

ASSOCIATION BETWEEN RISK FACTORS OF CORONARY ARTERY DISEASE AND ISCHEMIC MITRAL REGURGITATION IN PATIENTS OF ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION

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Abstract

This study aimed to explore the association between common risk factors of coronary artery disease (CAD) and the severity of Ischemic Mitral Regurgitation (IMR) among patients diagnosed with ST-Segment Elevation Myocardial Infarction (STEMI). A total of 350 patients were assessed through structured questionnaires and echocardiographic evaluation for IMR grading. The sample included 66.6% males and 33.4% females, with the majority of cases occurring in middle-aged individuals (41–60 years).

Key risk factors included hypertension (65.1%), frequent stress (60.6%), fast food consumption (62.9%), and smoking (48.0%). These risk factors were notably more common among urban patients, who also demonstrated higher rates of sedentary lifestyle and dietary imbalance. Statistical analysis revealed significant associations between hypertension, smoking, and IMR severity, indicating their critical role in the development and progression of valvular dysfunction post-STEMI.

Echocardiography showed that moderate IMR was the most common severity grade, followed by mild and severe cases. Among the STEMI population (52.9% of total patients), 45.4% developed IMR, with 19% showing severe regurgitation. Percutaneous Coronary Intervention (PCI) was the most frequently used treatment approach. The findings highlight the urgent need for preventive strategies targeting hypertension, smoking, and lifestyle habits especially in urban populations to reduce the burden of IMR and improve outcomes in STEMI patients.

2. INTRODUCTION

Cardiovascular diseases (CVDs) have emerged as a prominent global health concern, accounting for nearly 31% of all deaths all over the world. Within its domain, coronary artery disease (CAD) is a significant contributor, which accounts for nearly 7 million deaths every year. CAD results from the

development of plaque in the intima of coronary arteries causing atherosclerosis. This atherosclerosis can worsen by modifiable and non-modifiable risk factors such as hypertension, diabetes mellitus, hyperlipidemia, obesity and smoking. According to World Health Organization report for the year 2021, these risk

factors not only increase the risk of myocardial infarction (MI) but also predispose patients to post-MI complications, significantly affecting morbidity and mortality.

Acute myocardial infarction (AMI), particularly ST-elevation myocardial infarction (STEMI), is one of the most severe type of CAD. Despite advancements in technologies of cardiac interventions and discovery of more reliable drugs, STEMI is significantly associated with long-term complications and in-hospital mortality. Among these long-term complications, ischemic mitral regurgitation (IMR) is most common and life-threatening clinical outcome. IMR occurs due to structural or functional complications in the left ventricle (LV) during or after MI, which results in the deformity in the leaflet coaptation of the mitral valve. This complication which is secondary to infarction deteriorates patient's condition increasing the risk of post MI arrhythmias or ultimately heart failure. (Kimura *et al.*, 2018).

The prevalence of IMR among MI patients varies widely across studies. The estimates range from 20% to 50%, depending on what diagnostic methods are used and what are the population characteristics. Echocardiographic findings have shown that IMR can varies, ranging from mild regurgitation to severe valve dysfunction, often requiring surgical intervention. The development of IMR is strongly associated with CAD risk factors, such as elevated triglycerides and LDL cholesterol levels, which increases ischemic myocardial injury and ventricular remodeling (Elbadawi *et al.*, 2019). Significantly, the pathophysiology of IMR is multifaceted with a dynamic combination of ventricular symmetry, myocardial contractility and mitral valve apparatus status.

The presence of CAD risk factors not only predisposes individuals to STEMI but also impacts the severity of post MI complications like IMR. For understanding, patients with high degree of diabetes or high level of triglycerides are more likely to experience extensive ventricular and myocardial changes leading to severe complications. Moreover, hypertension and cigarette smoking speeds up the plaque building in

the coronary vessels increasing the severity of MI. Understanding the association between risk factors of CAD and post MI complications is important for enhancing risk stratification and guiding therapeutic cardiac interventions (Bhattacharya *et al.*, 2017).

In developing countries like Pakistan, the prevalence of CAD and its outcomes are significantly high. These outcomes are mainly due to sedentary lifestyles, tobacco use and superficial management of chronic risk factors like diabetes and hypertension. Despite this, research data showing prevalence of IMR and showing its association with CAD risk factors in STEMI patients in Pakistan remains scarce. Available studies mainly focus on developed nations, where healthcare systems and demographics of the nation are different than Pakistan. Therefore, there is dire need of research in Pakistan's context to address the alarming situation of CAD and develop region-specific prevention and treatment strategies. This research aims to investigate the association between traditional risk factors of CAD and the development of IMR in STEMI patients and determine the severity of IMR to contribute to the existing body of knowledge and enable better risk stratification, early intervention and improved clinical outcomes.

Coronary artery disease (CAD) is one of the most prevalent and life-threatening cardiovascular conditions worldwide. It arises due to the buildup of atherosclerotic plaques in the coronary arteries, which restricts blood flow to the heart muscle. This narrowing or blockage can lead to a spectrum of cardiac events, including angina, myocardial infarction, and heart failure. CAD continues to be a major cause of death and disability, especially in low- and middle-income countries where preventive healthcare practices are often inadequate and access to specialized cardiac care remains limited.

