical approval was obtained from hospital ethics and research committee. The objective and advantage of the study was clarified to participants in the study. An informed consent in written form was obtained from all the participants. Detailed history was obtained including duration of symptoms, co-morbidities present and occupation. A thorough clinical examination was done for signs of heart failure and ventricular septal rupture. All patients had serial ECGs, evaluation for cardiac biomarkers of myocardial infarction with troponin-I and a thorough echocardiographic evaluation including location of wall motion abnormalities and for presence/absence of VSR. Patients' demographics, clinical and laboratory parameters were recorded on the approved predesigned *pro forma*. The data was analyzed statistically by using SPSS software version 24.0. Numerical variables such as age were presented as mean standard deviation (SD). Categorical variables, such as gender, occupation, co-morbidities present, presence of shock, location of MI, reperfusion therapy and ventricular septal rupture was presented as frequencies and percentages. Stratification was done with regard to age, gender, occupation, comorbidities present, presence of shock, location of MI, reperfusion therapy and ventricular septal rupture. Post-stratification Chi square ($\chi 2$) test was used for categorical variables. *p*-value was calculated and *p*-value $\leq 0.05$ was considered statistically significant. All the data was presented in the form of tables and graphs.

## RESULTS

In this study, a total of 179 patients were included. The mean±SD age was 65.66±7.99. According to the age wise distribution, 98 (54.7%) patients were recorded in 50–65 years age group while 81 (45.3%) patients were recorded in 66–80 years age group. Gender wise distribution there were 111 (62.0%) male patients and 68 (38.0%) patients were recorded as female. Table-1 shows clinical parameters of patients included in the study. Ventricular Septal Rupture (VSR) was cross tabulated with age, gender, occupation, co-morbidities present, presence of shock, location of MI, reperfusion therapy and presence of Shock. (Table-2)

**Table-1: Clinical parameters of the patients included in our study**

| Parameter | Category | Frequency | Percentage |
|---|---|---|---|
| Hypertension | Yes | 40 | 22.3 |
| | No | 139 | 77.7 |
| Diabetes mellitus | Yes | 65 | 36.3 |
| | No | 114 | 63.7 |
| Smoking | Yes | 49 | 27.4 |
| | No | 130 | 72.6 |
| Previous MI | Yes | 80 | 44.7 |
| | No | 99 | 55.3 |
| Obesity | Yes | 119 | 66.5 |
| | No | 60 | 33.5 |
| Location of MI | Anterior | 111 | 62.0 |
| | Inferior | 68 | 38.0 |
| Reperfusion therapy | Yes | 68 | 38.0 |
| | No | 111 | 62.0 |
| Presence of shock | Yes | 94 | 52.5 |
| | No | 85 | 47.5 |
| Ventricular septal rupture | Yes | 7 | 3.9 |
| | No | 172 | 96.1 |

**Table-2: Cross tabulation of ventricular septal rupture with demographic and clinical parameters**

| Parameter | Category | Ventricular Septal Rupture | | |
|---|---|---|---|---|
| | | Yes n (%) | No n (%) | *p* value |
| Gender | Male | 4 (57.1) | 107 (62.2) | 0.519 |
| | Female | 3 (42.9) | 65 (37.8) | |
| Age group | 50–65 years | 3 (42.9) | 95 (55.2) | 0.787 |
| | 66–80 years | 4 (57.1) | 77 (44.8) | |
| Hypertension | Yes | 1 (14.3) | 39 (27.7) | 0.601 |
| | No | 6 (85.7) | 133 (77.3) | |
| Diabetes mellitus | Yes | 1 (14.3) | 64 (37.2) | 0.216 |
| | No | 6 (85.7) | 108 (62.8) | |
| Smoking | Yes | 2 (28.6) | 47 (27.3) | 0.942 |
| | No | 5 (71.4) | 125 (72.7) | |
| Previous MI | Yes | 2 (28.6) | 78 (45.3) | 0.381 |
| | No | 5 (71.4) | 94 (54.7) | |
| Obesity | Yes | 4 (57.1) | 115 (66.9) | 0.593 |
| | No | 3 (42.9) | 57 (33.1) | |
| Location of MI | Anterior | 5 (71.4) | 106 (61.6) | 0.600 |
| | Inferior | 2 (28.6) | 66 (38.4) | |
| Reperfusion therapy | Yes | 4 (57.1) | 64 (37.2) | 0.287 |
| | No | 3 (42.9) | 108 (62.8) | |
| Presence of shock | Yes | 4 (57.1) | 90 (52.3) | 0.802 |
| | No | 3 (42.9) | 82 (47.7) | |

