



ORIGINAL RESEARCH PAPER

General Medicine

A STUDY OF CLINICAL PRESENTATION AND RISK FACTORS FOR ACUTE MYOCARDIAL INFARCTION IN PATIENTS BELOW 40 YEARS AT A TERTIARY CARE CENTRE

KEY WORDS: acute myocardial infarction, smoking, hyperhomocysteinemia, young

Dr Surendra Singh*	PG resident, department of medicine, JMC Jhalawar, Rajasthan*Corresponding Author
Dr Javed Khan	PG resident, department of medicine, JMC Jhalawar, Rajasthan
Dr Aiswarya Ravikrishnan	PG resident, department of medicine, JMC Jhalawar, Rajasthan
Dr Ram Babu Saini	Senior Resident, department of medicine, JLN Medical College

ABSTRACT

INTRODUCTION: Coronary Artery Disease (CAD) in young Indians, which accounts for 12-16% of cases in people below 45 years old and contributes to 50% of CAD-related deaths in those below 50 years. Traditional risk factors for CAD as hypertension and smoking explain most cases of CAD, but 15-20% have no identifiable risk factors. Recent studies show elevated Lp(a) and hyperhomocysteinemia play a role in MI and that measuring Apo B and Apo A1 is better than measuring LDL-C and HDL-C. The true prevalence of CAD in the young is understated and this study aims to determine the association of newly identified and traditional risk factors with premature onset of CAD in those 40 years or younger. **Method:** This was a prospective, observational study conducted in the department of general medicine at Jhalawar Medical College on 50 patients who had suffered an acute myocardial infarction. A comprehensive evaluation was performed using a pre-test proforma that included a detailed clinical history, physical examination, electrocardiography, biochemical analysis, and an echocardiographic evaluation. **Results:** The majority of patients (60%) were in the age range of 35-40 years, with the youngest being 19 years old. 88% of the patients were male and the mean age for female patients was 36.17 years and for males, it was 34.02 years. The most common symptom in young patients was chest pain (90%), followed by sweating (52%) and breathlessness (30%). The most common risk factor for MI was tobacco abuse (86%), followed by a positive family history of CAD (16%) and a high BMI (8%). The majority of patients (72%) had multiple risk factors for AMI, 24% had a single risk factor, and 4% had none. The homocysteine level was above normal in 42% of patients, with 2% having a high risk. **Conclusion:** Our study highlights the importance of addressing risk factors for better patient outcomes in the case of Acute Myocardial Infarction (AMI). To address the high prevalence of cigarette smoking in young adults, preventive educational programs and smoking cessation clinics need to be established. Medical personnel should prioritize educating the youth on diabetes and cholesterol management.

INTRODUCTION

Coronary artery disease (CAD) is the most common cause of mortality in the entire world¹. CAD in the absence of atherosclerosis, uncommon in older patients accounts for approximately 20% of cases in patients under age 45⁽⁴⁻⁶⁾.

The prevalence of CAD in young Indians (below 45 years) is about 12%–16%⁽²⁻³⁾. About 50% of CAD-related deaths in the young below 50 years and about 25% of myocardial infarction (MI) in India occurs under the age of 40yrs⁽⁷⁻⁸⁾.

MI in the young can be divided into two groups, those with angiographically normal coronary arteries and those with CAD. The prevalence of MI with normal coronary arteries varies between 1% and 12%⁹. Young MI patients have a higher percentage of normal coronary arteries. MI in them can be caused by arteritis, thrombosis, embolization, or spasm. As is the case with venous thrombosis, coronary thrombosis can be seen in hypercoagulable states, such as protein C and protein S deficiency, antiphospholipid syndrome, or nephrotic syndrome⁽¹⁰⁻¹¹⁾. Coronary artery spasm can cause MI in patients with cocaine abuse and also in association with alcohol binges⁽¹²⁻¹³⁾. Other unusual causes include hypertension, coronary aneurysms, mediastinal irradiations, valvular abnormalities, and infective endocarditis. Although traditional risk factors such as hypertension, insulin resistance, diabetes mellitus, smoking, hyperlipidemia, physical inactivity and obesity explain most of CAD, 15%–20% of those with CAD have no identifiable risk factors and therefore miss the opportunity for primary prevention¹⁴.

