POST MYOCARDIAL INFARCTION VENTRICULAR SEPTAL RUPTURE AND FACTORS ASSOCIATED WITH ITS MORTALITY: A RETROSPECTIVE STUDY

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ABSTRACT

OBJECTIVES: To determine the incidence of ventricular septal rupture (VSR) following acute myocardial infarction (AMI) and to find out factors associated with its mortality.

METHODS: This retrospective study was done at Lady Reading Hospital, Peshawar, Pakistan in which 03years (January-2014 to December-2016) data of AMI patients was studied. Patients with VSR after AMI, diagnosed on echocardiography were included. Chi-square test was applied to correlate cardiovascular risk factors and clinical parameters with the mortality in post-MI VSR patients.

RESULTS: A data of 6240 patients with AMI was analyzed in which 60 patients had VSR (incidence rate of 0.96%) with 64.7% having acute anterior MI. It is 8.5 times greater in first-MI and have a delayed onset. Twenty-six patients were excluded due to presence of concomitant complications and rest of 34 were studied in detail. Mean age of post-MI VSR patients was 63.21 ±8.9years, among them 52.9% were males. Mean time of development of VSR was 4.1 ±2.2days with the minimum of 01day and maximum of 10days after diagnosis of AMI. Nineteen patients (55.9%) didn't receive streptokinase. The mortality rate was 38.2% which was significantly associated with diabetes, tachycardia, shock, high Killip class, renal impairment and multiple VSR's (P-value of 0.012, 0.021, 0.032, 0.031, 0.036 and 0.016 respectively).

CONCLUSIONS: VSR incidence after AMI in our study was 0.96% with 8.5 times greater in first-MI and have a delayed onset. Diabetes mellitus, multiple lesions, presence of shock, tachycardia, renal impairment and high Killip class after development of VSR are associated with high mortality.

KEY WORDS: Ventricular Septal Rupture (MeSH); Myocardial Infarction (MeSH); Mortality (MeSH); Killip class (Non-MeSH); Coronary Artery Disease (MeSH); Streptokinase (MeSH).

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INTRODUCTION

Cardiovascular diseases are ranked first for the morbidity and mortality of people world widely.[1] According to the figures of World Health Organization (WHO), out of the 17.3 million cardiovascular deaths in 2008, heart attacks were responsible for 7.3 million.[1]The Asian population is more susceptible to myocardial infarction (MI).[2,3] It has been estimated that MI is 50% higher in South Asians than white people of United Kingdom.[4] Jaffar TH, et al. in 2007 showed that one in four subjects aged ≥40 years may have underlying coronary artery disease (CAD) in urban Pakistan.[5] Jafary MH, et al. in 2007 found 2.5% mortality after acute MI in Pakistan.[6]

One of the deadly complication of acute myocardial infarction is left ventricular free wall/ventricular septal rupture, which occurred in 4-24% in necropsy patients with fatal MI before the widespread use of cardiac care units.[7] Among the survivors of acute myocardial infarctions, 1-2% developed this devastating complication in the pre-thrombolytic era.[8-10] This incidence has reduced to a figure of 0.4% in the thrombolytic era as shown by the Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries (GUSTO-I) trial, which studied 41,021 patients at 1081 sites in 15 different countries.[11,12] This is further reduced to 0.17% in APEX-MI registry, with improvement in pharmaco-invasive therapy being the reason for this drastic reduction.[13,14] Similarly, Moreyra AE, et al. in 2010 found incidence of acquired VSR as 0.2% from Microbial Database for Activated Sludge (MiDAS) database in New Jersey, USA.[15]

It usually occurs in the first week after MI, with a mean time from symptom onset of 3 to 5 days. GUSTO Investigators showed that risk factors most associated with this complication were advanced age, anterior infarction, female sex and no previous smoking.[11]

VSR has extremely poor outcomes, particularly in untreated cases where mortality is 94 percent at 30 days.[16] The transcatheter closure of post-MI VSR has a success rate of 89% (95% CI 84% - 93%) as reported by the meta-analysis reported by De Puy, et al.[16]

The aim of this study is to determine the incidence of ventricular septal rupture after acute myocardial infarction and to identify cardiovascular risk factors and clinical parameters with the mortality in these patients once this complication occurred. By determining this information in our region where it is not known till now, we will be able to find out the cases which need early intervention for correction that will definitely reduce the mortality from acquired VSR.