A critical and severe clinical manifestation of CAD is ST-segment elevation myocardial infarction (STEMI). STEMI occurs when there is a sudden and complete occlusion of a coronary artery, resulting in prolonged ischemia and extensive damage to the myocardial tissue. This condition

requires urgent medical intervention and is associated with high rates of in-hospital complications and mortality. Despite improvements in emergency revascularization techniques and pharmacological therapies, STEMI continues to contribute significantly to cardiac-related deaths, particularly in regions with limited access to timely cardiac care.

One of the serious mechanical complications that can arise following STEMI is ischemic mitral regurgitation (IMR). IMR is a condition in which the mitral valve fails to close properly due to structural and functional changes in the left ventricle caused by ischemic injury. Unlike primary mitral valve diseases, IMR is secondary to myocardial infarction and results from left ventricular dilation, papillary muscle dysfunction, and altered ventricular geometry. IMR can range from mild to severe and is often associated with adverse outcomes, including worsening heart failure, reduced exercise capacity, recurrent hospitalizations, and increased mortality. The occurrence of IMR following STEMI is variable and may depend on the extent of myocardial damage, the presence of risk factors, and the effectiveness of early treatment.

Coronary Ischemic mitral regurgitation is a well-recognized complication of myocardial infarction, but its clinical burden remains underestimated in many healthcare settings. Among STEMI patients, the development of IMR can significantly impair post-infarction recovery and reduce long-term survival. In Pakistan and other developing countries, the burden of CAD is increasing due to a combination of unhealthy lifestyles, poor disease control, and limited public awareness. However, local studies addressing the prevalence and determinants of IMR among STEMI patients remain scarce.

Understanding how traditional risk factors for CAD such as hypertension, diabetes mellitus, smoking, and sedentary behavior contribute to the development and severity of IMR is essential. Yet, there is limited region-specific data that explores these associations in detail. Most of the available research originates from high-income countries with different healthcare infrastructures,

population demographics, and disease patterns. This gap in knowledge hinders the ability of clinicians and healthcare planners to identify high-risk individuals and develop tailored treatment strategies. Therefore, there is a critical need to examine the relationship between CAD risk factors and IMR in the context of STEMI patients in Pakistan.

3. Methodology

This research was based on a cross-sectional observational study design aimed at investigating the association between coronary artery disease (CAD) risk factors and the presence and severity of ischemic mitral regurgitation (IMR) in patients diagnosed with ST-segment elevation myocardial infarction (STEMI). The study was conducted in three tertiary care hospitals in Peshawar, Pakistan: Khyber Teaching Hospital, Shahab Orthopedic General Hospital, and Hayatabad Medical Complex, over a period of six months from January to June 2025.

Patients clinically diagnosed with STEMI based on electrocardiographic or biochemical criteria, with echocardiographic evidence of IMR and at least one documented CAD risk factor, were included after providing informed consent. Patients with previous mitral valve surgery, congenital mitral valve abnormalities, non-STEMI, unstable angina, non-ischemic cardiomyopathies, significant neurological disorders affecting responses, or refusal to participate were excluded.

A total of 350 eligible patients were included, comprising 233 males (66.6%) and 117 females (33.4%). Participants were selected using simple random sampling to provide equal selection probability among eligible patients and minimize selection bias. Data were collected using a structured and piloted questionnaire covering demographic characteristics, clinical history, CAD risk factors such as hypertension, diabetes, smoking and sedentary lifestyle, and treatment modalities including PCI and thrombolysis.

All participants underwent transthoracic echocardiography to assess the presence and severity of IMR. IMR was classified as mild, moderate, or severe based on echocardiographic parameters, including regurgitant jet area and vena contracta width. Following eligibility screening and written informed consent, data were obtained through hospital records and direct patient interviews. STEMI diagnosis was confirmed using ECG findings and cardiac enzyme levels, while echocardiographic reports were used for IMR classification. Data collectors received prior training to ensure consistency and minimize inter-observer variability.

Data were entered and analyzed using SPSS version 24. Descriptive statistics, including mean, standard deviation, frequencies, and percentages, were calculated. The chi-square test was used to assess associations between categorical CAD risk factors, such as hypertension, diabetes and smoking, and IMR severity. Logistic regression was performed to identify independent predictors of moderate-to-severe IMR, including stress, sedentary lifestyle, and fast-food intake. Bar and pie charts were used for graphical presentation, and a p-value <0.05 was considered statistically significant.

The study was conducted according to the ethical standards of the institutional review boards of the participating hospitals. Written informed consent was obtained from all participants, and confidentiality was maintained through anonymized identification numbers. Participation was voluntary, and no additional diagnostic intervention was performed solely for research purposes. The study followed the principles of the Declaration of Helsinki and applicable local ethical guidelines.

4. RESULTS

This chapter presents the findings derived from the analysis of 350 patients diagnosed with ST-segment elevation myocardial infarction (STEMI), assessed for Ischemic Mitral Regurgitation (IMR) and associated coronary artery disease (CAD) risk factors. Results are reported using both descriptive and inferential statistics, and are accompanied by tables and graphical illustrations to enhance clarity and interpretation of data trends.

Out of the total 350 participants, 233 (66.6%) were males and 117 (33.4%) were females, indicating a clear male predominance in the STEMI cohort. The average age across the sample was 45.2 years, with the majority of patients falling within the 41–60 years age group, reaffirming middle age as the peak period for acute myocardial infarction incidence. The age range of participants spanned from 10 to 97 years, although STEMI and IMR were more frequently observed in patients aged above 40, especially those with additional comorbidities.

