



## Research Brief

# Clinical and angiographic profile of very young adults presenting with first acute myocardial infarction: Data from a tertiary care center in Central India

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## ARTICLE INFO

## Article history:

Received 17 October 2019

Accepted 24 December 2019

Available online 3 January 2020

## Keywords:

Acute myocardial infarction

Young adults

Coronary angiography

## ABSTRACT

Acute myocardial infarction (AMI) is afflicting young individuals more frequently nowadays. The present study was planned to evaluate the clinical and angiographic profile in adults aged less than 30 years, presenting with first AMI as data from Central India is very scarce. This cross-sectional study included 41 patients of STEMI with a mean age of  $27 \pm 2.8$  years. Risk factors were male gender (95.1%), dyslipidemia (51.2%), tobacco consumption (48.8%), obesity (34.1%), and smoking (29.3%). Anterior wall myocardial infarction (AWMI) was the most common presentation (82.9%) with obstructive CAD noted in 61% cases frequently due to LAD coronary artery involvement (46.4%).

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## 1. Introduction

Coronary artery disease (CAD) is responsible for the highest mortality globally.<sup>1</sup> Acute coronary syndrome (ACS) represents the most common mode of presentation of CAD.<sup>2</sup> Data indicate that Asian Indians are more prone to develop CAD with symptoms occurring a decade earlier than the western population.<sup>3</sup> It has been estimated that there could be around 30 million patients suffering from CAD in India.<sup>4</sup> Acute myocardial infarction (AMI) in very young adults has been poorly studied but is estimated to be less than 2%.<sup>5</sup> 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.<sup>4</sup> Apart from conventional risk factors, ST-segment elevation myocardial infarction (STEMI) in the very young ( $\leq 30$  years) patients has been linked to substance abuse and nontraditional risk factors. Coronary angiographic data from various studies indicate preponderance of single-vessel disease or nonobstructive CAD in very young patients suffering from AMI.<sup>5</sup> The present study is aimed to identify the clinical, risk factor and coronary angiographic characteristics in very young adults less than 30 years of

age presenting with first STEMI as literature regarding this is very limited and exceptionally scarcer in Central Indian population.

## 2. Methods

The present study was a cross-sectional hospital-based single-center study conducted among 41 patients aged less than 30 years of age, admitted in the Department of Cardiology, Government Medical College and Super Speciality Hospital, Nagpur, Maharashtra during July 2018 to June 2019, who gave written informed consent. Inclusion criteria were based on the diagnosis of STEMI according to the guidelines given by the Joint European Society of Cardiology (ESC)/American College of Cardiology Foundation (ACCF)/American Heart Association (AHA)/World Heart Federation (WHF) Task Force.<sup>6</sup> The patients with a history of prior myocardial infarction or revascularization were excluded from the study. The study was approved by the institutional ethical committee.

All patients were subjected to Coronary Angiography after detailed clinical evaluation. Information on age, sex, history of type-2 diabetes mellitus, hypertension, substance abuse, and family history of premature coronary artery disease (CAD) were obtained through self-report. Patients were classified as obese with BMI  $> 25$  kg/m<sup>2</sup>. All patients underwent complete hematological and biochemical investigations and electrocardiograms. Dyslipidemia was defined as serum total cholesterol level (TC) of  $\geq 200$  mg/dl, triglyceride (TG)  $> 150$  mg/dl, low-density lipoprotein

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(LDL) > 130 mg/dl, high-density lipoprotein (HDL) < 50 mg/dl in women and <40 mg/dl in men and/or participants on lipid-lowering treatment.

Left ventricular ejection fraction (LVEF), regional wall motion abnormality (RWMA) and diastolic dysfunction were documented by echocardiography.

Coronary angiography was performed using standard percutaneous techniques either via femoral or radial route after Allen's test. Angiographic severity was assessed in at least two orthogonal views using eye-balling. The obstructive CAD was defined as  $\geq 70\%$  lesion in one of the major epicardial arteries [viz., left anterior descending (LAD), left circumflex (LCx), and right coronary artery (RCA)], or their major branches, or  $\geq 50\%$  luminal narrowing of the left main coronary artery (LMCA). Accordingly, patients were further classified as suffering from single-vessel (SVD), double-vessel (DVD), or triple-vessel disease (TVD). All other lesions not amounting to the above-mentioned severity were grouped together as nonobstructive CAD.

