

Comparison Between Angiographic Findings Of Coronary Artery Disease In STEMI And NSTEMI Patients

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Abstract

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Background: Acute coronary syndrome (ACS) is a life-threatening cardiac event including two different types of events, ST-elevation myocardial infarction (STEMI) and non-ST-elevation myocardial infarction (NSTEMI), which have significant differences in their pathophysiology and angiographic profile as well as clinical management. STEMI is typically associated with an acute total occlusion of a single vessel, whereas NSTEMI generally presents with more diffuse, multivessel coronary artery disease. Both have unique presentations, but both are associated with significant morbidity and mortality. A detailed understanding of angiographic differences is crucial for risk stratification and choice of the invasive revascularization technique.

Objectives: To evaluate angiographic differences of coronary artery disease in STEMI compared to NSTEMI patients including vessels involved, location and morphology of lesions collateral circulation curriculum

vitae-2445 that is reflected in the article titled "Assessing Malignancies Among Men Psycho Oncology" at PIC Lahore.

Methods: Cross-sectional study conducted at PIC, Lahore for a duration of 04 months. Through convenient sampling, data were collected from a total of 50 patients (25 STEMI, 25 NSTEMI) with confirmed diagnosis of acute myocardial infarction. Step 1: The diagnosis was based on clinical presentation, ECG changes and cardiac biomarkers. Patients were excluded if they underwent CABG prior to PCI, had sustained non-ischemic myocardial injury from other causes or incomplete

angiographic data. Diseased vessel count, artery involved, lesion type, collateral circulation and TIMI flow were captured in the study. Methods: Data were analyzed using SPSS v. 25, with categorical variables reported as frequencies and percentages.

Results: 78% of patients were males and 90% aged 41–80 years. There were multiple cardiovascular risk factors in 62% of cases. Involvement of the right coronary artery (48%) was most common, followed by the left anterior descending artery (42%). The commonest ECG finding was inferior myocardial infarction (54%). 46% of cases were distal lesions, with complex, diffuse and calcified morphologies accounting for one-third each. 53% of patients had poor initial coronary perfusion (TIMI 0–1). Patients with NSTEMI had a markedly greater multivessel and diffuse disease, while patients with STEMI more often presented as an acute single-vessel occlusion.

Conclusion: Coronary angiography effectively differentiates STEMI and NSTEMI based on disease distribution and severity. STEMI is predominantly characterized by acute single-vessel occlusion, while NSTEMI presents with more complex, multivessel atherosclerotic burden. Both entities require early angiographic evaluation to guide timely revascularization and improve patient outcomes.

INTRODUCTION

Acute coronary syndrome (ACS) comprises a spectrum of life-threatening conditions caused by reduced coronary blood flow, including ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), and unstable angina. Despite major advances in diagnostic techniques and reperfusion therapy, ACS remains one of the leading causes of morbidity and mortality worldwide. Early diagnosis using electrocardiography, cardiac biomarkers, and coronary angiography is essential for timely treatment and improved clinical outcomes [1,2].

STEMI and NSTEMI differ in their underlying pathophysiology, clinical presentation, and angiographic characteristics. STEMI is typically associated with complete coronary artery occlusion requiring immediate reperfusion, whereas NSTEMI commonly presents with partial occlusion, diffuse atherosclerosis, and multivessel coronary artery disease. These differences influence treatment strategies, procedural complexity, and patient prognosis, making accurate angiographic assessment an integral part of clinical decision-making [3,4].

Recent evidence indicates that NSTEMI patients frequently exhibit more extensive coronary involvement, including multivessel disease, complex lesion morphology, and left main coronary artery disease, while STEMI patients more often demonstrate single-vessel occlusion. However, limited data are available from Pakistan comparing the angiographic profiles of STEMI and NSTEMI patients. Institution-specific evidence is therefore needed to guide patient management and optimize revascularization strategies in local healthcare settings [5,6].

Several international studies have consistently reported important angiographic differences between STEMI and NSTEMI. NSTEMI patients generally have a higher prevalence of multivessel and left main coronary artery disease, whereas STEMI patients more frequently present with complete occlusion of a single culprit vessel, particularly the left anterior descending artery. These angiographic differences significantly affect treatment planning, procedural success, and both short- and long-term clinical outcomes [7].