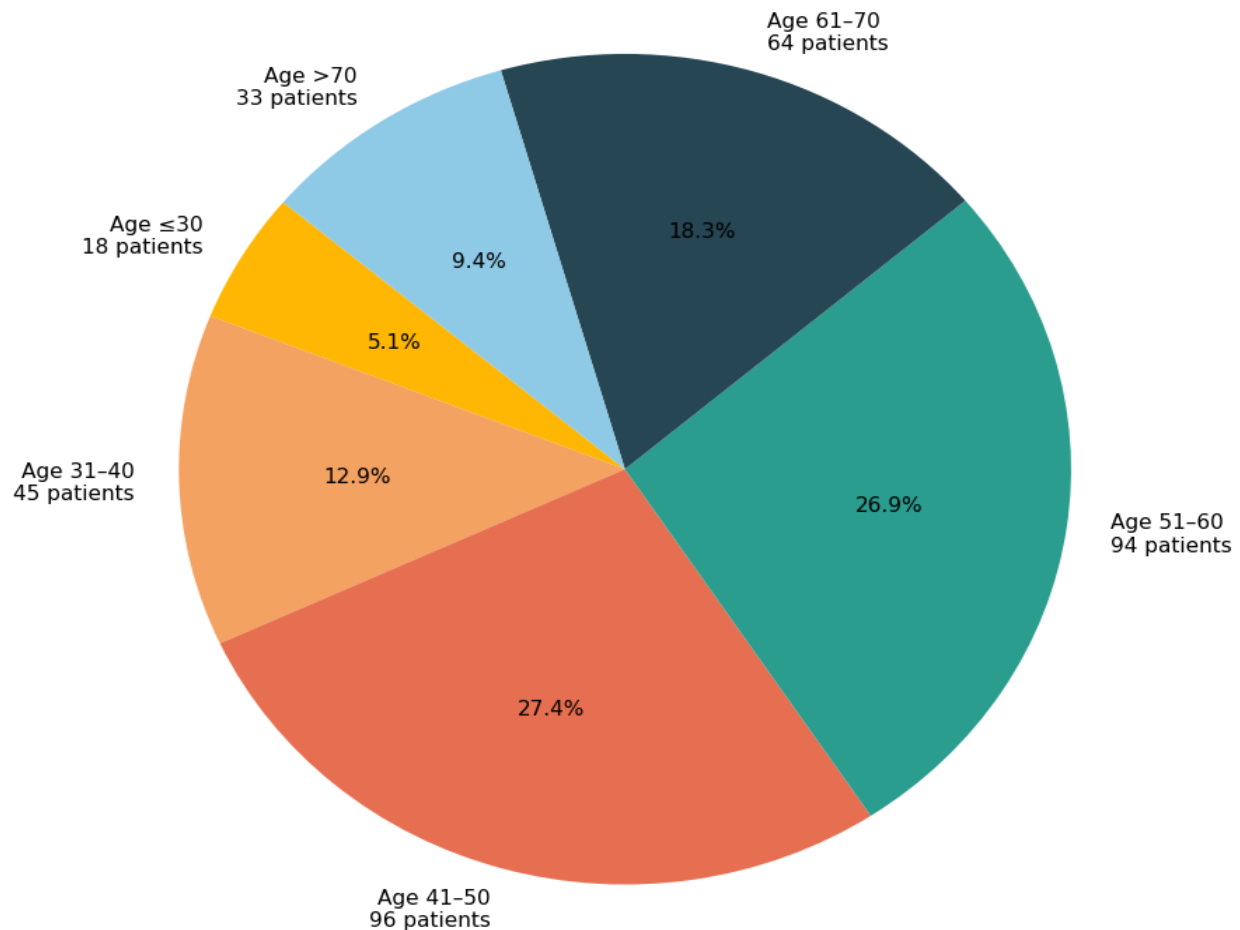


Figure 4.1: Age distribution of STEMI patients

The age distribution analysis reveals that the majority of STEMI patients belonged to the 41-50 (27.4%) and 51-60 (26.9%) age groups, reinforcing middle age as the peak risk period for myocardial infarction. Older adults aged 61-70 accounted for 18.3%, while patients above 70 made up 9.4% of the sample. Only 5.1% were under 30. This pattern underscores that STEMI and its complications, such as IMR, are most prevalent among middle-aged and older individuals.

Analysis of the full dataset revealed gender-based variation in the severity of ischemic mitral regurgitation (IMR). Among the 85 male patients diagnosed with IMR, 36 had mild, 32 had moderate, and 17 had severe IMR. In contrast, among 31 female IMR cases, 12 were classified as mild, 14 as moderate, and 5 as severe. While male patients exhibited a higher overall prevalence of IMR, the proportional distribution of severity levels was relatively comparable across genders, with moderate IMR remaining the most frequent grade in both groups.

