

EVALUATION OF CLINICAL PROFILE, CORONARY ANGIOGRAPHIC CHARACTERISTICS, AND MANAGEMENT IN YOUNG STEMI PATIENTS

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ABSTRACT

Background: ST-elevation myocardial infarction (STEMI) in young adults is increasingly recognized, particularly in developing countries, with distinct clinical and angiographic characteristics compared to older populations. **Materials and Methods:** This cross-sectional observational study included 50 consecutive patients aged ≤ 40 years presenting with STEMI who underwent coronary angiography at a tertiary care center. Clinical data, cardiovascular risk factors, presenting symptoms, echocardiographic findings, angiographic characteristics, and management strategies were recorded. Left ventricular ejection fraction (LVEF) was categorized, and coronary artery disease was classified based on vessel involvement. Data were analyzed using descriptive statistics. **Results:** The majority of patients were aged 36–40 years (46%), with male predominance (92%). Smoking (70%) and dyslipidemia (62%) were the most common risk factors, followed by alcohol use (26%) and diabetes (22%). Chest pain was present in 98% of patients, with sweating in 80% and breathlessness in 32%. Anterior wall myocardial infarction was the most common presentation (48%). Single vessel disease was observed in 58% of patients, while double and triple vessel disease were seen in 22% and 10%, respectively. The left anterior descending artery was the most common culprit vessel (46%), followed by the right coronary artery (28%). Preserved or mildly reduced LVEF ($>40\%$) was seen in 76% of patients, whereas 6% had severe dysfunction. Primary PCI was performed in 48%, pharmacoinvasive strategy in 26%, medical management in 18%, and CABG in 8%. **Conclusion:** Young STEMI patients predominantly present with modifiable risk factors, single vessel disease, and preserved ventricular function. Early recognition and timely intervention, particularly primary PCI, remain central to management in this population.

INTRODUCTION

Cardiovascular diseases continue to be the leading cause of death worldwide, and ST-elevation myocardial infarction (STEMI) represents one of the most critical and life-threatening manifestations of acute coronary syndromes. While myocardial infarction has been considered a disease of older individuals, there has been a concerning and consistent rise in its occurrence among younger adults over the past few decades.^[1,2] This is evident in developing countries such as India, where the burden of premature coronary artery disease (CAD) is higher compared to Western populations.^[3,4] The occurrence of STEMI in younger individuals carries profound clinical, social, and economic

consequences, as it affects individuals during their most productive years of life.

Young patients with STEMI often exhibit a clinical profile that differs from that of older patients. Modifiable risk factors such as smoking, dyslipidemia, alcohol consumption, and sedentary lifestyle are observed in this group and play a major role in disease development.^[5,6] In contrast, risk factors like hypertension and diabetes mellitus are present, tend to be less prevalent compared to older populations.^[7] This pattern suggests that lifestyle-related factors and behavioral risks contribute significantly to the early onset of CAD. The pathophysiology in younger patients is also believed to differ, with acute plaque rupture, thrombus formation, and hypercoagulable states playing a more dominant role rather than the diffuse and

chronic atherosclerotic changes seen in older individuals.⁸

In addition to differences in risk factors, coronary angiographic characteristics in young STEMI patients show distinct patterns. Single vessel disease is more commonly observed, and the left anterior descending artery is identified as the culprit vessel.^[9,10] These findings reflect a relatively localized disease process compared to the multivessel involvement often seen in older patients. Furthermore, young patients tend to have better preserved left ventricular function at presentation, possibly due to a lower burden of comorbidities and better myocardial reserve.^[11] Early presentation and reperfusion therapy, particularly through primary percutaneous coronary intervention (PCI), further contribute to favourable functional outcomes in this population.^[12,13]

Comprehensive data on the clinical profile, cardiovascular risk factors, coronary angiographic characteristics, left ventricular function, and management strategies of young patients with ST-elevation myocardial infarction remain limited. Therefore, the present study was undertaken to evaluate the clinical profile, cardiovascular risk factors, coronary angiographic characteristics, left ventricular function, and management patterns in young patients presenting with STEMI.

MATERIALS AND METHODS

Study Design and Setting: This cross-sectional observational study was conducted on a total of 50 consecutive patients aged ≤ 40 years presenting with STEMI. The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrollment.

Inclusion & Exclusion Criteria

Patients aged ≤ 40 years with a confirmed diagnosis of acute STEMI who underwent coronary angiography were included in the study. Patients aged > 40 years, those with a prior history of myocardial infarction, previous PCI or coronary artery bypass grafting (CABG), those presenting with non-ST elevation acute coronary syndromes, and patients with incomplete clinical or angiographic data were excluded.

Methods

All patients underwent detailed clinical evaluation including history, physical examination, and relevant laboratory investigations. Data were collected using a structured proforma from patient interviews and hospital records. The variables recorded included demographic characteristics (age and gender), cardiovascular risk factors such as smoking/tobacco use, dyslipidemia, diabetes mellitus, hypertension, obesity (BMI > 25 kg/m²), alcohol consumption, and family history of CAD, as well as clinical presentation including chest pain, sweating, breathlessness, palpitations, syncope, and nausea/vomiting.

