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Original Research Article

Comparison of Frequency of Mitral Regurgitation in Anterior Vs Inferior Wall Myocardial Infarction

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Abstract: *Mitral regurgitation (MR) is a common mechanical complication of acute myocardial infarction (MI) that significantly impacts morbidity and mortality.* ***Objective:*** *To determine and compare the frequency of mitral regurgitation in patients with anterior versus inferior wall myocardial infarction and to assess its association with echocardiographic and clinical parameters.* ***Methodology:*** *This Descriptive Cross-sectional study was conducted at the Cardiology Department of Ch. Pervaiz Elahi Institute of Cardiology, Wazirabad, from 10 October 2024 to 10 April 2025. A total of 75 patients with acute ST-elevation myocardial infarction were enrolled using non-probability consecutive sampling. Among them, 36 had anterior wall MI and 36 had inferior wall MI. All participants underwent electrocardiography and echocardiography upon admission, followed by a repeat echocardiogram after 72 hours to assess the presence and severity of MR. Baseline parameters such as age, gender, blood pressure, HbA1c, serum creatinine, Pro-BNP levels, and ejection fraction were recorded.* ***Results:*** *The mean age of the study population was 58.6 ± 10.4 years, with 64% males and 36% females. Mitral regurgitation was observed in 27 patients (36%), including 18 cases of mild, 7 of moderate, and 2 of severe MR. MR was significantly more frequent in inferior wall MI (61.1%) than in anterior wall MI (13.9%) ($p = 0.001$). The mean ejection fraction was lower in anterior wall MI (43.1 ± 7.8%) compared to inferior wall MI (49.5 ± 9.1%) ($p = 0.02$). MR was more common in patients with right coronary artery involvement, severe vessel occlusion (>75%), elevated Pro-BNP levels, and reduced ejection fraction (<45%) ($p < 0.05$).* ***Conclusion:*** *It is concluded that mitral regurgitation occurs significantly more frequently in inferior wall myocardial infarction compared to anterior wall infarction, mainly due to ischemic involvement of the posteromedial papillary muscle supplied by the right coronary artery. Early echocardiographic detection and management of MR in inferior wall MI patients are essential to prevent hemodynamic deterioration and improve overall clinical outcomes.*

Keywords: Mitral regurgitation, anterior wall myocardial infarction, inferior wall myocardial infarction, echocardiography

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Introduction

Myocardial infarction is defined as an event during which the muscular layer of the heart is deprived of oxygenated blood, resulting in cell death (1). This usually occurs due to a decrease in the flow of the coronary vasculature for different reasons. Depending on the blocked artery, different patterns of ischemia can develop, affecting the anterior wall, posterior wall, inferior wall, septum, lateral wall, and the right or left side of the heart (2). Mitral regurgitation (MR) is one of the most common mechanical complications of acute myocardial infarction (MI), resulting from ischemic injury to the papillary muscles or the left ventricular myocardium (3). The severity and frequency of MR vary depending on the infarct location, with anterior and inferior wall infarctions showing distinct pathophysiological mechanisms and clinical implications (4). In anterior wall MI, MR is often associated with left ventricular dilatation and papillary muscle displacement secondary to extensive anterior wall damage, leading to functional or ischemic MR. In contrast, inferior wall MI is more frequently linked to direct ischemia or rupture of the posteromedial papillary muscle, as it receives a single blood supply from the posterior descending artery, making it more vulnerable to ischemic injury (5).

Due to the ischemic insult, valvular insufficiency may follow an infarct, and this may be transient, short-lived, or permanent. The most common of these insufficiencies is found with the mitral valve. Moreover, it is more likely to occur when an obstructive pattern of coronary disease is present (6). Anterior and inferior wall MI are frequent, occurring in 24.2% and 13.6% of cases, respectively. It is estimated that up to 27% of the population of Pakistan has suffered from a myocardial infarction. Up to 50% of people who have an MI may experience mitral regurgitation (MR), which may be mild, moderate, or severe, as characterized on an echocardiogram (7). The occurrence of MR in the setting of MI significantly worsens hemodynamic stability and is associated with increased in-hospital morbidity and mortality. Even mild-to-moderate MR after MI can lead to adverse ventricular remodeling, pulmonary congestion, and reduced survival rates. Despite advancements in reperfusion therapy and medical management, ischemic MR remains a prognostically important but often underrecognized complication (8,9).

