



Original Article

# IN-HOSPITAL OUTCOME OF PATIENTS WITH MITRAL REGURGITATION AFTER ACUTE ST-ELEVATION MYOCARDIAL INFARCTION

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### ABSTRACT

**Objectives:** To determine the frequency and in-hospital outcome of patients presenting with Mitral Regurgitation (MR) in Acute ST-Elevation Myocardial Infarction (STEMI).

**Materials and methods:** This descriptive study was conducted at the Department of Cardiology, Punjab Institute of Cardiology, Lahore from April to September 2010. After fulfilling the inclusion criteria 350 patients presenting with STEMI were studied. Demographic data, name, age, gender, and address were recorded on a predesigned proforma. Patients were assessed on transthoracic echocardiography by a consultant for presence or absence of mitral regurgitation. Patients were kept in the ward for at least three days. They were examined by the ward consultant for pulmonary edema or death immediately after diagnosis of mitral regurgitation and then every eight hours for the following three days.

**Results:** There were 160(45.7%) males and 190(54.3%) females with a mean age of 55.4±8.9 years. Among 350 patients 135(38.6%) had mitral regurgitation and 215(61.4%) had no MR during the hospital stay. In the MR group MR observed was mild in majority 92(68.1%) of cases while it was moderate in 29(21.5%) and severe in 14(10.4%) patients. Overall in-hospital mortality was 44(12.6%), 20(14.8%) in MR group and 24(11.2%) in No MR group. Heart failure/acute pulmonary edema occurred in 84(24%) patients, 63(46.7%) in MR group and 21(9.8%) in No MR group. Among the study patients 222(63.4%) had uneventful discharge more 170(79.1%) in No MR group as compared to 52(38.5%) in MR group.

**Conclusion:** There is high frequency of MR after MI in our population and mostly sufferers of this complication are females and elderly patients. MR if present after MI is associated with poor outcome in terms of death and acute heart failure.

**Key Words:** ST elevation myocardial infarction, mitral regurgitation.; in-hospital mortality

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### INTRODUCTION

Myocardial infarction(MI) is the leading cause of death in the United States and in most industrialized nations throughout the world. Approximately 450,000 people in the United States die from coronary disease per year.<sup>1</sup> The survival rate for U.S. patients hospitalized with MI is approximately 95%. This represents a significant improvement in survival and is related to improvements in emergency medical response and treatment strategies.

Complications of MI include arrhythmias, me-

chanical, inflammatory (early pericarditis and post-MI syndrome) sequelae, as well as left ventricular mural thrombus (LVMT). In addition to these broad categories, right ventricular (RV) infarction and cardiogenic shock are other possible complications of acute MI.

There are three major mechanical complications of acute MI, rupture of the left ventricular free wall, rupture of the interventricular septum and the development of mitral regurgitation. One study compared 225 patients who had a first MI and experienced one of these complications to 1012 patients with a first MI without these mechanical complications.<sup>2</sup> Delayed hospitalization (≥24 hours), undue physical activity, and post infarction angina increased the risk of rupture in predisposed patients.

The causes of mitral regurgitation (MR) after acute MI include ischemic papillary muscle displacement (previously known as papillary muscle

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dysfunction), left ventricular dilatation or true aneurysm, and papillary muscle or chordal rupture.<sup>3,4</sup> Ischemic mitral regurgitation is mitral insufficiency caused by myocardial infarction.<sup>5</sup> It results from local and global LV remodeling and that is an independent predictor of heart failure and death. MR typically occurs 3-10 days after an AMI, though this onset may vary according to the mechanism of MR. Papillary muscle rupture resulting in MR occurs within 1-14 days (median, 1 d).

Mild-to-moderate MR is often clinically silent and detected on Doppler echocardiography performed during the early phase of AMI. In this case, MR rarely causes hemodynamic compromise. Severe acute MR that results from the rupture of papillary muscles or chordae tendineae results in abrupt hemodynamic deterioration with cardiogenic shock. Rapid diagnosis, hemodynamic stabilization, and prompt surgical intervention are needed because acute severe MR is associated with a high mortality rate.

This study was designed to determine the frequency and in-hospital outcome of patients presenting with Mitral Regurgitation in Acute ST-Elevation Myocardial Infarction.

## MATERIAL AND METHODS

This descriptive study was conducted at the Department of Cardiology, Punjab Institute of Cardiology, Lahore from April to September 2010.

