Acute myocardial infarction in very young adults: A clinical presentation, risk factors, hospital outcome index, and their angiographic characteristics in North India-AMIYA Study

Santosh Kumar Sinha[1], Vinay Krishna[1], Ramesh Thakur[2], Ashutosh Kumar[3], Vikas Mishra[3], Mukesh Jitendra Jha[3], Karandeep Singh[3], Mohit Sachan[3], Rupesh Sinha[3], Mohammad Asif[3], Nasar Afdaali[3], Chandra Mohan Varma[2]

Original Article

Abstract

BACKGROUND: India is currently in the fourth stage of epidemiological transitions where cardiovascular disease is the leading cause of mortality and morbidity. Purpose of the present study was to assess the risk factors, clinical presentation, angiographic profile including severity, and in-hospital outcome of very young adults (aged ≤ 30 years) with first acute myocardial infarction (AMI).

METHODS: Total of 1,116 consecutive patients with ST-segment elevation acute myocardial infarction (STEMI) were studied between March 2013 and February 2015 at LPS Institute of Cardiology, Kanpur, Uttar Pradesh, India.

RESULTS: Mean age of the patients was 26.3 years. Risk factors were smoking (78.5%), family history of premature coronary artery disease (CAD) (46.8%), obesity (39.1%), physical inactivity (38.7%) and stressful life events (29.6%). The most common symptom and presentation was chest pain and anterior wall myocardial infarction (AWMI) in 94.8% and 58.8%, respectively. About 80.6% of patients had obstructive CAD with single vessel disease (57.6%), double-vessel disease (12.9%) and left main involvement (3.2%). Left anterior descending (LAD) was commonest culprit artery (58.1%) followed by right coronary artery in 28.2%. In-hospital mortality was 2.8%. Percutaneous coronary intervention was performed in 71.6% of patients. Median number and length of stent were 1.18 and 28 ± 16 mm, respectively.

CONCLUSION: AMI in very young adult occurred most commonly in male. Smoking was the most common risk factor. AWMI owing to LAD artery involvement was the most common presentation. Mean time of presentation after symptom onset was 16.9 hours. In contrast to western population, it is characterised by earlier onset, delayed presentation, more severity, diffuse disease, and more morbidity but with favourable in-hospital mortality.

Keywords: Myocardial Infarction, Angiography, Percutaneous Coronary Intervention, Young Adults

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Introduction

Coronary artery disease (CAD) is the leading cause of mortality worldwide[1] and by 2020, will be the leading cause of disability.[2] India is going through an epidemiologic transition whereby burden of communicable diseases has been declining slowly, but that of non-communicable diseases (NCD) has been rising rapidly, thus facing a dual burden. Current estimates from various epidemiologic studies indicate the prevalence of coronary heart disease (CHD) to be 7%-13% in urban[3] and 2%-7% in rural[4] populations. Acute myocardial infarction (AMI) is one of the most common presentations of CAD.[5] Although individuals younger than 40 years of age account for only 3% of all patients with coronary artery disease,[6] they are not completely immune from CAD.[7] Additionally, AMI in very young patients aged ≤ 35 years has been poorly

1- Assistant Professor, Department of Cardiology, Laxmipat Singhania (LPS) Institute of Cardiology, Ganesh Shankar Vidyarthi Memorial (GSVM) Medical College, Kanpur, India
2- Professor, Department of Cardiology, Laxmipat Singhania (LPS) Institute of Cardiology, Ganesh Shankar Vidyarthi Memorial (GSVM) Medical College, Kanpur, India
3- Department of Cardiology, Laxmipat Singhania (LPS)Institute of Cardiology, Ganesh Shankar Vidyarthi Memorial (GSVM) Medical College, Kanpur, India
Correspondence to: Santosh Kumar Sinha, Email: fionasan@rediffmail.com