Excel data analysis tool was employed for the descriptive statistical analysis. Continuous variables were presented as mean  $\pm$  standard deviation, while categorical variables were expressed as frequency (percentage).

### 3. Results

During the one-year study period, 2456 coronary angiograms were done for various indications pertaining to CAD. Forty-one young patients aged less than 30 years of age suffering from acute STEMI were included in the study according to the predefined study protocol. Table 1 describes the demographic and risk factor profile of the enrolled patients. The majority of the patients were within the age range of 25–30 years. The youngest patient was a 19-year-old male. Apart from the male gender, the most common risk factor was dyslipidemia, followed by smokeless tobacco consumption, obesity, and smoking. A family history of premature CAD in first-degree relatives was present in less than 10% cases. The frequency of hypertension and diabetes mellitus was very low.

The most common symptom was chest pain in 39 (95.1%) patients followed by excessive diaphoresis in 36 (87.8%) patients. Two patients presented with heart failure while one patient presented with ventricular tachycardia, which was promptly reverted with direct current (DC) cardioversion. Thirteen patients (31.7%) reported significant physical stressor, while only 2 patients reported significant emotional stress before the event. None reported intense physical exercise before the event.

Table 2 depicts the clinical profile of the patients. Anterior wall myocardial infarction (AWMI) was the most common presentation

**Table 2**

Clinical profile of the patients ( $n = 41$ ).

Variables	$n$ (%)
Left ventricular ejection fraction % (Mean $\pm$ SD)	43 $\pm$ 9.8
<b>Pattern of Acute Myocardial Infarction</b>	
Anterior wall myocardial infarction	34 (82.9)
Inferior wall myocardial infarction	7 (17.1)

resulting in mild to moderate left ventricular dysfunction. Regional wall motion abnormality (RWMA) was noted in 90.2% of the cases with RWMA corresponding to LAD, RCA, and LCx territory being observed in 30 (73.2%), 6 (14.6%) and 1 (2.4%) cases, respectively. However, no RWMA was observed in 4 (9.8%) cases. Also, diastolic dysfunction was found in 95.1% cases, with maximum suffering from Grade - I diastolic dysfunction being observed in 31 (75.6%) cases followed by Grade - II and Grade - III diastolic dysfunction that was observed in 6 (14.6%) and 2 (4.9%) cases respectively.

Notably, 25 (61%) patients underwent thrombolysis before undergoing coronary angiography.

Details of the severity of CAD and the pattern of coronary artery involvement are tabulated in Table 3. Obstructive CAD with SVD was the most common angiographic diagnosis. LAD was the most common culprit vessel followed by RCA involvement. The proportion of DVD and TVD was very low. No case of LMCA disease was observed. Spontaneous coronary artery dissection was observed in only 2 (4.87%) patients, while nonculprit vessels were found to be diseased in 7 (17.1%) patients. Notably, more than a single lesion in the culprit vessel was observed in only 4 (9.75%) patients.

In all, 23 (56%) patients underwent percutaneous coronary intervention (PCI) with drug-eluting stent (DES) placement, one patient with TVD underwent Coronary artery bypass grafting (CABG), and 17 (41%) patients were managed medically with guideline-directed optimum medical management. There was one death of the patient who underwent CABG. All the remaining 40 patients were subsequently discharged in satisfactory condition.

### 4. Discussion

The present study included 41 patients younger than 30 years of age presenting with first AMI, and during the study period, 2456 coronary angiograms were performed for CAD. It provides a rough estimate about the prevalence of AMI in very young adults to be less than 2%, which is in close concordance with other studies, albeit scarce.<sup>4</sup> Male sex is one of the most consistently reported risk factors for CAD in many studies accounting for skewed gender distribution even in the present study with 95.1% patients being male (Table- 1).<sup>4,5,7</sup> Protective effects of estrogens against

**Table 1**

Demographic and risk factors profile of the patients ( $n = 41$ ).