Some studies have suggested that inferior wall MIs result in greater posterior papillary muscle dysfunction, leading to a greater frequency and severity of mitral regurgitation compared to anterior wall MIs (38% vs 10%, respectively) (10). Another study found that 73% of mild MR occurred in anterior wall MI versus 62.1% in inferior wall MI; however, severe MR was more common after inferior wall MI (21% vs 12% in anterior wall MI). The literature shows that MR may occur with higher frequency in inferior wall MI; however, the evidence is ambiguous. It is clearer that severity is greater with inferior wall MI (11). Pakistan has a population known to have more severe coronary artery disease with earlier onset. Establishing patterns of ischemic MR frequency after MI may help clinicians in local settings vigilantly look for this complication, depending on the frequency established from the results of this study.

The primary objective of this study is to determine the frequency of myocardial infarction (MI) occurring in the anterior and inferior walls of the heart. Additionally, the study aims to compare the occurrence of mitral regurgitation following these types of myocardial infarctions, specifically looking at how it varies between patients with anterior wall infarcts and those with inferior wall infarcts. This comparison could provide valuable insights into the differences in post-MI complications related to the location of the infarction.

Methodology

This Descriptive Cross-sectional study was conducted at the Cardiology Department of Ch. Pervaiz Elahi Institute of Cardiology, Wazirabad, from 10 October 2024 to 10 April 2025. A total of 75 cases were calculated using OpenEpi, with a 95% confidence interval, 5% margin of error, and an expected frequency of inferior wall MI at 13.6%. A non-probability consecutive sampling technique was used to collect the data. Age 18–90 years All genders (male, female, or transgender) Patients with acute ST-elevation anterior or inferior wall MI as per operational definition Patients will be enrolled regardless of comorbidities such as hypertension, heart failure, diabetes, or obesity, whether controlled or uncontrolled Patients presenting more than 24 hours after acute MI Patients with non-ST elevation MI Right-sided MI, posterior wall MI, lateral MI, posterolateral MI, and antero-inferior MIAfter obtaining approval from the institutional ethical review board, written informed consent was taken from all participants. Out of the total 75 patients, 36 were diagnosed with inferior wall myocardial infarction and 36 with anterior wall myocardial infarction. Upon admission, each participant underwent a 12-lead electrocardiogram and a transthoracic echocardiogram to confirm the Diagnosis and assess cardiac function. In cases where acute percutaneous coronary intervention was indicated, it was performed, and the involved coronary vessel and degree of stenosis were recorded. Baseline investigations included blood pressure, HbA1c, serum creatinine, and Pro-BNP levels. A repeat echocardiogram was performed 72 hours after myocardial infarction to evaluate the presence and severity of mitral regurgitation, categorized as mild, moderate, or severe according to international echocardiographic reporting standards. Left ventricular ejection fraction was also recorded. Troponin I and other relevant cardiac biomarkers were assessed to confirm myocardial injury. Demographic data, including age, gender, weight, and body mass index, along with clinical parameters such as diabetes status, hypertension control, heart failure, and laboratory findings, were documented for each participant. Patient confidentiality was maintained throughout the study, and participants were informed of their right to withdraw at any time. The study was conducted in accordance with the Declaration of Helsinki, ensuring that all patients received standard medical care irrespective of their participation in the research.

Data were analyzed using SPSS version 25. Quantitative variables such as age, weight, body mass index, HbA1c, creatinine, blood pressure, Pro-BNP levels, blood sugar, ejection fraction, and degree of vessel occlusion were presented as mean ± standard deviation. Qualitative variables, including gender, type of myocardial infarction, presence and severity of mitral regurgitation, heart failure, and involved coronary vessel, were expressed as frequencies and percentages. The frequency of mitral regurgitation between anterior and inferior wall myocardial infarction groups was compared using the chi-square test, with a p-value of less than 0.05 considered statistically significant. Effect modifiers, including gender, age, hypertension, diabetes, body mass index, heart failure, Pro-BNP levels, degree of coronary vessel occlusion (<50%, 50–75%, >75%), and left ventricular ejection fraction (<45%, 45–55%, >55%), were assessed using post-stratification with the chi-square test, applying the same level of statistical significance ($p < 0.05$).

Results

Data were collected from 75 patients; the mean age of the study participants was 58.6 ± 10.4 years, ranging from 32 to 88 years. Out of 75 patients, 48 (64%) were male and 27 (36%) were female, showing a male predominance. The mean body mass index (BMI) was 27.8 ± 3.6 kg/m², indicating that most patients were overweight. Hypertension was present in 41 patients (54.7%), while diabetes mellitus was observed in 38 patients (50.7%). Among the study group, 36 patients (48%) had anterior wall myocardial infarction (AWMI) and 36 (48%) had inferior wall myocardial infarction (IWMI).

