

Mitral Valve Regurgitation and Associated Factors after Acute Myocardial Infarction: A Cross-Sectional Study

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Abstract

Background: Mitral regurgitation is a clinically important complication of acute myocardial infarction. The patients of mitral regurgitation after acute myocardial infarction undergo into serious life-threatening conditions such as heart failure, pulmonary congestion Cor pulmonale and other.

Objectives: To determine the frequency and severity of mitral regurgitation after acute myocardial infarction.

Methods: This cross-sectional study was conducted in Cardiology Departments of two tertiary care hospitals in Peshawar, for six months. Adult patients of both gender with first myocardial infarction were included. Patients were selected through convenient sampling technique. The data was collected through a standard questionnaire and was analysed in SPSS-26.

Results: Among the total subjects, majority (62%) were males. The mean age of participants was 59.53 ± 12.54

years. Among the total participants, 81% had mitral regurgitation of which majority (46%) were male. Mitral regurgitation was higher in anterior (40.3%) than inferior infarction (22.6%). Moreover, mitral regurgitation was found more in patients having >50 years age.

Conclusion: The frequency of myocardial infarction in male gender was higher than females in our population. After acute myocardial infarction, mitral regurgitation found a common complication in age group >50 years and found more in anterior infarction than other types of myocardial infarction.

Introduction

Coronary artery disease (CAD) is main aetiology of CVD specific mortality worldwide (1), acute myocardial infarction (MI) is the most common and severe life threatening presentation of CAD (2). In 2021, globally, the prevalence of ischemic heart disease (IHD) and its death was reported about 247 million and 8.88 million respectively and are expected to be increased by 106% (510 million) and 80% (16 million) by 2050 (3). Mitral regurgitation (MR), is one of the mechanical complications associated with myocardial infarction (MI), and is linked to a higher risk of death, heart failure and other complications (4). The incidence rate of ischemic MR is about 13 to 59% after acute MI (5). Ischemic MR develops in the beginning stage of MI with mild to severe range of severity. Even temporary ischemia develops MR which may be reversed upon treatment of ischemia (6). About 75% of the patients with ischemic MR have grade-I severity though it is also associated with worse clinical outcomes (7,8). Even in the absence of massive left ventricular damage, individuals with moderate or severe MR had only 5-year survival rate at 70% probability due to deterioration of long-term prognosis in according with the severity of MR (8). Hemodynamically severe ischemic MR can worsen ischemic events and sequelae after revascularization, which include increased in pressure of pulmonary vasculature, the risk of cardiac failure, dysrhythmias and others (9).

Ischemic MR brings long-term alterations in the structure and function of the left ventricle (LV) as a result of CAD, even there is no structural abnormality in mitral valve apparatus itself. It depicts the valvular effects of increased tethering forces and decreased closure forces (10). The infarcted segments beneath the papillary muscles (usually an inferior or lateral infarct) causes that area of the ventricle to remodel. The papillary muscles are moved laterally, posteriorly, and apically as a result of LV remodeling. Both cusps get restricted chordae from the papillary muscle; its displacement causes the cups and their coaptation point to move further apically (10). The resulting MR causes ventricular dilatation, which in turn causes additional papillary muscle displacement, annular enlargement, and ultimately increases severity of MR (10).

Ischemic MR is best described by Carpentier's classification of leaflet malfunction, which is categorized on the motion of the leaflet's margin with respect to the annular plane (10). In type I, MR is due to annular dilatation or leaflet perforation with normal leaflet motion. While in type II, leaflets motion increases as seen in mitral valve prolapse (MVP), chordal or papillary muscle rupture or elongation (10,11). In type III, there is restriction of mitral valve leaflets. Restricted motion of leaflets in both systole and diastole as seen in rheumatic valvular disease is classified as type IIIa (11). In type IIIb, restricted motion is only seen in systole due to LV dilatation or papillary muscle displacement and is the most prevalent form of IMR (10,11).

The signs and symptoms of patient with functional MR may be of varying range from asymptomatic to symptoms like shortness of breath, cough, orthopnoea, paroxysmal nocturnal dyspnoea (PND) (6). If patient presenting with MI is treated in time and revascularization was achieved with thrombolytic therapy, it will decrease LV myocardial remodelling and the development of ischemic MR (7).

It is now fact that IMR is a strong predictor of risk following MI, LV myocardial remodeling and offers more predictive information than traditional risk factors, causing strain on non-ischemic myocardium (12,13).

2D Echocardiography, and Colour Doppler imaging (CDI) are the most common way to diagnose MR and assess its severity. The general criterion is that as the severity of the MR increases, the size and the extent of the colour jet into the LA also increases. On observation, larger colour jets that covers deep into the LA represent more MR than smaller thin jets that appear just beyond the mitral leaflets (14).