Variables	$n$ (%)
Age in years (Mean $\pm$ SD)	27 $\pm$ 2.8
<b>Gender</b>	
Male	39 (95.1)
Female	2 (4.9)
<b>Age group</b>	
<25 years	7 (17.7)
25–30 years	34 (82.9)
<b>Coronary risk factors</b>	
Hypertension	5 (12.2)
Diabetes mellitus	1 (2.4)
Smoking	12 (29.3)
Smokeless tobacco consumption	20 (48.8)
Obesity	14 (34.1)
Dyslipidemia	21 (51.2)
Family history of premature CAD	4 (9.8)

**Table 3**

Coronary Angiographic profile of the patients ( $n = 41$ ).

Variables	$n$ (%)
<b>Obstructive CAD</b>	<b>25 (61)</b>
Single vessel disease	22 (53.7)
1. LAD	19 (46.4)
2. LCx	0
3. RCA	3 (7.3)
Double vessel disease	2 (4.9)
1. LAD and RCA	1 (2.4)
2. LAD and LCx	1 (2.4)
3. RCA and LCx	0
Triple vessel disease	1 (2.4)
Left main disease	0
<b>Non obstructive CAD</b>	<b>13 (31.7)</b>
<b>Normal coronaries</b>	<b>3 (7.3)</b>

CAD: Coronary artery disease, LAD: Left anterior descending coronary artery, LCx: Left circumflex coronary artery, RCA: Right coronary artery.

atherosclerosis in females and high prevalence of smoking in males have been attributed for male preponderance.<sup>5</sup>

Dyslipidemia is a conventional risk factor for CAD with more than 50% prevalence in the present study (Table- 1). Various other studies conducted among young patients of AMI have reported dyslipidemia in their study cohort ranging from 20 to 80%.<sup>4,5,7–9</sup> Obesity at a younger age poses a significant threat to the development of early CAD. More than one-third of the patients were found to be obese in the present study (Table- 1). These findings are in line with the study done in North India.<sup>5</sup> However, obesity was reported as an infrequent cause in most of the other previous studies, with a prevalence of 11–15%.<sup>4,7</sup> Systemic hypertension and diabetes mellitus are well-established risk factors for CAD. There was a low frequency of hypertension (12.2%) and diabetes mellitus (2.4%) in the studied population (Table- 1). The prevalence of hypertension ranged between 10 and 44% in other studies.<sup>4,5,7–9</sup> However, the prevalence of diabetes mellitus was reported to be less than 10% in many studies.<sup>4,8,9</sup>

A positive family history of premature CAD is associated with increased plaque content in the coronary arteries. Various Indian studies report a much lower prevalence rate of positive family history of premature CAD being centered around 10%, which is quite consistent with the findings of the present study with a prevalence rate of 9.8% (Table- 1).<sup>4,9</sup> However, few Indian studies contrastingly report a much higher prevalence ranging from 30 to 47%.<sup>5,7</sup> Tobacco use is the most preventable cause of death worldwide that adversely affects all phases of atherosclerosis.<sup>5</sup> There was a high prevalence of smokeless tobacco consumption (48.8%) and smoking (29.3%) in the studied population (Table- 1). Smoking cessation substantially reduces the risk of CAD, and its cessation before the age of 40 years reduces the mortality risk by 90%.<sup>10</sup> Smokeless tobacco consumption is still not an established cardiovascular risk factor. However, it is widely prevalent in the South Asian population, thereby requiring systematic testing before any specific recommendations can be made in context with STEMI.

