

Acute myocardial infarction in young adults of North East India : a clinical and angiographic study

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Abstract :

Background/ Aims and Objectives : Acute myocardial infarction (AMI) in young adults (≤ 40 years) is being increasingly encountered in recent years among the South Asian population, particularly in Indians and data regarding the presentation, risk factors and angiographic findings on this important subset of patients is lacking from the North-Eastern region of India. Paucity of published literature on young AMI patients from this part of the Country formed the basis for the present study.

Material and Methods : A Prospective observational cross-sectional analytical study was conducted on fifty young adults who were admitted with AMI over a period of 18 months. The clinical features, conventional cardiovascular risk factor profiles and pattern of coronary artery involvement on angiography were analysed and compared with fifty older patients (≥ 55 years) admitted concurrently during the study period.

Results : Majority of the young patients were males ($P < 0.05$), presented with anterior wall ST elevation MI ($P < 0.05$), had no history of antecedent angina prior to the AMI ($P < 0.05$) and had a relatively preserved left ventricular ejection fraction ($P = NS$). Predominant cardiovascular risk factors present in this subset of the population were cigarette smoking, dyslipidaemia ($P < 0.05$) and family history of premature CAD ($P = NS$). Hypertension and diabetes were less commonly encountered compared with the older population ($P < 0.05$). Single vessel disease ($P < 0.05$), left anterior descending artery involvement ($P < 0.05$) and angiographically normal coronary artery ($P = NS$) were more common in the young group. Left main, double and triple vessel disease were significantly more common in the older group ($P < 0.05$).

Conclusion : Our study confirms that smoking, dyslipidemia and family history of premature CAD are the major conventional cardiovascular risk factors present in young AMI patients of this region. Single vessel disease, mostly LAD artery involvement and angiographically normal coronary arteries are more prevalent. AMI in young occur more frequently in males as ST elevation MI without any prior history of angina and have a preserved left ventricular EF compared to older population. These findings provide vital information on young AMI patients amongst the diverse population of N-E India and will help to guide the treating physicians and the health care system to adopt appropriate steps directed towards primary and secondary prevention of premature CAD in young patients of this region. especially smoking cessation, which is the commonest modifiable risk factor, in their most productive years of life.

Keywords - Acute myocardial infarction, young adults, clinical presentation, traditional risk factors, coronary angiographic findings

I. Introduction

An increasing trend of Coronary Artery Disease (CAD) in young patients under 40 years of age is being noticed among the South Asian population in recent years, particularly in Indians. Apart from extreme poverty and infectious diseases, control of heart attack in young adults can be most rewarding for Indians in the 21st century for saving productive life years. Genetic predisposition and rapid acquisition of traditional cardiovascular risk factors as a result of unhealthy life style practices specifically cigarette smoking, tobacco consumption, unbalanced dietary pattern, lack of physical activity, ill effects of urbanization, psychosocial stress, all contribute to a greater risk of developing premature CAD in Indians. Acute myocardial infarction (AMI) in the young, defined as being less than 40-45 years of age in most studies, are being frequently encountered in recent years amongst the diverse population of North East India. Previous studies from the rest of the world and other parts of India have shown that there are differences in the clinical presentation, risk factor profiles and the pattern of coronary artery involvement in young patients compared with those of older ones. There is a paucity of information on young patients with acute myocardial infarction from the North Eastern region of India. Despite the relatively low frequency of myocardial infarction in the young adult population, the potential for death and long-term disability make this entity an important clinical problem. The lack of published literature on this important subset of patients from this region is the basis for the present study. This information will help guide health care providers for better identifying and targeting primary and secondary preventative strategies.

II. Material And Methods

This study was carried out in the Department of Cardiology, Gauhati Medical College, which is located in the city of Guwahati in the northeastern Indian state of Assam. Our centre, by virtue of being a referral centre for speciality and superspeciality treatment, caters not only to the indigenous people of the state of Assam, but also to the contiguous states of Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Nagaland and Tripura in northeastern India, apart from a large migrant population from Bangladesh.

