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Original Article

Prevalence and 2D Echocardiographic, Color Doppler Assessment of Mitral Regurgitation in Acute STEMI patients at Tertiary Care Center

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Abstract

Introduction: Acute mitral regurgitation (MR) is a frequent complication of acute myocardial infarction (MI), with a variable presentation depending on the severity of MR and the integrity of the subvalvular apparatus. Several pathogenic mechanisms and dynamics may lead to ischemic MR after an acute MI.

Purpose: The purpose of this study is to assess the prevalence of MR in acute MI and to compare the clinical profile and outcome of acute MI in patients with and without MR.

Materials and Methods: The patient who was included in the study underwent 12 leads electrocardiograms and got their CBC, FLP, RBS, FBS, PPBS, and CKMB done. 2-D echocardiography and color Doppler study were done to assess left ventricular ejection fraction (LVEF) and severity of MR and further followed up 1-month postdischarge.

Results: In this study, the mean age group of cases was 53 ± 11 years. Out of total cases, 38% had hypertension, 26% were diabetic and 77% cases were chronic smokers. Most of the cases, 63.8% had anterior wall MI (AWMI), followed by inferior wall MI (IWMI) in 34.3%. Ischemic MR was present in 54.3%, of which 45.7% had mild MR. Severe grade of ischemic MR was not detected in any of the cases. The analysis of the association between age and severity of ischemic MR showed a positive correlation. "The correlation coefficient was 0.36, $P = 0.002$".

Conclusion: Ischemic MR is common in STEMI patients, it presents more frequently in IWMI as compared to AWMI cases and is usually seen in the elderly male. No statistically significant correlation was found between LVEF and cardiovascular risk factors.

Key words: Cardiovascular disease risk, Ischemic mitral regurgitation, Left ventricular ejection fraction, STEMI

INTRODUCTION

Cardiovascular and circulatory diseases are now recognized as the leading causes of death in the world. In 2013, there were >54 million deaths globally and 32% of these deaths or 17 million (95% UI, 16.5–18.1 million), were attributable to cardiovascular disease (CVD). The majority of these CVD deaths were attributable to either ischemic heart disease or cerebrovascular disease. In contrast to developed countries, where mortality from CHD is rapidly declining, it is increasing in developing countries. This increase is driven by industrialization, urbanization, and related lifestyle changes and is called epidemiological transition.[1]

According to 2010–2013 RGI data, proportionate mortality from CVD increased to 23% of total and 32% of adult deaths in the years 2010–2013. The mortality varies from <10% in rural locations in less developed states to >35% in more developed urban locations. There is a linear relationship of increasing proportionate CVD mortality with the regional Human Development Index, which confirms the presence of the epidemiological transition introduced earlier.[2]

The risk factors include dyslipidemia, smoking or tobacco use, known hypertension, known diabetes, abdominal obesity, physical inactivity, low fruit and vegetable intake,

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and psychosocial stress.[3] Acute mitral regurgitation (MR) is a frequent complication of acute myocardial infarction (MI), with a variable presentation depending on the severity of MR and the integrity of the subvalvular apparatus. Several pathogenic mechanisms and dynamics may lead to ischemic MR after an acute MI.[4]

These mechanisms include papillary muscle ischemia and changes in left ventricular (LV) geometry. Papillary muscle dysfunction, as well as partial/complete rupture of a papillary muscle or mitral chordae may cause hemodynamic instability due to acute MR, with subsequent pulmonary edema or cardiogenic shock, eventually resulting in poor short-term outcomes.[5]

The advent of primary percutaneous coronary intervention, which is one of the most important therapeutic interventions for acute ST elevation MI in the present era, reduced the general incidence of mechanical complications (<1%).[6,7] Nevertheless, mortality due to mechanical complications following an acute MI remains unacceptably high (around above 50%), and cardiogenic shock is still as an important cause of early mortality despite improvements in therapeutic strategies, complicating 3–7% of cases with acute MI.[8]

In several trials, it has been observed that a higher proportion of cardiogenic shocks were caused by acute MR in women. Tran thoracic echocardiography (TTE) with color flow Doppler is the initial imaging modality, having a sensitivity of 65–85% for the diagnosis of papillary muscle rupture with concomitant MR.[9,10]

The purpose of this study is to assess the prevalence of MR in acute MI and the objective is to compare the clinical profile and outcome of acute MI in patients with and without MR.