described but is estimated to be less than 2%.[8] 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.[9] CAD among Indians occur at a younger age, with more extensive angiographic involvement contributed by genetic, metabolic, and conventional causes.[10] Hypertriglyceridemia, low levels of high-density lipoprotein cholesterol (HDL-C), metabolic syndrome, high lipoprotein-a, dietary habits, and unplanned modernization associated with sedentary but stressful lifestyle are suggested as additional risk factors for CAD. Apart from smoking, ST-segment elevation acute myocardial infarction (STEMI) in the very young (≤ 30 years) is likely related to drug abuse[11] or non-traditional risk factors, such as hyperhomocysteinemia.[12] The pattern of care and outcomes of very young with STEMI is therefore not well defined.[13] Coronary angiography (CAG) performed in young patients with AMI has identified a relatively high incidence of non-obstructive stenosis or single-vessel disease.[2] Very few studies have been conducted among North Indian patients regarding the risk factors, clinical features, coronary angiographic findings and in-hospital outcome in very young adults (< 30 years) with STEMI. So, this study was conducted to learn the details of such patients.

Materials and Methods

The present study was a prospective, single-center trial conducted among 1,116 patients. 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 compelling the principal of Helsinki.

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. Bodyweight was measured in kilograms to the nearest 0.1 kg using a digital scale, which was calibrated regularly. Height was measured to the nearest 5 mm using a height gauge. Body mass index (BMI), was also calculated using Quetlet's formula as weight in kg/square of the height in meters.[2] Overweight was defined as BMI > 25 kg/m^2. 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.

Statistical analyses were performed using the SPSS for windows (version 17.0, 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.

Results

Baseline Characteristics: The mean age of the patients was 26 ± 3.9 years, with a maximum number of patients (60.2%) being within the age of 25–30 years and the rest in the age group of 20-25 years. The youngest patient was 20.1 years old. Men comprised 95.1% (n = 1061) of the patients (Table 1). AMI in very young patients was highly prevalent in urban population (63.9%). Smoking was the most common risk factor (77.4%), hyperlipidemia being the second common risk factor (78.5%), whereas 46.8% of the patients had a family history of premature CAD. Hypertension was seen in 229 patients (20.5%) while 191 patients had diabetes (17.2%). Hyperhomocysteinemia was present in 214 (19.2%) patients. Physical inactivity was present in 432 (38.7%) patients and obesity in 437 (39.1%) patients. Substance abuse was rare, 52 patients reported using cannabis (4.6%). Oral contraceptive drugs were used by 34 women (35.7%) while 27 (28.5%) were either tobacco chewer or smoker. Out of 95 five women (4.1%) were unmarried.

Mode of clinical presentation: The most common symptom was chest pain in 1057 (94.8%) patients with radiation of pain (49.7%), followed by sweating 1002 (89.8%), nausea/vomiting 370 (33.2%), breathlessness 98 (8.8%), and palpitations 46 (4.2%). Fifty patients (4.5%) had atypical symptoms. One hundred ninety-nine patients (17.8%) experienced prodromal symptoms (Table 2).

Table 1. Baseline characteristics of the patients (n = 1116)

Variables	n (%)
Age (year)	26.0 ± 3.9
Sex (male/female)	1061/95 (95.1/4.9)
Background (urban/rural)	714/452 (63.9/36.1)
Smoking	877 (78.5)
Hypertension	229 (20.5)
Diabetes	191 (17.2)
Family history of premature CAD	522 (46.8)
Obesity	437 (39.1)
Hyperhomocysteinemia	214 (19.2)
Physical inactivity	432 (38.7)
Substance abuse (cannabis)	52 (4.6)
Stressful life events	330 (29.6)
Dyslipidemia	236 (21.2)
Total cholesterol (mg/dl)	193.7 ± 36.4
LDL-C (mg/dl)	123.2 ± 26.1
TG (mg/dl)	177.1 ± 57.4
HDL-C (mg/dl)	33.2 ± 7.3
Non-HDL-C (mg/dl)	158.0 ± 14.9

CAD: Coronary artery disease; LDL-C: Low-density lipoprotein cholesterol; TG: Triglyceride; HDL-C: High-density lipoprotein cholesterol

The mean time of presentation after the onset of the symptoms was 16.9 hours.

