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Original Research Article

Angiographic Findings in ST-Segment Elevation Myocardial Infarction in Patients With Age Less Than 40 Years Admitted to a Tertiary Care Hospital

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Abstract: *We sought to find trends about culprit vessels, lesion features, the existence of collateral circulation, and other noteworthy abnormalities by concentrating on a particular age group. The ultimate objective of this study was to improve knowledge of STEMI among younger individuals to guide therapeutic procedures and improve management outcomes for this susceptible group.* ***Objective:*** *To evaluate the angiographic findings in ST-segment elevation myocardial infarction in patients aged less than 40 years admitted to a tertiary care hospital.* ***Methods:*** *This cross-sectional study was carried out at the department of Cardiology, LRH, Peshawar, during the period (05-01-2025) till (05-04-2025). Male and female patients aged less than 40 years diagnosed with STEMI were enrolled. Angiography was performed, and findings were noted regarding culprit vessels, lesion characteristics, presence of thrombus, multi-vessel disease, coronary anomalies, and collateral circulation. Data were analyzed using SPSS v.26. Results: The mean age of the 385 participants was 30.50±5.28 years, with 198 (51.4%) patients aged over 30 years and 235 (61.0%) male. Single-vessel disease was the most frequently recorded in 262 patients (68.1%). Among the culprit vessels, the left anterior descending was most frequently observed in 191 patients (49.6%), followed by the right coronary artery in 110 patients (28.6%). 336 patients (87.3%) had an occlusive lesion, while thrombus was observed in 295 participants (76.6%).* ***Conclusion:*** *Male participants were more likely than females to be affected by STEMI under the age of 40 years. The most frequent angiographic diagnosis was single-vessel disease, and the most frequent culprit vessel was LAD.*

Keywords: Myocardial Infarction, STEMI, Young Age, Angiographic Findings

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Introduction

ST-Elevation Myocardial Infarction (STEMI) is a severe form of acute myocardial infarction (AMI), which continues to be a major cause of morbidity and death globally. (1) Due in significant part to the long-term cumulative impact of risk factors like cigarette smoking, high blood pressure, diabetes, and hyperlipidemia, STEMI has historically been thought to afflict elderly persons predominantly. (2,3) Recent epidemiological statistics, however, point to a growing prevalence of STEMI in younger people, especially those under 40 years. (4) This pattern is alarming since, in contrast to their older counterparts, younger patients with STEMI frequently face particular difficulties, such as distinct cardiovascular risk profiles, clinical manifestations, and long-term consequences.

The most common cause of mortality on the Indo-Pak subcontinent nowadays is cardiovascular disease. (5) STEMI is a prominent public health issue in developed nations, but it is also growing in importance in developing nations. (1,6) The United States is thought to host 500,000 STEMI occurrences annually.

Younger patients' risk factors for STEMI differ from those of older adults. (8). Conventional health risks like tobacco use, lipid disorders, and high blood pressure remain common. However, lifestyle-related variables like drug abuse, especially with cocaine and amphetamines, are more common, and genetic predisposition has a big influence. According to research, 15.4% of patients under 40 years old had a STEMI diagnosis. We sought to identify trends in culprit vessels, lesion features, collateral circulation, and other notable abnormalities by focusing on a specific age group. The ultimate objective of this study was to improve knowledge of STEMI among younger individuals to guide therapeutic procedures and improve management outcomes for this susceptible group.

Methodology

This cross-sectional study was carried out at the Department of Cardiology, LRH, Peshawar, from (05-01-2025) to (05-04-2025) after obtaining IRB approval. Male and female patients aged below 40 years diagnosed with ST-segment elevation MI were enrolled. Pregnant females, patients with valvular heart disease, and a prior history of PCI or CABG were excluded. STEMI was diagnosed when an ECG showed at least 1 mm of ST-segment elevation in two or more contiguous leads or a new symptomatic left bundle branch block (LBBB) and the presence of elevated levels of cardiac troponins (Troponin I or T) or other markers of myocardial necrosis. Angiographic findings were noted in terms of 1) Culprit vessel: Identification of the specific coronary artery responsible for the myocardial infarction, which included the left anterior descending artery (LAD), left circumflex artery (LCX), or right coronary artery (RCA). 2) Lesion Characteristics, including a) Classification of lesions as obstructive or non-obstructive, b) Lesion severity by degree of stenosis, categorized as mild (<50% stenosis), moderate (50-70% stenosis), or severe (>70% stenosis). 3) Presence of intravascular thrombus, 4) Multi-vessel disease, 5) Presence of Collateral circulation, and 6) Coronary artery anomalies. The sample size was 385, calculated using the WHO sample size calculator, with an anticipated proportion of single-vessel disease of 85.5% (9), a 10% margin of error, and a 95% confidence level. Participants were recruited using a non-probability consecutive sampling technique.