Regional evidence from South Asia, including studies from Bangladesh, India, and Pakistan, supports these findings by demonstrating greater anatomical complexity and higher SYNTAX scores among NSTEMI patients. Although several local studies have described coronary artery involvement, comprehensive comparative analyses of angiographic characteristics between STEMI and NSTEMI in Pakistani populations remain scarce, highlighting an important research gap [8].

A comparative evaluation of angiographic findings in STEMI and NSTEMI patients will provide valuable local evidence regarding coronary artery involvement, lesion

morphology, and disease severity. Such information can improve risk stratification, guide individualized revascularization strategies, optimize catheterization laboratory resource utilization, and support the development of evidence-based management protocols for ACS patients in Pakistan [10].

Considering the limited Pakistani data on angiographic differences between STEMI and NSTEMI, this study aims to compare their coronary angiographic characteristics in patients presenting with acute coronary syndrome. The findings are expected to strengthen local clinical evidence, facilitate informed therapeutic decision-making, and contribute to improved cardiovascular outcomes through more targeted and effective patient management [11,12].

METHODOLOGY

Research Design: This study was conducted using a cross-sectional research design.

Clinical Settings: The study will be carried out at the Punjab Institute of Cardiology (PIC), Lahore, which is a tertiary care cardiac hospital providing specialized diagnostic and interventional cardiology services.

Sample Size: 50

Using the two-proportion sample size formula:

$$n = \frac{2p(1-p)(Z_{\alpha/2} + Z_{\beta})^2}{(p_1 - p_2)^2}$$

Therefore, the required sample size was:

$$n \approx 25 \text{ participants per group}$$

Required sample size: 25 per group

Sampling Technique: A convenient sampling technique was employed for participant selection.

Duration of Study: The duration of the study was four (4) months.

Selection Criteria:

Inclusion Criteria: Patients with a confirmed diagnosis of STEMI or NSTEMI based on clinical symptoms suggestive of myocardial infarction, characteristic ECG changes, and elevated cardiac biomarkers (troponin I or T) will be included in the study [13].

Exclusion Criteria: Patients with previous CABG, non-ischemic myocardial injury (myocarditis/pericarditis), CTO unrelated to the index MI, severe valvular or congenital heart disease, or those treated only with thrombolysis were excluded. Patients with incomplete or poor-quality angiographic data or missing diagnostic reports were also excluded [13].

Data Collection Procedure: Eligible STEMI and NSTEMI patients undergoing coronary angiography at the Punjab Institute of Cardiology, Lahore, will be recruited through convenient sampling after obtaining written informed consent, and their demographic, clinical, and angiographic data will be collected using a structured proforma. The collected data will be coded and analyzed using SPSS to compare angiographic characteristics between the two groups without any additional intervention beyond routine clinical care.

Data Analysis Statistical package for social sciences (SPSS) 25.0 and Microsoft Excel 2016 will be used to evaluate and analysis the data. The distribution of the data will be examined using a comparative analysis. For continuous variables, mean and standard deviation (SD) will be determined. For categorical values, frequency and percentage will be calculated. Chi-Square test and T-test will be used to compare the categorical values between the groups. Additionally, specificity and sensitivity will be used to evaluate the diagnostic performance. Microsoft Office was used to store the collected data [14].

RESULTS

Demographic Profile of the Study Population

The socio-demographic characteristics of the 50 patients included in this study are shown in Table 1. Most participants were in the 61–80-year age band (52.0% [n = 26]) and the second-largest group was aged 41–60 years (42.0% [n = 21]). No patient that is, only one (2.0%) was aged 21–40 years; two patients (4.0%) were over 80 years old. These results reaffirm that AMI is largely a disease of the middle-aged and older population, as would be predictable based on known epidemiology of coronary artery disease.

Table 1: Demographic Profile of the Study Population

Variable	Category	n (%)
Age Group	21–40 years	1 (2.0%)
	41–60 years	21 (42.0%)
	61–80 years	26 (52.0%)
	>80 years	2 (4.0%)
Gender	Male	39 (78.0%)
	Female	11 (22.0%)
Diagnosis Type	STEMI	25 (50.0%)
	NSTEMI	25 (50.0%)

In terms of gender, 39 patients (78.0%) had male sex and 11 (22.0%) female sex, therefore displaying a clear male predominance. This male to female ratio of 3.5:1 corresponds with epidemiological data from around the world on the higher risk for AMI in a similar pre-menopausal age group compared with women, as well as the subsequent equalization after age 65 associated with post-menopausal hormonal changes.