MATERIALS AND METHODS

This cohort study was conducted in the Department of Cardiology, Superspeciality Hospital, N.S.C.B. Medical College Jabalpur, a tertiary care center in Central India. All patients with a diagnosis of acute ST-elevation MI, according to American College of Cardiology criteria[10] were included during a period from March 2022 to June 2023. Patients with a previous history of MI, heart failure, Patients having organic mitral valve disorders (rheumatic heart disease, chronic autoimmune disease, and mitral valve prolapsed) and who had previous mitral surgery are excluded from the study.

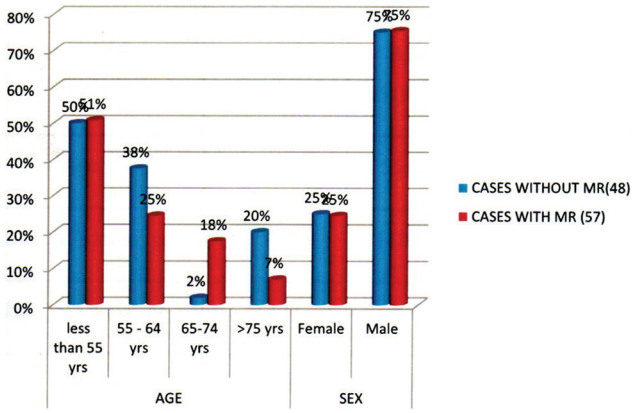
The patient's demographic information, coronary artery risk factors and MI territory with respect to electrocardiographic and echocardiographic changes, and medical treatment therapeutic modalities were recorded and further followed up for 1-month postdischarge. All studied patients are evaluated and counseled for coronary artery disease risk factors such as diabetes mellitus, hypertension, obesity, dyslipidemia, tobacco use, and family history of CVDs.

All patients underwent relevant blood investigations like complete blood count, fasting blood sugar, random blood sugar, fasting lipid profile, and CKMB. All studied patients underwent on admission and serial 12 lead computerized electrocardiogram to establish the diagnosis of ST elevation MI and Echocardiograms were obtained using GE E 90 machine with a 2.5–3.5 MHz probe by an experienced echo cardiologist during hospitalization. MR was considered ischemic if the mechanism identified in the echocardiogram was ischemic in nature according to the American Society of Echocardiography guideline. For the statistical analyses, the statistical software SPSS version 16.0 for Windows (SPSS Inc., Chicago, IL) was used.

RESULTS

Altogether, 105 patients were enrolled in this study, and 79% of the patients were male. The mean age group of cases was 53 ± 11 years. Out of the total cases, 40 had hypertension, 28 were diabetic and 81 cases were chronic smokers. Most of the cases, 63.8% of anterior wall MI (AWMI), followed by inferior wall MI (IWMI) in 34.3%. MR was present in 54.3%, and 45.7% of the total had mild MR.

Demographic and Clinical Profile of first acute Myocardial Infarction with and without MR

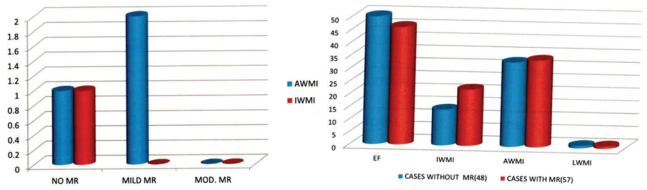


There were no significant differences between the patients with ischemic MR and those without ischemic MR regarding age 56 ± 12 years and 52 ± 10 years ($P = 0.096$). There was no significant difference in SBP on admission

between cases with ischemic MR and without ischemic MR (118 ± 32 mmHg and 118+21 mmHg, $P = 0.9$). There was no significant difference in having DM between patients with and without ischemic MR (17(29.8%), 11(22.9%), $P = 0.42$).