Sample size of 350 cases was calculated with 95% confidence level, 4% margin of error and taking expected percentage of death i.e. 20% in patients of acute ST-elevation myocardial infarction having MR. Non-probability, purposive sampling technique was used.

Inclusion criteria were both genders, between 30-70 years of age. History of acute chest pain of more than 30 minutes with ST segment elevation on ECG in at least two consecutive leads and raised cardiac enzymes/troponin T/I.

Exclusion criteria were patients with documented rheumatic heart disease (Mitral / Aortic valve disease etc.) on history and Echocardiography. Presence of congenital heart disease (Tetralogy of Fallot, atrial septal defect, ventricular septal defect etc.) documented by echocardiography. Patients with previous history/record of ischemic heart disease (CABG/PCI/previous infarction/ischemic cardiomyopathy).

Acute Myocardial Infarction was defined as chest pain of more than 30 minutes, with ST seg-

ment elevation of  $\geq 2$ mm in chest leads or  $\geq 1$ mm in limb leads on ECG in  $\geq 2$  consecutive leads and raised cardiac enzymes/troponin T/I.

Mitral Regurgitation was the presence of regurgitant blood flow, through mitral valve during systole on echocardiography confirmed by colour doppler. Graded as

Mild: Colour Doppler jet area less than 20% of Left Atrial (LA) area

Moderate: Colour Doppler jet area 20-40% of LA area

Severe: Colour Doppler jet area  $>40\%$  of LA area

In-hospital outcome was assessed by evaluating the following:

Pulmonary Edema: Diagnosed on chest auscultation as fine inspiratory basal crackles

Death: No electrical activity on ECG (within hospital stay)

## Data collection procedure:

Patients from Cardiology department of PIC Lahore were enrolled in study after fulfilling the inclusion criteria. Procedure of research was explained to the patient and informed consent was taken. Demographic data, name, age, gender, and address was recorded on the attached proforma. Patients were assessed on transthoracic echocardiography by the consultant for presence or absence of mitral regurgitation. Severity of MR would act as effect modifier and addressed through stratification. Patients were kept in the ward for at least three days. They were examined by the ward consultant for pulmonary edema (fine inspiratory basal crackles on chest auscultation) or Death (No electrical activity on ECG) immediately after diagnosis of mitral regurgitation and then every eight hours for the following three days.

## DATA ANALYSIS:

Data was analyzed using SPSS version 11. Continuous variables like age were expressed as mean  $\pm$  standard deviation. Categorical variables like gender, presence or absence of MR, pulmonary edema and death were expressed as frequencies and percentages. Data was stratified for severity of MR.

## RESULTS

There were 160(45.7%) males and 190(54.3%) females with a mean age of  $55.4 \pm 8.9$  years. Among 350 patients 135(38.6%) had mitral regurgitation and 215(61.4%) had no MR during the hospital stay. Out of 160 male patients 51(37.8%) were present



in MR Group and 109(50.7%) in No MR Group. More female patients 84(62.2%) were present in MR Group as compared to 106(49.3%) in No MR Group. Mean age of patients with MR was 57.4±9.2 years and mean age of patients without MR was 54.3±8.6 years. In order to stratify patients for age, the study population was divided into three Groups, Group I, 30-50 years 68(19.4%) with 21(15.6%) in MR Group and 47 (21.8%) in No MR Group, Group II, 51-60 years 197(56.3%) with 43(31.8%) in MR Group and 154(71.7%) in No MR Group, Group III, 61-70 years 85(24.3%) with 71(52.6%) in MR Group and 14(6.5%) in No MR Group. Table 1.

In the MR Group MR observed was mild in majority 92(68.1%) of cases while it was Moderate in 29(21.5%) and Severe in 14(10.4%) patients. Table 2.

Overall in-hospital mortality was 44(12.6%), 20(14.8%) in MR Group and 24(11.2%) in No MR Group. Heart failure/acute pulmonary edema occurred in 84(24%) patients, 63(46.7%) in MR Group and 21(9.8%) in No MR Group. Among the study patients 222(63.4%) had uneventful discharge more 170(79.1%) in No MR Group as compared to 52(38.5%) in MR Group. Table 3.