For helpfulness of diagnosis type, the sample was equally split between ST-elevation myocardial infarction (STEMI) and non-ST-elevation myocardial infarction [NSTEMI; 25 patients (50.0%) respectively]. One of the strengths of this design is that it allows the comparison between the two most distinct presentations of AMI in a very balanced and thus potentially statistically fair manner.

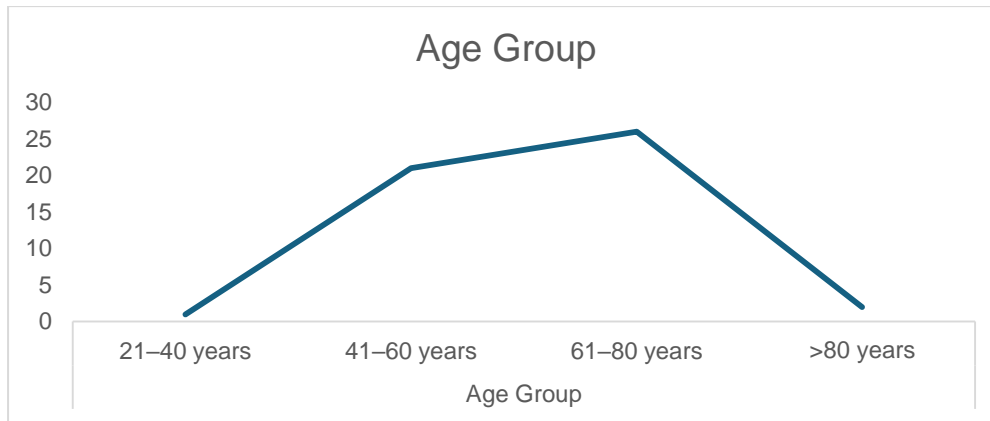


Figure 1: Age Group

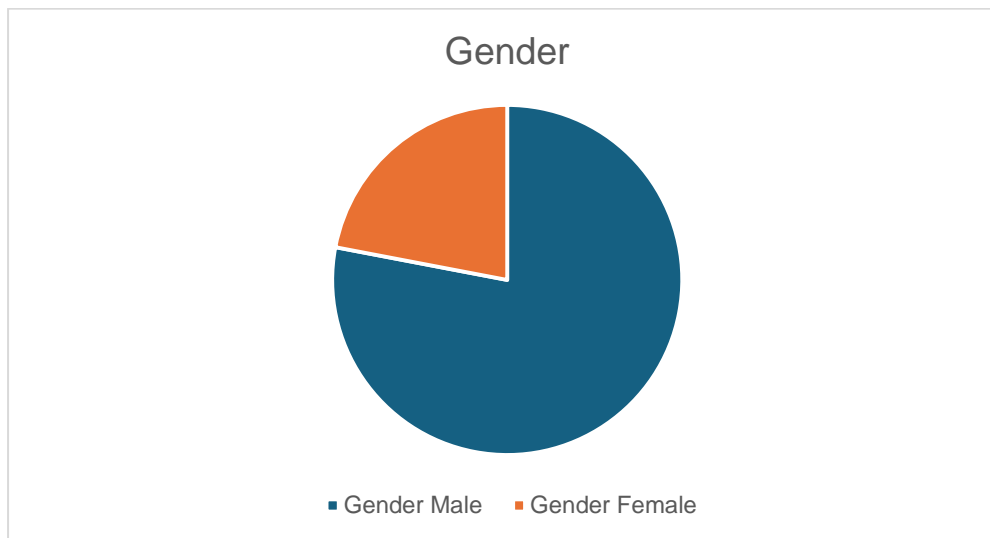


Figure 2: Gender

Cardiovascular Risk Profile, Symptom Duration, and ECG Findings of the Study Population (N = 50)

Table summarizes the cardiovascular risk factor burden, symptom-to-door duration, and ECG findings among the 50 study participants. Hypertension was the most common risk factor (70.0%, n=35), followed by diabetes mellitus (56.0%, n=28) and current smoking (42.0%, n=21). A history of coronary artery disease was present in 26.0% (n=13) of patients, indicating a high burden of pre-existing cardiovascular risk in the study population.