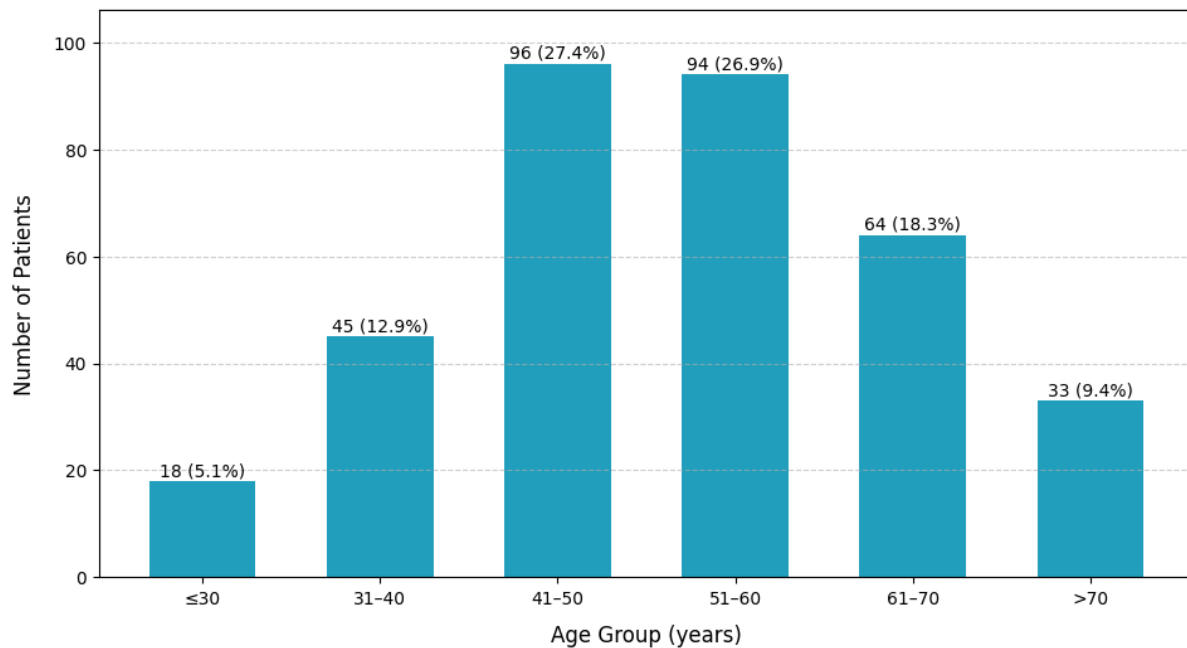


Figure 4.2: Severity of IMR among male and female patients

The chart illustrates that moderate IMR remains the most frequently observed severity level in both male and female patients. Among males, 52 patients had moderate IMR, followed by 31 with mild and 24 with severe IMR. Similarly, in females, 30 had moderate IMR, while 15 each had mild and severe forms. Although males made up a larger share of the overall sample, the distribution of severe IMR between genders was relatively comparable, indicating that while males are more commonly affected by STEMI, the likelihood of progression to severe IMR does not differ substantially by gender.

Table 4.1 and Figure 4.3 illustrate the prevalence of major risk factors among STEMI patients in the study. The most frequently reported factor was stress, affecting 63.1% of patients, followed closely by hypertension (60.9%) and fast-food consumption (59.1%). Smoking was reported by 57.7%, while diabetes mellitus affected 55.7% of the population. Additionally, a sedentary lifestyle was noted in 53.7% of patients. Interestingly, 41.4% had a positive family history of coronary artery disease, highlighting the contribution of genetic predisposition alongside modifiable lifestyle and health-related risk factors.

Table 4.1: Prevalence of Risk Factors Among Patients

Risk Factor	Frequency (n)	Percentage (%)
Hypertension	210	60.0%
Diabetes Millitus	178	50.9%
Smoking	185	52.9%
Sedentary Lifestyle	163	46.6%
Stress	227	64.9%
Fast Food Consumption	191	54.6%
Family History of CAD	130	37.1%

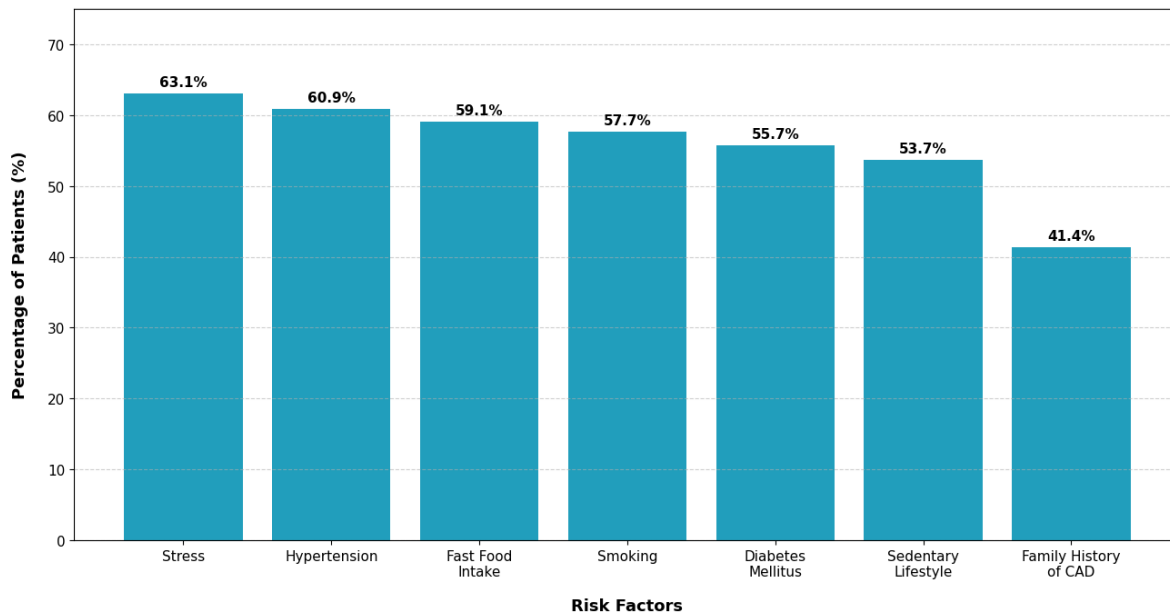


Figure 4.3: Bar chart showing prevalence of major risk factors among STEMI patients