This prospective observational cross-sectional analytical study was conducted on fifty young adults (≤ 40 years) who were admitted with Acute Myocardial Infarction (AMI) over a period of 18 months from January, 2014 to June, 2015. Patients aged equal to or less than 40 years with guideline-defined AMI were included in the study and those who were not willing for coronary angiography or presence of any serious co-morbidities that precluded coronary angiography were excluded. Written informed consent were obtained from all the study participants prior to enrollment. AMI was diagnosed by detection of elevated Troponin or CK-MB cardiac biomarkers at admission along with either ischemic symptoms or electrocardiographic (ECG) changes of ST elevation or depression, development of pathological Q waves in ECG or new regional wall motion abnormalities on two dimensional trans thoracic echocardiography (2D-TTE) examination. Their clinical presentation, conventional cardiovascular risk factor profiles and pattern of coronary involvement on angiography were analysed and compared with a group of fifty older patients (≥ 55 years) admitted concurrently during the study period. All relevant data were prospectively recorded as per the study protocol. The weight, height, waist and hip circumference were recorded for each patient. Fasting blood glucose, fasting lipid profile (sample obtained after overnight fast of 9 to 12 hours of hospital admission), serial ECGs and the cardiac enzymes Troponin and (CK- MB) were evaluated at hospital admission. Echocardiography was performed in all the patients. All patients underwent coronary angiography which was performed by the standard Judkin's technique after adequate preparation. The clinical assessment of the 100 patients in both groups included age, sex, history of angina prior to the MI, infarction pattern and measurement of left ventricular ejection fraction by 2D-TTE to document presence and degree of left ventricular systolic dysfunction. A history of angina pectoris was considered to be present if patients complained of retrosternal distress of short duration related to exertion or excitement and relieved by sublingual nitroglycerin. The conventional cardiovascular risk factors assessed included Smoking, Hypertension, Diabetes Mellitus, Dyslipidemia, Positive family history of premature CAD in first degree relatives, Body mass index (BMI), Waist circumference and Waist to Hip ratio. Current smokers were defined as those who reported to smoke regularly during the 3 years preceding the AMI and non-smokers and former smokers if they had stopped smoking at least 1 year before the infarction. Hypertension was considered to be present if the patient was taking anti-hypertensive treatment at the time of hospital admission or if blood pressure was recorded to be ≥ 140 mmHg systolic and /or ≥ 90 mm Hg diastolic, at least on two occasions during admission. Diabetes mellitus was diagnosed on the basis of fasting blood glucose levels of ≥ 126 mg/dl or any patient already on anti diabetic medications. Dyslipidemia was defined as per NCEP-ATP III guidelines [Total cholesterol (TC) ≥ 200 mg/dl, Low Density Lipoprotein cholesterol (LDL-C) ≥ 130 mg/dl, High Density Lipoprotein cholesterol (HDL-C) ≤ 40 mg/dl and Triglycerides (TG) ≥ 150 mg/dl]. In addition, use of lipid lowering medications were also used as a criteria for dyslipidemia. Atherogenic dyslipidemia comprises a triad of increased blood concentrations of small, dense LDL particles, decreased HDL particles, and increased TG. Family history of premature Coronary heart disease was considered to be positive when it occurred in male first degree relative ≤ 55 years and in female first degree relative ≤ 65 years of age. BMI, used as a measure of total obesity, was derived from Quetlet's formula (weight in Kg / height in meter²). A BMI of 18.5 - 24.9, 25.0 - 29.9 and ≥ 30.0 were considered to be normal, overweight and obese respectively. For waist circumference, the International Diabetes Federation criteria for South Asians were taken as reference and values > 90 cm in males and > 80 cm in females were considered significant. A waist - hip ratio of ≥ 0.90 cm in males and ≥ 0.85 cm in females according to the World Health Organization criteria were taken as reference values to indicate substantially increased risk of metabolic complications. The coronary angiographic profile was studied in all these patients to assess the number and the type of the vessels which were involved. Significant CAD (obstructive CAD) is defined as 70% reduction in luminal diameter of major epicardial coronary arteries (left anterior descending, left circumflex or right coronary artery) or > 50 % narrowing of the left main coronary artery. A narrowing of < 50 % was considered non significant (non obstructive) CAD. The absence of any appreciable narrowing in coronary diameter on angiography was considered evidence of a normal coronary artery. Coronary angiography data of all the 100 patients were obtained from the Phillips software system database of our cardiac catheterization laboratory. Data were described as mean \pm SD and percentage. Chi square analysis was used for inter group comparison and variance was checked at 95% confidence interval. SPSS software was used for data analysis.