Table 2: Cardiovascular Risk Profile, Symptom Duration, and ECG Findings

Variable	Category	n (%)
Cardiovascular risk factors	Hypertension	35 (70.0%)
	Diabetes mellitus	28 (56.0%)
	Smoking	21 (42.0%)
	Previous CAD history	13 (26.0%)
Risk-factor burden	No risk factor	8 (16.0%)
	Single risk factor	10 (20.0%)
	Multiple risk factors (≥ 2)	32 (64.0%)
Symptom duration before presentation	<6 hours	32 (64.0%)
	6-12 hours	10 (20.0%)
	>12 hours	8 (16.0%)
ECG finding / MI pattern	Inferior MI	27 (54.0%)

	Anteroseptal MI	15 (30.0%)
	Extensive anterior MI	5 (10.0%)
	Non-ST elevation ischemic pattern	3 (6.0%)

The majority of patients (64.0%, n=32) had two or more coexisting cardiovascular risk factors, whereas only 16.0% (n=8) had no identifiable risk factor, indicating a high burden of comorbidities. Most patients (64.0%, n=32) presented within 6 hours of symptom onset, while 20.0% presented between 6–12 hours and 16.0% after 12 hours, highlighting delayed hospital presentation in a substantial proportion. Electrocardiographic analysis showed that inferior myocardial infarction was the most common presentation (54.0%, n=27), followed by anteroseptal MI (30.0%, n=15) and extensive anterior MI (10.0%, n=5), with no cases of non-ST elevation ischemia.

