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Mitral Regurgitation and its Predictors after Acute Myocardial Infarction in the Era of Coronary Intervention

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ABSTRACT

Introduction: Mitral regurgitation is one of the common complications of acute myocardial infarction but a very limited study was published about its prevalence and associated factors from Nepal.

Methods: A prospective cross-sectional study was conducted in admitted patients of the cardiology unit, Manipal Teaching Hospital from 01- 06- 2020 to 15- 09- 2021 after obtaining approval from Institutional Review Committee (MEMG/IRC/337/GA). All cases of first time acute myocardial infarction, who presented within 12 hours of symptom onset and underwent revascularization with the coronary intervention were selected for the study

Results: A total of 219 patients with a mean age of 60.55± 12.5 years were taken for study. Moderate to severe mitral regurgitation was detected in 60 (27.4%) cases. The most common risk factors among responders was being overweight, followed by having low levels of high-density lipoprotein and smoking. Age >65yrs [OR:8.26(95%CI, 1.82-37.52); p=0.006], female gender [OR:2.05(95% CI,1.12-3.76); p=0.01], pre-obesity [OR: 2.43(95% CI, 1.14-5.17); p=0.01], longer ischemic time of >6 hrs [OR: 4.57(95%CI, 2.10-9.91); p= 0.001] and involvement of infero-posterior wall[OR: 3.04(95%CI, 1.61-5.774); p= 0.001] and left circumflex artery involvement [OR: 7.67(95%CI, 3.15-18.63); p= 0.001] were significantly associated with moderate to severe ischemic mitral regurgitation.

Conclusion: Mitral regurgitation is a common complication of acute myocardial ischemia. Elderly age, female gender, longer ischemic time of more than six hours, involvement of infero-posterior wall and left circumflex artery was significantly associated with moderate to severe mitral regurgitation.

Keywords: *Mitral Valve Insufficiency; Myocardial Infarction; Myocardial Ischemia*

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INTRODUCTION

The prevalence of myocardial infarction (MI) is increasing even in developing countries. MI is one of the leading causes of death around the world. Myocardial infarction frequently complicates with Mitral regurgitation (MR) of variable severity. Ischemic mitral regurgitation (IMR) is defined as mitral regurgitation in the case of MI with normal morphology of mitral valve.[1] Based on timing and technique used, the prevalence of mitral regurgitation varies from 11% to 59%, and around half of them reported to have moderate to severe regurgitation.[2,3] The risk factors include advanced age, prior myocardial infarction, infero-posterior wall involvement, infarct extension, and recurrent ischemia.[4] Mitral regurgitation that develops in patients of acute myocardial infarction leads to short and long-term mortality.[5-7] Limited data are available regarding IMR in Nepal, so this study is conducted to find out the prevalence and associated factors.

METHODS

A prospective cross-sectional study was conducted in admitted patients of the cardiology unit of Manipal teaching hospital, Pokhara, Nepal from 01-06-2020 to 15-09-2021, after obtaining approval from Institutional Review Committee (MEMG/IRC/337/GA).

All cases of acute myocardial infarction who presented within 12 hours of symptom onset and underwent revascularization with the coronary intervention were selected for the study. All echocardiograms were performed by a cardiologist within three days of coronary intervention. The echocardiographic measurements were obtained by cardiologist, using a 2D color and Doppler echo system (Siemens ACUSON SC2000 PRIME, Berlin, Germany), according to the recommendations of the American Society of Echocardiography (ASE).[8] A pre-designed semi-structured proforma was used to collect the required data. Informed consent was taken from each patient. The collected data was secured and made accessible only to the investigator to maintain confidentiality. Patients with hypertrophic cardiomyopathy, valvular or subvalvular structural mitral disease, mitral prosthesis, previously diagnosed cases of mitral regurgitation, or current evidence of left atrial enlargement that suggest chronic MR were excluded from the study. MR was classified into five categories: no MR (including trace MR); mild ischemic MR; moderate ischemic MR; severe ischemic MR.[8] Data were analyzed using the software SPSS for windows version 20. Descriptive statistics like frequency, percentage, mean, and SD were used. Inferential statistics like the chi-square test were used for categorical data. The risk estimate was calculated using relative risk or Odds ratio as appropriate. The difference was considered significant at a predetermined α level of 5%.

Table 1: Demographic profile and Frequency of risk factors (n = 219)

Characteristics	Frequency (f)	Percentage (%)
Age (years)		
< 45	26	11.9
45 – 65	117	53.4
> 65	76	34.7
Mean ± SD	60.55±12.58	
Gender		
Male	137	62.6
Female	82	37.4
BMI		
Normal (18.8 – 24.9)	80	28.8
Pre-obesity (25 – 29.9)	139	71.2
Pain duration (hours)		
≤6	49	36.5
>6	139	63.5
Hypertension	139	36.5
Diabetes	67	30.6
Smoking	119	54.3
Low HDL	126	57.5
High LDL	41	18.7
High TG	95	43.4
Family history	41	18.7
Other risk factors	11	5.0

RESULTS

A total of 219 cases were enrolled for the study and the mean age was 60.55± 12.5 years. Nearly half of the population were in the age group of 45-65 years and 62.5% were male (Table 1). Young MI (<45 Yrs) was detected in 11.9%. Moderate to severe MR was detected in 27.4% of cases.

The most common risk factors among responders were pre-obesity followed by low HDL levels and smoking. Only around one-third (36.5%) of cases reached hospital within 6 hours of symptoms onset.

