Original Research Article

AN OBSERVATIONAL STUDY OF RISK FACTORS AND CLINICAL PRESENTATION OF MYOCARDIAL INFARCTION IN YOUNG INDIVIDUALS LESS THAN 45 YEARS OF AGE.

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ABSTRACT

Background: Myocardial infarction (MI) in individuals under 45 years is increasingly recognized as a distinct clinical entity with rising incidence in developing nations. It carries significant psychosocial and economic burden due to its occurrence in the most productive phase of life. This study aims to assess the risk factors and clinical presentation of young adults presenting with MI.

Materials and Methods: This cross-sectional observational study was conducted in the Department of General Medicine, Adichunchanagiri Institute of Medical Sciences, Karnataka, India. Fifty patients aged between 18–45 years with confirmed MI (STEMI or NSTEMI) were included in this study. Detailed clinical history, physical examination, laboratory investigations, cardiac biomarkers, ECG, and echocardiography were performed. Risk factors such as BMI, smoking, alcohol use, family history, diabetes, hypertension and dyslipidemia were documented. Data were analyzed using SPSS v23.0. For statistical purposes p<0.05 was taken as statistically significant.

Results: The majority of patients were male (80%) with the most affected age group between 41–45 years of age. Obesity (BMI ≥25) was present in 90% of patients. Smoking (42%), hypertension (48%), diabetes (36%) and dyslipidemia (78%) were the most common modifiable risk factors. A positive family history of coronary artery disease was found in 62% of patients. Typical chest pain radiating to left arm was the most common symptom (56%) followed by chest heaviness and breathlessness. Anterior wall MI was the most frequent type (72%) and left ventricular dysfunction of some or the other degree was observed in 90% of patients.

Conclusion: MI in young adults demonstrates a strong association with modifiable risk factors particularly obesity, smoking, hypertension and dyslipidemia. Early recognition, lifestyle modifications, and aggressive risk factor management are crucial to reduce the burden of premature cardiovascular disease in young population.

Keywords: Myocardial Infarction, Young Adults, Risk Factors, Chest Pain, Anterior Wall MI.

INTRODUCTION

Myocardial infarction (MI) can be defined as the irreversible necrosis of myocardial tissue secondary to prolonged ischemia.[1] It is most commonly a result of coronary artery disease (CAD) which is often caused by rupture of atherosclerotic plaque followed by thrombus formation within the coronary arteries.[2] MI remains one of the important causes of mortality and disability particularly in older individuals. While MI is traditionally associated with older populations there is growing concern about its incidence in

younger individuals. In developing countries, the age-standardized incidence of MI in individuals under 45 years has shown a worrying upward trend.[3] The pathogenesis of MI is multifactorial and consist of many modifiable and non-modifiable risk factors. Non-modifiable risk factors include age, male gender, ethnicity and a positive family history of premature CAD.[4] Among these genetic predisposition and early-onset atherosclerosis in first-degree relatives have been implicated in increasing the likelihood of MI at a young age. On the other hand, modifiable risk factors include factors such as smoking, hypertension, diabetes mellitus, dyslipidemia, obesity and sedentary lifestyle. Emerging risk factors such as elevated lipoprotein(a), high-sensitivity C-reactive protein (hs-CRP), hyperhomocysteinemia and substance abuse (notably cocaine and anabolic steroids) are also being increasingly recognised.[5] Importantly, lifestyle-associated risk factors are more prevalent in younger individuals.[6]

MI in young adults is usually defined as MI in patients aged below 45 years. It is increasingly recognized as a distinct clinical entity with unique pathophysiological and prognostic features compared to older populations. While older individuals often present with multivessel atherosclerotic disease younger patients tend to have single-vessel involvement and are more likely to have non-atherosclerotic causes including spontaneous coronary artery dissection (SCAD), coronary vasospasm and thromboembolic events. The psychosocial impact of MI in young adults is significant given their active involvement in workforce as well as in family responsibilities. Additionally, this subgroup often demonstrates poor compliance with secondary prevention measures which is cornerstone of management of patients of MI.[7]