Stressful life events can cause instability of the plaque leading to its rupture, thereby resulting in STEMI. This is evident in the present study too by the high prevalence of significant physical stressor (31.7%) before the event.<sup>5</sup>

LVEF is a commonly employed tool for risk stratification. The mean LVEF in the present study was found to be  $43 \pm 9.8\%$  (Table- 2). This finding is in close concordance with other studies reporting mild to moderate left ventricular dysfunction with mean LVEF ranging from 37 to 55% in young patients.<sup>4,5,7</sup> The left ventricular dysfunction can be attributed to the higher prevalence rate of AWMI and RWMA corresponding to LAD territory (73.2%) in the studied population with more than 80% being diagnosed as AWMI (Table- 2). AWMI, as the most common STEMI pattern, was observed in other studies as well.<sup>5,8</sup> Since diastolic dysfunction frequently accompanies systolic dysfunction and is often a first echocardiographic manifestation of AMI, more than 95% of cases suffered diastolic dysfunction in the present study, with a majority being diagnosed with Grade-I diastolic dysfunction (75.6%).

All 41 patients in the present study underwent coronary angiography, which revealed a 61% prevalence of obstructive CAD (Table- 3). Available literature also supports the aforementioned findings, with many studies reporting similar rates of obstructive CAD ranging from 60 to 70% in their study cohort.<sup>4,8,11</sup> However, many other studies have reported a much higher prevalence rate (>80%) of obstructive CAD.<sup>5,7,9,12</sup> More than 60% of the patients underwent thrombolysis before undergoing coronary angiography that might have recanalized the infarct related artery as evidenced by the higher rate of nonobstructive CAD (31.7%) and normal coronaries (7.3%) in the present study (Table- 3). Apart from thrombolysis with reperfusion, prevalent coronary artery spasm in younger

adults and spontaneous recanalization can result in normal coronary arteries.<sup>13</sup> Plaque formation in coronary artery, which can lead to its adaptive enlargement, thereby preserving the luminal area, and widely known as Glagov phenomenon, could not be ruled out, as intravascular ultrasound (IVUS) was not employed.<sup>14</sup>

Most studies conducted among young patients of AMI demonstrate a preponderance of SVD as observed in the present study, being present in 54% cases (Table- 3).<sup>4,5,7–9,12</sup> Both DVD and TVD were quite infrequent in the present study (Table- 3). Similarly, low prevalence of DVD (10–16%) and TVD (3.3–6.6%) was observed in other studies as well, thereby suggesting that extensive coronary involvement is infrequent in young adults presenting with ACS.<sup>4,5,7,8</sup> The present study reveals LAD as the commonest culprit artery being involved singularly in 46.4% of cases followed by RCA in 7.3% of cases. The findings are in close concordance with other studies where LAD was the most common vessel involved followed by RCA, LCx, and LMCA respectively.<sup>4,5,7–9,11,12</sup> However, Kennelly et al in 1982 reported RCA to be the most common vessel involved in their study cohort.<sup>15</sup> Notably, nonculprit vessels were found to be diseased in only 7 (17.1%) patients, and more than a single lesion in the culprit vessel was observed in only 4 (9.75%) patients, thereby suggesting that majority of the lesions were nonatherosclerotic. However, spontaneous coronary artery dissection was observed in only 2 (4.87%) cases in the present study, which is in line with a study done in North India.<sup>5</sup>

More than 56% of the patients underwent PCI with DES implantation successfully while another female patient with TVD underwent CABG. Only one death was reported, while the remaining 40 patients were discharged from the hospital in satisfactory condition. More than 40% of the patients were managed medically. These findings suggest a good prognosis in young adults.

The data from the present study must be interpreted in light of certain limitations. The study being cross-sectional without any control group, risk of each factor, and their statistical significance could not be analyzed. The study being monocentric, which enrolled few patients, the results cannot be extrapolated to the whole community. As in previous studies, eye-balling was used to grade angiographic stenosis, one may argue in favor of using more objective quantitative methods to yield more accurate results. Also, it was not possible to differentiate atherosclerotic from other nonatherosclerotic causes of STEMI as IVUS was not employed in the present study.

## 5. Conclusion

AWMI is the most common presentation of STEMI among the very young adults in the Indian population. SVD is the most common angiographic diagnosis, with LAD being the most common culprit vessel. Smoking was found to be the most common preventable risk factor. Smokeless tobacco consumption needs further testing to be established as a cardiovascular risk factor. Early diagnosis and treatment of CAD and its modifiable risk factors can have a huge impact on survival in this productive age group.

## Conflict of interest

All authors have none to declare.

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