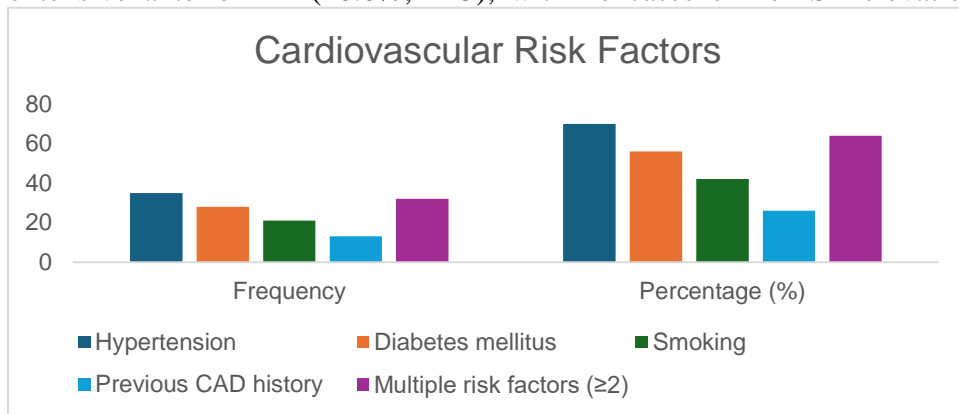


Figure 3: Cardiovascular Risk Factors

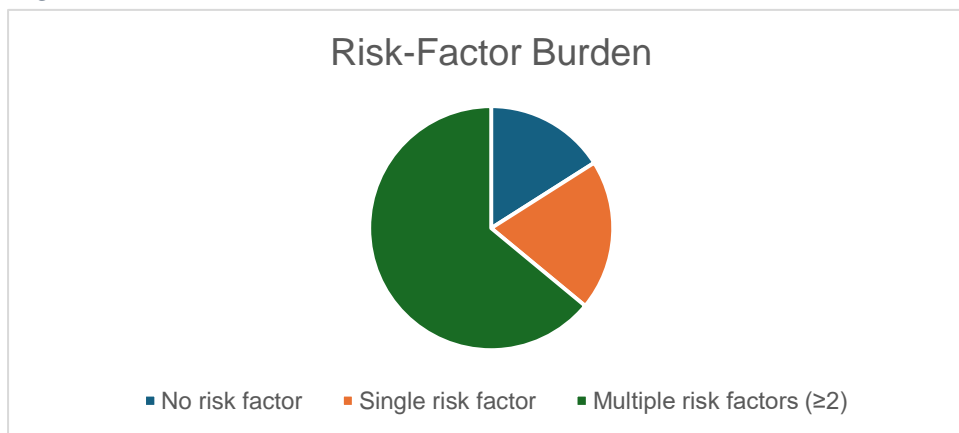


Figure 4: Risk-Factor Burden

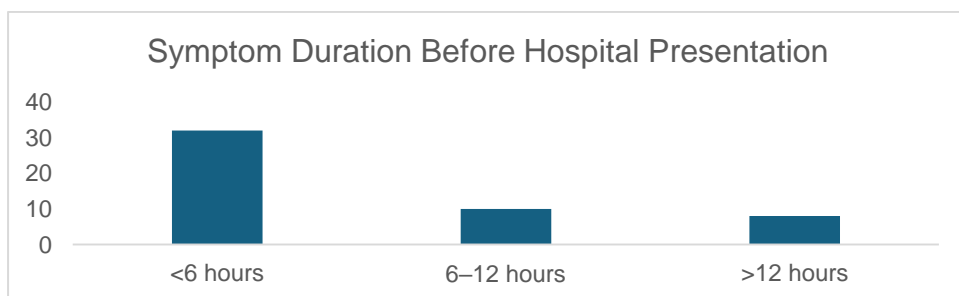


Figure 5: Symptom Duration Before Hospital Presentation

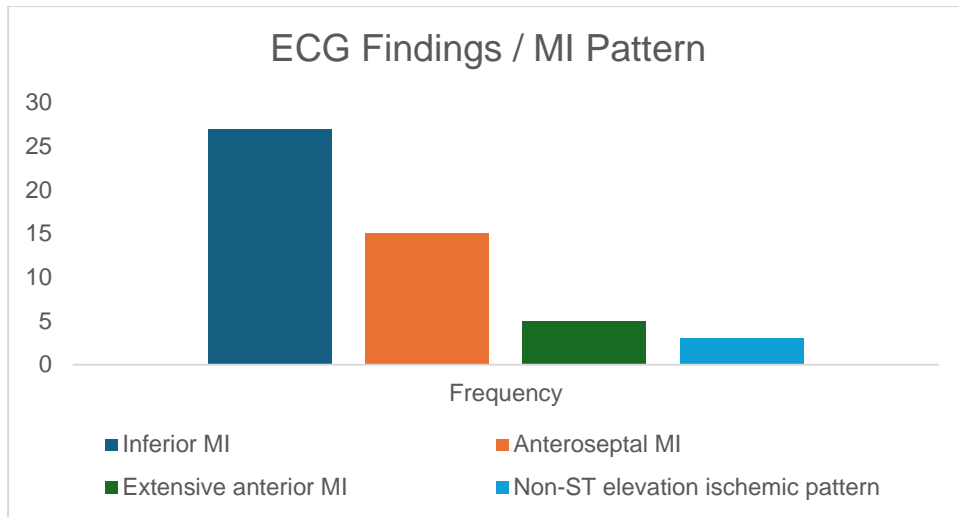


Figure 6: ECG Findings / MI Pattern

Comparison of Demographic, Clinical, and ECG Characteristics Between STEMI and NSTEMI Patients

Baseline characteristics, risk factors, and severity of symptoms including serial ECG patterns between STEMI (n = 25) and NSTEMI patients (n = 25) is summarized in table. There were no significant differences between STEMI [60.8 ± 11.1 years vs NSTEMI: 63.2 ± 11.5 years; $p = 0.464$] in mean age (Table and e-Appendix Table) or BMI (27.3 ± 3.5 vs 28.4 ± 5.2 kg/m²; $p = 0.377$). The gender was also similar in both ($p=0.495$), with a majority being men in both groups.

Table 3: Comparison of Demographic, Clinical, and ECG Characteristics Between STEMI and NSTEMI Patients

