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Original Research Article

Frequency of Multivessel Disease in Patients Presenting with Acute Myocardial Infarction

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Abstract: *Acute myocardial infarction (AMI) is a major cause of morbidity and mortality worldwide. Multivessel disease, defined as the involvement of more than one vascular bed including coronary, peripheral, and cerebrovascular circulation, significantly influences prognosis and management strategies in AMI patients. However, local data regarding its frequency remains limited.* ***Objective:*** *To determine the frequency of multivessel disease in patients with acute myocardial infarction. Study Design: Cross-sectional study. Place and Duration of Study: At Punjab Institute of Cardiology, Lahore, Cardiology Department from 15-01-2025 to 15-04-2025.* ***Methodology:*** *This cross-sectional study was conducted after taking ethical approval from the IRB of Punjab Institute of Cardiology, Lahore. This study was done on 120 patients diagnosed with AMI (STEMI and NSTEMI) after taking informed consent. Data was collected using a proforma. Demographic details of patients and frequency of multivessel disease (involvement of more than one vascular bed, including peripheral arterial disease, coronary artery disease, and cerebrovascular disease) were noted. Data analysis was completed using SPSS version 26.* ***Results:*** *Among 120 patients with AMI, 39% patients had coronary artery disease, 17% had peripheral arterial disease, and 9% had cerebrovascular disease. Multivessel disease was found in 13% of the study population. Multivessel disease was more common in older patients, females, those with higher BMIs, and those presenting with NSTEMI; however, none of these associations were statistically significant (p >).* ***Conclusion:*** *This study highlights that a significant proportion of patients with acute myocardial infarction have underlying multivessel disease, emphasizing the systemic nature of atherosclerosis. Identifying the presence of multivessel involvement is crucial, as it is associated with a higher risk of adverse cardiovascular outcomes. Early recognition and comprehensive vascular assessment in AMI patients can guide more effective management strategies and improve long-term prognosis.*

Keywords: Frequency, multivessel disease, acute myocardial infarction

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Introduction

Myocardial infarction remains a major contributor to global mortality. Clinically, AMI is classified into two main categories: STEMI and NSTEMI (1). The estimated annual incidence of MI is around 550,000 new cases and 200,000 recurrent cases, with 57% of cases occurring in men and 43% in women (2). Myocardial infarction leads to irreversible myocardial injury due to reduced oxygen supply, compromising both diastolic and systolic cardiac function and predisposing patients to life-threatening complications. (3) Timely reperfusion therapy, especially within six hours of symptom onset, is vital to improving clinical outcomes (4). Atherothrombosis is now recognized as a systemic condition that frequently involves multiple vascular beds, including the coronary, peripheral, and cerebrovascular territories. (5) Atherosclerotic plaque formation mainly results from endothelial dysfunction, lipid buildup, inflammation, and the growth of smooth muscle cells (6). These plaques can rupture, triggering thrombosis and leading to partial or complete occlusion of the affected vessel (7). Over time, this process can occur in more than one vascular territory, a condition termed multivessel disease, which reflects the widespread nature of atherosclerosis and significantly increases the risk of adverse cardiovascular events (8). Although the clinical burden of multivessel disease has been explored in various populations, limited data are available from the South Asian region, particularly Pakistan. Internationally, studies such as that by Jonelid B et al. have reported multivessel disease prevalence of 13.8% among patients with AMI (9). However, regional prevalence and patterns remain unclear. Therefore, this study was designed to determine the frequency of multivessel disease in patients presenting with acute myocardial infarction in our local population, aiming to provide region-specific insights that may inform clinical management and preventative strategies.

Methodology

After obtaining approval from the IRB (REF: RTPGME-Research-351; dated 01-01-2025), this cross-sectional study was conducted at the Cardiology Department of PIC, Lahore, over a period of three months (dated 15-01-2025 to 15-04-2025). This study was conducted on 120 patients meeting the selection criteria. Inclusion criteria: Patients of either gender, aged 30 to 80 years, admitted with acute myocardial infarction, presenting with retrosternal chest pain, including both STEMI and NSTEMI, within 12 hours of symptoms onset.(10) Exclusion criteria: Patients with a history of coronary artery bypass grafting, valve replacement, ischemic heart disease, or those in cardiogenic shock at presentation were excluded. A sample size of 120 patients was calculated using the WHO sample size calculator, with a 95% confidence level, an 8% margin of error, and an expected frequency of multivessel disease of 13.8%. (9) Patients were enrolled using non-probability consecutive sampling. The following demographic and clinical data were recorded for all patients: name, age, gender, and presence of risk factors, including diabetes, hypertension, and smoking. All patients underwent ECG, echocardiography, and cardiac enzymes. Coronary artery disease was diagnosed through coronary angiography performed during cardiac catheterization, i.e., reduction of ≥50% in luminal diameter of any major coronary artery. Peripheral arterial disease was assessed using the Ankle-