All patients underwent a 12-lead electrocardiogram and two-dimensional echocardiography. Left ventricular ejection fraction (LVEF) was assessed and categorized as preserved ($> 50\%$), mildly reduced (41–50%), moderately reduced (31–40%), or severely reduced ($\leq 30\%$). Coronary angiography was performed in all patients after initial stabilization. CAD was classified as single vessel disease (SVD), double vessel disease (DVD), triple vessel disease (TVD), non-obstructive CAD, or normal coronary arteries. The culprit vessel was identified as the left anterior descending artery (LAD), right coronary artery (RCA), left circumflex artery (LCX), or left main coronary artery (LMCA). Based on clinical condition and angiographic findings, patients were managed with one of the following strategies: primary (PCI), pharmacoinvasive strategy (thrombolysis followed by coronary angiography and PCI within 3–24 hours), medical management alone, or coronary artery bypass grafting (CABG).

Statistical Analysis

Data were entered into Microsoft Excel. Categorical variables were expressed as frequencies and percentages. Since patients may have had more than one cardiovascular risk factor and more than one presenting symptom, percentages for these variables were calculated based on the total number of patients (n=50) and do not sum to 100%.

RESULTS

The majority of patients were aged 36–40 years (46%), followed by 31–35 years (28%) and increased male patients (92%) compared to females (8%) were observed. [Table 1]

Table 1: Demographic Characteristics of Study Population

Variable	Category	n (%)
Age Group (Years)	18–25	4 (8.0%)
	26–30	9 (18.0%)
	31–35	14 (28.0%)
	36–40	23 (46.0%)
Gender	Male	46 (92.0%)
	Female	4 (8.0%)

The most prevalent risk factors were smoking (70%) and dyslipidemia (62%), followed by alcohol use (26%) and diabetes (22%). Most patients presented

with chest pain (98%), while sweating (80%) and breathlessness (32%) were also common. [Table 2]

Table 2: Clinical Profile: Risk Factors and Presenting Symptoms

Variable	Category	n (%)
Risk Factors	Smoking/Tobacco Use	35 (70.0%)
	Dyslipidemia	31 (62.0%)
	Diabetes Mellitus	11 (22.0%)
	Hypertension	10 (20.0%)
	Family History of CAD	7 (14.0%)
	Obesity (BMI >25 kg/m ²)	9 (18.0%)
	Alcohol Consumption	13 (26.0%)
Presenting Symptoms	Chest Pain	49 (98.0%)
	Sweating	40 (80.0%)
	Breathlessness	16 (32.0%)
	Palpitations	8 (16.0%)
	Syncope	4 (8.0%)
	Nausea/Vomiting	12 (24.0%)

Anterior wall MI (48%) was the most common STEMI presentation. Single vessel disease (58%) predominated on angiography. The most frequently

involved culprit vessel was the LAD (46%), followed by the RCA (28%). [Table 3]

Table 3: Coronary Angiographic and STEMI Characteristics (n=50)

Variable	Category	n (%)
STEMI Type	Anterior Wall MI	24 (48.0%)
	Inferior Wall MI	17 (34.0%)
	Inferolateral MI	5 (10.0%)
	Extensive Anterior Wall MI	3 (6.0%)
	Posterior Wall MI	1 (2.0%)
Angiographic Findings	Single Vessel Disease (SVD)	29 (58.0%)
	Double Vessel Disease (DVD)	11 (22.0%)
	Triple Vessel Disease (TVD)	5 (10.0%)
	Non-obstructive CAD	3 (6.0%)
	Normal Coronaries	2 (4.0%)
Culprit Vessel	Left Anterior Descending (LAD)	23 (46.0%)
	Right Coronary Artery (RCA)	14 (28.0%)
	Left Circumflex (LCX)	7 (14.0%)
	Left Main Coronary Artery (LMCA)	2 (4.0%)
	Normal/Non-obstructive	4 (8.0%)

Most patients had preserved or mildly reduced LVEF (>40%) (76%), while 6% had severe dysfunction (≤30%). The most common treatment

was primary PCI (48%), followed by pharmacoinvasive strategy (26%), with CABG performed in 8%. [Table 4]

Table 4: Left Ventricular Function and Treatment Modality

Variable	Category	n (%)
LVEF (%)	>50	18 (36.0%)
	41–50	20 (40.0%)
	31–40	9 (18.0%)
	≤30	3 (6.0%)
Treatment Modality	Primary PCI	24 (48.0%)
	Thrombolysis Followed by PCI	13 (26.0%)
	Medical Management	9 (18.0%)
	CABG	4 (8.0%)

DISCUSSION

STEMI in young adults is recognized as an important clinical entity with distinct characteristics. This study aimed to evaluate the clinical profile, risk factors, angiographic features, and management patterns in young STEMI patients. The findings showed a predominance of male patients, high prevalence of modifiable risk factors, single vessel disease, and generally preserved left ventricular function.

