Original Article

Demographic and angiographic profile in premature cases of acute coronary syndrome: analysis of 820 young patients from South India

Surender Deora[1], Tarun Kumar[1], Rangaraj Ramalingam[2], Chollenhalli Nanjappa Manjunath[2]

[1]Department of Cardiology, Dr Ram Manohar Lohia (RML) Hospital & Post Graduate Institute of Medical Education and Research (PGIMER), New Delhi, India; [2]Department of Cardiology, Sri Jayadeva Institute of Cardiovascular Sciences & Research, Rajiv Gandhi University of Health Sciences, Bengaluru, India

Contributions: (I) Conception and design: S Deora, R Ramalingam, C Nanjappa Manjunath; (II) Administrative support: R Ramalingam, C Nanjappa Manjunath; (III) Provision of study materials or patients: R Ramalingam, C Nanjappa Manjunath; (IV) Collection and assembly of data: S Deora, T Kumar; (V) Data analysis and interpretation: All authors; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Dr. Surender Deora, MD, DM. Assistant Professor, Department of Cardiology, Dr Ram Manohar Lohia (RML) Hospital & Post Graduate Institute of Medical Education and Research (PGIMER), New Delhi 110001, India. Email: drsdeora@gmail.com.

Background: Prevalence of acute coronary syndrome in young individuals is increasing progressively. Previous studies have focused on the analysis of risk factors and to some extent coronary angiographic profile in young *vs*. old patients with acute coronary syndrome, but no study compared the angiographic profile in young patients based on the type of acute coronary syndrome. So, this study was conducted to determine the differences in demographic and coronary angiographic profile of young patients with ST-elevated myocardial infarction (STEMI) *vs*. those with non-ST-elevated myocardial infarction (NSTEMI) or unstable angina (UA).

Methods: We retrospectively analyzed young patients (age <40 years) with acute coronary syndrome who underwent coronary angiography at Sri Jayadeva Institute of Cardiovascular Sciences and Research, Bengaluru, India between April 2010 and March 2011. Coronary risk factor profile and angiographic features were compared between STEMI and NSTEMI/UA patients.

Results: Of 8,268 patients who underwent coronary angiography during the study period, 820 (~10%) were ≤40 year age. Of them, 611 exhibited STEMI and 209 exhibited NSTEMI/UA. Angiographic analysis revealed that single-vessel disease was significantly more common in the STEMI group (56.6% *vs*. 36.6% respectively; P<0.001) whereas triple-vessel disease was significantly more common in the NSTEMI/UA group (3.6% *vs*. 10.5% respectively; P<0.001). Conversely, left anterior descending coronary artery was more commonly involved in the STEMI group (55.3% *vs*. 40.2% respectively; P<0.001), whereas left circumflex coronary artery was more commonly involved in the NSTEMI/UA group (11.8 *vs*. 23.4% respectively; P<0.001). Of note, smoking/tobacco consumption was the most significant coronary risk factor with prevalence as high as 65% in both groups.

Conclusions: In the present study, significant differences were observed in coronary risk factor profile and angiographic features between young patients with STEMI and NSTEMI/UA. Larger studies will be required to establish specific associations between presentation of acute coronary syndromes and angiographic profiles in young patients.

Keywords: Acute coronary syndrome; coronary angiography; coronary artery disease (CAD); young

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Introduction

Ischemic heart disease is a major public health problem associated with high morbidity and mortality. Acute coronary syndrome is a common presentation of ischemic heart disease (1). It is also the single largest cause of death in developed countries as well as developing countries (2). Despite being identified as a major burden on health-care systems, there have been no large prospective cohort studies to define the incidence of coronary artery disease (CAD) among Indians. Therefore, the magnitude of the problem can only be estimated from cross-sectional point prevalence studies (3). Reports have shown that risk of CAD among Asian Indians is 3–4 times higher than white Americans, 6 times higher than Chinese, and 20 times higher than Japanese counterparts (4). A conservative estimate indicates that there could be 30 million CAD patients in India. If the current trend continues, the burden of CAD in India will surpass other regions of the world by the year 2020 (5). In addition to higher rate, it is also reported that Indian individuals may develop CAD at a very early age (6). According to an estimate, more than half of death related to cardiovascular disease occurs in patients below the age of 50 years and one-fourth of acute myocardial infarction cases are being reported in patients under the age of 40 years (6). It has also been noted that the clinical presentation, risk factor profile, and coronary anatomy of young patients who develop CAD differs to those who develops CAD at an older age (1,6,7). Overall, these studies have indicated that patients with early onset of CAD exhibit preponderance of single-vessel disease, and dominance of coronary risk factors such as hypercholesterolemia, family history of CAD, and cigarette smoking as compared to older patients. However, there have been very limited data on comparison of demographic and angiographic characteristics in young patients stratified according to the type of acute coronary syndrome. Therefore, we aimed to identify the differences between risk factor profile and coronary angiographic characteristics of young adults presenting with ST-elevated myocardial infarction (STEMI), non-ST-elevated myocardial infarction (NSTEMI), or unstable angina (UA). We selected an age cut-off of 40 years to define a premature CAD, based on previous Indian studies (6,8).