Dyslipidemia was present in 18 (31.5%) cases of patients with ischemic MR, while it was present in 11 (22.9%) cases of patients without ischemic MR, making the statistical difference insignificant ($P = 0.2$). 55(96.4%) cases of patients with ischemic MR survived at the end of 1-month follow-up. In comparison, 46 (95.8%) cases of patients without ischemic MR survived at the end of 1 month, again making it statistically insignificant difference (0.86).

Clinical Profile of Acute MI Patients Outcome at 1 Month Follow Up



There was no significant difference in ejection fraction between cases with ischemic MR and those without ischemic MR (46 ± 13, 50 ± 13, 0.18). 22 (61%) IWMI cases had ischemic MR, while 14 (38%) cases of IWMI did not develop ischemic MR. 34 (50.7) AWMI cases developed ischemic MR, while 33 (49.2%) did not develop ischemic MR. A total of 3 cases of AWMI died at 30 days interval. Of which 2 had mild ischemic MR and 1 case was without ischemic MR. In the case of IWMI without ischemic MR died at 30 days interval.

The analysis of the association between age and severity of MR showed a positive correlation. "The correlation coefficient was 0.36, $P = 0.002$". Altogether, 105 patients were enrolled in this study, and 79% of the patients were male. The mean age group of cases was 53 ± 11 years. There was no statistically significant association found between the presence of MR and arterial hypertension, diabetes, dyslipidemia, or smoking between the groups, those with MR and those without it.

Ischemic MR of varying degrees was reported in 57 (54, 3%) patients and ischemic MR was not present in 48 (45, 7%) patients. Mild degree of ischemic MR was present in 48 (45.7%) cases, while 9 (8.6%) had moderate ischemic MR. A severe grade of ischemic MR was not detected in any of the cases. There was a significant association seen between IWMI and its association with the development of ischemic MR.

STEMI cases without ischemic MR had a mean ejection fraction of 50 ± 13%, while it was 46 ± 13% in patients with ischemic MR ($P = 0.18$). There was no significant difference in ejection fraction in STEMI cases without ischemic mitral and in those with ischemic MR. The analysis of the association between age and severity of ischemic MR showed a positive correlation. "The correlation coefficient was 0.36, $P = 0.002$" Out of 105 cases, 4 (3.8%) died in 30 days duration. 2 (4%) cases of STEMI without ischemic MR and 2 (3.5%) cases of STEMI with ischemic MR died in 1-month duration ($P = 0.86$).

DISCUSSION

Ischemic MR and functional MR, in general terms, share important associated clinical determinants such as older age and female gender.[11-13] In this study, also higher grade of ischemic MR is associated with older age group, but there is no significant association found between ischemic MR and gender.

Pellizon *et al.*[14] reported that ischemic mitral regurgitation and diabetes mellitus or hypertension were not significantly related. In this study, ischemic MR was not associated with cardiovascular risk factors such as hypertension and diabetes mellitus. Previous studies reported a prevalence of MR after MI ranging from <20%, in angiographic studies,[15] 9–55% of patients by auscultation", and in 20–56% of patients by echocardiography.[15-17] These patients do not reflect all subjects with MI in the community,[18,19] which leaves uncertainties with regard to the broad applicability of these findings. After MI, MR is frequent and often silent, and this clinical observation in a large community-based cohort extends previous reports"[20,21] that indicated that in ischemic MR, the intensity of the murmur does not reflect the degree of regurgitation. Indeed, severe MR may even be silent because reduced ventricular function minimizes the atrioventricular gradient, regurgitant flow, and subsequent murmur.