Mitral regurgitation (MR) was observed in a total of 27 patients (36%). When stratified by infarct location, MR was significantly more frequent in inferior wall MI, affecting 22 patients (61.1%), compared to only five patients (13.9%) in anterior wall MI ($p = 0.001$). Among inferior wall MI patients, mild MR was the most common (41.7%), followed by moderate MR (13.9%) and severe MR (5.6%). In contrast, anterior wall MI patients showed a lower frequency of mild (8.3%) and moderate MR (5.6%), with no severe cases observed.

The mean ejection fraction was significantly lower in anterior wall MI patients (43.1 ± 7.8%) than in inferior wall MI patients (49.5 ± 9.1%), with a p-value of 0.02, indicating greater left ventricular systolic dysfunction in anterior infarctions. However, despite better systolic function, inferior wall MI patients had a substantially higher frequency of MR (61.1% vs. 13.9%, $p = 0.001$). Left ventricular dilatation was slightly more common in the inferior MI group (38.9%) compared to the anterior MI group (25%), but this difference was not statistically significant ($p = 0.19$).

Coronary angiography revealed that the left anterior descending (LAD) artery was the culprit vessel in 36 patients (48%). In comparison, the right coronary artery (RCA) was involved in 31 patients (41.3%), and the left circumflex (LCx) artery in 8 patients (10.7%). MR was significantly more frequent among patients with RCA involvement (59.3%) compared to those with LAD involvement (29.6%) ($p = 0.03$), indicating a strong link between RCA occlusion and MR. Severe vessel occlusion (>75%) was found in 44 patients (58.7%) and was significantly associated with MR presence (77.8% vs. 47.9%, $p = 0.02$).

Mitral regurgitation was more prevalent in patients older than 60 years (59.3%) compared to younger patients (37.5%), showing a significant age-related association ($p = 0.04$). Gender, diabetes, hypertension, and obesity (BMI > 30 kg/m²) did not significantly influence the occurrence of MR ($p > 0.05$). However, patients with reduced ejection fraction (<45%) had a markedly higher incidence of MR (70.4%) compared to those with preserved ejection fraction (33.3%), which was statistically significant ($p = 0.002$). Similarly, elevated Pro-BNP levels (>400 pg/mL) were significantly associated with MR (51.9% vs. 22.9%, $p = 0.01$), indicating that MR contributes to increased ventricular strain and neurohormonal activation.

Table 1. Baseline Demographic and Clinical Characteristics of the Study Population (n = 75)

Variable	Mean ± SD / n (%)
Age (years)	58.6 ± 10.4
Gender	Male: 48 (64.0%) Female: 27 (36.0%)
Body Mass Index (kg/m²)	27.8 ± 3.6
Hypertension	41 (54.7%)
Diabetes Mellitus	38 (50.7%)
Type of MI	Anterior Wall MI: 36 (48.0%) Inferior Wall MI: 36 (48.0%)
Mean Ejection Fraction (%)	46.3 ± 8.9

Table 2. Frequency and Severity of Mitral Regurgitation in Anterior vs Inferior Wall Myocardial Infarction

MI Type	Mild MR	Moderate MR	Severe MR	Total with MR	p-value
Anterior Wall MI (n = 36)	3 (8.3%)	2 (5.6%)	0 (0.0%)	5 (13.9%)	
Inferior Wall MI (n = 36)	15 (41.7%)	5 (13.9%)	2 (5.6%)	22 (61.1%)	0.001
Total (n = 72)	18 (25.0%)	7 (9.7%)	2 (2.8%)	27 (37.5%)	

Table 3. Comparison of Echocardiographic Parameters between Anterior and Inferior Wall Myocardial Infarction

Parameter	Anterior Wall MI (n = 36)	Inferior Wall MI (n = 36)	p-value
Ejection Fraction (%)	43.1 ± 7.8	49.5 ± 9.1	0.02
MR Presence (%)	5 (13.9%)	22 (61.1%)	0.001
Left Ventricular Dilatation (%)	9 (25.0%)	14 (38.9%)	0.19

Table 4. Coronary Angiographic Findings and Their Association with Mitral Regurgitation

Coronary Vessel Involved	MR Present (n = 27)	MR Absent (n = 48)	Total (n = 75)	p-value
Left Anterior Descending (LAD)	8 (29.6%)	28 (58.3%)	36 (48.0%)	0.04
Right Coronary Artery (RCA)	16 (59.3%)	15 (31.3%)	31 (41.3%)	0.03
Left Circumflex (LCx)	3 (11.1%)	5 (10.4%)	8 (10.7%)	0.87
Vessel Occlusion >75%	21 (77.8%)	23 (47.9%)	44 (58.7%)	0.02