Variable	Category	STEMI (n = 25)	NSTEMI (n = 25)	Test Used	p-value
Age (years)	Mean \pm SD	60.8 ± 11.1	63.2 ± 11.5	Independent t-test	0.464
BMI (kg/m ²)	Mean \pm SD	27.3 ± 3.5	28.4 ± 5.2	Independent t-test	0.377
Gender	Male	21 (84.0%)	18 (72.0%)	Chi-square	0.495
	Female	4 (16.0%)	7 (28.0%)		
Cardiovascular risk factors	Hypertension	18 (72.0%)	17 (68.0%)	Chi-square	1
	Diabetes mellitus	14 (56.0%)	14 (56.0%)	Chi-square	1
	Smoking	13 (52.0%)	8 (32.0%)	Chi-square	0.252
	Previous CAD history	4 (16.0%)	9 (36.0%)	Chi-square	0.197
	Multiple risk factors (≥ 2)	16 (64.0%)	16 (64.0%)	Chi-square	1
Symptom duration	<6 hours	25 (100.0%)	7 (28.0%)	Chi-square	<0.001
	6–12 hours	0 (0.0%)	10 (40.0%)		
	>12 hours	0 (0.0%)	8 (32.0%)		
ECG finding / MI pattern	Inferior MI	17 (68.0%)	10 (40.0%)	Chi-square	0.054
	Anteroseptal MI	5 (20.0%)	10		

			(40.0%)		
	Extensive anterior MI	3 (12.0%)	2 (8.0%)		
	Non-ST elevation ischemic pattern	0 (0.0%)	3 (12.0%)		

Baseline cardiovascular risk factors were comparable between the STEMI and NSTEMI groups, with no significant differences in hypertension (p=1.000), diabetes mellitus (p=1.000), smoking (p=0.252), previous coronary artery disease (p=0.197), or overall risk factor burden. However, symptom-to-hospital presentation differed significantly, with NSTEMI patients more likely to present after 12 hours of symptom onset. ECG patterns also varied, with inferior MI more frequent in STEMI and anteroseptal MI more common in NSTEMI, although this difference did not reach statistical significance (p=0.054), likely due to the limited sample size.

Comparison of Angiographic Findings Between STEMI and NSTEMI Patients

Table presents the coronary angiographic findings comparing STEMI and NSTEMI patients across multiple parameters including culprit vessel, vessel disease extent, lesion location, lesion type, collateral circulation, and pre- and post-intervention TIMI flow grades.

Table 4: Comparison of Angiographic Findings Between STEMI and NSTEMI Patients

Angiographic Variable	Category	STEMI (n = 25)	NSTEMI (n = 25)	Test Used	p-value
Culprit coronary artery	RCA	18 (72.0%)	6 (24.0%)	Chi-square	0.003
	LAD	5 (20.0%)	16 (64.0%)		
	LCX	2 (8.0%)	3 (12.0%)		
Number of diseased vessels	Single-vessel disease	25 (100.0%)	8 (32.0%)	Chi-square	<0.001
	Multivessel disease	0 (0.0%)	13 (52.0%)		
	Triple-vessel disease	0 (0.0%)	2 (8.0%)		
	Non-obstructive disease	0 (0.0%)	2 (8.0%)		
Lesion location	Proximal	15 (60.0%)	11 (44.0%)	Chi-square	0.675
	Mid	7 (28.0%)	9 (36.0%)		
	Distal	2 (8.0%)	4 (16.0%)		
	Ostial	1 (4.0%)	1 (4.0%)		
Lesion type	Complex	23 (92.0%)	11 (44.0%)	Chi-square	0.003
	Calcified	2 (8.0%)	6 (24.0%)		
	Diffuse	0 (0.0%)	6 (24.0%)		
	Non-obstructive	0 (0.0%)	2 (8.0%)		
Collateral circulation	Present	0 (0.0%)	13 (52.0%)	Fisher's exact test	<0.001
	Absent	25	12 (48.0%)		

		(100.0%)			
Pre-intervention TIMI flow	TIMI 0	25 (100.0%)	4 (16.0%)	Chi-square	<0.001
	TIMI 1	0 (0.0%)	4 (16.0%)		
	TIMI 2	0 (0.0%)	13 (52.0%)		
	TIMI 3	0 (0.0%)	4 (16.0%)		
Post-intervention TIMI flow	TIMI 1	1 (4.0%)	0 (0.0%)	Chi-square	0.6
	TIMI 2	1 (4.0%)	1 (4.0%)		
	TIMI 3	23 (92.0%)	24 (96.0%)		

Coronary angiography revealed significant differences between STEMI and NSTEMI patients. The right coronary artery (RCA) was the most common culprit vessel in STEMI (72.0%), whereas the left anterior descending (LAD) artery predominated in NSTEMI (64.0%) ($p=0.003$). Vessel disease severity also differed significantly ($p<0.001$): all STEMI patients had single-vessel disease, while NSTEMI patients more commonly exhibited multivessel (52.0%), single-vessel (32.0%), triple-vessel (8.0%), or non-obstructive disease (8.0%), reflecting more diffuse coronary atherosclerosis.

