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Original Research Article

Coronary Angiographic Profile, Clinical Presentation and Risk Factors of Young Adults (≤40 Years) Presenting with Acute Myocardial Infarction at a Tertiary Care Center in Bihar, India

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Conflict of interest: Nil

Abstract

Introduction: ACS in very young adults with age ≤30 years is rare. In India, the prevalence of acute myocardial infarction (AMI) in this population is <2%. A similar study reported that 0.4% of patients presented with ACS in ≤30 years age group. ACS leads to significant effects on patient's psychology, morbidity, and increased financial burden when it occurs at this young age.

Aim and Objectives: To identify the clinical, risk factor and coronary angiographic characteristics in very young adults less than 40 years of age presenting with myocardial infarction.

Material and Methods: The present study was a prospective study conducted among 100 patients of age less than 40 yrs at Department of cardiology Narayan medical college, Jamuhar, South Bihar. Patients subsequently underwent coronary angiography and revascularization by either primary PCI or pharmaco-invasive PCI or CABG surgery after obtaining informed consent with study protocol approved by Institutional Ethics Committee. All patients were clinically evaluated after detail history taking

Result: 43% study subjects had involvement in AW area, 18% subjects had involvement in EAW area, 11% subjects had inferior wall area, 9% subjects had APL involvement, 7% subjects had involvement in ILW area. 72% study subjects were had single vessel disease, in that 41 had LAD, 21 had RCA and 10 had LCX involvement. 19% subjects had double vessel involvement in which 12 % subjects had LAD and RCA, 3subjects had RCA and LCX. Whereas 9% subjects had triple vessel disease.

Conclusion: The major modifiable risk factors in very young Indian population are smoking and dyslipidemia. Primary prevention by educating the public about the effects of smoking, unhealthy dietary habits, and sedentary lifestyle in early years of life may help to prevent the development of cardiac problems later in life

Keywords: Angiography, Myocardial Infarction, LAD, RCA, LCX

Background

Coronary artery disease (CAD) is responsible for the highest mortality globally. Acute coronary syndrome (ACS) represents the most common mode of presentation of CAD.2 Data indicate that Asian Indians are more prone to develop CAD with symptoms occurring a decade earlier than the western population [1]. It has been estimated that there could be around 30 million patients suffering from CAD in India. Acute myocardial infarction (AMI) in very young adults has been poorly studied but is estimated to be less than 2%. In spite of limited data, it has been observed that the clinical and coronary angiographic profile is quite different in young patients as compared to those who develop CAD at an older age [2].

ACS in very young adults with age ≤30 years is rare. In India, the prevalence of acute myocardial infarction (AMI) in this population is <2%. A similar study reported that 0.4% of patients presented with ACS in ≤30 years age group. ACS leads to significant effects on patient's psychology, morbidity, and increased financial burden when it occurs at this young age. The risk as well as the clinical factor profile and the arterial involvement pattern differs between young and elderly CAD patients. Metabolic, genetic, and conventional causes may result in CAD occurring at a younger age in India [3].

AMI in very young patients aged ≤ 40 years has been poorly described but is estimated to be less than 2%. Moreover, it carries significant morbidity, psychological impact, and financial burden for the patient and their family when it occurs at a young age as the productive age group is being affected. The prevalence of CAD as well as AMI has progressively increased in India in the last three decades from 1.1% to 7.5% in the urban and 2.1% to 3.7% in the rural population. CAD among Indians occur at a younger age, with more extensive angiographic involvement contributed by genetic, metabolic, and conventional causes [4].

Young patients frequently have characteristics that are different from those of older patients. Up to two-thirds of young MI patients present with non-ST-elevation MI (STEMI) and one-third with STEMI. While conventional cardiovascular risk factors clearly play a major role in the predisposition to CAD, novel risk factors such as hyperhomocysteinaemia and lipoprotein (a) may have significance in younger people. There are few data available regarding novel risk factors, clinical features, coronary angiographic findings and prognosis in young patients presented with acute MI in India [5].

