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Original Research Article

A cross sectional study of acute myocardial infarction in young individuals below 40 years and associated risk factors in Mandya institute of medical sciences, Mandya, Karnataka

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ABSTRACT

Background: Acute coronary syndrome (ACS) is a potentially life-threatening condition which is more common in elderly people, and young are relatively protected. Its incidence in young Indians is about 12-16%. Currently, the protective effect on young from coronary artery disease (CAD) is taken away by several risk factors. The aim of this study is to determine the conventional and new emerging risk factors like hyperhomocysteinemia and lipoprotein a (Lp [a]) which are suggested to play an important role in myocardial infarction (MI).
Methods: This study was a hospital-based retrospective cross-sectional analytical study involving 61 patients aged ≤40years presented with signs and symptoms of ACS confirmed by ECG changes and cardiac enzyme levels admitted in the cardiac ICU from April 2019 to March 2020.
Results: Although ACS is a less common entity in young adults aged ≤40 years, smoking was the most common cause of the MI (75%) in young adults. Homocysteine and Lp (a) should be measured in young MI patients. Smoking cessation and prevention of diabetes and hypertension (HTN) should be encouraged.
Conclusions: Smoking was the most common cause of the MI (75%) in young adults and is the major modifiable risk factor for MI in very young patients which needs strict prevention. Young patients with CAD were mainly males. There is a need for early detection of a risk factor to prevent the progression of ACS,

Keywords: Acute coronary syndrome, Coronary artery disease, Myocardial infarction, Lipoprotein

INTRODUCTION

Acute coronary syndrome (ACS) is an important global cause of death and also the major cause of morbidity and mortality in India. The risk of CAD in Indians is 3-4 times higher than white Americans, 6-times higher than Chinese, and 20-times higher than Japanese.[1] The prevalence of CAD is two-times higher in urban than in rural India. South Indians have higher prevalence.[2] Asians in general and Indians in particular are at an increased risk of MI at a younger age (≤40 years).[3] Various risk factors contribute to the increased prevalence of CAD in young individuals. Conventional risk factors like Smoking, dyslipidemia, obesity, diabetes, hypertension, sedentary lifestyle, positive family history are still the most common risk factors in young age onset ACS. New emerging risk factors are hyperhomocysteinemia, raised lipoprotein-a, hypercoagulability states (protein C and S deficiency, APLA syndrome, nephrotic syndrome), arteritis, aneurysms, coronary spasm due to cocaine abuse. Homocysteine and Lp-a are now recognised as an independent risk factor for CAD. The risks of hyperhomocysteinemia are comparable with the cigarette smoking and dyslipidaemias. Lp-a is a genetic risk factor and is not affected by any level of lifestyle modifications

like changes in diet and exercise.[1] Coronary angiography (CAG) studies performed in young AMI patients have revealed a relatively high incidence of normal coronary arteries, nonobstructive coronary lesions, and single-vessel coronary artery disease.[4] Many very young patients in India present with none or a single risk factor. Stable angina is uncommon, and the first presentation of CAD in the very young is usually a fully evolved MI.[5] 15-20% of those with CAD have no identifiable risk factors and therefore miss the opportunity for primary prevention.[6] Hence this study is aimed at identifying both conventional and new emerging risk factors in young individuals presenting with AMI.

METHODS

A retrospective cross-sectional analytical study was conducted over a period of 1 year from April 2019 to Match 2020 involving 61 patients of ACS admitted in the cardiac ICU in Mandya institute of medical sciences, Mandya. Institutional ethical committee clearance was obtained before conducting the study. Written consent from all the participants was obtained before data collection.

The world health organization definition was followed for the diagnosis of AMI in this study. Patients were divided into two groups, group A: 18-30 years and group B: 30-40 years.

A detailed clinical history, physical examination, electrocardiography (ECG), biochemical, and echocardiographic evaluation were done using a pre-test proforma.