Recent studies show that increased Lp(a),

hyperhomocysteinemia plays an important role in MI¹⁵. Some 10%–20% of cases of CAD have been linked to elevated level of serum homocysteine. Lp(a) is considered to be 10 times more atherogenic than low-density lipoprotein-cholesterol (LDL-C) and is associated with a family history of MI in asymptomatic individuals, as well as with clinical MI, CAD, and restenosis of coronary artery vein grafts⁽¹⁶⁻¹⁹⁾. Factor V Leiden mutation also has been shown to increase the risk for MI. It may be possible that there is increased prevalence of hyperhomocysteinemia and elevated Lp(a) levels in Indian subcontinent leading to an early age of onset of first MI in Indians. Recently in studies, it has been found that measuring apolipoprotein (Apo)-B and Apo-A1 is better than measuring LDL-C and high-density lipoprotein-cholesterol (HDL-C) as the type of HDL-C and LDL-C (size and density) is more important rather than the absolute values. Small dense LDL-C particles are more atherogenic²⁰. Approximately, 50% of patients have single vessel disease (SVD) while the remainder has multivessel disease. The prevalence of left main coronary artery stenosis is approximately 5%²¹.

The true prevalence of CAD in the young is grossly underestimated. Therefore, this study was done to find out the association of recently identified risk factors along with traditional risk factors with the premature onset of CAD in young patients who are 40-year-old or younger.

CASE STUDY

The study was carried out on fifty patients aged ≤40 years admitted with MI in the Department of Medicine in Jhalawar medical college. A detailed clinical history, physical examination, electrocardiography (ECG), biochemical, and

echocardiographic evaluation were done using a pretest proforma.

INCLUSION CRITERIA

All patients aged 40 years or younger admitted with MI. The final diagnosis of acute MI (AMI) was based on the following criteria:

- Evidence of elevated cardiac Troponin levels (>99th percentile upper reference limit)
 - At least one of the following
 - a. Ischemic chest pain lasting 20 min or more
 - b. ECG evidence of myocardial injury
- i. Greater than or equal to 0.1 mv ST elevation in two contiguous leads other than V2-V3 where the cut-off point of ≥0.25 mv in men<40 yrs; or >0.15mv in women.
- ii. New horizontal or down sloping ST depression ≥0.05 mv in two contiguous leads and/or T wave inversion ≥0.1 mv in two contiguous leads with prominent R wave or R/S ratio > 1.
- iii. Development of pathological Q waves
- c. Evidence of new RWMA on 2D Echo

EXCLUSION CRITERIA

Patients below 18 years and above 40 years were not included. Patients with past history of myocardial infarction. Patients who refused to give consent.

STUDY PERIOD

December 2021- August 2022

STUDY DESIGN

Observational study of CAD risk factors among western Indians. Subjects studied were men and women aged 18–40 years.

STATISTICAL ANALYSIS

Chi-square test was used for statistical analysis. Proper informed and written consent was taken from patients and following parameters studied:

- a. History
 - Age, Sex
 - History of hypertension, diabetes mellitus, substance abuse i.e. smoking, alcohol consumption, cocaine and duration. Family history premature CAD (defined as CAD occurring below the age of 65 in women and 55 in men)
 - Symptoms- chest pain, shortness breathing, sweating, nausea, and a sense of impending doom
- b. Physical examination
 - Systolic and diastolic blood pressure, Height/weight, Waist-hip ratio, Body mass index.
- c. Laboratory values
 - Lipid profile (Total cholesterol, HDLs, LDLs, Triglycerides (Tgs) Novel risk factors (Homocysteine, C-reactive protein.) RBS, FBS
- d. Electrocardiography (ST-segment elevation myocardial infarction (STEMI) or non-STEMI (NSTEMI).
- e. Echocardiography

RESULTS

In this study, the risk factors, clinical and laboratory profile of fifty young patients of age between 18 and 40 years with MI were studied from December 2021 to August 2022 presenting to our hospital.