Brachial Index, which was measured with a handheld Doppler device. ABI value of ≤0.90 was considered indicative of peripheral arterial disease. (11) Cerebrovascular disease was evaluated using carotid doppler ultrasound, peak systolic velocity of more than 2.3 m/s in the internal carotid artery (ICA), and ICA to CCA systolic ratio greater than four were taken as evidence of significant carotid artery stenosis, suggestive of ≥70% narrowing. (12) All assessments were performed by qualified personnel using standardized techniques. Multivessel disease frequency was noted, defined as the presence of more than one affected vascular bed, including coronary artery disease, peripheral arterial disease, and cerebrovascular disease. Patients found to have multivessel disease were managed according to the standard institutional protocol. The researcher was responsible for data collection and record maintenance using a pre-designed proforma. The data were analyzed and entered into SPSS version 26. Quantitative variables were presented as mean and standard deviation, whereas qualitative as frequency and percentage. Data was stratified for effect modifiers and post-stratification chi-square test was applied and p-value <0.05 was considered significant

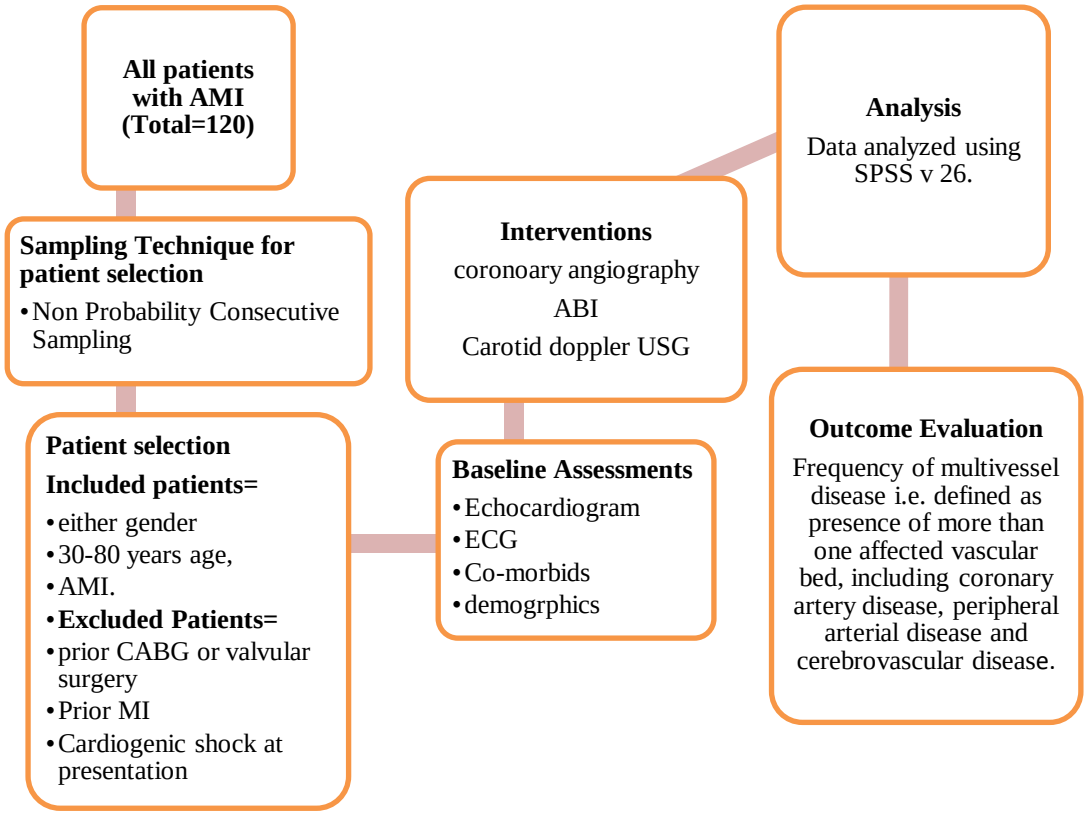

Figure I: Patient Flow Diagram

Results

A total of 120 AMI patients were enrolled in the study. As shown in Table I, mean age of study participants was 54.25 ± 8.59 years, among them 61% were males and 39% were females. Mean BMI was calculated was 24.87 ± 1.78 kg/m². Regarding comorbid conditions, 43.3% patients were diabetic, 54.2% were hypertensive, and 31.7% were active smokers. The average duration from the onset of symptoms to hospital presentation was 7.81 ± 1.79 hours. NSTEMI was more commonly observed in 64% patients, while STEMI was present in 36%. In terms of arterial involvement, 39% of patients had coronary artery disease, 17% had peripheral arterial disease, and 9% had cerebrovascular disease. Multivessel disease, defined as involvement of more than one vascular bed, was found in 13% of study population. Multivessel disease was stratified against various effect modifiers as shown in table III. Among patients aged ≤55 years, 12% had multivessel disease, while the prevalence was 14% in those older than 55 years; however, difference was not statistically significant (p = 0.736). Gender-wise analysis revealed that 11% of males and 17% of females had multivessel disease, with no significant association (p = 0.340). When stratified by BMI, multivessel disease was observed in 11% of those with BMI ≤25 kg/m² and in 18% of those with BMI >25 kg/m² (p = 0.267). Presentation time was also assessed: 14% of patients presenting within 6 hours had multivessel disease compared to 11% of those presenting between 6–12 hours (p = 0.641). When compared based on AMI type, multivessel disease was seen in 12% of STEMI patient's vs 14% of NSTEMI patients (p = 0.681).