In our study, most patients belonged to the 30-40 years age group. There was a clear male predominance, with very few female patients, showing that young males are more commonly

affected. Samir et al. reported a male predominance of 87% in the young cohort, which was significantly higher compared to older STEMI patients (73%) ($p = 0.004$), with the younger age group constituting approximately 20% of all STEMI presentations.^[12] Similarly, Wang et al., in a comparative study, reported a significantly higher male predominance in the young group compared to the older group ($p < 0.001$), with the younger cohort characterized by a lifestyle-related risk profile.^[14] Furthermore, Haq et al., reported that the majority of the cohort were men (82.4%), with a median age of 46.9 years.^[15] These findings consistently confirm that young STEMI predominantly affects males in the upper

range of the young adult age group across diverse populations.

In present study, smoking and dyslipidemia were the most common risk factors. Other factors like diabetes, hypertension, and alcohol use were also seen. Most patients came with typical symptoms like chest pain, often associated with sweating and breathlessness. Samir et al. reported smoking as the most prevalent risk factor in young STEMI patients (72.4% vs. 49.7% in older patients; $p < 0.001$), with the young cohort demonstrating significantly lower rates of diabetes (20.4% vs. 44.7%), hypertension (20.4% vs. 44.9%), and dyslipidemia (12.7% vs. 21.8%; $p < 0.05$ for all).^[12] Similarly, Gupta et al., reported that young STEMI patients (<50 years) had a significantly higher prevalence of tobacco use (60.6% vs. 52.4%; $p < 0.001$), while hypertension (18.5% vs. 29.9%; $p < 0.001$) and diabetes (16.0% vs. 26.3%; $p < 0.001$) were significantly less common compared to their older counterparts.^[2] Additionally, Haq et al. reported smoking (59%) and hyperlipidemia (44%) as the most prevalent risk factors in young STEMI patients under 50 years, with nearly three-quarters of the cohort being current or former smokers (74%), while drug use was rare (8.3%).^[15] These findings across multiple populations results that smoking and dyslipidemia are the dominant modifiable risk factors driving premature STEMI, distinct from the metabolic comorbidity burden seen in older patients

Our study demonstrates, anterior wall myocardial infarction was the most common type. Most patients had SVD on angiography. The LAD artery was the most commonly involved vessel. Similarly, Wang et al. reported that among young patients (≤ 45 years; $n=108$), the LAD was the most common culprit vessel (60% vs. 45.9% in older patients; $p = 0.031$), with smoking strongly associated with LAD involvement (OR 3.5; 95% CI 1.12–10.98; $p = 0.042$).^[14] Similarly, Alexander et al., reported that young STEMI patients more frequently presented with SVD compared to older patients (88.3% vs. 70%; $p < 0.001$) and that the LAD was the most common infarct-related artery (66.2% vs. 54.8%; $p < 0.001$).^[1] These findings indicate that LAD-related anterior wall STEMI with single vessel involvement is the predominant angiographic pattern in young patients, due to acute plaque rupture and thrombosis rather than diffuse multivessel atherosclerosis.

In our study, most patients had preserved or mildly reduced heart function, while only a few had severe dysfunction. Primary PCI was the most commonly used treatment, followed by thrombolysis with PCI, and a small number required surgery. Similarly, Samir et al. reported that young STEMI patients had a lower prevalence of diabetes, hypertension, and dyslipidemia compared to older patients, along with fewer adverse cardiovascular events and heart failure hospitalizations.^[12] Similarly, Gupta et al. reported that young STEMI patients were less likely to die both in-hospital (5.9% vs. 10.0%) and at 30 days (11.1% vs. 16.2%) compared to their older

counterparts, and identified LVEF $< 30\%$ at admission as the strongest predictor of in-hospital mortality (OR: 8.00; 95% CI: 4.60–13.90; $p < 0.001$), underscoring the central prognostic role of LV function even in young patients.^[2] Furthermore, Alexander et al. demonstrated that young MI patients had significantly reduced in-hospital mortality (3.4% vs. 6.4%; $p = 0.005$) and one-year mortality (7.6% vs. 17.6%; $p < 0.001$) compared to older patients.^[1] These findings indicate that preserved LV function in young STEMI patients, combined with early revascularization through primary PCI, though LVEF remains the single most important determinant of outcome even in younger cohorts.

Our findings show STEMI in young patients is predominantly seen in males, associated with modifiable risk factors, with single vessel disease and preserved function, highlighting the need for early prevention and management.

Limitations

The small sample size and single-center design limit generalizability. Its cross-sectional nature precludes assessment of temporal relationships and long-term outcomes. The absence of a comparison group and reliance on descriptive statistics restrict analytical interpretation. Selection bias may be present, as only patients undergoing coronary angiography were included, and dependence on hospital records may introduce information bias.

CONCLUSION

STEMI in young patients is predominantly seen in males and is associated with modifiable risk factors, particularly smoking and dyslipidemia. Most patients present with typical symptoms, have single vessel involvement, and maintain relatively preserved left ventricular function. Early recognition and timely intervention, especially primary PCI, remain essential components in the management of this population.

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