



IMPACT OF AGE ON PRESENTATION, RISK FACTORS, AND CARDIAC IMAGING FINDINGS IN ST-ELEVATION MYOCARDIAL INFARCTION (STEMI)

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Abstract

Introduction: The incidence of Acute Myocardial Infarction (AMI) in young patients has increased. Despite the prevalence of MI among older individuals, cardiovascular events, especially MI, remain a significant concern for younger people.

Objective: To determine the impact of age on the presentation of MI, prevalence of risk factors, type of MI, and cardiac imaging findings in STEMI patients.

Methodology: A retrospective study was conducted at cardiology ward of Sheikh Zayed Hospital, from June to August 2023. The data of STEMI patients was taken from registry of cardiology ward. Patients were divided into two age groups, age group 1 (18-45 years, young age group) and age group 2 (above 45 years, old age group). Patients' data including gender, age, risk factors, type of MI, angiographic findings and left ventricular ejection fraction was collected and entered in SPSS version-23 for statistical analysis. Chi-square test was applied and $p\text{-value} \leq 0.05$ was taken as significant.

Results: STEMI was more common among males of age group 1 (85.2% vs 72.3%), while among females, the proportion was greater in age group 2 (14.8% vs 27.7%). Diabetes Mellitus ($p\text{-value}=0.006$), hypertension ($p\text{-value}=0.001$), and dyslipidemias ($p\text{-value}=0.003$) were more prevalent in age group 2, while smoking ($p\text{-value}=0.113$) was not significantly different between age groups. Family history of coronary artery disease was significantly more common in age group 1 ($p\text{-value}=0.001$). The SMuRF less status was significantly more common in age group 1 ($p\text{-value}=0.015$). Age group 2 had a higher prevalence of MVCAD compared to age group 1 (3.6% vs 0.8%).

Conclusion: The study revealed that older women (age group 2) have a higher rate of Myocardial Infarction than younger women (age group 1). Family history was more common in the younger age group (age group 1).

Keywords: STEMI, MVCAD, Risk factors, Chest pain

Introduction

Cardiovascular diseases are a leading cause of death worldwide, with mortality increasing from 12.4 million in 1990 to 19.8 million in 2022.¹ There are multiple risk factors for Acute Coronary Syndrome, including modifiable factors such as dyslipidemias, smoking, diabetes mellitus, and hypertension, as well as non-modifiable factors like age, gender, and family history of coronary artery disease.^{2,3} Atherosclerosis, which begins in childhood with the development of fatty streaks in artery walls, can progress to atheroma and fibrous plaques over time, increasing the risk of plaque rupture and coronary thrombosis.⁴ Despite a decrease in ACS among older individuals, cardiovascular events, especially myocardial infarctions, remain a significant concern for younger people, with over 2000 Americans dying from CVD daily, many of whom are under 65 years old. This trend is particularly noticeable among both men and women.⁵ During a 10-year period in the Framingham Heart Study, the rate of acute myocardial infarction (AMI) was 12.9 cases per 1000 men aged 30 to 34 years and 5.2 cases per 1000 women aged 35 to 44 years. In a separate multinational study, the incidence of AMI in patients under 55 years old was 23%.²¹ The risk of CAD increases with age in both genders, with men having a prevalence of 10 per 1000 population between 45 and 54 years and 74 per 1000 population between 85-94 years. In women, the prevalence increases from 4 to 64 per 1000 people for the same age groups. However, older women have a higher incidence of Cardiovascular Disease (CVD) than older men due to the cessation of steroidal sex hormones.^{22,23}

Young STEMI patients have less mortality rate and less incidence rate of MACE (Major adverse cardiovascular events) and have higher successful rate of PCI (percutaneous coronary intervention) treatment and less bleeding complications as compared to older patients.²⁴ The incidence rate of MACE increases with the age due to decreased biological and physiological processes.²⁵ The disease pattern and mechanism of STEMI may differ in younger patients from elder ones, with premature history of CAD and smoking with or without cocaine use, being the strongest risk factors associated with cardiovascular diseases in youth.