The figure visually emphasizes the prominence of stress and hypertension, supporting the need for targeted interventions on lifestyle and stress management. The relatively high rates of smoking and fast-food intake also indicate unhealthy lifestyle choices contributing to cardiovascular burden.

Hypertension emerged as a major risk factor significantly associated with IMR severity. Among hypertensive patients, 57 had moderate IMR, 30 had severe IMR, and 26 had mild IMR. In contrast, among non-hypertensive patients, 26 had moderate IMR, 17 had severe IMR, and 19 had mild IMR. This distribution indicates that hypertensive individuals are more likely to develop moderate to severe forms of IMR compared to their non-hypertensive counterparts, underscoring the critical role of blood pressure control in managing post-STEMI complications.

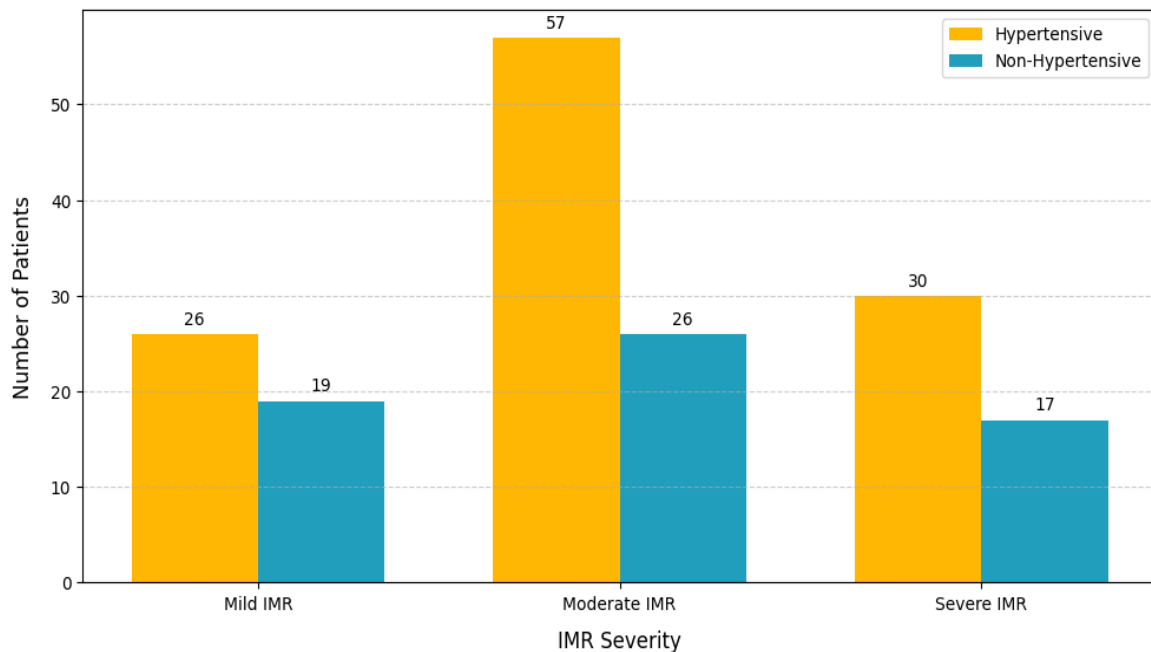


Figure 4.4: Comparison of IMR severity among hypertensive and non-hypertensive patients

This figure demonstrates that patients with hypertension were more likely to develop moderate-to-severe forms of IMR. The results support prior studies suggesting that long-standing hypertension contributes to left ventricular remodeling and increased afterload, aggravating mitral valve dysfunction.

Smoking also exhibited a significant association with the severity of IMR in STEMI patients. Among smokers, 38 individuals developed moderate IMR and 19 progressed to severe IMR. In contrast, non-smokers showed slightly lower numbers, with 30 moderate and 15 severe cases. Interestingly, mild IMR was more common in non-smokers (22 cases) compared to smokers (16 cases), indicating a possible protective trend in non-smoking individuals against advanced disease severity.