Table 5. Stratification of Mitral Regurgitation by Effect Modifiers

Effect Modifier	MR Present (n = 27)	MR Absent (n = 48)	p-value
Age > 60 years	16 (59.3%)	18 (37.5%)	0.04
Male Gender	17 (63.0%)	31 (64.6%)	0.88
Diabetes Mellitus	13 (48.1%)	25 (52.1%)	0.73
Hypertension	16 (59.3%)	25 (52.1%)	0.56
BMI > 30 kg/m²	9 (33.3%)	14 (29.2%)	0.71
Ejection Fraction <45%	19 (70.4%)	16 (33.3%)	0.002
Pro-BNP > 400 pg/mL	14 (51.9%)	11 (22.9%)	0.01

Discussion

This study aimed to compare the frequency of mitral regurgitation (MR) between patients with anterior and inferior wall myocardial infarction (MI) and to identify the associated clinical and echocardiographic factors. The findings revealed that MR occurred significantly more often in patients with inferior wall MI compared to those with anterior wall MI. Specifically, 61.1% of inferior wall MI cases showed MR compared to only 13.9% in anterior wall MI, with the difference being statistically significant ($p = 0.001$). This observation aligns with previous research indicating that inferior wall infarctions, which commonly involve the right coronary artery (RCA) supplying the posteromedial papillary muscle, are more prone to developing MR due to ischemic or structural damage to this muscle. In contrast, anterior wall MI is generally associated with global left ventricular (LV) dysfunction and remodeling rather than focal papillary muscle ischemia. The anterior infarctions in this study demonstrated a lower mean ejection fraction (43.1 ± 7.8%) than inferior infarctions (49.5 ± 9.1%), suggesting more extensive myocardial damage but less direct involvement of the papillary muscles. This supports the concept that anterior MI predominantly leads to functional MR secondary to ventricular dilatation rather than direct papillary muscle injury. The higher ejection fraction in inferior MI patients despite a greater MR frequency reflects the injury's localized rather than global nature (12-14).

The present study also found that MR severity was influenced by the degree of coronary vessel occlusion and the specific artery involved. Patients with RCA involvement and severe vessel stenosis (>75%) showed a higher prevalence of MR ($p = 0.02$). These findings are consistent with prior studies demonstrating that RCA occlusion compromises perfusion to the posteromedial papillary muscle, which has a single blood supply, making it more vulnerable to ischemic dysfunction (15). Conversely, the anterolateral papillary muscle, supplied by the left anterior descending (LAD) and left circumflex (LCx) arteries, is relatively protected against ischemia, explaining the lower MR frequency in anterior infarctions. Ejection fraction was another key determinant in this study. MR was significantly more common in patients with reduced ejection fraction (<45%), reinforcing the role of LV dysfunction in worsening valvular insufficiency (16). Previous literature has reported a similar correlation between low ejection fraction and MR due to ventricular dilation, mitral annular stretching, and papillary muscle displacement. Moreover, elevated Pro-BNP levels were significantly associated with MR presence ($p = 0.01$), suggesting that MR contributes to increased LV filling pressures and neurohormonal activation, further exacerbating heart failure (17-20).

Overall, the results highlight that MR is a frequent and clinically important complication of inferior wall MI. Its presence is linked to RCA involvement, greater vessel occlusion, and reduced ejection fraction, all of which portend worse outcomes. While anterior MI patients tend to have lower ejection fractions due to larger infarct size, the functional impact on the mitral apparatus is less direct, leading to a lower MR incidence. These findings emphasize the importance of early echocardiographic evaluation in all MI patients, especially those with inferior wall involvement, to promptly identify MR and guide therapeutic decision-making. From a clinical perspective, early detection and management of ischemic MR can significantly influence prognosis. Patients with MR following MI have higher rates of pulmonary congestion, prolonged hospital stays, and increased long-term mortality. Therefore, timely recognition and optimization of post-MI care, including pharmacologic management, revascularization, and consideration of surgical or percutaneous valve interventions in select cases, are essential to improving outcomes.

Conclusion

It is concluded that mitral regurgitation occurs significantly more frequently in patients with inferior wall myocardial infarction than in those with anterior wall myocardial infarction. This higher frequency is likely due to ischemic dysfunction of the posteromedial papillary muscle, which receives a single blood supply from the right coronary artery,

making it more susceptible to ischemia. In contrast, anterior wall infarctions, though associated with greater left ventricular dysfunction and lower ejection fraction, show less direct involvement of the mitral apparatus, resulting in a lower incidence of MR.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-24)
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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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