Diabetes was defined as having a history of diabetes diagnosed and/or treated with medication and/or diet or fasting blood sugar ≥126 mg/dl & postprandial blood sugar ≥200 mg/dl. Hypertension (HTN) was defined as having a history of hypertension diagnosed and/or treated with medication, diet, and/or exercise, blood pressure ≥140 mmHg systolic or ≥90 mmHg diastolic on at least two occasions. Hyperlipidaemia was defined as history of dyslipidemia diagnosed and/or treated by a physician or total cholesterol (TC)>200 mg/dl, low-density lipoprotein (LDL)>100 mg/dl, triglycerides (TG)>150 mg/dl, high-density lipoprotein (HDL)<40 mg/dl, according to the NCEP-ATP3 guidelines. High homocysteine (HC) was defined as HC levels more than 15 mg/dl and high Lipoprotein a [Lp(a)] as [Lp(a)] more than 30 mg/dl. The patients who were currently smoking and those who claimed to have stopped smoking for one year were considered as smokers and others were considered as non-smokers. A positive family history for coronary artery disease (CAD) was defined as any first degree relative younger than 55 years who had Angina pectoris or MI. Overweight was defined as body mass index (BMI) greater than 25 kg/ m^2. Obesity was defined as BMI greater than 30 kg/m^2.

Inclusion criteria

All patients aged ≤40 years admitted with diagnosis of acute myocardial infarction were included in the study.

Exclusion criteria

All cases with proven non cardiac chest pain and patients below 18 years and above 40 years were excluded from the study.

Statistical methods

Statistical analysis was performed using the software SPSS version 20 (SPSS IBM (PC+version 20.0)). Parameters compared were age, gender, risk factors. Continuous variables were expressed as mean and standard deviation, whereas categorical variables were expressed as numbers and percentages. Continuous variables were compared using an unpaired t-test and categorical variables using chi-squared or Fisher's exact test. P value≤ 0.05 was taken as statistically significant for each risk factor between the groups.

RESULTS

The 61 cases included in the present study, mean age of the patients was 37.03±1.20 years, youngest being 22 years with a maximum number of patients (70%) in the age group of 35-40 years. Majority of cases were males across the included age groups (58 out of 61 were males). Out of 61, 55 patients had ST elevation MI (STEMI) (90.16%), 6 patients had non-ST elevation MI (NSTEMI) (9.83%), 46 patients (75.40%) were smokers, 42 patients (68.85%) had dyslipidemia, 16 patients (26.22%) were diabetic, 11 patients (18.03%) were hypertensive, 5 patients (8.19%) had positive family history of CAD and 6 patients (9.83%) were overweight or obese. 23 patients (37.70%) had hyperhomocysteinemia and 14 patients (22.95%) had raised [Lp (a)] which were the emerging risk factors. P value is statistically significant (p<0.05) among younger individuals for smoking, dyslipidemia, diabetes, hypertension, obesity, family history, hyperhomocysteinemia, raised [Lp (a)]. 3 patients (4.91%) presented with AMI who were a known case of CKD one at the age of 22 years, one more at 35 and another at 37 years of age.

Table 1: Baseline characteristics of acute myocardial infarction patients.

Characteristics	Age group (years)	
	Group A: 18-30 (n=11) (%)	Group B: 30-40 (n=50) (%)
Age	18.03	81.96
Male sex	11 (18.03)	47 (77.04)
Female sex	0 (0)	3 (4.91)
BMI (Kg/m^2)	26.1± 3.8	28.6±4.6

Out of all admitted cases, deaths were in 6 patients (9.83%); mortality probability among males were more (8.19%) compared to females (1.63%). Case fatality rates were the lowest in the age group 18-30 years (3.27%) followed by 30-40 years (6.55%), ACS deaths were significantly associated with diabetes, HTN, smoking and family history, and not so with gender, religion, dietary habits, and physical activity. Among comorbidities, diabetes was most significantly (p=0.002) associated with death followed by HTN (p=0.009). A family history of myocardial infarction was also a significant (p=0.037) risk factor.

Table 2: Risk factors for acute myocardial infarction among young.

