ORIGINAL RESEARCH

Assessment of clinical spectrum and risk factors in young patients with acute myocardial infarction

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ABSTRACT
Background: Worldwide, cardiovascular disease continues to be a leading cause of negative outcomes in young adults, in contrast to its reduction in older age groups. As this demographic has not been extensively researched and possesses a distinct risk profile that includes fewer conventional cardiovascular risk factors relative to older populations, the present study aims to assess baseline and clinical characteristics, modifiable, non-modifiable risk factors, echocardiography findings, complications and in-hospital mortality in young adults diagnosed with acute myocardial infarction (AMI). **Methods:** This prospective, observational single-centre study was conducted at a tertiary care centre in India between January 2008 and June 2009. The study included 50 young adult patients aged between 18-40 years diagnosed with AMI. Patients underwent comprehensive clinical evaluation, including physical examination, ECG monitoring, cardiac enzyme investigations, and 2D echocardiography. **Results:** The study revealed significant male predominance with 84% of the patients being male. The age group of 40-44 years old was most prevalent. Smoking was the most common social habit, affecting 77% of male patients. Chest pain was the primary clinical manifestation, often accompanied by nausea, vomiting, and sweating. Dyslipidaemia (44%) and family history of ischemic heart disease (IHD) (25%) were the most prominent risk factors. Anterior wall myocardial infarction (AWMI) (80%) followed by interior wall myocardial infarction (IWMI) (20%) were the most common site of infarction in our study. Thrombolysis was received by 68% of the patient population. In-hospital complications were observed in 18% of the patients, left ventricular failure (10%) being the most common complication followed by cardiogenic shock (4%) and atrioventricular block (4%) and in-hospital mortality was 6% in our study. **Conclusion:** The present study demonstrated remarkably low in-hospital complications and mortality, suggesting a potentially favorable prognosis for young adults experiencing AMI and highlighting the critical importance of early risk factor identification and comprehensive clinical management.
Keywords: chest pain; hospital mortality; myocardial infarction; risk factors; young adult

INTRODUCTION
As the frequency of acute coronary syndrome has shown a downward trend among older age groups, the same pattern does not hold true for adults of young age. Specifically, younger men and women diagnosed with acute myocardial infarction (AMI) have not experienced comparable reductions in cardiovascular complications, with male patients showing a particularly persistent risk profile.[1] Recent studies have shown that approximately 4% to 10% of patients experiencing AMI are aged 40 years or younger, highlighting an important subset of cardiovascular risk that extends beyond traditional age-related expectations.[2,3] Research suggests that younger patients exhibit unique risk factor patterns compared to older patients along with substantially different characteristics and magnitude of coronary risk factors between them.[4,5]

Risk factors and aetiologies like coronary artery anomaly, connective tissue and autoimmune disorder, substance abuse are more common causes of AMI in younger individuals than that in older patients.[6] Apart from all these factors for AMI, there are various lifestyle and potential genetic risk factors that can act as major risk factor for AMI in young adults. Familial hypercholesterolemia and cigarette smoking can also cause premature atherosclerosis.[7] Recent studies have also identified that premature atherosclerotic processes, characterized by plaque rupture or erosion acts as a primary underlying cause of AMI in younger patient population. These pathological mechanisms are estimated to be responsible for approximately 90%

of early-onset cardiovascular events in young adult patients.[8]Although AMI in younger individuals has a better overall prognosis and low frequency of recurrence, it remains a potentially life-threatening condition with significant long-term complications. It potentially causes profound psychological and socioeconomic challenges for patients and their families. Recognizing these serious consequences, medical professionals are increasingly focusing on identifying and modifying risk factors in younger patient population.[6] Hence the aim of our study was to to assess baseline and clinical characteristics, modifiable, non-modifiable risk factors, echocardiography findings, complications and in-hospital mortality in young adults diagnosed with AMI.

MATERIALS AND METHODS
Study design and population
This prospective, observational single-centered study was conducted at tertiary care center of India between January 2008 to June 2009.The study comprised 50 young adult patients, aged between 18 and 40 years, who were diagnosed with acute myocardial infarction (AMI) and subsequently admitted to the intensive cardiac care unit (ICCU). Patients were assessed based on clinical features, cardiac enzymes and ECG. The study excluded patients younger than 18 and older than 40 years of age. Additionally, patients with prior history of ischemic heart disease (IHD) or those presenting with stable or unstable angina were not included in the study.

Data collection
A detailed history of patients along with complete physical examination was performed. Patients were observed for complications which included left ventricular failure (LVF), cardiogenic shock (CS) and first degree atrio-ventricular (AV) block.