Table 2. Clinical characteristics of the patients (n = 1116)

Variables	n (%)
Clinical presentation	
Chest pain	1057 (94.8)
Breathlessness	98 (8.8)
Nausea/vomiting	370 (33.2)
Sweating	1002 (89.8)
Palpitation	46 (4.2)
Diarrhea	123 (11.1)
Violent urge to defecate	35 (3.2)
Syncope	26 (2.3)
Atypical presentation	50 (4.5)
Prodromal symptoms	199 (17.4)
Pattern of AMI	
AWMI	656 (59.0)
IWMI without RVMI	370 (33.0)
IWMI with RVMI	48 (2.5)
LWMI	14 (1.2)

AMI: Acute myocardial infarction; AWMI: Anterior wall myocardial infarction; IWMI: Inferior wall myocardial infarction; RVMI: Right ventricular myocardial infarction; LWMI: Lateral wall myocardial infarction

Anterior wall myocardial infarction (AWMI) was found in 58.8% of the patients, 33.2% had inferior wall MI (IWMI) without right ventricular MI (RVMI), 4.3% had IWMI with RVMI, 2.5% had posteroinferior MI while 1.2% had lateral wall MI (Table 2). All patients were preloaded with 325 mg chewable aspirin and high-dose statin. One hundred seventy patients (15.3%) underwent primary Percutaneous transluminal coronary angioplasty (PTCA) within 12 hours of culprit artery and they received either clopidogrel, prasugrel or ticagrelor. About 310 patients (27.8%) presented late (> 12 hour) and they were managed medically as per guideline. Remaining 620 patients (55.6%) received thrombolysis with streptokinase, reteplase or tenecteplase (Table 3). Eight patients (1.3%) developed intracranial hemorrhage after thrombolysis of whom 4 died (50%). Thirty-one patients (2.7%) were in cardiogenic shock and they were managed with inotropes and Intra-aortic balloon pump (IABP) (Table 3). The remaining 25 patients refused the procedure. The rest of the patients were subjected to coronary angiography with intent to ad hoc PTCA (Figure 1).

Coronary angiographic characteristic and PCI: Angiography was done by either radial or femoral route after Allen's test (TIG Cath-Teumo Inc., USA; JL/JR Medtronic, USA) in 1061 patients. About 855 (80.5%) patients had obstructive CAD, 55 (5.2%) had normal angiogram while 21 (0.02%) had spontaneous dissection. Single vessel disease (SVD) was observed in 611 (71.5%), double vessel disease (DVD) in 137 (16.1%), triple vessel disease (TVD) in 56 (6.6%), left main in 28 (3.2%) and anomalous coronaries in 23 (2.3%) patients.

Table 3. Medications used during hospital stay (n = 1116)

Variables	n (%)
Aspirin	1116 (100)
Clopidogrel	817 (73.3)
Prasugrel	221 (19.8)
Ticagrelor	78 (6.9)
Tenecteplase (TNK)	266 (43.0)
Reteplase	85 (17.0)
Streptokinase (STK)	269 (44.0)
Statin	1116 (100)
Beta-blocker	794 (71.2)
ACEI/ARBs	721 (64.5)
Diuretics	299 (26.8)
Aldosterone antagonist	126 (11.3)
Amiodarone	24 (2.3)
Lignocaine (i.v)	26 (12.4)
Inotropes (i.v)	59 (5.3)
Magnesium (i.v)	19 (1.7)
Atropine	85 (7.6)
Heparin (UFH)	494 (44.3)
Enoxaparine	959 (85.9)
Abciximab	101 (9.1)
Temporary pacing	36 (3.2)
IABP	31 (2.7)
Stents [total number/number of patients (%)]	945/799 (71.6)
BMS	43 (5.3)
DES	902 (94.7)
i. Everolimus eluting stent	378 (41.4)
ii. Zotarolimus eluting stent	397 (44.4)
iii. Sirolimus eluting stent	109 (12.3)
BRS	18 (1.9)
Median stents/patient	1.18
LV function (EF)	43.0 ± 6.7
Median length of stent (mm)	28.0 ± 16.0

ACEI/ARBs: Angiotensin converting enzyme inhibitors/angiotensin receptor blockers; IABP: Intra-aortic balloon pump; LV: Left ventricle; BMS: Bare metal stent; DES: Drug-eluting stent; BRS: Bioresorbable scaffold