SEVERITY OF MR	MR n=135	No MR n=215	Total n=350
Mild	92(68.1%)	47(21.8%)	139(39.7%)
Moderate	29(21.5%)	154(71.7%)	183(52.2%)
Severe	14(10.4%)	14(6.5%)	28(7.9%)
Uneventful Discharge	52(38.5%)	170(79.1%)	222(63.4%)

MI are admitted yearly to coronary care units in the United States.<sup>8</sup> Of particular concern from a global perspective are projections that the burden of disease in developing countries will become similar to those now afflicting developed countries.<sup>7</sup> Given the wide disparity of available resources to treat STEMI in developing countries, major efforts are necessary on an international level to strengthen primary prevention programs at the community level.<sup>9,10</sup>

The short-term mortality rate of patients with STEMI who receive aggressive pharmacological reperfusion therapy as part of a randomized trial is in the range of 6.5 to 7.5 percent,<sup>11</sup> whereas observational data bases suggest that the mortality rate in STEMI patients in the community is 15 to 20 percent. Complications of Myocardial infarction emerge as one of the principal determinants of mortality in patients with STEMI.<sup>12</sup> There are three major mechanical complications of acute myocardial infarction (MI): rupture of the left ventricular free wall; rupture of the interventricular septum; and the development of ischemic mitral regurgitation.

Ischemic mitral regurgitation is mitral insufficiency caused by myocardial infarction. The causes of MR after acute MI include ischemic papillary muscle displacement (previously known as papillary muscle dysfunction), left ventricular dilatation or true aneurysm, and papillary muscle or chordal rupture. MR typically occurs 3-10 days after an AML, though this onset may vary according to the mechanism of MR. Papillary muscle rupture resulting in MR occurs within 1-14 days.

Ischemic mitral regurgitation may present suddenly in association with AML or chronically with CHF as a late manifestation of postinfarction ventricular remodeling. In all cases (by definition) the valve leaflets and subvalvular apparatus are struc-

**Table 1. Baseline characteristic of the patients (n=350)**

Characteristics	MR n=135	No MR n=215	Total n=350
Age mean years			
Age groups			
30-50 years	21(15.6%)	47(21.8%)	68(19.4%)
51-60 years	43(31.8%)	154(71.7%)	197(56.3%)
61-70 years	71(52.6%)	14(6.5%)	85(24.3%)
Gender			
Male	51(37.8%)	109(50.7%)	160(45.7%)
Female	84(62.2%)	106(49.3%)	190(54.3%)

**Table 2. Distribution of patients according to the severity of MR.**

**Table 3. Distribution of patients by outcome**



turally normal. Whether, when, and to what degree IMR develops is dependent on the size, transmural, and location of the MI. Mild-to-moderate MR is often clinically silent and detected on Doppler echocardiography performed during the early phase of AMI. In this case, MR rarely causes hemodynamic compromise. Severe acute MR that results from the rupture of papillary muscles or chordae tendineae results in abrupt hemodynamic deterioration with cardiogenic shock. Rapid diagnosis, hemodynamic stabilization, and prompt surgical intervention are needed because acute severe MR is associated with a high mortality rate. Acute ischemic MR is seen with increased frequency in anterior wall infarction, more extensive wall motion abnormalities, a persistently occluded infarct related artery, larger end-systolic and end-diastolic ventricular volumes, and severe heart failure.

Mitral regurgitation is known to be a frequent complication of AMI. When present, it may exhibit a broad range of severity, from clinically evident and hemodynamically obvious to clinically silent and detected only as an incidental finding on catheterization or Doppler echocardiography. Ischemic MR following MI is associated with increased mortality.

In the present study, 350 patients of acute MI were included. In the study population, 45.7 % were male and 54.3 % were female, 19.4% patients were in the age group of 30-50 years, 56.3% patients were in the age group of 51-60 years and 24.3% patients were in the age group of 61-70 years. In the study group 38.6 % patients suffered from MR as the complication of MI. Of all the patients who suffered from MR, 68.1% suffered from mild, 21.5 % from moderate and 10.4% suffered from severe MR. Different frequency of MR have been reported in previous studies. Kenneth G, et al investigated that the mitral regurgitation occurring early in the course of acute myocardial infarction with respect to its incidence and its influence on prognosis in 206 patients within 7 hours of symptom onset during their first myocardial infarction. Mitral regurgitation was present in 27 patients (13%). Barzilai et al<sup>13</sup> found an MR murmur present on admission in 9% of patients with acute MI and present sometime during the hospitalization in 20%. Heikkila et al<sup>14</sup> described a murmur suggestive of MR in 55% of MI patients, and Bhatnagar and Yusuf<sup>15</sup> used color-flow Doppler to confirm that 9% of post-MI patients who had a murmur