TABLE I: BASELINE CHARACTERISTICS OF POST MYOCARDIAL INFARCTION VENTRICULAR SEPTAL RUPTURE PATIENTS (n=34)

	Mean ± S.D	Frequency (percentage)
CV Risk Factors		
Age (years)	63.21 ± 8.9	---
Gender (male)	---	18 (52.9%)
Hypertension	---	08 (23.5%)
Diabetes Mellitus	---	12 (35.5%)
Smokers	---	06 (17.6%)
Previous MI	---	04 (11.8%)
Family History of CAD	---	04 (11.8%)
Clinical Parameters		
Shock	---	08 (23.5%)
Systolic BP (mmHg)	92.4 ± 22.7	---
Heart rate (per min)	82.9 ± 24.4	---
Tachycardia	---	08 (23.5%)
Killip class		
Class 1	---	15 (44.1%)
Class 2	---	06 (17.6%)
Class 3	---	09 (26.5%)
Class 4	---	04 (11.8%)
VSR characteristics		
Time of VSR (days)	4.1 ± 2.2	---
Location of MI		
Anterior MI	---	22 (64.7%)
Non-Anterior MI	---	09 (26.5%)
Ant + Inferior MI	---	03 (8.8%)
Number of VSR		
Single	---	14 (41.2%)
Multiple	---	20 (58.8%)
Streptokinase		
Given	---	15 (44.1%)
Not given	---	19 (55.9%)
Creatinine (mg/dl)	1.95 ± 1.9	---
Blood sugar (mg/dl)	198.6±123.2	---
Outcomes		
Discharged/referred	---	21 (61.8%)
Death	---	13 (38.2%)

VSR=ventricular septal rupture; MI=myocardial infarction; BP=blood pressure; CAD=coronary artery disease; CV=cardiovascular

METHODS

This is a retrospective study done at Cardiology department of Lady Reading Hospital, Pakistan. In this study record of 6240 patients with acute MI admitted over a period of three years between January, 2014 and December, 2016 were analyzed.

Record of included patients was from either gender, having AMI complicated by VSR which were confirmed by trans-thoracic echocardiography. Patients were grouped on the basis of their outcomes, whether they survived (discharged/reffered) or died during hospital stay. Those patients who were previously diagnosed as having VSD, cerebro-vascular accident, recent trauma or major surgery, severe mitral regurgitation, free wall rupture, or heart block were excluded.

Record regarding (blood pressure, heart rate and Killip class) and renal profile were recorded at the time of VSR diagnosis.

All cases underwent a comprehensive echocardiography examination that included M-Mode, 2 Dimensional and Doppler (continuous wave and color) with Toshiba machine by an experienced cardiac sonographer at a time of development of acquired VSR. Number and location of defects, direction and severity of shunt and effect of VSR on cardiac chambers sizes and function were studied in detail.

The data was entered into SPSS version 20. Normally distributed continuous variables like age, systolic and diastolic BP, heart rate, creatinine and random blood sugar were expressed as mean± standard deviation. Frequency and percentages were used for categorical variables like gender, hypertension (HTN), diabetes mellitus (DM), smoking, previous MI, Killip class, number of VSR and outcome. Correlation of cardio-vascular risk factors and different clinical parameters with the mortality was assessed with the chi-square test.

RESULTS

A total of 6240 patients with acute myocardial infarction data were analyzed in which 60 patients developed ventricular septal rupture. Twenty six patients were excluded due to presence of other concomitant complications (Figure 1). It showed an incidence of acquired VSR which is 0.96%, with acute anterior MI having 64.7% among them.

A data of rest 34 patients was studied in detail. Mean age of post-MI VSR patients was 63.21±8.9 years, with 52.9% were male patients. Mean time of development of VSR was 4.1±2.2 days with the minimum of one day and maximum of 10 days after diagnosis of acute MI. Nineteen patients (55.9%) didn't receive streptokinase (either late for it or there was significant contraindication for it). About 38.2% of patients of total VSR died. Rest were either discharged on medical therapy or referred for closure. Cardiovascular risk factors and clinical features of these patients are shown in Table I.