Risk factors	Group A: 18-30 (n=11) (%)	Group B: 30-40 (n=50) (%)	P value
Smoking	7 (11.47)	39 (63.93)	0.0341
Dyslipidemia	12 (19.67)	30 (49.18)	0.0054
Diabetes mellitus (DM)	6 (9.83)	10 (16.39)	0.0020
Hypertension	4 (6.55)	7 (11.47)	0.0091
Hyperhomocysteinemia	6 (9.83)	17 (27.86)	0.0310
Raised Lp (a) levels	8 (13.11)	6 (9.83)	0.0012
Obesity	2 (3.27)	4 (6.55)	0.0409
Family history	1 (1.63)	4 (6.55)	0.0037
CKD	1 (1.63)	2 (3.27)	0.0510

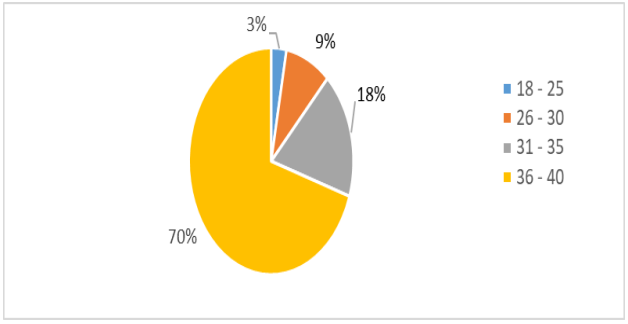

Figure 1: Age distribution of young adults with myocardial infarction.

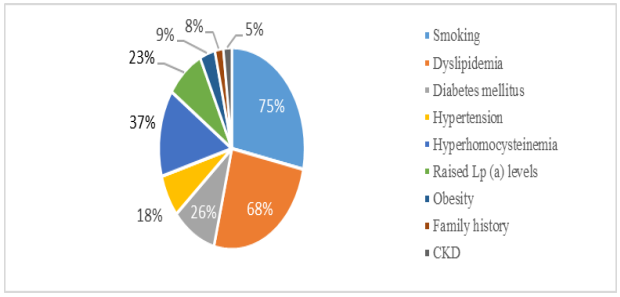

Figure 2: Comparison of various risk factors among two groups in percentage.

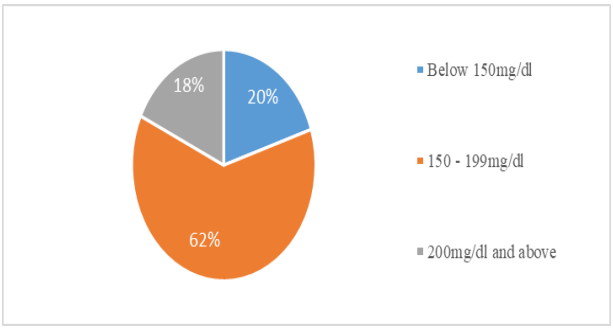

Figure 3: Triglyceride levels.

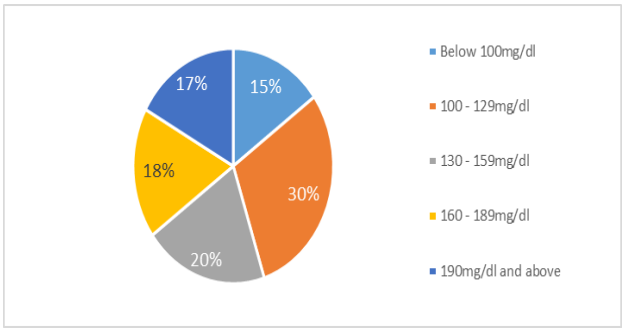

Figure 4: Low density lipoprotein cholesterol levels.

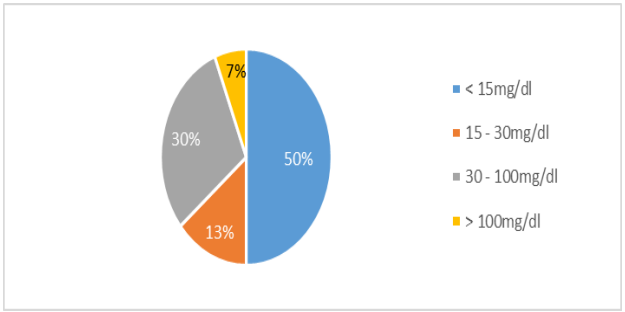

Figure 5: Homocysteine levels.