III. Results

The present study comprised of total 100 cases of acute myocardial infarction (AMI) of which 50 belonged to Group I (age ≤ 40 years) and 50 belonged to Group II (age ≥ 55 years). The clinical presentation of

AMI differed in the Group I as compared to Group II. The mean ages of patients in Group I and Group II were 35.38 ± 5.20 and 63.5 ± 6.11 years (mean \pm SD), respectively. Significant male preponderance was seen in the younger group. In Group I, 48 (96%) were males and 2 (4%) were females compared to 40 (80%) males and 10 (20%) females in Group II. The classic presentation of worsening angina culminating in MI is rare in younger patients. Six patients (15%) in Group I gave history of antecedent angina prior to the episode of AMI, whereas in Group II, 17 (42.5%) had a history of angina. Significantly higher proportion of young MI patients presented with Anterior wall ST elevation MI compared to the older group. Whereas, Non ST elevation MI was significantly more common in the older patients. The left ventricular ejection fraction (EF%) was abnormal in 27 (54%) of young MI patients compared to 31 (62%) in the older group. Mean EF% were 50.72 ± 9.65 and 48.84 ± 9.50 in group I and group II respectively. Moderate (EF % $\geq 35 - 44\%$) to severe ($\leq 35\%$) left ventricular dysfunction was more evident in the older group compared to the younger group [12 (24%) vs 8 (16%)]. Table I. Dyslipidemia and smoking were significantly the most common risk factors present in young patients of AMI (82% vs 60%; $P < 0.05$ and 64% vs 22%; $P < 0.05$). Family history of premature CAD was also higher in the younger group compared to the older patients although it did not reach statistical significance (24% vs 10%; $P = NS$). Hypertension and diabetes were significantly more prevalent amongst the older group (58% vs. 22%; $P < 0.05$ and 32% vs 10%; $P < 0.05$). Table 2A significantly higher number of young AMI patients showed single vessel disease (70% vs 30%; $P < 0.05$) with the left anterior descending (LAD) coronary artery being most commonly involved (50% vs 20%; $P < 0.05$). Double vessel, triple vessel and left main disease were significantly more common in the older group compared to the young AMI patients (36% vs 16%; $P < 0.05$, 28% vs 04%; $P < 0.05$ and 16% vs 0; $P < 0.05\%$ respectively). Normal coronaries were seen in majority of young patients compared to the older group although it did not reach statistical significance (10% vs 02%; $P = NS$). Table 3

IV. Discussion

Age and Gender :

Our study showed a male preponderance in both the Groups (<40 years vs >55 years). Also, there was significant difference between the two groups in terms of gender differences with males more frequently present in the younger group. In an earlier study by *Fournier JA* et al, women were found to comprise 5% to 10% of all MI patients under age 40 years [1]. In another study comparing the incidence of various risk factors with angiographic disease in Asian Indians and Caucasians, by *Vallapuri S* et al, 85% of the cases were males in the Indian arm whereas only 68% were males in the Caucasian arm [2]. Similar observations of male preponderance was also reported by *Tewari* et al [3]. This may be because more men seek admission to hospitals than women in India. The maximum number of patients in the younger age group were in the 35-40 years category. In the INTERHEART study, *Yusuf et al* found that the first MI attack occurs in 4.4% of Asian women and 9.7% of men at an age less than 40 years, which is 2- to 3.5- fold higher than in the west European population and is third highest of all regions studied world wide [4].

