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Frequency of Ventricular Septal Rupture in Patients of Acute Myocardial Infarction

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Objective: To determine the frequency of ventricular septal rupture in patients of acute myocardial infarction presented at the adult cardiology department of National Institute of Cardiovascular Disease (NICVD), Karachi.
Methods: A cross-sectional study was conducted at the National Institute of Cardiovascular Disease, Karachi, Pakistan for a period of six months. A total of 384 patients with acute myocardial Infarction diagnosed within 4 weeks duration were included in this study. ECG and transthoracic echocardiogram (TTE) was formed. Patients were followed for 7 days and the study outcome. Data was collected on a pre-designed structured questionnaire.
Results: The average age of the patients was 54.40±7.99 years. Frequency of ventricular septal rupture in patients of acute myocardial infarction was observed in 1.3% (5/384) in which defect in Inter ventricular septum was observed in 60%, Evidence of left-to-right shunt 40%.

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Conclusion: Our study revealed a ventricular septal rupture (VSR) rate of 1.3%. The study further revealed a correlation between smoking and rate of VSR.A multidisciplinary team of researchers must work together to develop a plan that is specific to each patient.

Keywords: Ventricular septal rupture; acute myocardial infarction; transthoracic echocardiogram.

1. INTRODUCTION

Acute myocardial infarction (AMI) can result in the rare but deadly consequence of ventricular septal rupture (VSR) [1]. Rupture can happen anywhere anatomically and results from full-thickness (transmural) infarction of the ventricular septum. Similar rates of ventricular septal rupture appear to occur in anterior and inferior/lateral infarctions [2]. Septal rupture has a bimodal pattern, occurring most frequently on the first day, on days three through five, and infrequently more than two weeks after infarction [3].

Irrespective of hemodynamic stability at the initial diagnosis, the American College of Cardiology Foundation and American Heart Association (ACCF/AHA) currently advocate urgent surgical correction [4]. When patients have surgery right away, they have a better chance of long-term survival. It might be necessary to do concurrent coronary artery bypass grafting (CABG). Inclusion of CABG has increased long-term survival. The time from the beginning of acute MI to the surgery was the most crucial factor affecting operative mortality and in-hospital survival. Operative mortality is strongly related to the gap between MI and surgical repair [5,6].

Men are far more frequently affected than females by VSR. The incidence of VSR dropped to 0.17–0.31 percent once reperfusion treatments were adopted as the gold standard for treating AMI [7]. Nevertheless, the death rate from VSR remains exceedingly high, ranging from 45 to 80 percent, despite advancements in the early detection and treatment of both AMI and VSR [8-10].

According to studies, children who undergo primary PCI after myocardial infarction had a lower occurrence of VSR than those who receive delayed or elective PCI. Out of a total of 1,48,881 patients with their first AMI, 408 (0.27 percent) individuals had VSR, according to a study by Moreyra AE et al. [2] based on the MIDAS database. As per a local study by Rehman A et al. [11], 53.3 percent of people with post-MI ventricular septal defects died in hospitals.

To the best of our knowledge, no data are available on the magnitude of this lethal complication in our population. With third world medical facilities, low literacy rate, and late access to medical care may aggravate this life threatening complication in our population as compared to western world. The purpose of the study was to determine the frequency of ventricular septal rupture in patients of acute myocardial infarction presented at the adult cardiology department of National Institute of Cardiovascular Disease (NICVD), Karachi.

2. METHODS AND MATERIALS

A cross-sectional study was conducted at the National Institute of Cardiovascular Disease, Karachi, Pakistan for a period of six months.

A non-random consecutive sampling technique was adopted to recruit the participants in the study. Sample size was calculated using WHO sample size calculator version 2.0. Past study reported extremely small frequency (0.27%) of VSD in AMI patients [2]. Sample size was calculated using incidence rate approach with relative precision. Using WHO sample size calculator with relative precision of 10% and 95% confidence interval a sample of n=384 AMI patients was calculated.