In individuals under 45 years, the relative contribution of risk factors differs from older individuals. Smoking remains one of the most significant modifiable risk factor accounting for majority of cases. Dyslipidemia, particularly elevated low-density lipoprotein (LDL) cholesterol, low high-density lipoprotein (HDL) and increased triglycerides is frequently observed in these cases. Familial hypercholesterolemia often undiagnosed until the first cardiac event is also an important cause of early-onset MI. Metabolic syndrome and insulin resistance secondary to dietary transitions and reduced physical activity is also one of the important contributing factors. Lastly, genetic polymorphisms affecting lipid metabolism, coagulation pathways and endothelial function are some of the uncommon causes of MI in young individuals.[8]

The clinical presentation of MI in young adults is heterogeneous and often atypical. While classic symptoms such as retrosternal chest pain radiating to the left arm or jaw are present in many cases a substantial proportion report atypical features like epigastric pain, fatigue, palpitations or breathlessness. This atypical symptomatology can lead to diagnostic delays particularly when MI is not initially suspected due to the patient's age. Moreover young patients are less likely to have pre-existing comorbidities which may contribute to an underestimation of their cardiovascular risk by both patients as well as by healthcare providers. Notably, studies have shown that a significant number of young MI patients delay seeking medical care often attributing symptoms to benign causes such as gastritis or musculoskeletal pain.[9]

Despite extensive research on topic of MI there exists a critical knowledge gap concerning its occurrence in young adults. The present observational study aims to evaluate the risk factors and clinical presentation of MI in individuals aged less than 45 years.

MATERIALS AND METHODS

This cross-sectional observational study was conducted in the Department of General Medicine at Adichunchanagiri Institute of Medical Sciences, Karnataka, India. The objective was to evaluate the clinical presentation and associated risk factors of myocardial infarction (MI) in young patients. All participants were explained about the purpose of study and a written informed consent was obtained from participants before their inclusion in the study. A total of 50 patients aged between 18 and 45 years admitted to the Medical Intensive Care Unit (MICU) with a confirmed diagnosis of myocardial infarction were included in the study. The sample size was calculated based upon pilot studies on MI in young individuals. Minimum required sample size to achieve a statistical power of 80% (1–β) and a 95% confidence interval (α = 0.05) was calculated to be 45 cases. To improve the validity of the findings, 50 eligible patients were included on the basis of a predefined inclusion and exclusion criteria.

A detailed clinical history was obtained from each patient at the time of admission. Presenting symptoms including the nature, duration, and radiation of chest pain were recorded. Presence of associated symptoms such as palpitations, dyspnea, diaphoresis, nausea, vomiting, syncope or fatigue was also enquired into. The time interval between onset of symptoms and hospitalisation was documented. A past history of similar complaints or prior cardiovascular evaluations as well as presence of Risk factors were analysed. Demographic details (age, sex, occupation and socioeconomic status), Lifestyle-related factors (smoking, alcohol consumption, dietary habits, physical activity and psychological stress), Past medical history (hypertension, diabetes mellitus, dyslipidemia, hypothyroidism, and obesity) and relevant Family history (premature coronary artery disease, hypertension, or diabetes mellitus in first-degree relatives) was also recorded. Height and weight and body mass index (BMI) was calculated.

A thorough physical examination was done in all cases. General examination included assessment for pallor, clubbing and peripheral edema. Vital parameters such as pulse rate, blood pressure, respiratory rate and oxygen saturation was recorded. Cardiovascular examination was performed to assess heart sounds (S1, S2), and identify any additional findings such as murmurs, ejection clicks or gallops. Signs of congestive heart failure, if present, were noted. Respiratory examination was also conducted to assess for features which may suggest possibility of pulmonary edema.

All patients underwent baseline laboratory investigations including complete blood count (CBC), renal and hepatic function tests, fasting and postprandial blood glucose, glycated hemoglobin (HbA1c) and serum lipid profile. Electrocardiogram (ECG) and two-dimensional echocardiography were performed for all patients. Cardiac biomarkers, including serum troponin I or T and creatine kinase-MB (CK-MB), were measured to confirm myocardial injury.