The total number of patients was fifty. Most of the patients (60%) were within the age of 35–40 years and 4% of the patients were in the age group of 18 – 25 years. The youngest patient was 19-year-old. 88% of the patients were males (P < 0.05) The mean age of female patients was 36.17 years while for males was 34.02 years [Table 1 and Figure 1]. The most common symptom in young patients with MI was chest pain, which was present in 90% of the patients, followed by sweating (52%) and breathlessness (30%). Substance abuse (cocaine) was present in 2% patients. Tobacco abuse (smoking, chewing and/or sniffing) was the most common risk factor for MI (86%) in the young adults, The family history of CAD was positive in 16% of the patients. 8% patients had body mass index (BMI) value of >30 kg/m2. 16% percent of the patients were diabetic, of which 10% were newly detected. Hypertension formed 24% of the risk factors. The serum TC levels were elevated in 46% of the patients [Figure 4]. HDL-C was below 40 mg/dl in 68% of patients overall, but when taking gender distinction into account, it was below normal in 66% of patients. LDL-C levels were high in 20% of the patients while 16% of the patients had very high levels of LDL-C [Figure 5]. 72% of the patients had multiple risk factors for AMI. 24% had a single risk factor, while 4% had none of the risk factors. [Table 5]. The homocysteine level was above normal (> 15 µmol/L) in 42% of patients, of which 16% patients had homocysteine level between 15 and 30 µmol/L (moderate risk), 24% had levels between 30 and 100 µmol/L (intermediate risk), and 2% patients had levels above 100 µmol/L (high risk) [Figure 6].

Table 1: Sex distribution of young adults with myocardial infarction

Sex	Percentage
Male	88 %
Female	12 %

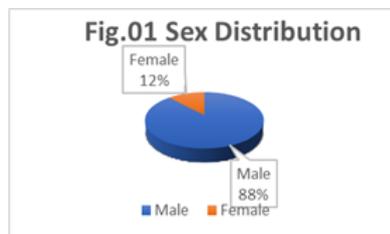


Table 2: Frequency of the symptoms

Symptoms	Number of patients (Percentage)
Chest pain	45 (90%)
Sweating	26 (52%)
Breathlessness	15 (30%)

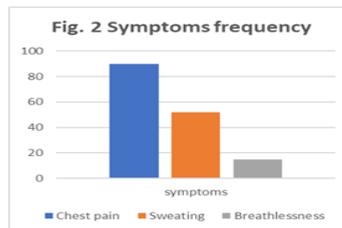


Table 3: Personal history (addiction)

Addiction	Number of patients (Percentage)
Tobacco abuse (smoking, chewing, sniffing)	43 (86%)
Cocaine abuse	1 (2%)

Table 4: Family history of CAD

Family History	Number of patients (Percentage)
Not significant	42 (84%)

History of CAD in first degree blood relatives	8 (16%)
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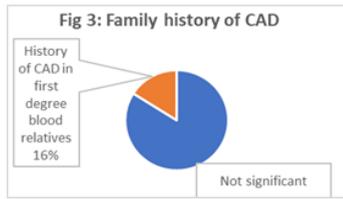


Table 5: Major Risk Factors

Risk factor	Number of patients (Percentage)
Smoking	38 (76%)
Hypertension	12 (24%)
Diabetes	8 (16%)
BMI >30kg/m2	4 (8%)
hyperhomocysteinemia (>100umol/l)	1(2%)