## DISCUSSION

A deadly consequence of acute myocardial infarction is ventricular septal rupture (VSR). Prior to extensive reperfusion treatment, the incidence of VSR worsening AMI was 1-3 percent. The occurrence has decreased to about 0.3 percent since the development of thrombolytic treatment.[8] Over the last two decades, a reported death rate of 34–54 percent has been relatively consistent.[9–12] In our study, a total of 179 patients were included. Our findings are in accordance with the previous study who reported 3% incidence of Ventricular Septal Rupture in patients having Acute ST elevation of MI [13] while higher than the 1% incidence reported by another study.[14] Multiple researches have investigated the different variables that contribute to the development of VSR. Hypertension, older age, female sex, lack of angina, previous history of MI, and anterior site of infarction are amongst these factors. In our study age, obesity, reperfusion therapy, location of MI and history of previous shock were observed to be associated with high incidence of Ventricular Septal Rupture in patients having Acute ST elevation of MI. In contrast to previous studies, we observed that individuals with VSR had a reduced incidence of hypertension and diabetes. Substantial protection against septal rupture may be provided by concentric cardiac hypertrophy in hypertensive individuals Diabetes prevalence in VSR populations has been found to vary from 11 percent to 39 percent in previous research.[15–19] There has been evidence that VSR occurs more often in patients with single-vessel disease and without collateral circulation.[19–21] Diabetes may have a preventive influence on the occurrence of VSR due to multi-vessel illness, with collateral circulation supplying blood to the ischemic septum and avoiding its rupture. In our study the incidence of Ventricular Septal Rupture in patients having Acute ST elevation of MI was higher in male as compared to female. In contrary to our study other studies reported high incidence in female as compared to male.[22,23] The high incidence in male in our study might be due to high number of male participants in our study. In our study it was observed that septal rupture worsens an AMI of the anterior left ventricular wall in 71.4% of patients, whereas it complicates an AMI of the inferior left ventricular wall in 28.6% of patients. These findings are in accordance with the previous study who reported that septal rupture worsens an AMI of the anterior left ventricular wall in 60% of patients, whereas it complicates an AMI of the inferior left ventricular wall in 40% of patients.[5] Another research found no difference between anterior and inferior infarctions in the incidence of VSR.[22] This research showed that only 7 (3.9%) patients having Acute ST elevation of MI with Ventricular Septal Rupture (VSR) and the patients who lived for more than two weeks and had successful per-cutaneous closure had a better long-term prognosis. In the current study, 94 (52.5%) patients were reported with presence of shock. These results emphasize the critical importance of hemodynamic stabilization during the early stages of PI-VSR. The best treatment approach and timing for VSR closure in PI-VSR patients are still being debated. Despite the fact that current recommendations urge prompt intervention in all patients with PI-VSR, independent of their clinical state[24,25], most of the percutaneous closures were done during the sub-acute or chronic phases[26,27]. The major drawback of the research was its setting in single center. In the present era of thrombolytic and interventional therapy of AMI, PI-VSR is rare, thus the study population was limited, and the research duration was lengthy. A study having large sample size by including multi centers is recommended for better results.

## CONCLUSION

AMI-related mortality has decreased dramatically during the last three decades. According to our findings, individuals with PI-VSR have a significant risk of acute-phase death. Furthermore, a significant incidence of acute-phase fatalities has been related to female gender and severe cardiac failure upon admission. As a consequence, in acute-phase survivors, percutaneous closure is suggested, resulting in good short- and long-term outcomes for PI-VSR patients.

## AUTHORS' CONTRIBUTION

Shahsawar: Literature search, study design, data analysis, interpretation, write-up. MR, MS, ZA: Literature search, data collection, proof reading.

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