Table 1: Summary of study variables (N=120)

Age (years) Mean±SD		**54.25±8.59**
Gender	Male frequency (%)	73 (61%)
	Female frequency (%)	47 (39%)
BMI (kg/m2) Mean±SD		24.87±1.78
Diabetes frequency (%)		52 (43.3%)
Hypertension frequency (%)		65 (54.2%)
Active smoker's frequency (%)		38 (31.7%)
AMI Duration (hours) Mean±SD		7.81±1.79
AMI Type	STEMI frequency (%)	43(36%)
	NSTEMI frequency (%)	77(64%)

Table 2: Frequency of arterial involvement (N=120)

Pattern of arterial involvement	Frequency (%)
Coronary artery disease	47 (39%)
Peripheral arterial disease	20 (17%)
Cerebrovascular disease	11 (9%)
Multivessel disease	16(13%)

Table 3: Stratification of multivessel disease according to Effect Modifiers

		Multivessel disease		p-value
		Yes frequency (%)	No frequency (%)	
Age	<Upto 55 years	5 (12%)	37 (88%)	0.736
	>55 years	11 (14%)	67 (86%)	
Gender	Male	8 (11%)	65 (89%)	0.340
	Female	8 (17%)	39 (83%)	
BMI	Upto 25kg/m2	8 (11%)	67 (89%)	0.267
	>25kg/m2	8 (18%)	37 (82%)	
AMI time	<6 hours	13 (14%)	79 (86%)	0.641
	6-12 hours	3(11%)	25 (89%)	
AMI Type	STEMI	5 (12%)	38 (88%)	0.681
	NSTEMI	11 (14%)	66 (86%)	

Discussion

This study examined the prevalence of multivessel disease among patients presenting with acute myocardial infarction and explored its association with various demographic and clinical characteristics. Mean age of participants having acute MI found was 54.25 ± 8.59 years with male predominance. Similarly, Kumar et al, involving cohort of 4,686 MI patients reported male prevalence of 78.8%.(13) A local study by Mir et al. reported high male predominance, with 90.5% of myocardial infarction cohort being male.(14) In our study, NSTEMI was observed in 64% patients, while STEMI accounted for 36%. However, Muneeb et al, reported that among patients presented with MI, STEMI found in 42.6% vs NSTEMI 26.7% (15). The current results revealed that 13% of the study population had multivessel disease, defined as the involvement of more than one vascular territory. Coronary artery disease was identified in 39% of patients, peripheral arterial disease in 17%, and cerebrovascular disease in 9%. These findings support the growing evidence that atherosclerosis is a systemic condition frequently affecting multiple vascular beds. Similarly, Manolis et al observed multivessel disease in approximately 15% to 30% patients (16). Vlis et al, found it in 16% patients (17). However, Junaid et al, found 6.9% frequency of Multivascular disease in patients presenting with acute coronary syndrome (18). In contrast, Kobo et al. observed a higher prevalence of 49.7%.(19) Furthermore, studies by Ghasemi et al, and Cherukumudi & Bhagavan also reported that CAD (56.1%-61%) is highly co-existing with PAD (20, 21). This study was limited by its single-centre design and relatively small sample size, which may affect the generalizability of the findings. Additionally, angiographic assessment was not correlated with long-term clinical outcomes.

Conclusion

This study highlights that significant proportion of patients with acute myocardial infarction have underlying multivessel disease, emphasizing the systemic nature of atherosclerosis. Identifying the presence of multivessel involvement is crucial, as it is associated with higher risk of adverse cardiovascular outcomes. Early recognition and comprehensive vascular assessment in AMI patients can guide more effective management strategies and improve long-term prognosis.

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. (RTPGME-Research-351)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

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Manuscript drafting, Study Design,
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Conception of Study, Development of Research Methodology Design,
SJ (Senior Registrar)
Study Design, manuscript review, critical input.
ZS (Resident Cardiology)
Manuscript drafting, Study Design,
AH (Resident Physiology)
Review of Literature, Data entry, Data analysis, and drafting article.
MAR (Resident Cardiology)
Conception of Study, Development of Research Methodology Design,
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Study Design, manuscript review, critical input.

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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