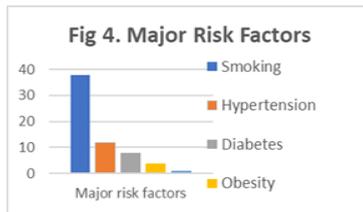


Table 6: Lipid profile

Lipid profile	Number of patients (Percentage)
Total cholesterol >200 mg/dl	34 (68%)
HDL M <40mg/dl FM <50mg/dl	33 (66%)
LdL >130mg/dl	27 (54%)
TG >150mg/dl	38 (76%)

Anterior wall MI was found in 64% of the patients, and 28% of the patients had inferior wall MI. Lateral wall MI was present in 4% of the patients [Figure 5-8].

DISCUSSION

AMI is rare before 40 years of age, but there is a rising trend in young population nowadays. Most of the patients belonged to higher range of age group that is 35–40 years which contributed 60% of the patients and only 4% of the patients were below 25 years of age. The mean age was 36.17 years for females and 34.01 years for males. The distribution of age group showed a striking increase in the disease with increasing age. This in accordance to previous studies which also showed increasing trend with increasing age even in young patients. In a study done by Sricharan et al. also the maximum number of the patients(70%) were within in the age of 35–40 years and 3.33% patients being in the age group of 25–30 years.[22] In addition, in a study by Prajapati et al. the mean age was 34.5 ± 4.7 years.[23] Male sex is an important risk factor for IHD. In our study 88% of the patients were male. A study by Prajapati et al., also 89.9% patients were male.[23] Thus, the demographic profile of our patients was similar to previous studies. Tobacco smoking is an established conventional coronary risk factor for CAD. Casual association between tobacco chewing (smokeless tobacco) and CAD is found in some case control studies. Tobacco increases the risk of cardiovascular (CV) disease by raising blood pressure, damaging vascular endothelium, increasing LDL cholesterol oxidation, and lowers the HDL cholesterol. Smoking was found to be a most prevalent risk factor (76%) in our study also. This was in line with a previously reported prevalence of 77% in Swiss patients aged ≤35 years by Schoenenberger et al. [24] Studies done in India also showed smoking the most

prevalent risk factor [22,23,25] Thus, an effort should be made to educate people about the hazards of cigarette smoking, and people should be educated at an early age to avoid smoking, and smoking cessation programs need to be established. About 24% of the patients were diabetic, of which 10% were newly detected and hypertension was present in 18% of the patients. BMI more than 25 kg/m2 was seen in 32% of the patients. A study by Sricharan et al. [22] and Jamil et al. [25] also showed a similar trend. The excess burden of CAD among South Asians appears to be primarily due to dyslipidemia that is characterized by: high levels of cholesterol, TGs, borderline high levels of LDL C, low levels of HDL C. Total cholesterol levels and LDL C levels are correlated with extent and severity of CAD in Asian Indians as in whites. However, at any given total cholesterol or LDL C level, Asian Indians have a greater CAD risk than whites. In our study, hyperlipidemia was present in 68% of the patients, with 54% of the patients having increased LDL C levels. In previous studies also hyperlipidemia was found to be a common risk factor. In a study by Sricharan et al. hyperlipidemia was the second most common risk factor (36.67%). [22] Hyperlipidemia was documented in 46% of the study population in the study by Hassan et al. [21] Similar results were obtained in the study by Prajapati et al. [23] Therefore, Asian Indians with dyslipidemia should be treated as aggressively as if they had a CAD risk equivalent similar to the treatment of patients with diabetes or heart disease. Lp(a) appears to be a major risk factor in Asian Indians as compared to whites. A high level of Lp(a) is shown to the most prevalent dyslipidemia in our young patients with premature CAD. Lp(a) levels are governed almost exclusively by race, ethnicity, and genetics, unlike other lipids, where the levels are influenced by age, gender, diet, and other environmental factors. The effect of Lp(a) on the atherogenicity is not additive but multiplicative. It constitutes an important inherited risk factor for atherosclerosis and is also regarded as a biological marker for familial CAD. Homocysteine levels are higher among Asian Indians than others. In India, most people adhere to a vegetarian diet and vegetarians have 3.0 times higher risk of hyperhomocysteinemia compared to those who eat nonvegetarian. In our study, homocysteine levels were above normal in 42% of the patients. Furthermore, in the study done by Arumalla and Reddy [27] hyperhomocysteinemia was found in 66% of the patients with AMI. The slightly lower prevalence of hyperhomocysteinemia in our patients might be due to increased fish consumption and fruits. Hence, we should encourage higher intake of fruits and avoid overcooking of vegetables to prevent hyperhomocysteinemia. Our study showed that 72% patients had multiple risk factors, 26% had a single risk factor, and 4% of the patients had no risk factors. According to Sricharan et al. [22] 46.67% of the patients had multiple risk factors for AMI, 46.67% had a single risk factor, while 6.67% had none of the risk factors. The most common presenting complaint in our study was chest pain (94%) followed by sweating (50%) and breathlessness (26%). The study by Sricharan et al. showed that the most common symptom was chest pain, which was present in 90% of the patients, followed by sweating (50%), breathlessness (20%), restlessness (6.7%), and palpitations (3.3%). [22] However, in the study by Hassan et al. 69% of the patients denied any chest pain. [21] The chest pain was absent in our study mainly in females and diabetics. most common presentation was with anterior wall MI which was found in 64% of the patients. It was followed by inferior wall MI in 28% and lateral wall MI in 4% of the patients. These results are in line with the prior studies done by Sricharan et al. and Prajapati et al., where also anterior wall MI was most common presentation followed by inferior wall MI [22,23]