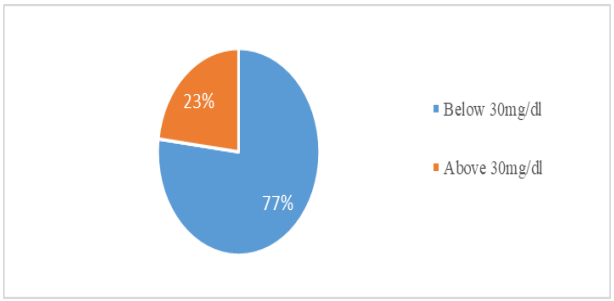

Figure 6: Lipoprotein a level.

DISCUSSION

In the present study, risk factors associated with Acute myocardial infarction in individuals ≤40 years of age were studied. Total 61 cases admitted were divided into 2 groups according to age of presentation. Group A: 18-30 years and group B: 30-40 years.

The global burden of CVDs is on rapid rise due to a predominant increase in the incidence and prevalence of the same in the developing countries. India, a developing nation, is following the same trend. During the past three decades, the prevalence of most of the cardiovascular risk factors including smoking, diabetes mellitus (DM), hypertension, and dyslipidemia has increased markedly in India.[3]

About 25% of acute MI in India occurs under the age of 40 & 50% under the age of 50. One center in Kerala reported a 47-fold increase in the incidence of first MI under the age of 40 in the last 20 years.[3]

All risk factors studied were corroborated with previous studies.

Table 3: Comparison of percentage of various risk factors.

Study	Year	Mean age (years)	Males (%)	Smoking (%)	Dyslipidemia (%)	DM
Sricharan et al[7]	2012	37.03	90	70	36.67	50
Bhardwaj et al[8]	2014	35.94±4.89	99.19	60	-	8.06
Surekha et al[9]	2016	39.80±1.80	80	55.56	-	13.34
Bhandari et al[6]	2017	-	80	72	68	24
Chandra et al[10]	2018	-	91.45	46.15	34.19	10.25
Nagamalesh et al[11]	2018	43.9 ± 5.4	-	-	69.8	27
Ramesh et al[12]	2019	-	-	-	-	-
Iragavarapu et al[3]	2019	36.11	-	-	-	-
Gupta et al[5]	2020	-	-	68.6	-	5.9
Present study	2020	37.03±1.20	95.08	75	68	26

Table 4: Comparison of percentage of various risk factors.

Study	Year	HTN	Hyperhomo-cysteinemia	Raised Lp (a)	Obesity	Family history	CKD
Sricharan et al[7]	2012	10	-	-	10	10	-
Bhardwaj et al[8]	2014	44.35	26.6	45.16	21.73	-	-
Surekha et al[9]	2016	26.67	2.22	2.22	44.44	-	-
Bhandari et al[6]	2017	18	42	24	32	18	-
Chandra et al[10]	2018	14.25	-	-	9.12	9.97	-
Nagamalesh et al[11]	2018	20.6	-	-	-	-	6.4
Ramesh et al[12]	2019	-	65.4	-	-	-	-
Iragavarapu et al[3]	2019	-	-	-	15	30	-
Gupta et al[5]	2020	9.8	-	-	-	27.5	-
Present study	2020	18	37	22	9	8	5

Age

In our study, the highest number of cases was among 36-40 years (70%). Mean age in our study was comparable to Sricharan et al, 37.03.[7]

Gender

In our study, males were 95.08% with male: female ratio 19.3:1. Male preponderance among STEMI cases in all age groups was observed in North India.[2] The percentage of males in our study was comparable to Sricharan et al, 90%, Bhardwaj et al, 99.19%, Chandra et al, 91.45%.[6-8]

Smoking/tobacco consumption

In our study, 75% reported tobacco smoking; international research groups noted smoking or smokeless tobacco as major risk factor for STEMI.[2] The risk of CAD begins to decline within months of smoking cessation and disappears within 3-5 years.[3] The percentage of Smokers in our study was comparable to and Sricharan et al, 70% Bhandari et al 72%.[6,7]

Dyslipidaemia

In our study, 68% of patients had dyslipidemia. The percentage of dyslipidemia in our study was comparable to Bhandari et al, 68% and Nagamalesh et al, 69.8%.[6,11]

Low HDL with or without high TG is very common among Indians and genetic factors may be involved. Conversely, people with low TG-high HDL levels have a low risk of CAD, but this profile is uncommon among Asian Indians.[3] Studies on epidemiological data from angiographically proven cases of PCAD (≤40 years) in native Indians suggest hyperlipidemia as the most prevalent risk factor.[3]

Diabetes mellitus

In our study, 26% of patients had diabetes mellitus. (Type 2 DM in 15 patients and type 1 DM in 1 patient).