Laboratory investigation
Initial ECG screening with right-sided chest leads was done at admission, with follow-up ECGs conducted every 8 hours on the day of admission. During the ICCU stay, ECGs were performed daily, and subsequent ECGs were ordered based on clinical requirements. For all patients who underwent thrombolytic therapy, a complete 12-lead ECG including right ventricular leads was conducted both before starting the treatment and 2 hours after administering the thrombolytic medication. Patients were monitored for any clinical and ECG changes. During the occurrence of arrhythmias, 12 lead ECG was recorded. Standard lead 2 was used to monitor and record rhythm disturbances and modified chest lead 1 was used whenever necessary. Symptoms of nausea, vomiting and sweating in patients were also recorded. Cardiac enzyme investigations like CK-MB and troponin were also done.

Definition
Acute Myocardial Infarction (AMI) is defined by a rise and fall of cardiac biomarkers, along with at least one of the cardiac symptoms which include ischemic ECG changes (ST elevation/depression), new pathological Q waves, or echocardiographic evidence of regional wall motion abnormalities.[9]

Statistical analysis
Data analysis was performed using Microsoft Excel 2021. Categorical data were reported as frequency and percentages.

RESULTS
A total of 50 young adults diagnosed with AMI were included in this study, characterized by a significant male predominance of 42 patients (84%), and 8 (16%) female patients.**Table 1**represents the baseline demographic characteristics of young AMI patients, highlighting a distinct age-gender distribution. The age group of 40-44 years old was most prevalent with 24 (48%) males and 5 (10%) females followed by second most represented age group of 35-39 years old with 12 (24%) males and 1 (2%) female. Social habits among the patient population revealed that smoking was most common among male (30; 77%) while smoking along with alcohol consumption was observed in 9 (23%) male patients. Chest pain emerged as the predominant clinical manifestation among the patients affecting 10 males (20%) and 5 females (10%) of the patient population. Chest pain along with associated symptoms like nausea, vomiting and sweating were mostly observed in 32 (64%) male patients than females (3; 6%). Thrombolysis treatment was received by 30 (71%) males and 4 females (50%). AWMI was seen most frequently in 33 males (78.5%) and 7 females (87.5%) followed by IWMI in 9 (21.4%) males and 1 (12.5%) female of the patient population.

Risk factors among young patients with AMI is represented in **Table 2**. Dyslipidaemia was the predominant cardiovascular risk factor, affecting 8 (44%) patients. Family history of ischemic heart disease (IHD) emerged as the second most significant risk factor, observed in 5 (25%) patients. Diabetes mellitus was present in 4 (22%) patients, while hypertension represented the least common single risk factor, identified in only 1 (6%) patient. In the two-risk factor category, the most prevalent combination involved patients with both a family history of IHD and dyslipidaemia, accounting for 5 (33.3%) patients, equally matched by patients presenting hypertension with dyslipidaemia (5; 33.3%). Diabetes mellitus concurrent with dyslipidaemia was observed in 2 (13%) patients, while the combination of family history of IHD with hypertension was prevalent in another 2 (13%) patients. In three risk factor category, 1 (50%) patient in combination group of family history of IHD, hypertension and dyslipidaemia and 1 (50%) patient in diabetes mellitus, dyslipidaemia and

family history of IHD combination group were affected.

Table 3 represented the complications and in-hospital mortality in patient population. Out of total 50 patients, there were 9 complications observed in this present study. Left ventricular failure (LVF) was the most common complication observed in 5 (10%) patients, followed by 2 (4%) patients with cardiogenic shock (CS) and 2 (4%) patients with atrioventricular block (AV-block). In hospital mortality was observed in 3 (6%) patients during the study period.

With the help of 2D echocardiography, ejection fraction of the patients were recorded which is illustrated in **figure 1**. Ejection fraction of 40% or more was observed in 38 (76%) patients while ejection fraction between 30-39% was observed in 7 (14%) patients and only 5 (10%) patients had ejection fraction of less than 30%.