Table 2: Echocardiographic and angiographic characteristics (n=219)

Variables	Frequency (f)	Percent (%)
MI wall		
AWMI	108	49.3
IWMI and IPWMI	111	50.7
MR		
No and mild	159	72.6
Moderate and severe	60	27.4
LVEF (40-54%)		
No and Mild MR	124	70.5
Moderate and severe	52	29.5
Artery involved		
LAD	110	50.2
RCA	79	36.1
LCX	30	13.7

AWMI: Anterior wall myocardial infarction
IWMI: Inferior wall myocardial infarction
IPWMI: Infero-posterior wall myocardial infarction
LAD: Left anterior descending
RCA: Right coronary artery
LCX: Left circumflex artery

The inferior and infero-posterior wall involvement in echocardiography and left anterior descending artery in coronary angiography was the most common finding in respondents. Moderate to severe MR was detected in 27.4%. The majority (80.03%) of respondents and nearly one-third (29.5%) of cases with moderate to severe MR had left ventricular ejection fraction in the range of 40-54 % (Table 2).

Elderly age (>65Yrs), female gender, pre-obesity, chest pain duration of more than six hours, inferior and infero-posterior wall involvement in echocardiography, and LCX or RCA territory in coronary angiography were significantly associated with moderate to severe MR. Systemic hypertension and diabetes mellitus was not related to significant MR (Table 3).

DISCUSSION

Mitral Regurgitation after acute MI is a common complication. We evaluated the prevalence and associated factors of ischemic MR after first-time MI. Ischemic mitral regurgitation (IMR) is defined as mitral regurgitation in the case of MI with normal morphology of mitral valve.[1] The prevalence of ischemic MR varies from 11-59 % based on timing and techniques used. [2, 3,7,9] All enrolled cases of acute MI underwent successful revascularization either in form of balloon dilation with stenting or balloon angioplasty (POBA) alone to establish blood flow in the distal artery. We found moderate to severe MR in an echocardiographic study in 27.4 % of the study population. A lower rate of moderate to severe ischemic MR was noted in a study by Aroson et al. (6.3%), while a similar finding with moderate MR in 16% and moderate to severe in 5% was noted in a study done by Carraba et al. [10,11]

Elderly age (>65Yrs), longer ischemic time of more than six hours, involvement of infero-posterior wall and LCX artery were strongly associated with moderate to severe MR which is similar to study done by Birnbaum et al. and Jimmy MacHaalany et al.[4,12] These finding of significant MR with longer ischemic time warrant early revascularization of coronary arteries after acute myocardial infarction.

In our study, the inferior or infero-posterior

walls were the most commonly involved territory in patients with moderate to severe MR. In a study by Yosefy et al. moderate to severe MR was most commonly associated with inferior wall territory.[13] Similar to previous studies, female gender was associated with significant mitral regurgitation in our study.[14,15] In a study done by Afsoon Fazlinezhad et al. most of the patients with IMR had a left ventricular ejection fraction < 35%.[16]

In our cohort, patients with significant MR had a left ventricular ejection fraction of >40%. There are a few limitations of our study. This is a single-centered study with a imited sample size. Due to non-probability convenient sampling, results may not represent the general population of Nepal.

Table 3: Association of the variables with the MR of the respondents (n = 219)

Characteristics	MR		COR (95% CI)	p-value
	No and Mild	Moderate and Severe		
Age (in years)				
< 45	24 (92.3)	2 (7.7)	Ref.	
45– 65	90 (76.9)	27 (23.1)	3.6(0.79-16.21)	0.09
>65	45 (59.2)	31 (40.8)	8.26(1.82-37.54)	0.006
Sex				
Male	107 (78.1)	30(21.9)	Ref.	
Female	52 (63.4	30 (36.6)	2.05 (1.12-3.76)	0.01
BMI				
Normal (18.8 – 24.9)	52 (83.9)	10(16.1)	Ref.	
Pre-obese (25.0 – 29.9)	107(68.2)	50(31.8)	2.43(1.14-5.17)	0.01
Hypertension				
No	57 (71.3)	23(28.8)	Ref.	0.73
Yes	102(73.4)	37(26.6)	0.89(0.48 – 1.66)	
Diabetes				
No	109(71.7)	43(28.3)	0.86(0.45-1.66)	0.65
Yes	50(74.6)	17(25.4)	Ref.	
Pain duration (hours)				
≤6	71(88.8)	9(11.3)	4.57 (2.10-9.91)	<0.001
>6	88 (63.3)	51(36.7)	Ref.	
MI wall				
AWMI	90(83.3)	Ref.		<0.001
IWMI + IPWMI	69(62.2)	3.04(1.61 – 5.74)		
Artery involved				
LAD	92(83.6)	18(16.4)	Ref.	
RCA	55(69.6)	24(30.4)	2.23(1.11 – 4.47)	0.02
LCX	12940.0)	60(27.4)	7.67(3.15– 18.63)	<0.001

AWMI: Anterior wall myocardial infarction
IWMI: Inferior wall myocardial infarction
IPWMI: Infero-posterior wall myocardial infarction
LAD: Left anterior descending
RCA: Right coronary artery
LCX: Left circumflex artery

CONCLUSION

Mitral regurgitation is a common complication of acute myocardial infarction. Elderly age, female gender, pre-obesity, longer ischemic time of more than six hours, involvement of infero-posterior wall and LCX artery were significantly associated with moderate to severe MR. Systemic hypertension and diabetes mellitus were not related to significant MR.

CONFLICT OF INTEREST

None

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None

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