Eccentric jets of MR seen in echocardiography as in inferior MI due to remodeling of inferolateral segments, while anterior or extensive MI can cause LV sphericity which leads to central jets of regurgitation (10) and the incidence of ischemic MR after inferior MI and anterior MI are 38% and 10%, respectively (15).

Acute MI continues to be one of the primary causes of cardiovascular fatalities, and sequelae such as mitral valve regurgitation considerably affect hemodynamics, the prognosis and post MI survival. Papillary muscle displacement and left ventricular remodeling, which lead to cardiac failure and higher mortality rates, are common causes of MR following MI. therefore, this study will provide relevant data in the local setup to further determine its clinical impact and further preventive and management strategies in future. The purpose of this cross-sectional study was to ascertain the frequency and severity of MR following acute MI.

Materials and Methods:

This descriptive cross-sectional study conducted in Cardiology department of two tertiary care hospitals, the Lady Reading Hospital (LRH), and Hayatabad Medical Complex (HMC), Peshawar. The study was conducted from 1st March to 30th August 2018. Total 300 acute MI participants (150 from each hospital) were selected by using convenient sampling technique. The inclusion criteria were adult age group >20 years (20) of both gender having first time MI. Patients who were known case of heart failure or any cardiomyopathy, prior MI, history of coronary artery bypass graft (CABG), history of rheumatic heart disease, prosthetic heart valve, or those with prior documented MR were excluded from the study.

Ethical approval was taken from the concerned institute. Inform consent was taken from each patient before collection of data. A self-designed questionnaire was used to collect data from selected patients. The questionnaire included age of patient, gender, site of MI, history of diabetes, presence of MR, and its severity, LV systolic function and its ejection fraction (EF), LA and LV size, presence of LV clot and rupture of papillary muscle/chordae.

The final data was analysed by software IBM-SPSS version 26. For continuous data (age), means and standard deviation were calculated while for categorical variables, frequency and percentage were calculated. Data was summarized in tabular form and graphical representation was done according to type of data.

Results:

Out of 300 patients, male and female were 186 (62.0%) and 114 (38.0%), respectively. The mean age of the patients was 59.53 ± 12.54 years. Same numbers of sample (150) were taken from two Tertiary Care Units in Peshawar, Hayatabad medical complex (94 male and 56 female), and Lady-Reading Hospital (92 male, and 58 female). Among STEMI, acute anterior wall MI has highest frequency of 121, followed by acute inferior wall MI (n=71), and extensive MI (n=31). Only 25 patients were presented with NSTEMI. The frequency of diabetes was 94, with 51 male and 43 female patients. MR was presented 243 patients with distribution in male and female was 145 and 98, respectively. Severity of MR was graded into mild (n=182), followed moderate n=55, and severe (n=11). Most patients had impaired LV function n=224. LVEF was categorized into 20-30% (n=6), 31-40% (n=124), 41-50% (n=95), and >50% (n=75). LA size was increased in 95 patients (59 male and 36 female). LV cavity size was found increased in 60 patients with male and female distribution was 40 and 20, respectively. LV clot was found in 15 patients and rupture of papillary muscle/ Chordae in 8 patients with equal distribution in male and female, all these descriptive data are summarized in table 1.

Most patients with acute anterior MI had MR (n=98), followed by inferior MI (n=55) and extensive MI (n=28). IMR was not developed in patients with acute lateral wall MI

(n=2), the distribution of MR secondary to different sites of MI are summarized in table 2.

Table 1: Distribution of different variables according to gender

Characteristics	Gender			Total (n=300)
		Male (n=186)	Female (n=114)	
Site of Myocardial Infarction	Anterior	77 (41.4%)	44 (38.6%)	121 (40.3%)
	Posterior	7 (3.8%)	4 (3.5%)	11 (3.7%)
	Lateral	2 (1.1%)	0 (0.0%)	2 (0.7%)
	Inferior	38 (20.4%)	33 (28.9%)	71 (23.7%)
	Extensive	23(12.4%)	8 (7.0%)	31 (10.3%)
	Anterolateral	10 (5.4%)	5(4.4%)	15 (5.0%)
	NSTEMI	12(6.5%)	13 (11.4%)	25(8.3%)
	Others	17(9.1%)	7(6.1%)	24(8.0%)
Presence of MR	Yes	145 (78.0%)	98(86.0%)	243(81.0%)
	No	41(22.0%)	16(14.0%)	57(19.0%)
Severity of Mitral Regurgitation	Mild	107(57.5%)	75(65.8%)	182(60.7%)
	Moderate	33(17.7%)	17(14.9%)	50(16.7%)
	Severe	5 (2.7%)	6 (5.3%)	11 (3.7%)
Diabetes	Yes	51 (27.4%)	43 (37.7%)	94 (31.3%)
	No	135 (72.6%)	71 (62.3%)	206 (68.7%)
Left Ventricular function	Normal	38 (20.4%)	38 (33.3%)	76 (25.3%)
	Impaired	148 (79.6%)	76 (66.7%)	224 (74.7%)
LV Ejection Fraction	20 to 30 %	5 (2.7%)	1 (0.9%)	6 (2.0%)
	31 to 40 %	81 (43.5%)	43 (37.7%)	124 (41.3%)
	41 to 50 %	64 (34.4%)	31 (27.2%)	95 (31.7%)
	>50 %	36 (19.4%)	39 (34.2%)	75 (25.0%)
Left atrial size	Normal	127 (68.3%)	78 (68.4%)	205 (68.3%)
	Increased	59 (31.7%)	36 (31.6%)	95 (31.7%)
LV size	Normal	146 (78.5%)	94 (82.5%)	240 (80.0%)
	Increased	40 (21.5%)	20 (17.5%)	60 (20.0%)
LV Clot	Yes	13 (7.0%)	2 (1.8%)	15 (5.0%)
	No	173 (93.0%)	112 (98.2%)	285 (95.0%)
Papillary muscle/ Chordal Rupture	Yes	4 (2.2%)	4 (3.5%)	8 (2.7%)
	No	182 (97.8%)	110 (96.5%)	292 (97.3%)