There is a lack of comprehensive studies focusing on how age influences the characteristics and outcomes of ST-elevation myocardial infarction (STEMI) patients, despite cardiovascular diseases being a leading cause of mortality worldwide. This gap is significant as the epidemiology of cardiovascular diseases is evolving, with younger individuals experiencing acute coronary syndrome events alongside older adults. This study aims to investigate the impact of age on the clinical presentation, risk factors, and cardiac imaging findings in STEMI patients to address this gap in understanding.

Methodology

We collected data from the cardiology ward at Sheikh Zayed Medical College and Hospital from June to August 2023. We selected 486 patients with ST-Elevation Myocardial Infarction using a non-probability sampling technique. In this retrospective study, we focused on patients diagnosed with STEMI who underwent primary PCI. Patients with chronic comorbidities such as liver disease, kidney disease, and stroke were excluded from the study.

The patient's biodata, including age, gender, and file number, was recorded on a predefined questionnaire. The subjects were divided into two age groups: Age group 1 (18-45 years, young age group) and Age group 2 (above 45 years, old age group). We included five risk factors (Age, Hypertension, Diabetes Mellitus, Dyslipidemias, and Smoking) in our study. Out of these five risk factors, hypertension, diabetes mellitus, smoking, and dyslipidemias were considered as Standard Modifiable Cardiovascular Risk Factors (SMuRF), while patients presenting without these risk factors

were considered as SMuRFless. Risk factors were further categorized into five categories depending on the number of risk factors in a patient: 1 risk factor, 2 risk factors, 3 risk factors, 4 risk factors, and 5 risk factors. In our study, cardiac imaging findings included angiographic findings (SVCAD, 2VCAD and 3VCAD) and echocardiographic findings (left ventricular ejection fraction). The study included an assessment of ECG, angiographic data, and left ventricular ejection fraction after reviewed by a consultant cardiologist. The severity of the disease was determined based on angiographic findings as single-vessel coronary artery disease (SVCAD), two-vessel coronary artery disease (2VCAD), or three-vessel coronary artery disease (3VCAD). Echocardiographic findings were categorized based on the severity of heart failure as follows: preserved ejection fraction (51-60%), mildly reduced ejection fraction (41-50%), moderately reduced ejection fraction (31-40%), and severely reduced ejection fraction (below 30%).

Statistical analysis was performed using SPSS version 23. Frequencies and percentages were calculated for variables such as gender, risk factors, angiographic findings, type of MI, and echocardiographic findings. The chi-square test was applied with a statistical significance value set at 0.05.

Results

In our study, patients were categorized into two age groups. The majority of patients (74.89%) were in age group 2, with the remaining patients (25.11%) falling into age group 1. Chest pain was the most frequently reported symptom (97.7%). Males were more prevalent, comprising 367 (75.51%) of the sample, while females accounted for the remaining 119 (24.48%).

The Table 1 shows findings regarding the comparison of variables between two age groups, age group 1 (patients aged 18-45 years) and age group 2 (patients above 45 years). There is a significant difference in gender distribution between the two groups ($p = 0.004$). In age group 1, there were more males (85.2%) than females (14.8%), while in age group 2, the proportion of females diagnosed with STEMI increased compared to age group 1 (27.7% vs 14.8%). The difference in presenting complaints between the groups was borderline significant ($p = 0.052$). It is worth noting that all cases in the younger age group presented with chest pain (100%), while only a small percentage (3%) of cases in the older age group presented with dyspnea. Risk factors such as dyslipidemias (p -value = 0.003), diabetes mellitus (p -value = 0.006), hypertension (p -value = 0.001), and family history of heart disease ($p = 0.001$) showed significant differences among age groups, while smoking (p -value = 0.113) status did not differ significantly.

The risk factors were generally more prevalent among individuals above 45 years except family history of coronary artery disease which was more prevalent in age group 1 as compared to age group 2 (36.1% vs 20.9%). Additionally, the distribution of SMuRFless status significantly differed between the age groups ($p = 0.015$), indicating a higher proportion of individuals with SMuRFless status in the age group 1 compared to the older group (33.6% vs 22.5%).