Methods

Study design and patient population

This was a retrospective observational study conducted at Sri Jayadeva Institute of Cardiovascular Sciences and Research, Bengaluru, India. The study population for the present analysis was selected from the in-patients with acute coronary syndrome who underwent coronary angiography between April 2010 and March 2011. Inclusion criteria involved: (I) patients admitted for STEMI, NSTEMI, or UA; (II) age <40 years; and (III) underwent coronary angiography. Patients were divided in two groups according to the type of acute coronary syndrome: group 1 comprised patients admitted for STEMI who underwent coronary angiography (STEMI group) and group 2 comprised patients admitted for NSTEMI/UA who underwent coronary angiography (NSTEMI/UA group). All patients who underwent coronary angiography for surgical fitness e.g., patients of rheumatic heart disease and congenital heart disease were excluded from the study.

Ethical consideration

The study was approved by the institute's ethics committee. Written informed consents were obtained from all participants. Analysis was conducted in accordance with the Helsinki Declaration.

Data collection

Hospital records of the selected patients were examined for associated coronary risk factors like hypertension, diabetes, smoking, obesity, and family history of CAD. Ejection fraction at the time of presentation was also noted.

Patients were defined as hypertensive if they displayed a systolic blood pressure ≥140 mmHg, diastolic blood pressure >90 mmHg, or self-report of physician diagnosis of hypertension and/or current use of antihypertensive medications. Patients were considered diabetic if they presented with fasting glucose levels >126 mg/dL, or glycated hemoglobin levels >6.5%, or self-report of physician diagnosis of diabetes mellitus and/or use of antidiabetic medications. Body-mass index (BMI) was estimated based on the height and weight measurements to identify obese patients (BMI >25 kg/m^2). Patients were categorized as smokers if they reported smoking/tobacco consumption within last one year of study enrollment.

Coronary angiography analysis

All patients included in the study group underwent coronary angiography, which was performed using standard

Table 1 Comparative analysis of demographic characteristics and coronary risk factors between STEMI and NSTEMI/UA groups

Variables	STEMI (n=611)	NSTEMI/UA (n=209)	P value
Gender			<0.001*
Males, n (%)	589 (96.4)	171 (81.8)	
Females, n (%)	22 (3.6)	38 (18.2)	
Age in years, mean ± SD	35±18.6	36±17.8	0.703
Age group			0.151
20–30 years, n (%)	108 (17.7)	28 (13.4)	
31–40 years, n (%)	503 (82.3)	181 (86.6)	
Coronary risk factors			
Hypertension, n (%)	61 (10.0)	79 (37.8)	<0.001*
Diabetes, n (%)	54 (8.9)	61 (29.2)	<0.001*
Smoking habits, n (%)	415 (67.9)	146 (69.9)	0.603
Dyslipidemia, n (%)	504 (82.4)	181 (86.6)	0.205
Obese, n (%)	73 (11.9)	38 (18.1)	0.023*
Family history of CAD, n (%)	48 (7.9)	14 (6.7)	0.582
% Ejection fraction, mean ± SD	37±15.5	55±7.2	<0.001*

*, significant difference. STEMI, ST-elevation myocardial infarction; UA, unstable angina; NSTEMI, non-ST-elevation myocardial infarction; CAD, coronary artery disease.

percutaneous techniques. Generally, 6 or 7 Fr guide catheters were used and were introduced via the femoral artery. Angiographic severity of coronary artery stenosis was assessed visually using at least two orthogonal views. CAD was defined as the presence of a >70% lesion in one of the three major coronary arteries [i.e. left anterior descending coronary artery (LAD), left circumflex coronary artery (LCX), and right coronary artery (RCA)] or their major branches, or >50% luminal narrowing of the left main coronary artery (LMCA). Accordingly, patients were classified as having single-vessel, double-vessel or triple-vessel disease.