Indians are genetically prone to develop type-2 diabetes mellitus due to insulin resistance. Hyperinsulinemia in these patients accelerates the atherosclerotic process in the coronary arteries. During the past decade, the number of people with diabetes in India increased from 32 million to 50 million, and this figure may reach 87 million by 2030.[3] The percentage of diabetes mellitus in our study was comparable to Bhandari et al, 24% and Nagamalesh et al, 27%.[6,11]

Table 5: Comparison of risk factors among studies.

Study	Multiple risk factor (%)	Single risk factor (%)	No risk factors (%)
Sricharan et al[7]	46.67	46.67	6.67
Bhandari et al[6]	72	26	4
Present study	67.32	18.75	13.91

Hypertension

In our study, 18% of patients had hypertension. The exact mechanism through which systemic hypertension induces MI has not been studied in detail, but there is evidence that hypertension causes LV hypertrophy and progression of atherosclerosis, resulting in CAD. Hypertension was revealed as a significant risk factor among the young in the studied population.[3] The percentage of hypertension in our study was comparable to Bhandari et al, 18%, Chandra et al 14.25% and Nagamalesh et al 20.6%.[6,7,11]

Hyperhomocysteinemia

In our study, 37% of patients had hyperhomocysteinemia. 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 nonvegetarians.[6] The percentage of hyperhomocysteinemia in our study was comparable to Bhandari et al, 42%.[6]

Raised Lp (a) levels

In our study, 22% of patients had raised Lp (a) levels. 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 be the most prevalent dyslipidemia in our young patients with premature CAD. 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.[6] The percentage of raised Lp (a) in our study was comparable to Bhandari et al, 24%.[6]

Overweight and obese

In our study, 9% of patients were overweight and obese. Obesity is associated with increased risk of hypertension, diabetes, dyslipidemia, and CAD. Obesity is a well-established risk factor for CAD, particularly in urban India.[6] The percentage of overweight and obese in our study was comparable to Chandra et al, 9.12% and Sricharan et al, 10%.[7,10]

Family history

In our study, 8% of patients had positive family history. Studies have shown that person with positive family history of PCAD tends to have severe coronary atherosclerosis and is a very strong predictor of future acute coronary event.[3] The percentage of patients with positive family history in our study was comparable to Chandra et al 9.97% and Sricharan et al 10%.[7,10]

Chronic kidney disease

In our study, 5% of patients had CKD. In 1998, the U.S. national kidney foundation task force on cardiovascular disease in chronic renal disease recommended that patients with CKD be considered to belong to the highest risk group for the development of cardiovascular events. These patients present unique challenges to physicians attempting to manage concomitant ischemic heart and CKD.[3] The percentage of patients with CKD in our study was comparable to Nagamalesh et al 6.4%.[11]

Limitations

Some of the patients were already using lipid-lowering agents, so exact prevalence of dyslipidemia could not be traced. We have analyzed the patients who reached the hospital, so it might not be a true representative of the population. We also could not do any genetic studies.

As investigations were restricted to conventional and new emerging risk factors like hyperhomocysteinemia and raised Lp (a) those risk factors like hypercoagulability (APLA syndrome, nephrotic syndrome, protein C and protein S deficiency), vasculitis, aneurysms, fibromuscular dysplasia couldn't be ruled out.

CONCLUSION

Although ACS is a less common entity in young adults aged ≤40 years, urgent strategies are required to find risk factors and advice lifestyle modifications like enhancing physical activity and diet modification. We attempted to identify various associated risk factors involved in AMI cases to enable us to improve future care, smoking was the most common cause of the MI (75%) in young adults and is the major modifiable risk factor for MI in very young

patients which needs strict prevention. Homocysteine and Lp (a) should be measured in young MI patients. Most of the very young AMI patients presented with a stable hemodynamic profile, single vessel disease and better left ventricular ejection fraction. Young patients with CAD were mainly males. There is a need for early detection of a risk factor to prevent the progression of ACS.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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