The diagnosis of myocardial infarction was based on clinical presentation and elevated cardiac biomarker in presence og ECG findings in (ST-segment elevation at the J point in at least two contiguous leads with the following cut-off values: ≥2.0 mm in men and ≥1.5 mm in women in leads V2–V3; or ≥1.0 mm in other contiguous leads. Reciprocal ST depression in opposing leads and new or presumed new left bundle branch block (LBBB) in the presence of ischemic symptoms were also considered diagnostic. For non-ST-elevation myocardial infarction (NSTEMI) ECG findings included horizontal or downsloping ST-segment depression ≥0.5 mm in two contiguous leads and/or T wave inversion ≥1.0 mm in two contiguous leads accompanied by elevated cardiac troponin levels. In cases with nondiagnostic initial ECGs but persistent clinical suspicion serial ECGs were performed to detect dynamic changes.

Data collected from patient history, clinical examination, and investigations were entered into Microsoft Excel and analyzed using SPSS software version 23.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize patient characteristics. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Associations between variables were tested using the Chi-square or Fisher's exact test as appropriate. A p-value of <0.05 was considered statistically significant.

Inclusion Criteria
- Patients aged 18 to 45 years.
- Confirmed diagnosis of myocardial infarction (STEMI or NSTEMI).
- Patients who provided written informed consent.

Exclusion Criteria
- Patients below 18 or above 45 years of age.
- Refusal to give informed and written consent to be part of study.
- Patients with known congenital or structural heart diseases (e.g., rheumatic valvular heart disease, congenital heart defects).
- Patients with autoimmune vasculitis, myocarditis, or pericarditis.

RESULTS

The analysis of the gender distribution of the studied cases showed that out of a total of 50 patients 40 (80%) were males and 10 (20%) were females. There was a significant male predominance with a male-to-female ratio of 4:1 [Figure 1].
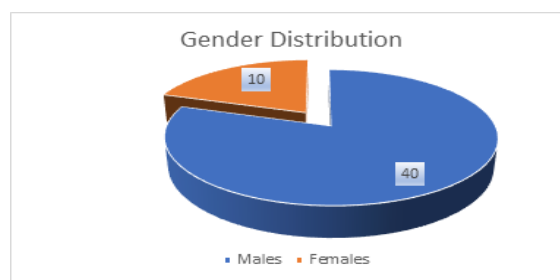

Figure 1: Gender Distribution of studied cases.

The analysis of the age distribution among the studied cases showed that the majority of male patients were in the 41–45 years age group (34.0%), followed by 36–40 years (26.0%), 31–35 years (12.0%) and less than 30 years (8.0%). Among females, the highest number were also in the 41–45 years group (12.0%) followed by 36–40 years (6.0%) and 31–35 years (2.0). The mean age of males and females was 38.4 ± 4.5 and 39.7 ± 3.2 years respectively. The mean age of male and female patients was found to be comparable with no statistically significant difference (p = 0.226) [Table 1].

Table 1: Age Distribution of studied cases.

Age Group	Male (n=40)	Female (n=10)
<30 years	4 (8 %)	0 (0.0%)
31–35 years	6 (12.0%)	1 (2.0%)
36–40 years	13 (26.0%)	3 (6.0%)
41–45 years	17 (34.0%)	6 (12.0%)
Total	40 (80%)	10 (20%)
Mean Age ± SD	38.4 ± 4.5	39.7 ± 3.2
P-value = 0.226 (NS)		

The analysis of risk factors among the studied patients showed that the majority were overweight with a BMI of 25–29.9 (58.00%) followed by obese individuals with BMI ≥30 (32.00%). History of

smoking was present in 21 patients (42.00%) while alcohol use was reported in 13 patients (26.00%). A positive family history of coronary artery disease was noted in 17 patients (34.00%) through the father, 3 (6.00%) through the mother, and 11 (22.00%) through both parents. 22 patients (44.00%) had high cholesterol (≥240 mg%), 17 (34.00%) had borderline high levels (200–240 mg%) and 11 (22.00%) had desirable levels (<200 mg%). Hypertension was present in 24 patients (48.00%). Diabetes mellitus was present in 18 patients (36.00%) and absent in 32 (62.00%) [Table 2].