The present study is aimed to identify the clinical, risk factor and coronary angiographic characteristics in very young adults less than 40 years of age presenting with myocardial infarction as literature regarding this is very limited and exceptionally scarcer in Bihari population.

Methodology

The present study was a prospective study conducted among 100 patients of age less than 40 yrs. at Department of cardiology Narayan medical college, Jamuhar, South Bihar.

Inclusion criteria were based on diagnosis of STEMI defined by the European Society of Cardiology (ESC)/American College of Cardiology Foundation (ACCF) as

a) new ST elevation at the J point in ≥ 2 contiguous lead of ≥ 2 mm in men or ≥ 1.5 mm in women in leads V2–V3 and/or of 1 mm in other contiguous chest or the limb leads, and
b) New or presumably new left bundle branch block (LBBB) was considered STEMI equivalent.

Exclusion criteria were

a) Patients with prior history of MI, coronary artery bypass graft (CABG) surgery or percutaneous coronary intervention (PCI),
b) Electrocardiogram (ECG) suggesting bundle branch block or left ventricular hypertrophy,
c) Electrolyte abnormality,
d) Certain conditions influencing ST-segment on ECG (e.g. suspected myocarditis, pericarditis, hypothermia, receiving amiodarone treatment etc.).

Patients subsequently underwent coronary angiography and revascularization by either primary PCI or pharmaco-invasive PCI or CABG surgery after obtaining informed consent with study protocol approved by Institutional Ethics Committee. All patients were clinically evaluated after detail history taking. Routine biochemistry [complete hemogram, urea, creatinine, viral markers such as hepatitis B surface antigen (HBsAg), hepatitis C virus (HCV) and human immunodeficiency virus (HIV), urine examination including routine and microscopy-active sediment, fasting lipid profile, antinuclear antibody (ANA), c-reactive protein (CRP), erythrocyte sedimentation rate (ESR), plasma homocysteine level, ECG and echocardiography were performed. Smokers were defined as those who were either currently smoking (> 4 weeks) including bidi, cigarette and cigar or who had quit their smoking (< 1 year). Participants were classified as physically active if they reported moderate (walking, cycling) or strenuous exercise (jogging, football, vigorous swimming) for ≥ 4 hours/week. Anthropometric and clinical examination including blood pressure (BP) measurement were carried out for each subject. Body weight and height were measured with participants standing without shoes in light clothes. Body mass index (BMI), was also calculated using Quetlet's formula as weight in kg/square of the height in meters. Overweight was defined as BMI > 25 kg/m2. Blood pressure was recorded in left arm in supine position with an appropriately sized cuff using a sphygmomanometer. Hypertension was defined as systolic blood pressure ≥ 140 and/or diastolic ≥ 90 mmHg and/or on anti-hypertensive treatment. Diabetes mellitus (DM) was defined as patients having fasting plasma glucose (FPG) ≥ 126 mg/dl and/or post-prandial plasma glucose (PPPG) ≥ 200 mg/dl or a past history of DM and/or taking medication for diabetes. Hyperlipidemia was defined as serum cholesterol of ≥ 200 mg/dl, triglyceride (TG) >150 mg/dl, low-density lipoprotein > 130 mg/dl, HDL-C < 50 mg/dl for female and < 40 mg/dl for male, a total cholesterol/HDL-C value of ≥ 4.5, known cases of dyslipidemia and/or those on medication for dyslipidemia. Homocysteine was measured by enzyme immunoassay (Axis-shield, Dundee, United Kingdom) according to the kit manual. Hyperhomocysteinemia was defined as plasma level ≥15 μmol/l. The risk factors which were studied were hypertension, diabetes mellitus, smoking habits, overweight, hyperlipidemia, hyperhomocysteinemia, physical inactivity, stressful life events (using Presumptive Stressful Life Events Scale i.e. PSLES) and a family history of premature CAD (in first degree relatives < 55 years in men and < 65 years in women). Obstructive CAD was defined as ≥ 70% lesion in major epicardial arteries or ≥ 50% lesion in left main coronary artery. Intermediate disease was defined as 50% to 69% stenosis of major epicardial arteries whereas minimal disease was defined as ≤ 50% lesion, and together they were combined and classified as having non-obstructive disease.11 Culprit artery was diagnosed on the angiographic finding.

