Original research

ASSESSMENT OF RISK FACTORS IN YOUNG ACUTE MYOCARDIAL INFARCTION PATIENTS: AN OBSERVATIONAL STUDY

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Abstract
Purpose: The present study was aimed to determine the prevalence of risk factors in younger patients (age <45 years) presenting with ami.
Methods: In this observational, cross-sectional study, a total of 150 patients were studied between april 2020 and june 2021 for the risk factors of ami. Patients with characteristic electrocardiographic changes suggestive of coronary artery disease, within 15-44 years of age were included and data regarding baseline clinical characteristics were reported.
Results: Maximum patients (82%) were in the age group of 35-44 years where males (73.3%) outnumbered females (26.7%).Among all the risk factors, dyslipidemia (77.3%) was the most prevalent, and significantly higher in smokers, obese (body mass index ≥25) and diabetic patients. Major complication was arrhythmia (45.3%), and anterior wall myocardial infarction was the most prevalent pattern of myocardial infarction (61.3%). Majority of patients had two risk factors and maximum number of patients i.e, 141 (94%) were discharged from hospital after treatment while 9 (6%) died.
Conclusion: The present study revealed that dyslipidemia was the major modifiable risk factor of ami in the younger population followed by sedentary lifestyle, obesity, tobacco chewing, smoking, diabetes mellitus, systemic hypertension, and family history where majority of patients had two risk factors.

Introduction
Coronary artery disease (cad) is a leading cause of death throughout the world where south asians around the globe have the highest rates of cad (1). It is interesting to note that, as compared to western population cad affects the indian population at younger age (<45 years) (2). The age-standardized cardiovascular disease mortality rate in india stands at 272 per hundred grand population, which is skewed as compared to global average of 235 per hundred grand population (3). In last three decades, the prevalence of cad has gradually increased in india from 1.1% to 7.5% and 2.1% to 3.7% in urban and rural population, respectively (4). One of the most common presentations of cad is acute myocardial infarction (ami) and the age group above 45 years is the most widely affected by ami. However, nowadays due to stressful life attributable to psychological, social, and financial constraints, there is no exception of persons below 45 years presenting with ami. According to interheart study report, sedentary lifestyle, unhealthy diet, physical inactivity, smoking, obesity, diabetes, hypertension and hyperlipidemia are the major causes for increasing rates of ami in younger population (5, 6). Moreover, dyslipidemia was found as the strongest predictor of myocardial infarction (mi) in previous studies (7, 8). In a study on younger patients (age <45 years) of ami, it was reported that 60.83% were dyslipidemic and the most common isolated deranged lipid fraction was triglyceride (tg) (45%) whereas low high-density lipoprotein (hdl) was least common (10.83%) (9). In an another study on patients younger than 35 years reported that, smoking (71%) and history of premature cad (27%) were the most common risk factors of cad (3). Compared to the elderly, the younger population are not well studied about the prevalence, comorbidities, and therapies of ami (10). Therefore, this study was aimed to determine the prevalence of various risk factors in younger ami patients (age <45 years).

Materials and methods
Study design and population: This was an observational and cross-sectional study conducted at a tertiary care center in india between april 2020 and june 2021. Total 150 patients (age 15-44 years) who represented characteristic electrocardiographic changes suggestive of cad were included. The study was approved by

institutional ethics committee of s. S. Medical college, rewa (m.p.) (s.no./iec/ss/mc/2020/4272) and the written informed consent was obtained from all the enrolled patients. Patients of age <15 years and ≥45 years, patients with chronic stable angina, unstable angina, and cardiovascular disease resembling mi like pericarditis, and aortic dissection were excluded from the study.