Table 2: Risk factors for MI in studied cases.

	Risk Factor	Number of Patients	Percentage (%)
Body Mass Index	Healthy (18.5–24.9)	5	10.00 %
	Overweight (25–29.9)	29	58.00 %
	Obese (≥30)	16	32.00 %
Smoking -	Present	21	42.00 %
	Absent	29	58.00 %
Alcohol Use	Present	13	26.00 %
	Absent	37	74.00 %
Family History -	Father	17	34.00 %
	Mother	3	6.00 %
	Both Parents	11	22.00 %
	Absent	19	38.00 %
Cholesterol	Desirable (<200 mg%)	11	22.00 %
	Borderline High (200-240 mg%)	17	34.00 %
	Cholesterol - High (≥240 mg%)	22	44.00 %
Hypertension	Present	24	48.00 %
	Absent	26	52.00 %
Diabetes Mellitus	Present	18	36.00 %
	Absent	32	62.0 %

The analysis of clinical presentation among the studied cases showed that the most common symptom was typical chest pain radiating to left arm (56.00%). This was followed by chest heaviness in 7 patients (14.00%), breathlessness in 4 patients (8.00%), sweating and palpitations each in 3 (6.00%). Nnausea and epigastric pain were noted in 2 patients each (4.00%). The least common symptom was syncope which was seen in only 1 patient (2.00%) [Table 3].

Table 3: Clinical Features of studied cases.

Clinical Feature	Number of Patients	Percentage (%)
Typical Chest Pain (radiating to arm)	28	56.00%
Chest Heaviness	7	14.00%
Breathlessness	4	8.00%
Sweating	3	6.00%
Nausea	2	4.00%
Palpitations	3	6.00%
Epigastric Pain	2	4.00%
Syncope	1	2.00%

The analysis of the type of myocardial infarction among the studied cases showed that anterior wall myocardial infarction was the most common (72.0%). This was followed by inferior wall MI in 9 patients (18.0%) and anteroseptal MI in 5 patients (10.0%) [Table 4].

Table 4: Distribution of MI types among the study population

Distribution of MI types	Number of Patients	Percentage (%)
Anterior Wall MI	36	72.0 %
Inferior Wall MI	9	18.0 %
Anteroseptal MI	5	10.0 %
Total	50	100 %

The analysis of left ventricular (LV) function in the studied cases revealed that mild dysfunction (ejection fraction 41–50%) was the most common finding (36.0%), followed closely by moderate dysfunction (31–40%) in 17 patients (34.0%). Severe LV dysfunction (EF <30%) was present in 10 patients (20.0%), while only 5 patients (10.0%) had normal left ventricular function (EF >50%) [Table 5].

Table 5: Presence and severity of Left Ventricular dysfunction in studied cases.

Left Ventricular Dysfunction	Number of Patients	Percentage (%)
Normal (>50%)	5	10.0
Mild Dysfunction (41–50%)	18	36.0
Moderate Dysfunction (31–40%)	17	34.0
Severe Dysfunction (<30%)	10	20.0

DISCUSSION

The current observational study dealt with risk factor profile and clinical presentation of myocardial infarction (MI) in individuals under 45 years. The predominance of males in our study (80%) is similar to the findings of Golla A et al who reported a similar gender disparity in their study of young Indian MI patients. In the study done by Golla A al 80.4 % were male. The authors attributed this to higher prevalence of smoking, diabetes and dyslipidemia.[10] Similarly, Choudhury et al highlighted a male preponderance in early-onset MI cases. The authors recommended that emphasis should be given on early diagnosis and management of existing risk factors in this group to prevent mortality and morbidity associated with MI.[11] In our study, the most affected age group was 41–45 years, comparable to Iragavarapu T et al study cohort where the overall mean age of studied cases was found to be 46.26 years. This suggests that the transition from young adulthood into midlife may represent a particularly vulnerable period likely due to exposure to lifestyle-related risk factors.