Data analysis

Statistical analyses were performed using the SPSS for windows (version 20.0, SPSS

Inc., Chicago, IL, USA). Continuous variables were expressed as mean ± standard deviation whereas categorical variables were given as numbers (percentages). The comparison between groups was done by Mann-Whitney U test for continuous variables and by chi-square or Fisher`s exact test for categorical variables. P < 0.05 was considered statistically significant.

Result

Figure 1: Distribution of study subjects

In our study mean age of study subjects was 33.98±4.71 yrs, with range 24-40 yrs, Majority of study subjects (91%) were male whereas 9% subjects were female.

Table 1: Distribution of study subjects as per the various risk factors present

Risk factors	No	%
DM	17	17
HTN	18	18
SMOKING	81	81
FAMILY HISTORY	45	45

Table 1 shows distribution of study subjects as per the various risk factors present, out of 100 study subjects 81 subjects were smoker, 45 subjects were had positive family history, 18 subjects were hypertensive and 17 subjects were diabetic.

Table 2: Distribution of study subjects as per site of involvement

		Frequency	Percent
Valid	APL	9	9.0
	AW	43	43.0
	EAW	18	18.0
	HL	6	6.0
	ILW	7	7.0
	IW	11	11.0
	IW&R	6	6.0
	Total	100	100.0

Table 2 shows Distribution of study subjects as per site of involvement, 43% study subjects had involvement in AW area, 18% subjects had involvement in EAW area, 11% subjects had inferior wall area, 9% subjects had APL involvement, and 7% subjects had involvement in ILW area.

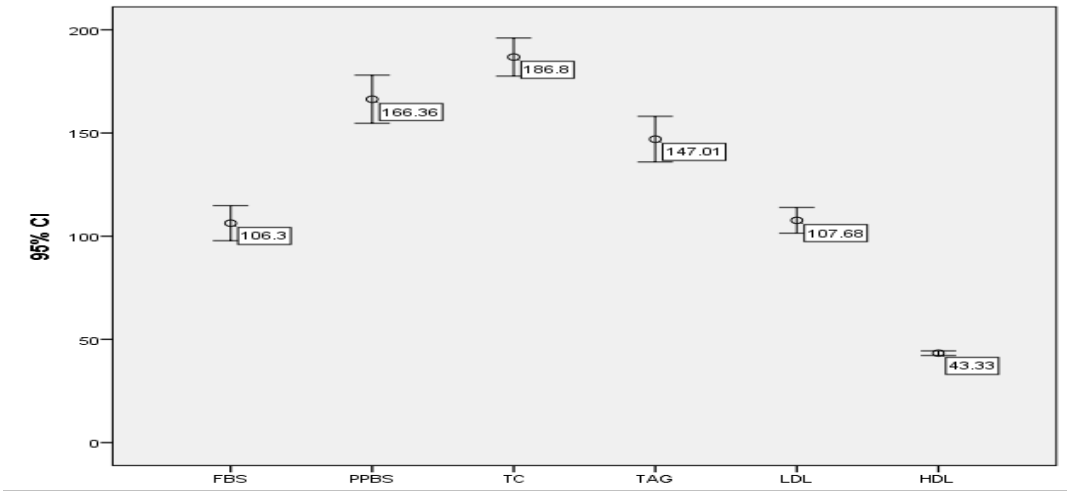

Figure 2: mean value of blood investigations of various study subjects

Figure 2 shows mean value of blood investigations of various study subjects, the mean fbs in study subjects 106.30±42.74, mean PPBS was 166.36±58.89, mean total cholesterol was 186.80±46.59, the mean triglyceride was 147.01±55.87 and mean LDL was 107.68±31.51 and mean HDL was 43.33±5.66

Figure 3: Classification of study subjects as per killip class

Figure 3 shows Classification of study subjects as per killip class, 85% study subjects were in Killip class I and 15% study subjects were in Killip class II. Mean ST elevations in the study subjects was 8.55±2.70 mm,