TABLE II: ASSOCIATION OF CARDIOVASCULAR RISK FACTORS AND VARIOUS CLINICAL PARAMETERS WITH MORTALITY IN PATIENTS WHO WERE COMPLICATED WITH VENTRICULAR SEPTAL RUPTURE AFTER ACUTE MYOCARDIAL INFARCTION

Characteristics	X^2	P-value
Age Group	0.389	0.533
Gender	0.389	0.533
Hypertension	0.613	0.434
Diabetes Mellitus	6.35	0.012
Smoker	0.074	0.785
Previous MI	0.266	0.606
Family History	0.266	0.606
Shock	6.4	0.032
Tachycardia	6.2	0.021
Killip Class	5.3	0.031
Location of MI	0.210	0.90
Multiple Lesions	5.78	0.016
SK given or not	1.52	0.217
Renal Impairment	5.1	0.036

MI= Myocardial Infarction; SK=Streptokinase

Table II shows chi-square correlation of different baseline characteristics with the outcomes in post-MI VSR patients. Figure 2 shows mortality in various CV risk factors and clinical parameter groups. It shows higher mortality in patients with negative history of CV risk factors except for diabetes, anterior MI, multiple VSRs, no thrombolytics, having shock and renal impairment. Figure 3 shows time of death in these patients after development of VSR. It shows that number of deaths increases with time if patient were not referred for closure.

DISCUSSION

VSR is one of the rare complications of acute myocardial infarction but carries a very high mortality rate. Its incidence in our study is 0.96% which is quite lower than pre-thrombolytic era. However, it is higher than GUSTO-I trial where it was 0.2%. This may be explained by two factors. First, all patients in GUSTO-I trial received thrombolytics and secondly, they were thrombolyzed within 6 hours.[12] The mean time of development of VSR after AMI is 4.1±2.2 days which is longer than Becker RC, et al. study.[17,18]

The mortality in our study was 38.2%, which is almost half of Crenshaw BS, et al. study i.e. 74%.[19] The reason for this may be that the patients who were discharged or referred were not followed. Secondly, the VSR patients may have died before echo. Lastly, the sample size was small. Unlike Crenshaw et al. study where inferior MI and advanced age were most significantly correlated with mortality after development of VSR, diabetes, multiple VSR's, tachycardia, shock, higher Killip class and renal impairment was positively correlated with mortality in our study.[19]

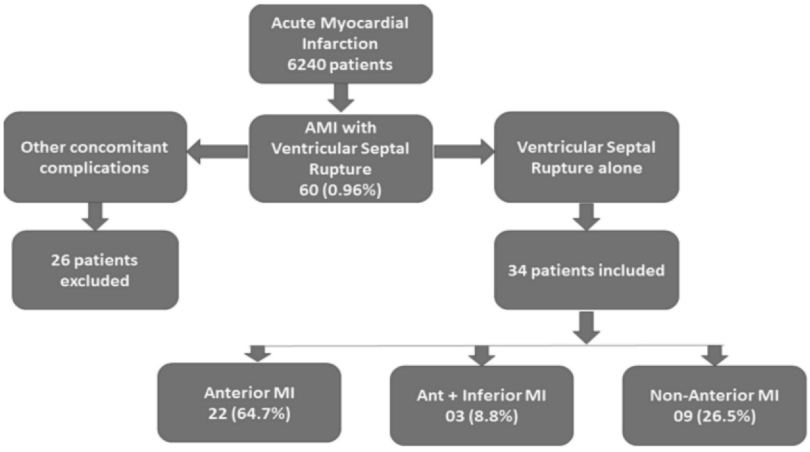

Figure 1: Incidence and spectrum of post-MI ventricular septal rupture.

Seventy five per cent of patients with Killip class 4 in our study died. A study by Srinivas SK, et al. in 2017 found 20% and 86.66% mortality in surgical and medically treated acquired VSR respectively in India.[20,21] Similarly, Reddy and Robert study suggested 3 times greater development of VSR in first MI compared to those with a previous infarct that healed, but this figure increased to 8.5 times in our study.[7]

It is certainly true that thrombolytics reduced the incidence of VSR development. However, once this complication occur, then history of streptokinase taken is no more significant in determining the outcome of these patients.[20,21] Late administration of thrombolytic therapy also appears to improve survival but may increase the risk of cardiac rupture.[21]

The limitations of the study are that it is a retrospective study in which data from software were retrieved which had some missing data. Secondly, number of patients with VSR was very small. Third, follow up data of these patients was not available as many survivors of it were referred to other units. Lastly, patients with concomitant presence of other complications like severe mitral regurgitation and heart block patients were also excluded which would have definitely reduced the true mortality from VSR.