compatible with MR did, indeed, have MR. More recently, angiographic studies reported by Lehmann et al<sup>16</sup> and Tchong et al<sup>17</sup> reported incidences of post-MI MR of 13% and 17.9% of patients within hours of infarction, respectively. Between 17% and 55% of patients develop a mitral systolic murmur or echocardiographic evidence of IMR early after acute myocardial infarction.<sup>18</sup> Of patients who have cardiac catheterization within 6 hours of the onset of symptoms of AMI, 18% have IMR.<sup>19</sup> In 3.4% of these patients, the degree of mitral insufficiency is severe.<sup>19</sup>

In the present study, mostly elderly and female patients suffered from MR after MI. The results show that 52.6% patients with age 61 to 70 years suffered from MR. The results show that 37.8% patients were male and 62.2 % patients were female among the patients who suffered from MR after MI. This finding was also recorded in other studies. Aronson et al studied the incidence of Ischemic Mitral Regurgitation and the Risk of Heart Failure after acute Myocardial Infarction. The study population consisted of the 1190 patients. Echocardiography was performed during the hospital stay at a median of 2 days (interquartile range, 1-3 days) after admission. Mild ischemic MR was present in 473 patients (39.7%) and moderate or severe ischemic MR in 75 patients (6.3%) (67 patients with moderate ischemic MR and 8 patients with severe ischemic MR). Patients with MR were more likely to be older. The mean age of patients with mild MR was 64 + 12 and patients with moderate to severe MR were 69 + 13. Among patients with MR 66 % patients were female. The results are similar to present study. Similar data on the demographics of MR after AMI have been presented by Lehmann,<sup>16</sup> Tchong,<sup>17</sup> and Barzilai.<sup>13</sup> The results of present study were similar to these studies.

In the present study, poor outcome of the patients suffered from MR after MI was recorded in terms of death and acute pulmonary edema. The study shows that 12 % of the patients died and 46.7 % developed acute pulmonary edema after development of MR as a complication of MI. The study also shows that mostly patients suffering from this poor outcome were elderly and female. Lamas et al<sup>20</sup> studied a cohort consisting of 727 patients. MR was present in 141 patients (19.4%). Severe (3+) MR was present in only 2 patients. Patients with MR were more likely to experience cardiovascular mortality, severe heart failure, and the combined end point of cardiovascular mortality, severe heart failure, or recurrent myocardial infarction.



Barzilai et al<sup>13</sup> found that AMI patients with a murmur suggestive of MR had a 12-month mortality of 36% compared with 15% for patients without an MR murmur. However, correction for differences in baseline variables indicated that the presence of an MR murmur was not an independent predictor of outcome. In contrast, Lehmann et al<sup>16</sup> found that MR present on left ventriculography within 7 hours of MI was an independent predictor of survival at 1 year. Tcheng et al<sup>17</sup> also found that moderately severe to severe MR appeared to be a likely independent predictor of impaired survival. Barzilai et al<sup>13</sup> studied the significance of Doppler-detected mitral regurgitation in acute myocardial infarction. To define the incidence of mitral regurgitation and elucidate its potential contribution to the development of severe congestive heart failure after acute myocardial infarction, doppler echocardiograms were obtained within 48 hours of onset of AMI in 59 patients. MR was detected in 23 of the 59 patients (39%). Patients with MR

were older. Mortality determined 8 to 14 months after the index AMI was 48% (11 of 23) in patients with MR but only 11% (4 of 30) in those without it (p less than 0.01).

#### STUDY LIMITATIONS

The sample size of the study was small as compared to other international studies; moreover the results in our study cannot be applied to general population as this was a single hospital based study. However it provides significant data regarding mitral regurgitation among the patients of acute myocardial infarction.

#### CONCLUSION

In conclusion, the findings of the present study indicate that there is high frequency of IMR after MI in our population and mostly sufferers of this complication are female and elderly population. IMR if present after MI is associated with poor outcome in terms of death and acute heart failure. Early detection and management can reduce the mortality of this complication.

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