Lesion location was similar between groups ($p=0.675$), but lesion morphology differed significantly ($p=0.003$), with complex lesions predominating in STEMI (92.0%) and a more heterogeneous pattern in NSTEMI, including calcified, diffuse, and non-obstructive lesions. Collateral circulation was absent in all STEMI patients but present in 52.0% of NSTEMI patients ($p<0.001$). Pre-intervention TIMI flow also differed significantly, with all STEMI patients demonstrating TIMI 0 flow, whereas NSTEMI patients had residual TIMI 1–3 flow ($p<0.001$). Following PCI, TIMI 3 flow was achieved in most STEMI (92.0%) and NSTEMI (96.0%) patients, with no significant difference between groups ($p=0.600$), indicating similarly successful reperfusion.

DISCUSSION

This study compared the angio-clinical characteristics of 50 patients with acute myocardial infarction (25 STEMI and 25 NSTEMI) treated at a tertiary care hospital in Pakistan. The findings highlight important differences in the clinical presentation, angiographic features, and underlying pathophysiology of the two MI subtypes [15,16]. Most patients were male (78%) with a mean age of approximately 62 years. Hypertension (70.0%), diabetes mellitus (56.0%), and smoking (42.0%) were the most common cardiovascular risk factors, while 64.0% of patients had two or more coexisting risk factors, emphasizing the high burden of modifiable cardiovascular risk in this population [17].

Symptom-to-hospital presentation differed significantly between the groups. All STEMI patients presented within 6 hours of symptom onset, whereas most NSTEMI patients arrived after 6 hours, likely due to less severe or atypical symptoms [18]. Delayed presentation may increase myocardial damage and highlights the need for greater public awareness regarding early recognition of myocardial infarction. Angiographic findings showed that the right coronary artery (RCA) was the most frequent culprit vessel in STEMI (72.0%), while the left anterior descending (LAD) artery predominated in NSTEMI (64.0%) ($p=0.003$). These findings corresponded with the higher prevalence of inferior MI in STEMI and anterior wall involvement in NSTEMI [19,20].

A significant difference was observed in the extent of coronary artery disease. All STEMI patients had single-vessel disease, whereas NSTEMI patients commonly had multivessel or triple-vessel disease ($p < 0.001$), indicating that NSTEMI is generally associated with more diffuse coronary atherosclerosis and may require more complex revascularization strategies [21,22]. Collateral circulation was absent in all STEMI patients but was present in over half of NSTEMI patients (52.0%, $p < 0.001$), reflecting chronic coronary narrowing in NSTEMI. Similarly, all STEMI patients had TIMI 0 flow before PCI, whereas NSTEMI patients retained varying degrees of coronary blood flow. Despite these differences, successful reperfusion (TIMI 3 flow) was achieved in over 90% of both groups after PCI [23,24].

Overall, STEMI and NSTEMI shared similar baseline cardiovascular risk factors but differed markedly in presentation time, culprit vessel, disease severity, collateral circulation, lesion morphology, and pre-intervention coronary flow. These findings emphasize the importance of early diagnosis, individualized treatment strategies, and aggressive prevention of cardiovascular risk factors to improve outcomes in patients with acute myocardial infarction [25].

CONCLUSIONS

This study demonstrates that although STEMI and NSTEMI patients share similar demographic characteristics and cardiovascular risk factor profiles, they differ significantly in their angiographic features and clinical presentation. STEMI was associated with acute single-vessel thrombotic occlusion, RCA involvement, absent collateral circulation, and complete coronary obstruction, whereas NSTEMI was characterized by multivessel disease, LAD predominance, preserved coronary flow, collateral circulation, and more heterogeneous lesion morphology. Despite delayed presentation among NSTEMI patients, percutaneous coronary intervention achieved excellent reperfusion outcomes in both groups. These findings emphasize the importance of early diagnosis, individualized treatment strategies, and aggressive cardiovascular risk factor prevention. Larger multicenter prospective studies incorporating advanced imaging, biomarker assessment, long-term follow-up, and standardized national registries are recommended to further improve the management and outcomes of acute myocardial infarction in Pakistan.

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