CONCLUSIONS

Modifying risk factors including novel and conventional, is a critical task but can be challenging. To address this, preventive educational programs and smoking cessation clinics should be set up, especially for young adults where

cigarette smoking is prevalent. Medical personnel should prioritize providing diabetes and cholesterol education to the youth. Early treatment with thrombolysis and angioplasty can save much of the at-risk myocardium in young patients with discrete lesions.

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REFERENCES:

1. The Global Burden of Disease, Update. WHO Press: Geneva; 2004. p. 11-2.
2. Negus BH, Willard JE, Glamann DB, Landau C, Snyder RW 2nd, Hillis LD, et al. Coronary anatomy and prognosis of young, asymptomatic survivors of myocardial infarction. *Am J Med* 1994;96:354-8.
3. Mammi MV, Pavithran K, Abdu Rahiman P, Pisharody R, Sugathan K. Acute myocardial infarction in North Kerala – A 20 year hospital based study. *Indian Heart J* 1991;43:93-6.
4. Yater WM, Traum AH, Brown WC, Fitzgerald RP, Geisler MA, Wilcox BB. Coronary artery disease in men 18 to 39 years of age. *Am Heart J* 1948;36:334-48.
5. Kennelly BM. Aetiology and risk factors in young patients with recent acute myocardial infarction. *S Afr Med J* 1982;61:503-7.
6. Berenson GS, Srinivasan SR, Bao W, Newman WP 3rd, Tracy RE, Wattigney WA, et al. Association between multiple cardiovascular risk factors and atherosclerosis in children and young adults. The Bogalusa heart study. *N Engl J Med* 1998;338:1650-6.
7. Bahuleyan CG. Hospital data on coronary artery disease from North Kerala. In Vijayaraghavan G (ed). *Cardiovascular Disease Prevention*. Trivandrum. 1996. p. 54-9.
8. Girija G. Risk factors profile of patients with acute MI. In Vijayaraghavan G (ed). *Cardiovascular Disease Prevention Trivandrum*. 78-83. American Heart Association Heart and Stroke Statistical Update 1997;26-7.
9. Choudhury L, Marsh JD. Myocardial infarction in young patients. *Am J Med* 1999;107:254-61.
10. Padler FA, Comad AR. Myocardial infarction with normal coronary artery: A case report and review of literature. *Am J Med Sci* 1997;314:342-5.
11. Fujimura O, Gulamhusein S. Acute myocardial infarction: Thrombotic complications of Nephrotic syndrome. *Can J Cardiol* 1987;3:267-9.
12. Ross GS, Bell J. Myocardial infarction associated with inappropriate use of topical cocaine as treatment for epistaxis. *Am J Emerg Med* 1992;10:219-22.
13. Moreyra AE, Kostis JB, Passanante AJ, Kuo PT. Acute myocardial infarction in patients with normal coronary arteries after acute ethanol intoxication. *Clin Cardiol* 1982;5:425-30.