Antecedent Angina:

In our study, acute clinical presentation without history of angina prior to the episode of AMI was more common in the younger age group. Similar observations were made by *Chen L* et al [5] who found that the first onset of angina that rapidly progresses to fully evolved MI was often the case in patients <45 years of age. They reported a prevalence of antecedent angina in their patients of acute MI in young adults to be 24%. *Klein* et al, in a series of patients who had their MI < 45 years of age, 69% denied any chest pain before MI. The duration of symptoms was found to be less than a week in most of the patients [6]. Thus, the clinical presentation of AMI in young adults differs from their older counterparts. The classic presentation of worsening angina culminating in MI is rare in younger patients.

Location of infarction:

Although the majority of the patients in our study in both groups had anterior wall MI, there was a significantly higher incidence in the younger group I (72% vs 44% in group II). Incidence of Inferior wall MI was also marginally higher in group I compared to group II (24% vs 18%). Acute lateral or posterior STEMI was not seen in any of the young participants.

In a study by *Colkesen* et al [7] in more than twenty five thousand patients <35 years of age over a 10 year period with acute MI, reported an incidence of 60% with Anterior wall MI and 31% with Inferior wall MI. Also, acute lateral or posterior wall MI was seen in 7% of the young participants in their study which may be probably due to the much higher number of participants in their study .

Another study reported similar findings where they found anterior wall MI to be the commonest in all three of their study groups (>55 years, 41 – 55 years and < 40 years) [3].

Left Ventricular Ejection Fraction :

Young MI patients in our study had a relatively preserved LV ejection fraction compared to the older patients. Moderate to severe LV dysfunction was more common in the older patients. Similar findings were reported by Mukherjee et al [8].

Chouhan et al [9] reported better left ventricular ejection fractions in patients with MI who were younger than 35 years old which is comparable to our findings.

Conventional Cardiovascular Risk Factors :

Dyslipidemia, smoking and family history of premature CAD were the predominant conventional cardiovascular risk factors seen in the younger AMI patients in our study whereas, hypertension and diabetes were more common in the older patients.

Data suggest that lipid fractions other than total cholesterol, i.e. serum triglycerides (TG) and high density lipoprotein (HDL) cholesterol are important for the pathogenesis of atherosclerosis. A combination of hypertriglyceridemia, low levels of HDL-cholesterol and high levels of small dense low density lipoprotein, termed as ‘atherogenic dyslipidemia’, is particularly seen in Asian Indians. Although precise reason for such dyslipidemia is unknown, genetic predisposition and characteristic body composition (excess truncal subcutaneous fat and intraabdominal fat) may be important contributors.

In the present study smoking was found predominantly among young adults with AMI compared to the older patients. Tewari et al [3] reported significantly higher prevalence of smoking in the younger population (53.63%) with AMI compared to the elderly group(32.40%). Other epidemiological studies from India [10-14] also suggest a greater association of smoking with CAD in younger individuals. Repeated exposure to cigarettes and the resulting frequent catecholamine surges damage endothelial cells, leading to dysfunction and injury of the vascular intima. Smoking cessation may thus prove to be one of the most cost effective approach in both primary and secondary prevention and the ban imposed on smoking in public places by the Government is one of the important step toward that goal.

Family history of CAD is an important independent risk factor for CAD in younger cases emerging out of various Indian studies [10, 12,14] which quote data varying from 20% to 40%. How a positive family history increases the risk of MI in young patients is not known, although it may involve inherited disorders of lipid metabolism, blood coagulation, or other genetic factors.

Low incidence of Diabetes in young MI patients have been reported in various previous studies [15,16]. Diabetes mellitus is more likely to be associated with MI in older patients than in young patients. Similarly, hypertension was also more common in the older patients [17]. Thus, Hypertension and Diabetes are less common in younger patients with AMI compared to the elderly.