Table 2: Frequency and percentages of MR according to the site of MI

Characteristics		Mitral Regurgitation	
		Yes (n=243)	No (n=57)
Site of MI	Anterior	98 (40.3%)	23 (40.4%)
	Posterior	9 (3.7%)	2 (3.5%)
	Lateral	0 (0.0%)	2 (3.5%)
	Inferior	55 (22.6%)	16 (28.1%)

	Extensive	28 (11.5%)	3 (5.3%)
	Anterolateral	13 (5.3%)	2 (3.5%)
	NSTEMI	18 (7.4%)	7 (12.3%)
	Others	22 (9.1%)	2 (3.5%)

Discussion:

In this study, we had sample size of 300 patients with means age of 59.53 ± 12.54 years with male and female subjects were 186 (62.0%) and 114 (38.0%), respectively. In our study, acute anterior wall MI was most prevalent (121 cases, 40.3%) with occurrence in male verses female was 77 (41.4%) and 44 (38.6%), respectively followed by acute inferior wall MI (71, 24%) with frequency in male (38, 20.4%) and female (31, 27%). This finding was consistent to previous studies showing that most common culprit artery is left ascending artery (LAD), that's why acute anterior MI is most prevalent, followed by acute inferior MI (16). But the results were not mirrored with study conducted by B. Murat et al. (2021), in which anterior MI was common in female (27, 75.0%) vs male (97, 55.1%) at significant level ($p=0.027$) (16).

Mitral regurgitation was developed in 243 (81%) patients in our study. The frequency was more than from previous studies, upto 59% reported by F. Bursi et al, 2006 (12), T. H. Kim et al, 2016 (5) and 29% by H. Sharma et al, 2021 (17). It is due the remodelling of LV and addition of trivial MR diagnosed with colour doppler, a sensitive mode of echocardiography (12). In our study, mild MR was most common 182 (74.8%), moderate MR was 50 (20.5%) and severe MR was 11 (4.5%) was aligned with studies conducted by H. Sharma et al, 2021, and I. Ullah et al. 2025, (17,18). The reason behind high frequency of MR may be late perfusion of coronary vasculature after symptoms appear (17).

Ischemic MR was most prevalent in 98 cases of anterior MI (40.3%) followed by 55 cases of inferior MI (22.6%) which is not aligned with previous study where frequency was 38% and 10% in inferior MI and anterior MI, respectively. (15,19) In inferior MI, there is mitral annulus dilatation and displacement of posteromedial papillary muscle which cause tethering of chord results in IMR more prominently than LV globalized remodelling seen in anterior MI (19,20). In this study, LV function was found impaired in 224 (74.6%) with 41.3% patients had LVEF in the range of 31 to 40%. This result was not mirrored with previous study, in which 22.3% patients had LVEF less than <40% (21).

Conclusion:

We concluded that the frequency of myocardial infarction was higher in male than female gender. After MI the mitral regurgitation appeared to be the common complication, especially the population more than 50 years were at high risk for developing MR in acute MI patients. The population who had anterior MI had increased frequency of MR than those who had other type of MI. Echocardiography should be performed routinely in patients with acute MI in order to detect in early stages and to treat it timely for better prognosis and prevention of further progressive deteriorating complications.

Limitations:

This was descriptive cross-sectional study with convenient sampling technique as we cannot generalized our results. Also, we used only colour doppler mode of echocardiography to detect MR and its severity which may cause discrepancy in results. Additionally, inferential statistics was not used in this study to find relationship between different variables of our study.

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