14. Smith SC Jr. Current and future directions of cardio-vascular risk prediction. *Am J Cardiol* 2006;97:28A-32A.
15. Tayal D, Goswami B, Koner BC, Mallika V. Role of homocysteine and lipoprotein (A) in atherosclerosis. An update. *Biomedical Research* 2011;22:391-405.
16. Lawn RM. Lipoprotein (a) in heart disease. *Sci Am* 1992;266:54-60.
17. Hoeffler G, Harnoncourt F, Paschke E, Mirtl W, Pfeiffer KH, Kostner GM, et al. Lipoprotein lp(a). A risk factor for myocardial infarction. *Arteriosclerosis* 1988;8:398-401.
18. Durrington PN, Ishola M, Hunt L, Arrol S, Bhatnagar D. Apolipoproteins (a), AI, and B and parental history in men with early onset ischaemic heart disease. *Lancet* 1988;1:1070-3.
19. Armstrong VW, Cremer P, Eberle E, Manke A, Schulze F, Wieland H, et al. The association between serum lp(a) concentrations and angiographically assessed coronary atherosclerosis. Dependence on serum LDL levels. *Atherosclerosis* 1986;62:249-57.
20. Sweetnam PM, Bolton CH, Downs LG, Durrington PN, MacKness MI, Elwood PC, et al. Apolipoproteins A-I, A-II and B, lipoprotein (a) and the risk of ischaemic heart disease: The Caerphilly study. *Eur J Clin Invest* 2000;30:947-56.
21. Hassan Z, Farooq S, Nazir N, Iqbal K. Coronary artery disease in young: A study of risk factors and angiographic characterization in the valley of Kashmir. *Int J Sci Res Publ* 2014;4:1.
22. Sricharan KN, Rajesh S, Rashmi K, Meghana HC, Badiger S, Mathew S. Study of acute myocardial infarction in young adults: Risk factors, presentation and angiographic findings. *J Clin Diagn Res* 2012;6:257-60.
23. Prajapati J, Jain S, Virpariya K, Rawal J, Joshi H, Sharma K, et al. Novel atherosclerotic risk factors and angiographic profile of young Gujrati patients with acute coronary syndrome. *JAPI* 2014;62:584-8.
24. Schoenenberger AW, Radovanovic D, Stauffer JC, Windecker S, Urban P, Niedermaier G, et al. Acute coronary syndromes in young patients: presentation, treatment and outcome. *Int J Cardiol* 2011;148:300-4.
25. Jamil M, Alkhazraji H, Haque A, Chedid F, Balasubramanian M, et al. Risk factor assessment of young patients with acute myocardial infarction. *Am J Cardiovasc Dis* 2013;3:170-4.
26. Schaefer EJ, Lamon-Fava S, Jenner JL, McNamara JR, Ordovas JM, Davis CE, et al. Lipoprotein(a) levels and risk of coronary heart disease in men. The lipid research clinics coronary primary prevention trial. *JAMA* 1994;271:999-1003.
27. Arumalla VK, Reddy KR. Plasma homocysteine and traditional risk factors in young acute myocardial infarction patients. *IJABPT* 2011;4:54-7.