Statistical analysis

Continuous measurements are presented as mean ± standard deviation, while categorical measurements are presented as frequency (percentage). Two-tailed Student's *t*-test was used to find the significant differences between two groups for study parameters on continuous scale. Chi-square/Fisher's exact test was used to find the significant differences between two groups for study parameters on categorical scale. Statistical difference was assessed at 5% level of significance. The Statistical Package for Social Sciences (SPSS for Windows version 20.0; Chicago, IL, USA) was used to analyze the data.

Results

A total of 8,268 patients with acute coronary syndrome underwent coronary angiography at our study-center between April 2010 and March 2011. Of them, 820 patients who were <40 years of age were examined in the present study. This population comprised 611 STEMI patients and 209 NSTEMI/UA patients. Baseline demographics for these individuals are described in *Table 1*. Majority of the patients in both the group were male and were between 31–40 years of age. Of note, proportions of females (P<0.001), hypertensive (P<0.001), diabetics (P<0.001), and obese patients (P=0.023) were significantly higher in the NSTEMI/UA group. Notably, more than 65% patients in both the groups were smokers and about 80% patients in both groups were dyslipidemic. In addition, the left ventricular ejection fraction was significantly lower in the STEMI group than that in the NSTEMI/UA group (P<0.001).

Details of severity of CAD and involvement of coronary artery vessels are given in *Table 2*. The proportion of patients with single-vessel disease was significantly higher in the STEMI group (P<0.001), while the proportion

Table 2 Comparative analysis of coronary angiographic profile between STEMI and NSTEMI/UA groups

Variables	STEMI (n=611)	NSTEMI/UA (n=209)	P value
Disease severity/No. of vessels involved			
Insignificant stenosis, n (%)	177 (29.0)	91 (43.6)	<0.001*
Single-vessel disease, n (%)	346 (56.6)	64 (30.6)	<0.001*
Double-vessel disease, n (%)	66 (10.8)	32 (15.3)	0.084
Triple-vessel disease, n (%)	22 (3.6)	22 (10.5)	<0.001*
Lesion location			
Left main coronary artery, n (%)	3 (0.5)	6 (2.9)	0.004*
Left anterior descending coronary artery, n (%)	338 (55.3)	84 (40.2)	<0.001*
Left circumflex coronary artery, n (%)	72 (11.8)	49 (23.4)	<0.001*
Right coronary artery, n (%)	116 (19.0)	49 (23.4)	0.165

*, significant difference; STEMI, ST-elevation myocardial infarction; NSTEMI, non-ST-elevation myocardial infarction; UA, unstable angina.

of patients with normal coronary arteries (P<0.001) was significantly higher in the NSTEMI/UA group (P<0.001). The NSTEMI/UA group of patients also had non-significantly higher proportion of patients with double-vessel disease (P=0.084) and significantly higher proportion of patients with triple-vessel disease (P<0.001). LAD involvement was more common among STEMI group of patients (P<0.001), while LMCA and LCX involvements were more common among NSTEMI/UA group of patients (P=0.004 and P<0.001 respectively). No significant difference was observed between the two groups with respect to RCA involvement.

Discussion

The present study determines the demographic characteristics and angiographic extent of coronary artery lesions in young adults having acute coronary syndrome, with comparative analysis focusing on patients presented with STEMI *vs.* NSTEMI/UA. Out of total 8,268 coronary angiographies performed between April 2010 and March 2011, more than 10% of cases were premature presentation of acute coronary syndrome. Earlier, studies have reported that only about 3% of all CAD cases occur in <40 years of age, which should be measured as the 'tip of the iceberg' since young asymptomatic patients usually do not undergo medical investigations (6). In this regard, the high rate of CAD in patients with ≤40 years of age in the present study is an alarming indication and demands the need for appropriate management measures at a younger age.