CONCLUSIONS

VSR incidence after AMI in our study was 0.96% with 8.5 times greater in first-MI and have a delayed onset. Diabetes mellitus, multiple lesions, presence of shock, tachycardia, renal impairment and high Killip class after development of VSR are associated with high mortality.

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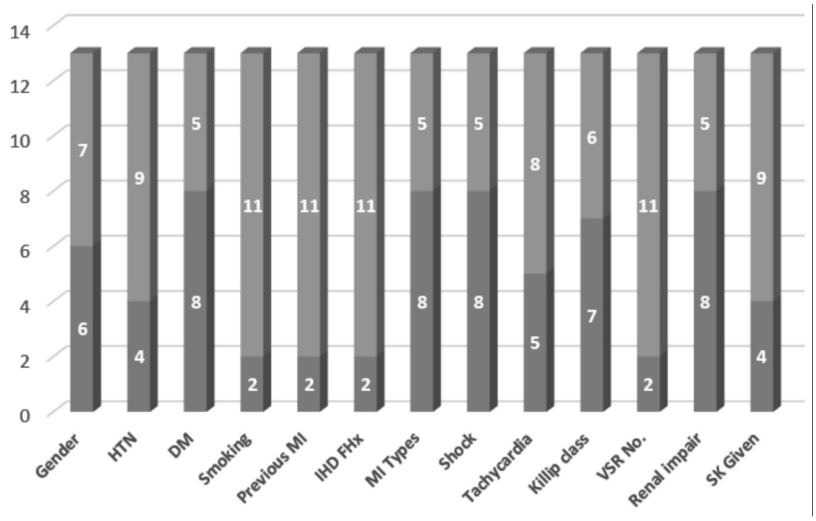

Figure 2: Mortality in various Cardiovascular risk factors and clinical parameters for acquired VSR (n=13). Lower figures represents male gender, Positive History (Hx) [Hypertension (HTN), Diabetes Mellitus (DM), Smoking, Previous MI, Ischemic Heart Disease (IHD) Hx, Shock, Tachycardia, Renal impairment and Streptokinase (SK) given], anterior MI, Killip I-II, and single VSR. Upper figures represents female gender, Negative Hx (HTN, DM, Smoking, Previous MI, IHD Hx, Shock, Tachycardia, Renal impairment, and SK given), non-anterior MI, Killip III-IV and multiple VSRs.

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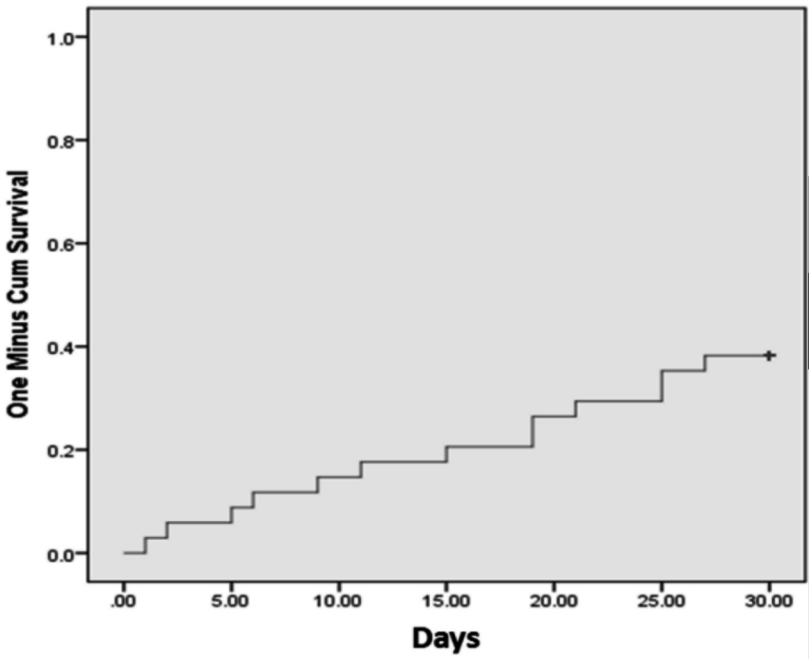

Figure 3: One month mortality after development of Post-MI VSR

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AUTHORS' CONTRIBUTIONS

Following authors have made substantial contributions to the manuscript as under:

MA: Concept & study design, drafting the manuscript, final approval of the version to be published.

ZUZ & MSJ: Acquisition, analysis & interpretation of data, final approval of the version to be published.

S & MI: Critical review, final approval of the version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

Authors declared no conflict of interest

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