Table 1: Baseline characteristics of young patients with AMI based on gender distribution

Variables	Male (n = 42)	Female (n = 8)
Age, years		
25-29	3 (6)	0 (0)
30-34	3 (6)	2 (4)
35-39	12 (24)	1 (2)
40-44	24 (48)	5 (10)
Social habits		
Smoking	30 (77)	0 (0)
Smoking and alcohol	9 (23)	0 (0)
Clinical features		
Chest pain	10 (20)	5 (10)
Associated symptoms	32 (64)	3 (6)
Thrombolysis		
Received	30 (71)	4 (50)
Not received	12 (29)	4 (50)
Wall involvement		
AWMI	33 (78.5)	7 (87.5)
IWMI	9 (21.4)	1 (12.5)

Data are presented as n (%)
AWMI: Anterior wall myocardial infarction; IWMI: Inferior wall myocardial infarction

Table 2: Risk factors among young patients with AMI

Variables	N = 50
Single risk factors	
FH of IHD	5 (28)
DM	4 (22)
HTN	1 (6)
DYS	8 (44)
Two risk factors	
FH of IHD + DM	1 (7)
FH of IHD + HTN	2 (13)
FH of IHD + DYS	5 (34)
DM + DYS	2 (13)
HTN + DYS	5 (33)
Three risk factors	
FM of IHD + HTN + DYS	1 (50)
DM + DYS + FH of IHD	1 (50)

Data are presented as n (%)
DM: Diabetes mellitus; DYS: Dyslipidaemia; FM: Family history; HTN: Hypertension; IHD: Ischemic heart disease

Table 3: Complications and in-hospital mortality in patients

Variables	N = 50
Complications	
Left ventricular failure	5 (10)
Cardiogenic shock	2 (4)

Atrioventricular block	2 (4)
In-hospital mortality	3 (6)

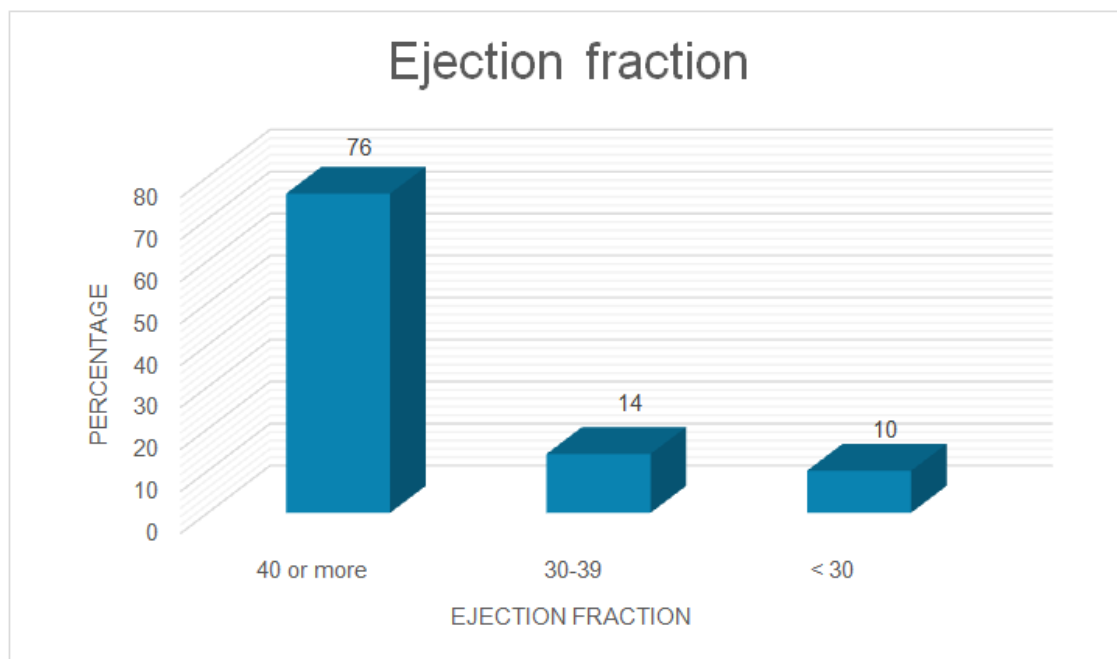Data are expressed in n (%)

Figure 1: Distribution of ejection fraction among young patient with AMI

DISCUSSION

The main findings of our study revealed male predominance, with chest pain as the primary symptom accompanied by nausea, vomiting, and sweating. Risk factor analysis highlighted smoking, dyslipidemia, and family history of IHD as key contributors. AWMI and IWMI were the most common site of infarction, with notably low in-hospital mortality and minimal complications.