Measurements and methodology: Data regarding demographic details, past medical history, family history and risk factors (dyslipidemia, tobacco chewing, smoking, systemic hypertension, diabetes mellitus, obesity, and sedentary lifestyle) were reported. Routine biochemical investigations including lipid profile, blood sugar level, electrocardiography (ecg), 2d echocardiography and other relevant investigations such as body mass index (bmi), jugular venous pressure, pulse, and blood pressure were recorded. Venous blood (4 ml) was collected in a plain vial after overnight fasting for routine biochemical investigations and lipid profile testing was done using auto analyzer. Dyslipidemia was diagnosed according to adult treatment panel (atp) iii criteria **(table 1)** (11). Acute/evolving/recent mi was characterized as typical rise or fall of biochemical markers of myocardial necrosis with ecg changes indicative of ischemia (st segment elevation or depression).

Table 1: atp iii criteria for diagnosis of dyslipidemia

Tc	≥200 mg/dl
Tg	≥150 mg/dl
Low hdl-c	≤44 mg/dl in males and ≤45 mg/dl in females
Increase in ldl	≥100 mg/dl in presence of cad/cad risk equivalent
	≥130 mg/dl in presence of ≥2 risk factors
	≥160 mg/dl in presence of 0-1 risk factors

Tc: total cholesterol; tg: triglycerides; hdl-c: high density lipoprotein-cholesterol; ldl: low density lipoprotein

Statistical analysis

Graphpad instat v3 (graphpad software, california, usa) was used for statistical analysis of all data. Unpaired t-test/mann-whitney u-test was used for comparison between different groups and chi-square/fischer's test was applied for qualitative variables where p-value of <0.05 was considered statistically significant.

Results

A total of 150 patients presenting with ami were included in the study. The maximum number of patients (82%) were within the age group of 35-44 years among which 73.3% were males. Baseline demographic characteristics of ami patients age <45 years are represented in **table 2.**

Majority of patients belonged to urban area (76.66%), were light workers (64%) and obese (60.7%). In this study, dyslipidemia (77.33%) was the major risk factor of ami among all.

Table 2: Baseline demographic characteristics of patients with mi age < 45 (n=150)

Characteristics	N (%)
Age groups	
15-24 years	5 (3.3%)
25-34 years	22 (14.7%)
35-44 years	123 (82%)
Gender	
Male	110 (73.3%)
Female	40 (26.7%)
Area	
Urban	115 (76.7%)
Rural	35 (23.35%)
Bmi (kg/m^2)	

<18.5 (underweight)	1 (0.6%)
18.5-22.9 (normal)	13 (8.7%)
23-24.9 (overweight)	45 (30%)
≥25 (obese)	91 (60.7%)
Occupation	
Light worker	96 (64%)
Moderate worker	38 (25.3%)
Heavy worker	16 (10.7%)
Risk factors	
Smoking	71 (47.3%)
Tobacco chewing	91 (60.6%)
Family history of cad	16 (10.6%)
Systemic hypertension	35 (23.3%)
Diabetes mellitus	36 (24.0%)
Dyslipidemia	116 (77.33%)
Obesity (bmi ≥25 kg/m^2)	91 (60.6%)
Sedentary lifestyle	96 (64%)

Bmi: body mass index; cad: coronary artery disease

The clinical characteristics of patients are depicted in **table 3**. Maximum patients were presented with typical chest pain (66%). Anterior wall myocardial infarction (awmi) was observed in 92 (61.3%) patients followed by inferior wall myocardial infarction (iwmi) in 46 (30.7%) patients. The mean tg and low-density lipoprotein (ldl) were 161.7±56.6 mg/dl and 101±58.3 mg/dl, respectively.