Patients who fulfilled the following criteria were included in this study: i) Patients between 30 years to 70 years of age, ii) Either gender, iii) Acute Myocardial Infarction diagnosed within 4 weeks duration. Patients with any of the following conditions was excluded from this study: i) old Cases of MI, ii) Chronic Kidney Disease, iii) Prior History of stroke

Study was conducted after taking approval from the ethical review committee of the institution. Patients of acute MI presenting at Adult Cardiology Department of NICVD, Karachi, fulfilling the inclusion criteria, were enrolled in this study after taking informed consent by the principal investigator. Demographic characteristics (gender, age (years)) and patient's history of diabetes mellitus, hypertension and smoking were recorded for all

patients. Diagnosis of AMI was made based on the criteria defined in operational definition. ECG and transthoracic echocardiogram (TTE) was formed by experienced staff for all patients. Patients was followed during their hospital stay (maximum 7 days) and study outcome such as, Ventricular Septal rupture (VSR), defect in inter ventricular septum, evidence of left-to-right shunt, and location of VSR was recorded as per the operational definitions for all patients by principal investigator. Data was collected on a pre-designed structured questionnaire. To avoid the biases in the diagnosis of VSR, echocardiographic finding was evaluated by three independent echocardiologists (with more than 5 years of experience) upon agreement of at least two VSR was labeled for the patient. Confounding variables was controlled by strictly following inclusion and exclusion criteria and through stratification. Patient information was kept secured and available to authorized persons only.

Data analysis was conducted using IBM SPSS Statistics for Windows, Version 21.0 (Armonk, NY: IBM Corp). Mean ± SD, minimum, and maximum was calculated for age (years) of the patient. Frequencies and percentages was computed for qualitative variables like gender, age groups, comorbid conditions i.e. DM, hypertension, smoking, and study outcome (Ventricular Septal rupture (VSR), defect in inter ventricular septum, evidence of left-to-right shunt, and location of VSR).

Through stratification, confounding variables such gender, age groups, diabetes, hypertension, and smoking were managed. Post stratification chi-square test or fisher exact test was applied. Two sided p-value of ≤ 0.05 was taken as criteria of statistical significance.

3. RESULTS

A total of 384 patients with acute myocardial Infarction diagnosed within 4 weeks duration were included in this study. Most of the patients were above 40 years of age. The average age of the patients was 54.40 ± 7.99 years (Table 1). There were 74.22% (285/384) male and 25.78% (99/384) female. Comorbid diabetic mellitus was observed in 59.11% and 68.75% were hypertensive. 33.85% patients were active smokers (Table 1)

Frequency of ventricular septal rupture in patients of acute myocardial infarction was observed in 1.3% (5/384) as presented in which defect in Inter ventricular septum was observed in 60%, Evidence of left-to-right shunt 40% (Table 2).

Table 1. Sociodemographic and Clinical characteristics of patients

Characteristics	Mean±SD/ N(%)
Age Groups	54.4 ± 7.99
≤40 Years	24 (6.3%)
41-50 Years	111 (28.9%)
51-60 Years	167 (43.5%)
61-70 Years	82 (21.4%)
Gender	
Male	285 (74.2%)
Female	99 (25.8%)
Diabetes mellitus	
Yes	227 (59.11%)
No	157 (40.89%)
Hypertension	
Yes	264 (68.75%)
No	120 (31.25%)
Smoker	
Yes	130 (33.85%)
No	254 (66.15%)

Table 2. Characteristics of ventricular septal rupture

	N (%)
Ventricular septal rupture	
Yes	5 (1.3%)
No	379 (98.7%)
Secondary outcome	
Defect in Inter ventricular septum	3 (60%)
Evidence of left-to-right shunt:	2 (40%)
Location of VSR	
Basal Septum	3 (60%)
Apical Septum	2 (40%)

Rate of ventricular septal rupture was not significant among different age groups (p=0.855). Similarly, the rate of ventricular septal rupture was also not significant between male and female (p=0.99) as well as in hypertensive and diabetic mellitus cases. The study revealed that there was a significantly higher frequency of ventricular septal rupture in patients who were active smokers as shown in Table 3.