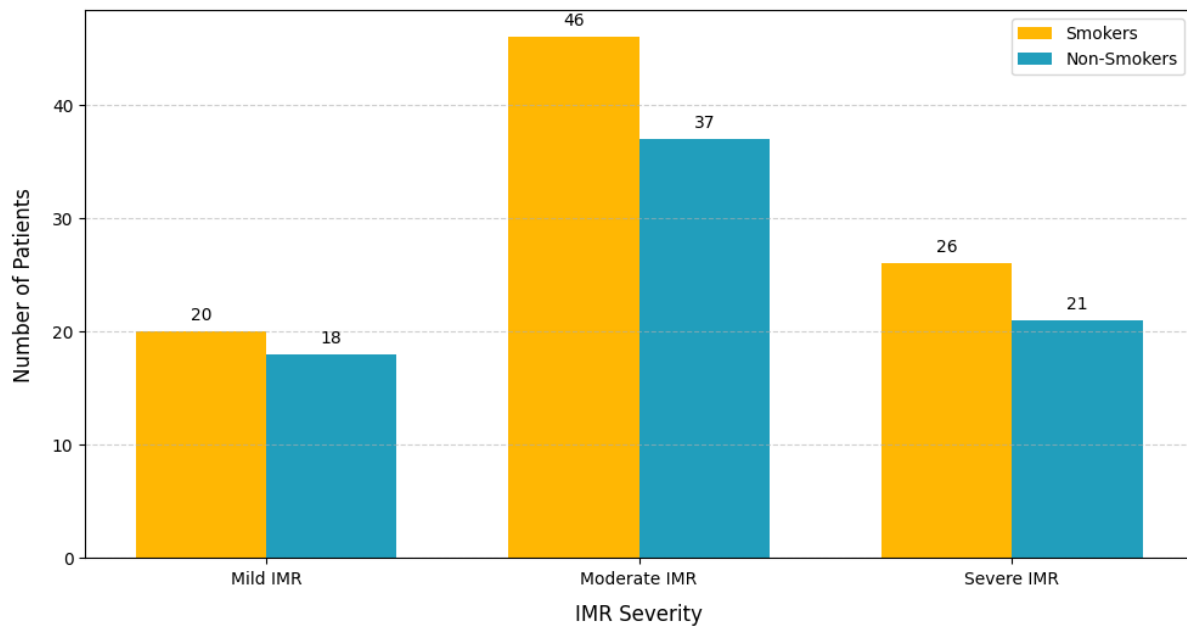


Figure 4.5: IMR severity among Smokers vs non-smokers

This figure clearly demonstrates the impact of smoking on the progression of mitral regurgitation post-STEMI. The data implies that smoking exacerbates myocardial injury and impairs healing, thus promoting ventricular dilation and worsening regurgitation severity.

Table 4.2 compares the distribution of major risk factors between urban and rural residents. Out of 350 patients, 212 were from urban areas and 138 from rural settings.

Table 4.2: Risk Factor Prevalence by Residence

Risk Factor	Urban (n=90)	Rural (n=50)	Urban %	Rural %
Hypertension	140	72	66.0%	52.2%
Diabetes Mellitus	113	61	53.3%	44.2%
Smoking	124	47	58.8%	34.1%
Sedentary Lifestyle	111	46	52.4%	33.3%
Stress	158	78	74.5%	56.5%
Fast Food Consumption	135	62	63.7%	44.9%
Family History of CAD	89	57	42.0%	41.3%

The updated table reveals notable disparities in the prevalence of major CAD risk factors based on residence. Urban patients exhibited consistently higher percentages across most risk factors, with stress (74.5%) and smoking (58.5%) being particularly prominent. Hypertension (66.0%) and sedentary lifestyle (52.4%) were also more prevalent among urban dwellers. In contrast, rural residents showed comparatively lower rates, although stress (56.5%) and fast-food consumption (44.9%) were still significantly represented. These findings underscore the impact of urban living—characterized by high stress levels, processed food consumption, and reduced physical activity—on cardiovascular health, highlighting the urgent need for lifestyle modification and preventive strategies tailored to urban populations.