Written informed consent was obtained from patients or their guardians. Data on all enrolled patients were collected from patient records,

including admission information, diagnostic tests (such as ECG and cardiac biomarkers), and demographic details. All the patients underwent angiography. The angiographic data involved a comprehensive documentation of findings, including the culprit vessel, lesion type and severity, presence of thrombus, occurrence of multi-vessel disease, collateral circulation, and any significant coronary anomalies. Data analysis was carried out using SPSS v.26. Numerical data, such as age, were expressed as mean ± standard deviation, and frequencies and percentages were presented for categorical data, such as gender and angiographic findings. Stratification was done to control effect modifiers. Post-stratification, the chi-square test or Fisher's exact test was applied at 5% significance level.

Results

The mean age of the participants was 30.50±5.28 years, and the mean BMI was 24.48±1.60 kg/m2, as reported in Table 1.

Table 1. Descriptive statistics of study participants (n = 385)

Parameters	Mean	Std. Deviation
Age (years)	30.50	5.288
BMI (kg/m^2)	24.481	1.6035

Participants aged more than 30 years were 198 (51.4%), and 235 patients (61.0%) were male. 243 patients (63.1%) had a BMI of more than 24.0kg/m2, as shown in Table 2.

Table 2. Baseline parameters of study participants (n = 385)

Parameters	Subgroups	Frequency	Percent
Age (years)	30 or below	187	48.6
	Above 30	198	51.4
Gender	Male	235	61.0
	Female	150	39.0
BMI (kg/m^2)	24.0 or below	142	36.9
	More than 24.0	243	63.1

Single-vessel disease was the most frequently recorded in 262 patients (68.1%). Among the culprit vessels, the left anterior descending was the most frequently observed in 191 patients (49.6%), followed by the right coronary artery in 110 patients (28.6%). 336 patients (87.3%) had occlusive lesions, while thrombus was observed in 295 participants (76.6%), as shown in Table 3.

Table 3. Angiographic findings among study participants (n = 385)

Angiographic findings	Subgroups	Frequency	Percent
Culprit artery	LAD	191	49.6
	LCX	84	21.8
	RCA	110	28.6
Lesion type	Occlusive	336	87.3
	Non Occlusive	49	12.7
MVD	Yes	123	31.9
	No	262	68.1
Collaterals	Yes	111	28.8
	No	274	71.2
Thrombus	Yes	295	76.6
	No	90	23.4
Anomalies	Yes	113	29.4
	No	272	70.6

Age-wise distribution of culprit vessel showed that 94 patients (49.2%) were aged 30 years or below, and 97 patients (50.8%) were aged more than 30 years. Similarly, among RCA disease, 54 (49.1%) were aged 30 years or below, and 56 (50.9%) were aged more than 30 years (p value 0.906). Thrombus was less common among patients aged 30 years or below (n = 132, 44.7%) versus 163 (55.3%) patients aged more than 30 years (p value 0.007), as shown in Table 4.

Table 4. Stratification of angiographic findings with age (n = 385)

		Age		Total	P value
		30 or below (n = 187)	Above 30 (n = 198)		
Culprit Artery	LAD	94	97	191	0.906
		49.2%	50.8%	100.0%	
	LCX	39	45	84	
		46.4%	53.6%	100.0%	
	RCA	54	56	110	
		49.1%	50.9%	100.0%	
Lesion type	Occlusive	159	177	336	0.199
		47.3%	52.7%	100.0%	

	Non Occlusive	28	21	49	
		57.1%	42.9%	100.0%	
MVD	Yes	53	70	123	0.140
		43.1%	56.9%	100.0%	
	No	134	128	262	
		51.1%	48.9%	100.0%	
Thrombus	Yes	132	163	295	0.007
		44.7%	55.3%	100.0%	
	No	55	35	90	
		61.1%	38.9%	100.0%	
Collaterals	Yes	55	56	111	0.807
		49.5%	50.5%	100.0%	
	No	132	142	274	
		48.2%	51.8%	100.0%	
Anomalies	Yes	61	52	113	0.171
		54.0%	46.0%	100.0%	
	No	126	146	272	
		46.3%	53.7%	100.0%	

Male patients were more likely to have LAD (n = 122, 63.9%) and LCX (n = 60, 71.4%) as the culprit, while RCA was more frequently affected in females (n = 57, 51.8%), p value 0.002. Similarly, occlusive-type lesions were prevalent among men (n = 198, 58.9%) compared to females (n = 138, 41.1%),p value 0.026). Likewise, multivessel disease was prevalent among men (p-value 0.000) as reported in Table 5.