Table 3: Distribution of study subjects as per Ejection fraction

Ejection fraction	No	%
<60	34	34
>60	66	66
Total	100	100

Table 3 shows Distribution of study subjects as per Ejection fraction, 66% study subjects were had ejection fraction >60 whereas 34% subjects had ejection fraction less than 60. The mean ejection fraction was 61.85±11.37

Table 4: Distribution of study subjects as per wall motion abnormality

		Frequency	Percent
Valid	-	52	52.0
	+	48	48.0
	Total	100	100.0

Table 4 shows Distribution of study subjects as per wall motion, 48% study subjects were had wall motion abnormality

Table 5: Distribution of study subjects as per no of vessel involvement

No of vessel involved	no	%
Single vessel involvement	72	72
• LAD	41	41
• RCA	21	21
• LCX	10	10
Double vessel disease	19	19
• LAD and RCA	12	12
• LAD and LCX	4	4
• RCA and LCX	3	3
Triple vessel disease	9	9

Table 5 shows Distribution of study subjects as per no of vessel involvement, 72% study subjects were had single vessel disease, in that 41 had LAD, 21 had RCA and 10 had LCX involvement. 19% subjects had double vessel involvement in which 12 % subjects had LAD and RCA, 3subjects had RCA and LCX. Whereas 9% subjects had triple vessel disease.

Table 6: Distribution of study subjects as per Reinfarction

		Frequency	Percent
Valid	-	91	91.0
	+	9	9.0
	Total	100	100.0

Table 6 shows distribution of study subjects as per Reinfarction, 9% study subjects had reinfarction in the present study.

Table 7: Distribution of study subjects as per Death

		Frequency	Percent
Valid	-	94	94.0
	+	6	6.0
	Total	100	100.0

Table 7 shows Distribution of study subjects as per Death, 6 subjects died in our present study.

Discussion

Premature CAD is a rapidly progressive form of atheromatous process. The risk factors and short term outcome of acute myocardial infarction in young adults varied from their elderly counterparts.

In our study mean age of study subjects was 33.98±4.71 yrs, with range 24-40 yrs, Majority of study subjects (91%) were male whereas 9% subjects were female. Study by Piyush Joshi *et al* [3] shows the mean age of patients with ACS was 27.63

± 2.03 years and 54.5% of patients were from rural background. In the present study, male predominance (95.4%) was observed, which is similar with other studies [6]. The protective effects of estrogen in women preventing atherosclerosis and smoking being much more common in males have been responsible for male predominance.

Cigarette smoking was found to be the main risk factor (54.5%) for the occurrence of coronary events in very young patients. It is one of the important causes of endothelial dysfunction. The INTERHEART study also showed smoking as a more significant risk factor in younger men population as compared to women [7] Many other studies have also shown that smoking is a major risk factor for AMI in young patients. Smoking cessation should be encouraged as primary prevention to reduce the burden of CAD in younger population as it can result in vasoconstriction, promotes atherosclerosis, and subsequently creates a thrombotic milieu in the vessel [3]. In our present study out of 100 study subjects 81 subjects were smoker.

Diabetes and hyperlipidemia are also frequently present in young CAD patients. Whereas the importance of these factors in the pathogenesis of CAD and their powerful relationship to rapid disease progression is well documented their importance in this population is not characterized in detail.

In our present study 45 subjects were had positive family history, 18 subjects were hypertensive and 17 subjects were diabetic**.** In a study done by Kanitz MK *et al* **[**8] to define the risk factors and clinical presentation of patients under age 40 who present to the emergency department (ED) of a community hospital with an acute myocardial infarction (AMI), 209 patients were studied. The major risk factor was tobacco use 81%, followed by family history 40%, hypertension 26%, and hyperlipidemia 20%. In another study conducted by Hong MK *et al* **[**9] 631 patients were studied. Their conclusions were, occurence of acute myocardial infarction below forty years was the predominant disease of men. Risk factor analysis revealed a history of cigarette smoking and hypercholesterolemia were more frequently found in the young patients, but a history of hypertension and diabetes were more frequently found in the elderly patients.