Table 3: Clinical characteristics of patients with mi age < 45 years (n=150)

Characteristics	N (%)
Symptoms	
Typical chest pain	99 (66%)
Atypical chest pain	8 (5.3%)
Sweating	14 (9.3%)
Nausea and vomiting	12 (8%)
Breathlessness	9 (6%)
Palpitation	5 (3.3%)
Atypical symptoms	3 (2%)
Clinical signs (mean ± sd)/n	
Hr (bpm)	88±12
Systolic bp (mmhg)	138±20
Diastolic bp (mmhg)	88±10
Lvf	10 (6.6%)
Raised jvp	8 (5.3%)
Basal crepitation	9 (6%)
Pattern of mi	
Awmi	92 (61.3%)

Iwmi	46 (30.7%)
Lwmi	8 (5.3%)
Nstemi	4 (2.7%)
Lipid profile	
Total cholesterol, mg/dl (mean ± sd)	178 ± 53.5
≥200	55 (36.67%)
<200	95 (63.37%)
Triglyceride, mg/dl (mean ± sd)	161.7 ± 56.6
≥150	83 (55.33%)
<150	67 (44.66%)
Hdl, mg/dl (mean ± sd)	45.1 ± 9.46
<45	59 (39.3%)
≥45	91 (60.33%)
Ldl, mg/dl (mean ± sd)	101 ± 58.3
≥100	68 (45.33%)
<100	82 (54.66%)

Hr: heart rate; bp: blood pressure; lvf: left ventricular function; jvp: jugular venous pressure; mi: myocardial infarction; awmi: anterior wall myocardial infarction; iwmi: inferior wall myocardial infarction; lwmi: lateral wall myocardial infarction; nstemi: non-st elevation mi; hdl: high density lipoprotein; ldl: low density lipoprotein.

Baseline and clinical characteristics among various lipid parameters are represented in **table 4**. Dyslipidemia was predominantly seen in urban population where patients within the age of 35-44 years had higher dyslipidemia as compared to lower age groups (≤34 years) and pattern of dyslipidemia was similar in both male and female. Dyslipidemia was significantly higher in obese (bmi ≥25) patients, diabetic patients, and smokers. High tg level was found especially in hypertensive patients, and patients with tobacco chewing. Arrhythmia was the major complication **(table 5).** Maximum number of the death occurred in the age group of 35-44 **(table 6)**. In this study, majority of patients had two risk factors and maximum number of patients i.e 141 (94%) were discharged from hospital after treatment while 9 (6%) died.

Table 4: Baseline and clinical characteristics among various lipid parameters

Characteristics	Tc (mg/dl)		Tg (mg/dl)		Hdl (mg/dl)		Ldl (mg/dl)	
	≥200	<200	≥150	<150	<45	≥45	≥100	<100
Gender and dyslipidemia								
Male	39 (35.4%)	71 (64.6%)	59 (53.6%)	51 (46.4%)	43 (39%)	67 (61%)	50 (45.4%)	60 (54.6%)
Female	16 (40%)	24 (60%)	24 (60%)	16 (40%)	16 (40%)	24 (60%)	18 (45%)	22 (55%)
Age and dyslipidemia								
15-24 years (5)	0 (0%)	5 (100%)	3 (60%)	2 (40%)	0 (0%)	5 (100%)	0 (0%)	5 (100%)
25-34 years (22)	9 (41%)	13 (59%)	9 (41%)	13 (59%)	11 (50%)	11 (50%)	8 (36.3%)	14 (63.7%)
35-44 years (123)	46 (37.4%)	77 (62.6%)	71 (57.7%)	52 (34.7%)	48 (39%)	75 (61%)	59 (48%)	64 (52%)