In this study, ischemic MR was found in 54.3% cases. In the existing literature, the association between the location of MI and the presence of MR remains questionable. Although often reported as a complication of inferior MI[22] MR is also described as chiefly associated with anterior MI, whereas other studies reported no association"[23] location with MI. In this study, ischemic MR was significantly associated with IWMI.

Investigation of the mechanism of MR is not within the scope of the present study; however, these data are consistent with emerging concepts on the pathophysiology of ischemic MR, which may be more related to local and

global ventricular remodeling than to papillary muscle dysfunction.[24] Ventricular remodeling results in valvular tenting, loss of annular contraction, and ventricular deformation, all elements that converge to generate and increase the presence and severity of MR.[25,26]

Lehmann *et al.* reported an ischemic MR prevalence of 13% in 206 patients and the presence of MR predicted all-cause mortality at 1 year (no MR;5%, mild MR; 18.2%, moderate or severe MR; 60%). Lehmann *et al.* also reported 1-year cardiovascular mortality rates for no MR (2.8%), mild MR (18.2%), and moderate or severe MR (60%). In a study by Feinberg *et al.*, 417 AMI patients underwent Doppler echocardiography within the 1st 48 h of admission. Patients with no, mild, moderate, or severe MR had 30-day mortality rates of 3.3%, 6.6%, and 16% ($P = 0.01$), and all cause -year mortality rates of 4.8%, 12%, and 24% (<0.001), respectively.

In the CARDILLAC trial, an increased severity of MR was associated with a higher mortality rate at 30 days (no MR: 1.4%, mild MR: 3.7%, moderate or severe MR: 8.6%) and 1 year (no MR: 2.9%, mild MR: 8.5%, moderate or severe MR: 20.8%). In a study of 773 patients who underwent echocardiography within 30 days after MI, noted a graded positive association between the severity of MR and all-cause mortality during 5 years of follow-up 162 patients with no, mild, and moderate or severe MR had 5-year overall survivals of 72%, 62%, and 40%, respectively. In the present study, out of total of 105 cases, 3.8% ($n = 4$) died, 4% ($n = 2$) cases were without MR and 3.5% ($n = 2$) cases had ischemic MR. Of these 4 cases, 3 had AWMI, while 1 patient had IWMI. As the sample size was small and only 4 cases died; hence, statistical significance could not be drawn.

CONCLUSION

The mean age of STEMI cases was 53 ± 11 years, with an overall male–female ratio of 3.7:1. Ischaemic MR was detected in 54.3% of cases, with a mean age group of 56 plus/minus 12 years, with a male: female ratio 4.18:1. Mild MR was detected in 45.7% ($n = 48$) and moderate MR was present in 8.6% ($n = 9$) cases. Out of 105 cases, 38.1% had HTN, 26.7% were diabetics, 77.1% had history of smoking, while 27.6% had dyslipidemia. The region of MI was localized by electrocardiography. Out of 105 STEMI cases, 63.8% had AWMI, followed by 34.3% cases of IWMI. 50.7% AWMI cases had ischemic MR, while 61% cases of IWMI cases had ischemic MR. The occurrence of ischemic MR in STEMI cases was significantly associated with IWMI.

The mean ejection fraction of total STEMI cases was 48.33%. All the cases were followed after discharge for 1 month for assessment of mortality. Out of total of 105 cases, 3.8% died, 4% cases were without MR and 3.5% cases had ischemic MR. Out of these 4 cases, 3 had AWMI while 1 had IWMI. Ischemic MR was detected in 54.3% of STEMI cases.

There was no statistically significant association found between the presence of MR and cardiovascular risk factors and LV ejection fraction. Ischemic MR was more common in IWMI cases as compared to AWMI cases. The evaluation of MR is semi-quantitative and operator-assessed based on two-dimensional echocardiography, so interpretation bias cannot be completely ruled out. trans-oesophageal (TEE) has a superior sensitivity and diagnostic accuracy compared with trans-thoracic echocardiography (TTE).

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