Coronary Angiographic Findings :

Greater involvement of SVD and preponderance of LAD artery involvement similar to our study have been reported by several earlier studies [18,19,3]. Crittin et al [20] reported a prevalence of LM involvement in young MI patients of approximately 3% in males and 7% in females. Probably the absence of LM involvement in our study may be explained by the relatively smaller study group. Incidence of normal coronaries is reported to be 12.8% in the younger group [18], which corroborated with our findings. Double and triple vessel disease were more commonly observed in older patients which was similar to the findings of earlier studies.

V. Figures And Table

TABLE 1 : Clinical characteristics and diagnosis of the patients

Variables	Group I (≤ 40 years) n (%)	Group II (≥ 55 years) n (%)	P value
Mean Age (yrs)	35.38 ± 5.20	63.5 ± 6.11	
% Male	48 (96%)	40 (80%)	<0.05
% Female	02 (04%)	10 (20%)	<0.05
History of angina prior to MI	06 (15%)	17 (42.5%)	< 0.05
Infarction pattern			
STEMI	48 (96%)	38 (76%)	<0.05
NSTEMI	02 (04%)	12 (24%)	<0.05
AWMI	36 (72%)	22 (44%)	<0.05
IWMI	12 (24%)	09 (18%)	N.S
InferoLateral wall MI	0	01	
IWMI + Posterior wall MI	0	01	
IWMI+ RVMI	0	04	
Anterior + Inferior MI	0	01	

LV ejection fraction			
Mean	50.72 ± 9.65	48.84 ± 9.50	N.S
Normal	23 (46%)	19 (38%)	
Abnormal	27 (54%)	31 (62%)	
Mild LV dysfunction	19 (38%)	19 (38%)	
Moderate LV dysfunction	03 (06%)	06 (12%)	
Severe LV dysfunction	05 (10%)	06 (12%)	

TABLE 2 : Risk factors among the patients

Risk Factors	Group I (≤ 40 years) N (%)	Group II (≥ 55 years) N (%)	P value
Smoking	32 (64%)	11 (22%)	< 0.05
Hypertension	11(22%)	29 (58%)	< 0.05
Diabetes Mellitus	05 (10%)	16 (32%)	<0.05
Dyslipidemia	41 (82%)	30 (60%)	<0.05
Family history	12 (24%)	05 (10%)	N.S

TABLE 3 : Coronary angiographic findings

Coronary angiographic findings	Group I (≤ 40 years) N (%)	Group II (≥ 55 years) N (%)	P value
Single Vessel disease	35 (70%)	15 (30%)	<0.05
LAD	25 (50%)	10 (20%)	<0.05
LCX	0	01 (02%)	
RCA	10 (20 %)	04 (08%)	
Double vessel disease	08 (16%)	18 (36%)	<0.05
Triple vessel disease	02 (04%)	14 (28%)	<0.05
Left main disease	0	08 (16%)	<0.05
Normal	05 (10%)	01 (02%)	N.S

VI. Conclusion

Our study has highlighted the important differences in acute myocardial infarction in young adults compared to the older population of our region. In the young it is predominantly a disease of men who present with anterior wall ST elevation MI, mostly without history of preceding angina. The predominant cardiovascular risk factors prevalent among the younger patients are dyslipidemia, smoking and family history of premature CAD. On the contrary, diabetes and hypertension are more common in the older population. Angiographically, single vessel disease with predominant LAD artery involvement and normal coronary arteries are common in the young whereas, double vessel, triple vessel and left main disease prevalence are more in the older patients. The majority of differences noticed in our study have been observed previously.

Our study is important in fact that it establishes the significance of smoking and dyslipidemia as primary targets for effective prevention of CAD in young patients of this region. Proper advice and patient education by treating physicians and health care providers regarding improving life style with smoking and tobacco cessation, appropriate diet modification with more fruits and vegetables and lower fat intake and increased physical activity are critical. Targeted control of hypertension, dyslipidemia and diabetes is required. Keeping in mind that family history of premature CAD is also an important risk factor, screening of young healthy people who are at risk is warranted to take more aggressive approach for effective preventive measures and life style modification.

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