Area and dyslipidemia							
Urban (115)	44 (38.2%)	71 (61.8%)	67 (58.3%)	48 (41.7%)	48 (41.7%)	67 (58.3%)	54 (47%)	61 (53%)
Rural (35)	11 (31.4%)	24 (68.6%)	16 (45.7%)	19 (54.3%)	11 (31.4%)	24 (65.6%)	14 (40%)	21 (60%)
Bmi (kg/m^2) and dyslipidemia							
<18.5 (1)	0 (0%)	1 (100)	0 (0%)	1 (100%)	0 (0%)	1 (100%)	0 (0%)	1 (100%)
18.5-22.9 (13)	2 (15.4%)	11 (84.6%)	3 (23%)	10 (77%)	2 (15.4%)	11 (84.6%)	3 (23%)	10 (77%)
23-24.9 (45)	12 (26.7%)	33 (73.3%)	16 (35.5%)	29 (64.5%)	13 (28.9%)	32 (71.1%)	19 (42.2%)	26 (57.8%)
≥25 (91)	41 (45%)	50 (55%)	64 (70.3%)	27 (29.7%)	44 (48.3%)	47 (51.6%)	46 (50.5%)	45 (49.5%)
Types of mi and dyslipidemia							
Awmi (92)	33 (33.7%)	65 (66.3%)	57 (58.1%)	41 (41.8%)	36 (36.7%)	62 (63.3%)	42 (42.9%)	56 (57.1%)
Iwmi (46)	21 (43.7%)	27 (56.3%)	24 (50%)	24 (50%)	22 (45.8%)	26 (54.2%)	24 (50%)	24 (50%)
Lwmi (8)	3 (37.5%)	5 (62.5%)	4 (50%)	4 (50%)	2 (25%)	6 (75%)	4 (50%)	4 (50%)
Nstemi (4)	1 (25%)	3 (75%)	2 (50%)	2 (50%)	1 (25%)	3 (75%)	1 (25%)	3 (75%)
Diabetes mellitus and dyslipidemia							
Diabetes mellitus	28 (77.8%)	8 (22.2%)	24 (66.7%)	12 (33.3%)	27 (75%)	9 (25%)	29 (80.5%)	7 (19.5%)
Hypertension and dyslipidemia							
Hypertension	15 (48.4%)	16 (56.6%)	23 (74.2%)	8 (24.8%)	16 (51.6%)	15 (48.4%)	17 (54.8%)	14 (45.2%)
Smoking and dyslipidemia							
Smoking	11 (14%)	68 (86%)	14 (17.7%)	65 (82.3%)	32 (40.5%)	47 (59.5%)	17 (21.5%)	62 (78.5%)
Tobacco chewing and dyslipidemia							
Tobacco chewing	39 (40.2%)	58 (59.8%)	59 (60.8%)	38 (39.2%)	42 (43.3%)	55 (56.7%)	50 (51.4%)	47 (48.6%)

Tc: total cholesterol; tg: triglyceride; hdl: high density lipoprotein; ldl: low density lipoprotein; bmi: body mass index; mi: myocardial infarction; awmi: anterior wall myocardial infarction; iwmi: inferior wall myocardial infarction; lwmi: lateral wall myocardial infarction; nstemi: non-st elevation mi

Table 5: Complications

Complication	N (%)
Arrhythmia	68 (45.3%)
Tachyarrhythmia	38 (25.33%)
Bradyarrhythmia	30 (20%)
Sinus bradycardia	19 (12.6%)
A-v block	4 (6%)
Complete heart block	5 (3.3%)
Lv failure	10 (6.6%)
Cardiogenic shock	5 (3.3%)

A-v block: atrioventricular block; lv failure: left ventricular failure

Table 6: Risk factors analysis among outcomes

Risk factors	Death (n=9)	Discharge (n=141)
Dyslipidemia	9 (100%)	107 (75.8%)
Bmi (≥ 25 kg/m^2)	9 (100%)	82 (58.2%)
Diabetes mellitus	9 (100%)	27 (19.1%)
Hypertension	6 (66.6%)	29 (20.5%)
Smoking	8 (88.9%)	63 (44.7%)
Tobacco users	6 (66.6%)	85 (60.2%)
Sedentary lifestyle	9 (100%)	87 (61.7%)
Family history of cad	4 (44.4%)	12 (8.5%)
Average risk factors	≥ 4	≥ 2