Table 1: Comparison of age groups with gender, presenting complain and risk factors

Variables		Age group 1 (18-45 year) N= 122 (%)	Age group 2 (above 45 years) N= 364 (%)	p-value
Gender				0.004
	Male	104 (85.2%)	263 (72.3%)	
	Female	18 (14.8%)	101 (27.7%)	
Presenting Complain				0.052
	Chest Pain	122 (100%)	353 (97%)	
	Dyspnea	0 (0%)	11 (3%)	
Risk Factors				
Smoking				0.113
	Yes	42 (34.4%)	98 (26.9%)	
	No	80 (65.6%)	266 (73.1%)	
Dyslipidemias				0.003
	Yes	29 (23.8%)	141 (38.7%)	

	No	93 (76.2%)	223 (61.3%)	
Diabetes mellitus				0.006
	Yes	29 (23.8%)	136 (37.4%)	
	No	93 (76.2%)	228 (62.6%)	
Hypertension				0.001
	Yes	44 (36.1%)	197 (54.1%)	
	No	78 (63.9%)	167 (45.9%)	
Family History				0.001
	Yes	44 (36.1%)	76 (20.9%)	
	No	78 (63.9%)	288 (79.1%)	
SMuRFless				0.015
	Yes	41 (33.6%)	82 (22.5%)	
	No	81 (66.4%)	282 (77.5%)	

The table 2 shows the distribution of risk factors across genders and age groups. Among males (N=367), 80 (21.8%) had no risk factors, while the proportion slightly decreased to 23 (19.3%) among females (N=119) (p = 0.040). As the number of risk factors increased, discernible discrepancies emerged between genders. For males, 110 (30%) presented with a single risk factor, contrasting with 24 (20.2%) among females. Similarly, the prevalence of individuals with two, three, or four risk factors varied notably between genders. Four risk factors were identified, with 32 (8.7%) of males and 22 (18.5%) of females displaying this profile. The proportion of risk factors decreased gradually in both age groups. The distribution of risk factors among the two age groups did not show statistical significance.

Table 2: Comparison of age groups and genders with multiple risk factors

	Male N=367 (%)	Female N=119 (%)	p-value	Age group 1 (18-45 year) N= 122 (%)	Age group 2 (above 45 years) N= 364 (%)	p- value
No Risk Factor	80 (21.8%)	23 (19.3%)	0.040	29 (23.8%)	74 (20.3%)	0.449
1 Risk Factor	110 (30%)	24 (20.2%)		40 (32.8%)	94 (25.8%)	
2 Risk Factors	74 (20.2%)	26 (21.8%)		21 (17.2%)	79 (21.7%)	
3 Risk Factors	70 (19.1%)	24 (20.2%)		22 (18%)	72 (19.8%)	
4 Risk Factors	32 (8.7%)	22 (18.5%)		10 (8.2%)	44 (12.1%)	
5 Risk Factors	1 (0.3%)	0 (0%)		0 (0%)	1 (0.3%)	

The table 3 compares type of MI, angiographic findings and ejection fraction in both age groups. The data revealed no significant differences in the distribution of type of myocardial infarction (MI) (p = 0.805). In both age groups, the majority of MI was anterior wall myocardial infarctions (AWMI), accounting for 32% in age group 1 and 30.8% in age group 2. Single-vessel coronary artery disease (SVCAD) was the most common angiographic finding in both age groups, with 91.8% in age group 1 and 90.9% in age group 2. Two-vessel coronary artery disease (2VCAD) and three-vessel coronary artery disease (3VCAD) were less common, with similar frequencies across both age groups. A higher percentage of cases in both age groups had ejection fractions in the 31-40% range. This range accounted for 15 (42.9%) cases in age group 1 and 24 (25.3%) cases in age group 2.

Table 3: comparison of age groups with MI, angiographic findings and ejection fraction

Variables		Age group 1 (18-45 year) N= 122 (%)	Age group 2 (above 45 years) N= 364 (%)	p-value
Type of MI				0.805
	IWMI	39 (32%)	112 (30.8%)	
	AWMI	83 (68%)	252 (69.2%)	
Angiographic Findings				0.229
	SVCAD	112 (91.8%)	331 (90.9%)	
	2VCAD	9 (7.4%)	20 (5.5%)	
	3VCAD	1 (0.8%)	13 (3.6%)	

		N=35 (%)	N=95 (%)	
Left Ventricular Ejection Fraction				0.280
Preserved	51-60%	8 (22.9%)	26 (27.4%)	
Mildly Reduced	41-50%	7 (20%)	26 (27.4%)	
Moderately Reduced	31-40%	15 (42.9%)	24 (25.3%)	
Severely Reduced	Below 30%	5 (14.3%)	19 (20%)	

Discussion

The study focused on the impact of age on the presence of risk factors, presenting complaints, type of STEMI, left ventricular ejection fraction, and angiographic fractions. Age is a crucial non-modifiable risk factor that is correlated with other factors in STEMI.