In the present study, demographic profile suggested that majority of patients were 31–40 years of age and males were predominant in both the groups. Of note, a significantly higher number of females were observed in the NSTEMI/UA group (18%), which could be because of the false positive electrocardiographic stress test in females. In addition, smoking/tobacco consumption was identified as the most prevalent risk factor in patients in the STEMI group as well as in the NSTEMI/UA group. We believe that dominance of smoking/tobacco consumption is a significant threat for young adults. Since it is a preventable risk factor, we recommend that healthy life styles should be encouraged and new precautions about smoking/tobacco consumption must be undertaken to combat high incidence of CAD. In our study, we also observed that hypertension and diabetes were less common (≤10%) among young patients with STEMI. On the other hand, 37.8% and 29.2% of patients with NSTEMI/UA had hypertension and diabetes respectively. This demands the need to further investigate the role of hypertension and diabetes in the occurrence of NSTEMI/UA. Obesity at younger age also emerged as an important coronary risk factor in the present study.

In the present study, nearly three-fourth of young patients with acute coronary syndrome exhibited STEMI (n=611), while one-fourth of patients had NSTEMI or UA (n=209). Our data is in similar lines with the studies reported from India and abroad. Earlier, Tungsubutra *et al.* investigated 544 patients aged <45 years with acute coronary syndrome and reported that 67.3%, 19.3%, and 13.4% of them exhibited STEMI, NSTEMI, and UA respectively (9). Similarly recently from India, Prajapati *et al.* examined 100

young Guajarati patients with acute coronary syndrome (age ≤40 years) and reported that 85% of them had STEMI and 15% had NSTEMI/UA (6). Such evidence-based information regarding the distribution of patients based on their presentation verifies the predominance of STEMI among young patients with acute coronary syndrome.

It was well-established from a large cohort that young patients with acute coronary syndrome may have a higher frequency of angiographically normal coronary arteries than their older counterparts (10). In our study, about one-third of young patients with acute coronary syndrome displayed normal coronary vessels. Of note, normal or insignificant lesions were more common in the NSTEMI/UA group than that in the in STEMI group. Furthermore, single-vessel disease was significantly more common in the STEMI group, whereas triple-vessel disease was more common in the NSTEMI/UA group. Overall, it was observed that severe or multiple-vessel CAD was less common in our study cohorts. Available literature also indicates that young adults with acute coronary syndrome are characterized by a less extensive coronary disease mainly as single-vessel form (1,6-9).

A study by Colkesen *et al*. involving young STEMI patients with ≤35 year age revealed that LAD was the most common vessel involved (11). Angiographic profile in the present study also revealed that LAD was the most commonly involved vessel, followed by RCA, LCX, and LMCA. We also observed a statistically significant difference between STEMI and NTEMIS/UA patients with respect to lesion locations, which can be viewed as a distinctive finding of the present study.

Although previous studies have put forward data on coronary risk factors (6-9), long-term outcome of MI survivors (12,13), and extent of angiographic coronary lesions (9-11,14), we believe that the available data was not sufficient to provide adequate information about angiographic profile based on the type of acute coronary syndrome. In this regard, the present study provides valuable insights regarding the similarities and differences in coronary risk factors and angiographic characteristics in STEMI and NSTEMI/UA patients. Larger studies will be required to establish specific associations between presentation of acute coronary syndromes and angiographic profiles in young patients. We strongly believe that such information may be of significant value for the prevention and management of cardiovascular disorders considering that acute coronary syndrome itself is an uncommon occurrence in younger patients. Overall, we encourage the recommendation of healthy lifestyles, particularly avoidance of smoking/tobacco consumption. We also emphasize the need of early diagnosis and management of modifiable coronary risk factors (such as diabetes mellitus, hypertension, and dyslipidemia) to prevent the occurrence of CAD and myocardial infarction at younger age.

Conclusions

Of all cases of acute coronary syndrome, about one in ten cases was reported at a younger age. Comparative analysis of young patients with STEMI and NTEMI/UA revealed that single-vessel disease was predominantly involved in STEMI group, whereas triple-vessel disease was predominant in NSTEMI/UA group. LAD was the most commonly involved coronary artery in both the groups. Affected patients were predominantly the male and showed a high prevalence of smoking/tobacco consumption. Larger studies will be required to establish specific associations between presentation of acute coronary syndromes and angiographic profiles in young patients.

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None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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