In the present study out of total patient population, 84% were male. A study conducted by Zasada W. et al. [10] on AMI in young patients also reported prevalence of 86.26% males in their study. A meta-analysis by Lei L. et al. revealed significant gender disparities in AMI across age groups, with young AMI patients showing a substantially higher proportion of males, ranging from 64.7% to 94.8%, compared to older AMI patient groups.[11] Maximum number of patients in our study belonged to the age group of 35-45 years old. In the 10-year Framingham follow-up study, male patients aged 30 to 55 years demonstrated a higher incidence of AMI compared to female patients within the same age range.[12]

Cigarette smoking stood out as the most prominent modifiable risk factor in our study, with an extensive prevalence among male patients. Specifically, 77% of males were smokers, and 23% demonstrated a combined pattern of smoking and alcohol consumption. Vaidya C. et al. [13] in their study observed that 40.7% of patients smoked or consumed tobacco in any form. Our study revealed a distinct pattern of myocardial infarction location, AWMI predominating at 80% and IWMI accounting for 20% of total patient population. These findings closely align with previous research examining ST-elevation myocardial infarction (STEMI) in younger patient population where 61.3% had AWMI and 22.7% had IWMI.[13] Another study conducted by Neki N. et al., where clinical profile of AMI in young patients was assessed, also found that AWMI (67.5%) followed by IWMI (32.5%) were the most common sites of infarction in their patient population.[14]

Our study revealed dyslipidaemia as the most prominent individual risk factor, affecting 44% of patients, followed by patients with significant family history of ischemic heart disease (IHD) at 28%. Notably, a substantial 34% of patients presented with a combined risk profile of both dyslipidaemia and family history of IHD. A clinical study conducted by Agarwal S. and colleagues to estimate the risk of myocardial infarction in young adults also concluded that 27% of patients suffered from dyslipidaemia and 15% of the patients had family history of IHD.[15]

Echocardiographic findings in present study revealed that 76% of the patients had ejection fraction of > 40%. A study conducted on the epidemiological profile of young patients ($\leq$ 45 years) with AMI observed that 83% of the patients had ejection fraction > 50%, and 16% of the patients had ejection fraction between 40% to 50% and only 1% had ejection fraction of < 40%.[16] The clinical presentation of patients in our study showed that 70% suffered from chest pain along with associated symptoms like nausea, vomiting and sweating while 30% of the

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patients had chief complaints of chest pain. In concordance to our study findings, another study conducted to analyse the clinical characteristics, management and prognosis of patients under 45 years of age with STEMI also found that about 41% of the patients experienced chest pain and 12% had symptoms like nausea, vomiting and sweating.[17]Thrombolysis was received by 68% of the patients in our study. Vaidya C. et al. [13] in their study found that maximum number of the patients (78.7%) received thrombolysis. In our study, 18% of the patients suffered from complications, where 10% had left ventricular failure followed by cardiogenic shock in 4% of the patients and 4% of patients had atrioventricular block (AV-block). In-hospital mortality was seen in 6% of the patients in our study. Study conducted by Dimitrova I. [6] to evaluate baseline characteristics, demographics and risk factor profile, clinical features, angiographic findings and in-hospital outcomes in young patients with AMI observed that most common complication in their study were ventricular fibrillation (4.9%), cardiogenic shock (4.9%), resuscited cardiac arrest (4.9%) and postinfarction angina (4.9%) and also concluded that in-hospital mortality was lower in young patients with AMI than that of older patients with AMI (4.9% vs 10.8%; p = 0.190). A study conducted Jortveit J. et al. [2] on incidence, risk factors and outcomes of young patients with AMI revealed that survival rate was better in young patients with AMI than the older patients with AMI. Specifically, only 9% of young patients experienced adverse events, including death, non-fatal stroke, or recurrent non-fatal AMI, during a 2.5-year follow-up period.

LIMITATIONS
The present study has several limitations that should be considered. Firstly, due to small sample size the generalizability of the study findings are limited. Secondly, as it was a single-centre study, our findings may have not reflected broader epidemiological patterns of AMI in young adults across different regions and healthcare settings. As the study was conducted for short span of period it may have not been able to capture long-term trends or comprehensive data on AMI in young adults. Furthermore, the study did not include long-term follow-up or assessment of patient outcomes after discharge.

CONCLUSION
The present study revealed that chest pain is the most common symptom, often accompanied by nausea, vomiting, and sweating. Smoking emerged as the primary modifiable risk factor, while dyslipidemia and family history of IHD represented significant non-modifiable risks. Echocardiographic findings predominantly showed AWMI and IWMI. Notably, the patient population demonstrated remarkably low in-hospital mortality and complications, suggesting a

potentially favorable prognosis for young adults experiencing acute myocardial infarction and highlighting the critical importance of early risk factor identification and comprehensive clinical management.

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