According to present study, majority of the patients were from age group 2 (74.89%) while the proportion was equally divided in both groups in a study by Dzubur et al.⁶ The difference may be due to sampling technique differences. STEMI was more common among males in age group 1 compared to age group 2 (85.2% vs 72.3%) while the proportion was opposite in female gender (14.8% in age group 1 vs 27.7% in age group 2). A study conducted by Yunyun et al showed the similar results (88.37% in young groups vs 63.08% in old age group).⁷ An interesting fact had been proved by our study that estrogen played a protective role in pre-menopausal state while incidence of MI increased in post-menopausal females. The loss of estrogen's protective effects contributes to an increased risk of atherosclerosis, plaque instability, and thrombotic events, leading to a higher incidence of MI in post-menopausal females.⁸

Chest pain emerged as most common presenting complaint in age group 1 while among age group 2 dyspnea was also significant presenting complain. A study conducted by Malik et al. showed that 93% of the patients presented with chest pain.⁹ Discussing the risk factors of Myocardial Infarction, family history was more commonly present in age group 1 as compare to age group 2. Similar results are also shown in a study conducted by Yunyun et al.¹⁰ According to a study by Wienbergen et al. family history of coronary artery disease is more common in young age group (22.4%).¹¹ Genetic factors are a key contributor to cardiovascular diseases, with certain genetic variants linked to a higher risk of heart attacks occurring at a younger age. This can result in a higher prevalence of family history of heart disease in younger individuals. Other risk factors such as diabetes mellitus, hypertension, smoking, and dyslipidemias were more commonly present in age group 2.^{12,13} Similar results were also reported by Dzubur et al.⁶ We observed a significant difference in SMuRFless status between the two age groups.¹³ In age group 1, SMuRFless status was more prevalent at 33.6%. Conversely, in another study, SMuRFless status was more common in the older age group.¹⁴

AWMI was the most commonly found type of myocardial infarction compared to IWMI, and these findings were consistent with previous studies by Palli et al. and Sankar et al.^{16,17} The prevalence of AWMI could be attributed to the anatomy of the Left Anterior Descending artery (LAD) and the role of risk factors in predisposing individuals to atherosclerotic plaque formation in the LAD. The most common angiographic finding in both groups was SVCAD, while MVCAD was predominantly found in the older age group. Bhardwaj et al. reported SVCAD in 57% of individuals, with 71.8% of SVCAD cases found in Asian women.^{18,19} The higher prevalence of MVCAD in older age groups compared to younger age groups is due to a combination of factors. These include the cumulative effects of atherosclerosis, age-related changes in arterial structure and function, the presence of comorbidities, reduced collateral circulation, and potential delays in diagnosis and treatment. In our study, 15 (42.9%) individuals in age group 1 and 24 (25.3%) in age group 2 were diagnosed with moderately reduced left ventricular ejection fraction (31-40%). According to Ibrahim et al., the average LVEF was 47.28 ± 8.76 .²⁰

Conclusion

The research findings showed that older women (age group 2) have a higher incidence of myocardial infarction (MI) compared to younger women (age group 1). In the younger age group, family history was the main factor associated with MI. Furthermore, a larger proportion of females had four risk factors compared to males. Age group 2 had a higher prevalence of multi-vessel coronary artery disease (MVCAD) compared to age group 1.

Limitations

Limitations of the study include the lack of assessment for myocardial infarction (MI) outcomes, which hinders understanding of cardiovascular prognosis, and the absence of evaluation of culprit arteries, making it difficult to identify the cause of the disease. Including MI outcomes would provide valuable information on disease severity and treatment effectiveness, while assessing culprit arteries could help clarify the underlying pathophysiology.

Conflict of Interest

The author declares no conflict of interest.

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No

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