4. DISCUSSION

Although early detection and treatment of both AMI and VSR have improved, the death rate

from VSR is still very high, ranging from 45 to 80 percent [2,8]. In this study to determine the frequency of ventricular septal rupture in patients of acute myocardial infarction, a total of 384 patients, of either gender and between 30 years to 70 years of age, with acute myocardial Infarction diagnosed within 4 weeks duration were included. The majority of our patients were men. As there were 74.22% were males and 25.78% were females. This is consistent with past investigations, although it differs from the results of the GUSTO-I and SHOCK trials, where it was shown that females predominated [12,13]. We found most of the patients in our study were above 40 years of age and the average age of the patients was 54.40±7.99 years which appears consistent with observed in the pre thrombolytic studies but lower than the GUSTO-I trial and SHOCK trial [14,15].

In patients receiving thrombolysis in the GUSTO-I trial, the incidence of post-infarction VSR was 0.2% [8]. Patients who underwent initial percutaneous coronary intervention reported experiencing a comparable incidence [2]. Cardiogenic shock complicated the AMI in 3.9% of patients with post-infarction VSR in the SHOCK Trial Registry [16]. The prevalence of these problems has significantly decreased over the past few decades as a result of reperfusion therapy's continued widespread introduction [17]. Despite a general decline in occurrence, ventricular septal defect continues to be a highly unfavorable clinical predictor. We discovered that 1.3 percent of patients with acute myocardial infarction experienced ventricular septal rupture. The ventricular septum rupture is the most prevalent form of myocardial rupture, occurring in 85% of cases. Less frequently occurring types include the rupture of the free left ventricular wall with the development of cardiac tamponade (10%) and the rupture of the papillary muscle with progression to acute mitral regurgitation in approximately 5 percent cases [18]. In our study out of 1.3% ventricular septal rupture 60% were observed as defect in Inter ventricular septum and evidence of left-to-right shunt 40%.

Numerous researchers have assessed risk variables linked to VSR development [3,8]. Hypertension, older age, women, lack of angina or prior MI, anterior wall MI, and high Killip class are some of the risk factors. In our study, the rate of ventricular septal rupture was not significant among different age groups (p=0.855), was also not significant between male and female (p=0.99), in hypertensive, diabetic mellitus cases. In previous investigations, the prevalence of diabetes in VSR populations was shown to range from 11 to 39 percent [13,19]. Smoking is a widely acknowledged risk factor for coronary artery disease (CAD) worldwide [20,21]. Tobacco users with coronary heart disease also have more fatalities and other negative outcomes [22,23]. In our study 33.85% of patients were smokers and Rate in ventricular septal rupture was significant in smokers. In conclusion, our study findings were in accordance with the current literature.

Table 3. Stratification of ventricular septal rupture

Parameters	Ventricular Septal Rupture		p-value
	Yes	No	
Age Groups			**0.855**
≤40 Years	0 (0%)	24 (100%)	
41-50 Years	1 (0.9%)	110 (99.1%)	
51-60 Years	3 (1.8%)	164 (98.2%)	
61-70 Years	1 (1.2%)	81 (98.8%)	
Gender			**0.999**
Male	5 (1.4%)	353 (98.6%)	
Female	0 (0%)	26 (100%)	
Diabetes mellitus			**0.652**
Yes	4 (1.8%)	223 (98.2%)	
No	1(0.6%)	156 (99.4%)	
Hypertension			**0.33**
Yes	5 (1.9%)	259 (98.1%)	
No	0 (0%)	120 (100%)	
Smoker			**0.047**
Yes	4 (1.8%)	126 (96.9%)	
No	1 (0.6%)	253 (99.6%)	

5. CONCLUSION

Our study revealed a ventricular septal rupture (VSR) rate of 1.3%. The study further revealed a correlation between smoking and rate of VSR. VSR is an uncommon but fatal consequence of an acute myocardial infarction is ventricular septal rupture. Most people die if the defect is not healed. Once a condition has been identified, it can be treated using a variety of methods, including palliative care, aggressive medication treatment, MCS, surgical repair, transcatheter closure, and innovative surgical/percutaneous hybrid procedures. Regarding the date of the repair, there is still uncertainty. A multidisciplinary team of researchers must work together to develop a plan that is specific to each patient.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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