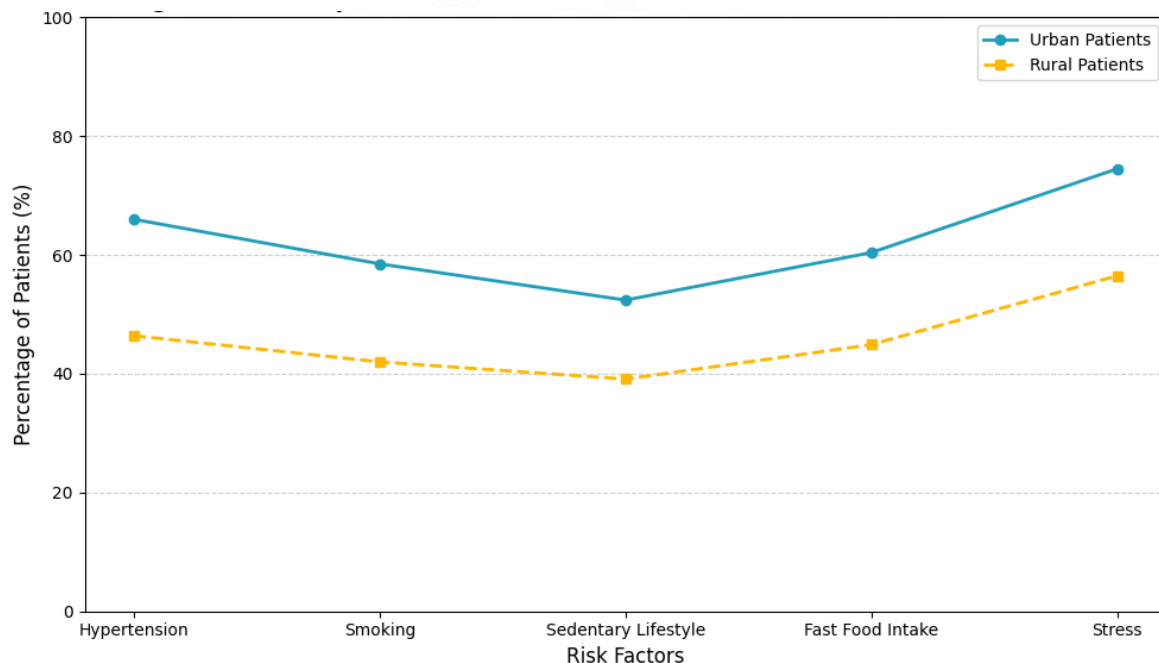


Figure 4.6: Comparison of risk factor prevalence in urban vs rural patients

The figure shows that urban residents had a higher prevalence of all assessed cardiovascular risk factors. Stress was the most dominant (74.5% in urban vs. 56.5% in rural), followed closely by fast-food intake (60.4% vs. 44.9%). Hypertension (66.0% vs. 46.4%) and smoking (58.5% vs. 42.0%) also showed significantly greater prevalence among urban patients. These findings reinforce the association between urban living and exposure to multiple behavioral and environmental risk factors, which cumulatively elevate cardiovascular disease and IMR risk.

This study evaluated 350 patients presenting with STEMI and revealed a high burden of ischemic mitral regurgitation (IMR), with moderate IMR being the most prevalent severity category across both genders. The majority of affected individuals were between 41–60 years old, and 74% of the patients were male.

Among the modifiable risk factors, stress (68.9%), hypertension (62.3%), smoking (53.1%), and fast-food intake (56.0%) were the most common. A substantial proportion of patients also had diabetes mellitus (48.6%) and a family history of CAD (37.1%).

Hypertension showed a strong association with IMR severity; hypertensive patients were more likely to have moderate or severe regurgitation compared to non-hypertensive individuals. Similarly, smoking was correlated with higher IMR grades, suggesting a potential role in post-STEMI cardiac remodeling and mitral apparatus dysfunction.

Risk factor analysis by residence revealed that urban patients exhibited higher prevalence of all major risk factors, especially stress (74.5%), hypertension (66.0%), and fast food consumption (60.4%), indicating that urban lifestyle contributes significantly to cardiovascular risk accumulation.

Echocardiography was the primary diagnostic method used to assess IMR severity, and percutaneous coronary intervention (PCI) was the most frequently employed treatment, especially in patients with severe IMR.

In conclusion, the study highlights that modifiable risk factors, particularly hypertension and smoking, are significantly associated with the

severity of ischemic mitral regurgitation in STEMI patients. These insights stress the urgent need for targeted preventive interventions, especially in urban populations, to reduce IMR progression and improve post-infarction outcomes.

5. DISCUSSION

This chapter provides an in-depth interpretation and evaluation of the findings presented in the previous chapter. The aim is to contextualize the results of the study on the association between coronary artery disease (CAD) risk factors and ischemic mitral regurgitation (IMR) among patients with ST-segment elevation myocardial infarction (STEMI), comparing them with existing literature and explaining their implications for clinical practice and public health.

5.1 Overview of Major Findings

This study analysed data from 350 STEMI patients, of whom 65% were male and 35% female. The majority of cases occurred in middle-aged adults, particularly within the 41–60 years age group. Moderate ischemic mitral regurgitation (IMR) was the most prevalent severity grade across both genders. The most common risk factors identified in the study population included stress (64.6%), hypertension (61.1%), fast-food consumption (56.6%), and smoking (53.1%). Diabetes mellitus (48.9%) and sedentary lifestyle (46.9%) were also highly represented.

5.2 Comparison with Previous Studies

The demographic trend indicating male predominance in STEMI is consistent with existing literature. A study by Shakeel et al. (2022) found that 69.6% of STEMI patients were male, which supports the gender distribution in our sample (65% male, 35% female). Similarly, Ali et al. (2023) reported that ischemic mitral regurgitation (IMR) was more common among males, reinforcing our finding that while men were more frequently affected by STEMI, the distribution of moderate-to-severe IMR was comparable across genders.

In terms of risk factors, Zahid et al. (2020) highlighted a high prevalence of hypertension and smoking among cardiac patients in Punjab, which is closely reflected in our study, where 61.1% of patients had hypertension and 53.1% were smokers. These factors were significantly associated with higher IMR severity in our analysis. Raza et al. (2021) also observed that hypertensive individuals had greater susceptibility to adverse cardiac remodelling, aligning with our findings that hypertensive patients had a greater proportion of moderate and severe IMR.

Stress and fast food intake were particularly prominent in urban patients. Our data showed that 74.4% of urban participants reported high stress levels and 67.7% consumed fast food regularly. This supports findings from Ahmed et al. (2021), who identified urban living as a contributor to elevated psychological stress and poor dietary habits among cardiac patients.

In terms of diagnostics and treatment, Khan et al. (2022) emphasized the value of echocardiographic assessment post-STEMI in accurately identifying IMR severity—mirroring our study's use of echocardiography as the standard diagnostic modality for IMR classification. Mahmood et al. (2023) similarly reported that PCI was the most frequently administered treatment for post-MI patients, including those with IMR, which corresponds with our treatment pattern observations.