Bmi: body mass index; cad: coronary artery disease

Discussion

In the present study, indian patients who had documented ami before 45 years of age were studied to determine the actual prevalence of dyslipidemia and other conventional risk factors. A skewed gender distribution of males (73.33%) vs females (26.7%) has been clearly demonstrated in our study which can be attributed to protective effects of estrogen for preventing atherosclerosis in females of reproductive age (4). The most common symptom in the study population was chest pain (66%) and awmi was the most common st-elevated myocardial infarction (61.3%). A study done by sinha s k et al. Among younger population, also reported similar results (59.0%) for awmi (4, 12).The high prevalence of hypercholesterolemia, hypertriglyceridemia, and low hdl, in younger population is a major cause of concern. Depending on the higher recorded levels of ldl, total cholesterol (tc), tg, and lower levels of hdl, dyslipidemia was found to be the most prevalent among young adult ami patients in previous studies (1, 13, 14). In our study, dyslipidemia was reported in 77.3% patients and similar results (78.5%) were observed in the previous findings of sinha s k et al. (4).The reason for increased prevalence of dyslipidemia is unknown, however, genetic factors and dietary habits seem to be important. High tg levels have been associated with increased levels of small dense ldl which is highly atherogenic. Low hdl-cholesterol levels are stronger predictor of occurrence and reoccurrence of mi and stroke and are also associated with premature and severe cad (1). In the present study, hypercholesterolemia, ldl, tg and hdl levels were observed in 36.6%, 45.3%, 55.3%, and 39.3% of study population, respectively. Also, similar results were observed in previous findings of sawant am et al. For high cholesterol level (33.6%), ldl level (25.83%), tg level (45.0%), and hdl level (42.7%) (1).

Sedentary lifestyle seems to contribute to increased prevalence of dyslipidemia in younger population. We observed that 64% of our patients had sedentary lifestyle which was equivalent to the previous findings of biswas pk et al. (15). Obesity is an independent risk factor for cad,the present study reported 60% cases of obese patients (bmi ≥ 25 kg/m^2). In our study, 60.6% of patients had oral tobacco addiction. Not many studies were done previously on the relation between oral tobacco addiction and the development of acute coronary syndrome (15). But interestingly we observed that there is a direct correlation between oral tobacco addiction and developing ami at younger age. Smoking was found in 47.3% cases in our study, similar findings were observed (46.0% cases) by faisal aw et al. Cigarette smoking accelerates cad, and atherosclerosis which increase thrombus formation, and this could contribute to mi at an earlier age (16).Diabetes was reported in 24% cases and this finding was consistent (21.3%) with the previous findings of prakash b et al. (16, 17). Hypertension was reported in 23.3% cases which can be attributed to the interaction between two risk factors, dyslipidemia, and hypertension. Atherosclerosis occurs due to lipids accumulation within the lumen of blood vessels, which results in obstruction of blood flow in the vascular system, then ends up in hypertension. Similar results were observed in a study done by faisal aw et al. Where 22% cases were hypertensive (13).In our study, family history of cad was reported in 10.6% study population and this finding was equivalent (9.40%) with previous findings of prakash b et al. (17). Our findings demonstrated that clustering of different risk factors

predisposes the younger individuals to premature ami. In the present study, maximum patients had two risk factors and the patients who died represented more than four risk factors.

Study limitations
This study has few limitations, the study did not have any control group and so the risk of each factor could not be analyzed. The statistical significance of the factors couldn't be analyzed. There were few lab tests like troponin-t and k for which the facilities were not available.

Conclusion
The present study concluded that dyslipidemia, sedentary lifestyle, obesity, tobacco chewing, and smoking are the major modifiable risk factors of ami in younger patients (age <45 years) followed by diabetes mellitus, systemic hypertension, and family history. Majority of patients were the cases of awmi, had two risk factors, and arrhythmia was the major complication in the study population. Discharge and death rates were 94% and 6%, respectively. For the management of dyslipidemia and prevention of cad, therapeutic intervention, dietary modification, enhanced physical activity, and smoking cessation should be highlighted to increase awareness among population at risk.

Conflicts of interest
Authors declare no conflicts of interest.
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