Table 5. Stratification of angiographic findings with gender (n = 385)

		Gender		**Total**	**P value**
		Male (n = 235)	**Female (n = 150)**		
Culprit Artery	LAD	122	69	191	0.002
		63.9%	36.1%	100.0%	
	LCX	60	24	84	
		71.4%	28.6%	100.0%	
	RCA	53	57	110	
		48.2%	51.8%	100.0%	
Lesion type	Occlusive	198	138	336	0.026
		58.9%	41.1%	100.0%	
	Non Occlusive	37	12	49	
		75.5%	24.5%	100.0%	
MVD	Yes	100	23	123	0.000
		81.3%	18.7%	100.0%	
	No	135	127	262	
		51.5%	48.5%	100.0%	
Thrombus	Yes	176	119	295	0.315
		59.7%	40.3%	100.0%	
	No	59	31	90	
		65.6%	34.4%	100.0%	
Collaterals	Yes	72	39	111	0.327
		64.9%	35.1%	100.0%	
	No	163	111	274	
		59.5%	40.5%	100.0%	
Anomalies	Yes	82	31	113	0.003
		72.6%	27.4%	100.0%	
	No	153	119	272	
		56.3%	43.8%	100.0%	

Discussion

There are significant disparities between experimental cohorts and real-world patient groups. Diversity in therapeutic approaches is also significant. (10) Consequently, it is crucial to supplement the knowledge gathered from randomized therapeutic trials with extensive observational data sets. According to our study, the angiographic profiles of young STEMI patients undergoing coronary angiography differed considerably from those of older patients.

According to our findings, patients aged 40 years or younger were more likely to be male. Accordingly, nearly every prior study has noted that individuals who are male, smoke, or have a family history of CAD are more likely to experience ACS earlier. (11) Men were around ten times more likely than women to have AMI in the Sozzi et al. study, and the young patients also had a high prevalence of tobacco use and a family history. (12) Young males with MI were more likely to have relatives with a diagnosis of CAD, according to Colkesen et al.(13). In young individuals, a family history of early MI has been identified as a distinct risk indicator for the occurrence of coronary events. (14) Numerous

findings regarding the function of genetic variables in the formation of intravascular plaque and the prevalence of STEMI in young individuals will conclude the significance of a family history of CAD.(15)

Our results, which showed that young patients had a greater incidence of single-vessel pathology and a normal coronary angiography more frequently than older patients, are in line with earlier findings. (16,17) On coronary angiography, multi-vessel disease was more frequently identified in our elderly individuals. Younger individuals with STEMI appear to have a higher propensity for thrombus formation but a lower atherosclerotic burden. According to autopsy findings, MI in young individuals with cardiovascular risks may be a sign of an early and severe atherosclerosis process. (18) Not unexpectedly, we found that younger individuals were less inclined to have had a previous catheterization and to have referred themselves for coronary revascularization surgery (CABG).

The available literature also supports the findings above, as other studies have reported comparable rates of obstructive CAD in their research groups. (19,20) Numerous other investigations, however, have documented a far greater prevalence rate of obstructive CAD. (21,22) The slightly greater proportion of non-occlusive disease in this study indicates that patients had thrombolysis prior to coronary angiography, which may have recanalized the infarct-related artery.

In addition to thrombosis with reperfusion, normal coronary arteries might also be the consequence of spontaneous recanalization and common coronary artery spasm in younger persons. The absence of intravascular ultrasonography (IVUS) made it impossible to rule out the possibility of plaque development in the coronary artery, known as the Glagov effect, which can cause adaptive expansion of the artery to preserve the luminal area. (23)

According to the current study, the LAD is the most commonly implicated artery in a single occurrence, followed by the RCA and LCX. The results closely match those of earlier studies, in which the most commonly affected vessel was the LAD, followed by the RCA, LCx, and LMCA. (20,21) However, according to one study, the most commonly used vessel among the participants was the RCA (24). Notably, just 7 (17.1%) patients had nonculprit arteries that were found to be unhealthy, and only 4 (9.75%) patients had more than one lesion in the culprit artery. This suggests that most lesions were nonatherosclerotic, consistent with research conducted in North India. (25)

Conclusion

STEMI was frequently observed among patients aged under 40 years in this study. Male participants were more likely to be affected than female participants. The most frequent angiographic diagnosis was single-vessel disease, and the most frequent culprit vessel was the LAD. No significant association was recorded between angiographic findings and patient age. Gender-wise distribution showed a statistically significant association with the culprit artery and the lesion's occlusive or non-occlusive nature.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

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Approved by the department concerned.

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The authors declared no conflict of interest.

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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the study's integrity.

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