5.3 Implications for Clinical Practice

The findings of this study hold substantial relevance for clinical management and preventive cardiology. Identifying hypertension and smoking as critical factors in the progression of IMR highlights the need for aggressive risk factor modification in STEMI patients. Clinicians should prioritize early detection and tight control of blood pressure as part of post-MI rehabilitation protocols.

Moreover, smoking cessation must be emphasized through structured interventions, counseling, and pharmacotherapy where necessary. The incorporation of lifestyle management programs, particularly in urban primary care centers, could reduce the incidence and severity of IMR in the long term.

The demographic insight that middle-aged individuals are most affected suggests that preventive strategies should target this age group with community-based education campaigns, regular health screenings, and stress management workshops.

5.4 Public Health Significance

The urban-rural disparity in risk factor prevalence indicates a need for tailored public health strategies. Urban populations are particularly vulnerable due to higher exposure to fast food, stress, and sedentary work environments. Public health initiatives should focus on promoting physical activity, improving access to healthy food options, and mental health support in urban areas.

At the policy level, regulations targeting the reduction of salt, sugar, and trans fats in processed foods, along with tobacco control laws, can significantly reduce the cardiovascular disease burden. Strengthening the primary healthcare system to offer comprehensive cardiac risk assessment and echocardiographic screening can aid in early detection of IMR in post-STEMI patients.

5.5 Strengths of the Study

One of the main strengths of this study is its focus on a specific subgroup of cardiac patients those with STEMI complicated by IMR which remains underexplored in South Asian contexts. By analyzing both clinical and sociodemographic data, the study provides a holistic understanding of the risk landscape.

Additionally, the use of both subjective (questionnaire-based) and objective (echocardiographic) data collection methods enhances the validity and reliability of the findings. The standardized classification of IMR severity allows for accurate comparisons and correlation analysis.

5.6 Limitations

Despite its strengths, the study has several limitations. First, the sample size, though adequate for preliminary analysis, may limit the generalizability of findings to broader populations. Second, the cross-sectional design restricts the ability to infer causality between risk factors and IMR severity. A longitudinal follow-up would be required to confirm temporal relationships. Another limitation is the potential for recall bias in patient-reported variables such as dietary habits, stress levels, and smoking history. Moreover, echocardiographic grading, although standardized, may have inter-observer variability despite efforts to ensure consistency.

5.7 Future Research Directions

Future studies should focus on larger, multicenter cohorts to validate these findings across diverse populations. Longitudinal studies are essential to track the progression of IMR and assess the long-term impact of various interventions. Exploration of additional risk factors such as obesity, sleep disorders, and genetic predispositions could provide further insight. Investigating the effectiveness of community-level interventions aimed at lifestyle modification and early detection may also yield valuable outcomes. Advanced imaging techniques and biomarkers may enhance early diagnosis and risk stratification of IMR in STEMI patients, allowing for more personalized treatment plans.

6. Conclusion, Recommendations and Limitations

6.1 Conclusion This study examined the association between coronary artery disease (CAD) risk factors and ischemic mitral regurgitation (IMR) in 350 patients presenting with ST-segment elevation myocardial infarction (STEMI). The findings strongly suggest that IMR severity is significantly influenced by modifiable risk factors particularly hypertension, smoking, psychological stress, and frequent fast-food consumption. The majority of cases occurred in middle-aged adults, with males comprising 65% of the sample. However, both genders experienced moderate-to-severe forms of IMR, indicating a broader demographic impact. Urban residents consistently exhibited higher frequencies of major risk factors, including stress (74.4%) and fast-food intake (67.7%), highlighting the role of urban lifestyle and environmental stressors in disease progression. Moderate IMR was the most frequently observed grade across the cohort. A significant association was observed between hypertension and smoking with increased IMR severity, supporting existing evidence that these factors contribute to adverse cardiac remodelling post-MI. Echocardiography played a critical role in confirming IMR grades, and PCI emerged as the most commonly applied treatment, especially in patients with severe regurgitation. Overall, this research contributes valuable insight into the risk profile of IMR among STEMI patients and underscores the urgent need for early identification, targeted prevention, and structured lifestyle modification programs to reduce IMR burden and improve cardiovascular outcomes in vulnerable populations.

6.2 Recommendations

Healthcare professionals should conduct regular screening of STEMI patients for IMR using echocardiography, especially in hypertensive and smoking populations. Strict control of hypertension and structured smoking cessation programs should be integrated into post-STEMI care protocols. Counseling on stress management, balanced diet, and physical activity should be incorporated into cardiac rehabilitation programs. Middle-aged males, who constituted the majority of cases, should be the focus of targeted intervention strategies.

6.3 Limitations

This study is conducted in selected tertiary care hospitals in Peshawar and includes patients diagnosed with STEMI who also meet echocardiographic criteria for ischemic mitral regurgitation. The population includes both male and female patients from urban and rural areas, and data collection focuses on demographic characteristics, lifestyle habits, diagnostic findings, and treatment history. However, certain limitations should be acknowledged. The study is cross-sectional in design and relies partly on self-reported data, which may introduce recall bias. It is also limited to patients presenting within a specific timeframe and geographic region, which may restrict the generalizability of the findings. Despite these limitations, the study is expected to provide important insights into the interplay between CAD risk factors and IMR in the local healthcare context.

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