In a prospective clinical study conducted by Fournier *et al* [10**]** 108 consecutive Mediterranean patients with AMI, aged < 40 years, were prospectively studied. Clinical features, risk factors, and in-hospital morbidity and mortality were evaluated. The most common risk factors were cigarette smoking 94.5% and hypercholesterolemia 48%.and that the short term prognosis was excellent. The short term outcome in the younger patients in this study was better than the older ones. Stefanos Garoufalis *et al* [11] conducted a study of risk factors comparing 460 patients and found that family history and smoking were the most common risk factors in patients ≤45 years old.

In our present study 66% study subjects were had ejection fraction >60 whereas 34% subjects had ejection fraction less than 60. The mean ejection fraction was 61.85±11.37. In study by Pradeep Deshmukh *et al* [2] shows LVEF is a commonly employed tool for risk stratification. The mean LVEF in the present study was found to be 43 ± 9.8%. This finding is in close concordance with other study by Surendra Deora *et al* [12] reporting mild to moderate left ventricular dysfunction with mean LVEF ranging from 37 to 55% in young patients. Study by piyush joshi [3] shows mean left ventricular ejection fraction in this study was found to be 40.3% ± 8.5%.

In our present study 72% study subjects were had single vessel disease, in that 41 had LAD, 21 had RCA and 10 had LCX involvement. 19% subjects had double

vessel involvement in which 12 % subjects had LAD and RCA, 3 subjects had RCA and LCX. Whereas 9% subjects had triple vessel disease. In study by Santosh Sinha *et al* [4] shows in their study SVD was present in 58 (61.1%) of female patients whereas 542 (51.1%) of male patients had SVD (P < 0.002). DVD was present in 8 (8.4%) female patients in comparison to 129 (12.2%) male patients (P = 0.350). In DVD, LAD and RCA involvement in 68 (6.4%) were the most affected arteris followed by LAD and LCX involvement in 50 (64.8%), and the least common was LCX and RCA involvement in 19 (1.8%) patients. TVD was seen in 2 (2.1%) female patients but in 54 (5.1%) male patients. left main coronary artery (LMCA) disease was seen only in male patients whereas none was seen in female patients (P = 0.001)**.** In the study by Piyush Joshi *et al* [3], single-vessel disease was the most common (59%) finding and this predominance was similar to the other studies on young patients with ACS. Low prevalence of double-vessel disease suggests that extensive coronary involvement is not a common finding in young adults presenting with ACS. In single-vessel disease group, LAD involvement was the most common infarct-related artery (40.9%), whereas RCA was involved in 13.6% and LCX in 4.5%. The findings are similar with other studies where LAD was the most common [13].

In our present study 48% study subjects were had wall motion abnormality. In study by Santosh Sinha *et al* [4] atrioventricular (AV) block was seen in 50 (4.5%) patients of which 33 (2.9%) were I° AV block, 12 (1.1%) were II° AV block, and 5 (0.5%) patients had complete heart block which recovered completely. In our present study 9% study subjects had reinfarction. Study by Santosh Sinha *et al* [4] shows Nineteen (1.7%) patients suffered reinfarction of which one had sub-acute stent thrombosis, four of them were previously thrombolysed with streptokinase and the rest of them were those who had presented late. 6(6%) subjects died in our present study. Study by Santosh Sinha *et al* [4] shows among 1116 patients, 32 (2.9%) patients died during index hospitalization, which is lower than our study.

Conclusions

Very young adults presented with less extensive CAD due to less atherosclerosis of the coronary arteries in them. The major modifiable risk factors in very young Indian population are smoking and dyslipidemia. Primary prevention by educating the public about the effects of smoking, unhealthy dietary habits, and sedentary lifestyle in early years of life may help to prevent the development of cardiac problems later in life. This will result in decreasing the burden from the already thinly stretched health-care system in our country

Limitations

Small number of patients in this study is its main limitation. Furthermore, there was lack of intracoronary imaging in our study. There was no follow-up of patients and as there was no control group, the statistical significance of each risk factor could not be analyzed.

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