The analysis of risk factors revealed a predominance of modifiable determinants such as obesity (90%), smoking (42%), and dyslipidemia (78%). These findings corroborate those of Mishra, V. A. et al. who documented that dyslipidemia and smoking were some of the common risk factors in their study of young MI patients from India.[12] In a detailed review article on myocardial infarction in young individuals Sood A et al reported that the most common Risk factor in patients of MI belonging to 17 to 45 age category were smoking (57%), dyslipidemia (52%) and hypertension (50%). The authors further reported that approximately 91% of patients had at least one risk factor. Interestingly, 34% of our patients had a paternal history of premature coronary artery disease underscoring the role of genetic predisposition. In comparison, a similar prevalence was noted by Akram MV et al who found that 36% of their young MI patients had a positive family history, thereby reinforcing the importance of targeted screening in high-risk families.[13]

Obesity, as evidenced by the high proportion of patients with elevated BMI, is emerging as a major contributor to early-onset cardiovascular events. Our findings echo those of Aggarwal A al who in their study found that that 49.6 % of young MI patients were either overweight or obese linking increased adiposity to metabolic syndrome and atherogenesis.[14] Moreover, a study by Dhawan D et al emphasized that abdominal obesity in young adults is associated with a pro-inflammatory state, endothelial dysfunction, and insulin resistance all of which are potent drivers of atherosclerosis.[15] The under-recognition of obesity as a cardiovascular risk factor in routine clinical practice among the young may delay early interventions. This is important and there is a need for incorporating anthropometric screening and aggressive lifestyle modifications as part of routine cardiovascular risk assessments even in patients below 45 years of age.

The clinical presentation in our study was predominantly typical chest pain (56%), but a significant portion reported atypical symptoms such as breathlessness, palpitations, and epigastric discomfort. These findings were similar to that of Madias et al who reported atypical presentations such as Fatigue and lightheadedness, intermittent epigastric discomfort without nausea or vomiting to be common presentation in patients of MI.[16] Similarly, Khan AI et al documented that atypical symptoms were more frequent in younger patients and were often misattributed to non-cardiac causes, especially in the absence of comorbidities.[17] This is compounded by the relatively low index of suspicion among healthcare providers when evaluating younger individuals presenting with atypical clinical presentation. Improving clinician awareness and incorporating structured clinical assessment tools for chest pain evaluation in younger patients is important for early diagnosis in young patients with MI.

Regarding the type of MI, anterior wall involvement was the most frequent (72%) in our study, followed by inferior and anteroseptal MIs. This pattern is consistent with the findings of Bhardwaj R al who reported anterior wall MI as the predominant presentation (70.97%) among young adults, often due to occlusion of the left anterior descending artery.[18] Likewise Dimitrova IN in their angiographic study of young MI patients found a high incidence of single-vessel disease with anterior wall infarcts suggesting a focal atherosclerotic process rather than diffuse coronary disease typically seen in older individuals.[19] Left ventricular dysfunction, noted in 90% of our patients. Wu WY reported some or the other degree of left ventricular dysfunction in cases of MI in young patients.[20] The incidence of LV dysfunction may be more in developing countries where patients often have significant myocardial damage likely due to delayed presentation and suboptimal recognition of symptoms.

CONCLUSION

Modifiable risk factors such as obesity, smoking, hypertension, dyslipidemia, and family history were observed in many of the studied cases. Clinically typical chest pain was the most frequent presenting symptom and anterior wall MI was the predominant type. These findings highlight the need for a high index of suspicion and preventive strategies targeting young adults. This is particularly important in males with multiple risk factors to mitigate early-onset cardiovascular morbidity and mortality.

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