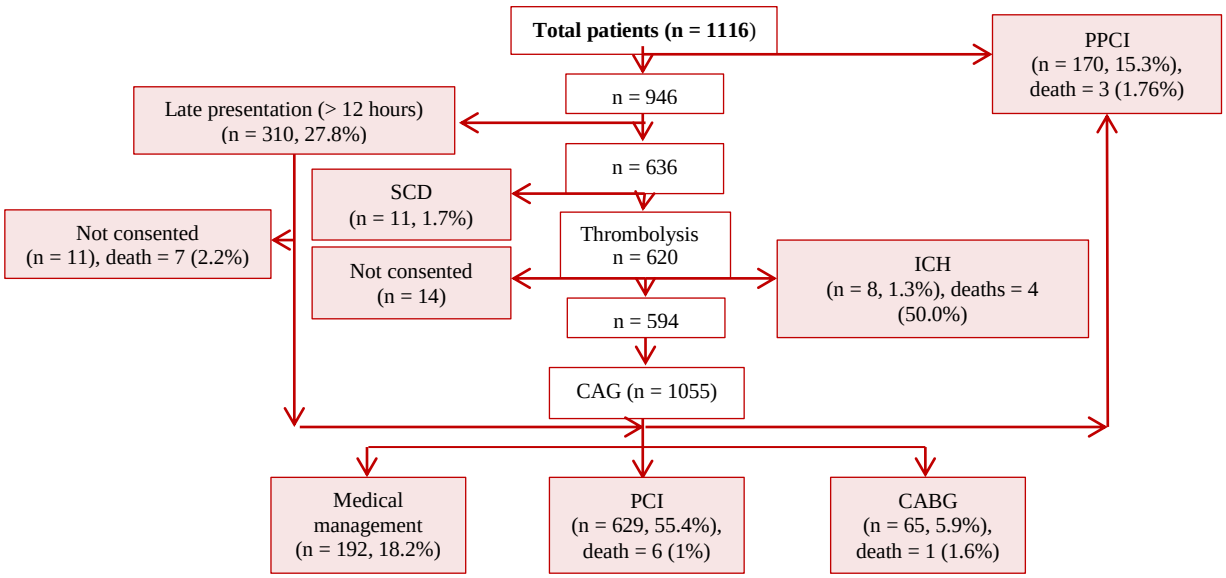

Figure 1. Flow chart of management of patients including their outcome
PPCI: Primary percutaneous coronary intervention; SCD: Sudden cardiac death; CAG: Coronary angiography; PCI: Percutaneous coronary intervention; CABG: Coronary artery bypass graft; ICH: Intracranial hemorrhage

Left anterior descending (LAD) artery was infarct related artery (IRA) in 58.1%, right coronary artery (RCA) in 28.2% and the left circumflex coronary artery (LCX) in 13.7% patients (Table 4).

Table 4. Coronary angiographic characteristics of the patients (n = 1061)

Variables	n (%)
Obstructive CAD	855 (80.6)
Single vessel disease	611 (71.5)
a. LAD	381 (58.1)
b. RCA	185 (28.2)
c. LCX	89 (13.7)
Double Vessel Disease	137 (16.1)
a. LAD and RCA	68 (6.4)
b. LAD and LCX	50 (4.8)
c. RCA and LCX	19 (1.8)
Triple vessel disease	56 (6.6)
Left Main disease	28 (3.2)
a. Isolated involvement	3 (0.3)
b. With SVD	19 (1.8)
c. With DVD/TVD	6 (0.5)
Anomalous coronaries	23 (2.8)
a. Split RCA	3 (13.0)
b. ACAOS	16 (69.6)
c. Single origin giving all three coronary arterie	4 (17.4)
Non-obstructive CAD	130 (12.2)
Spontaneous dissection	21 (0.02)
Normal coronaries	55 (5.2)
Lesion characteristics (length wise)	
a. Type A	34.1
b. Type B	18.4
c. Type C	47.5

CAD: Coronary artery disease; ACAOS: Anomalous coronary artery from opposite sinus; DVD: Double vessel disease; LAD: Left anterior descending artery; LCX: Left circumflex artery; RCA: Right coronary artery; SVD: Single vessel disease; TVD: Triple vessel disease

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). Non-obstructive CAD was seen in 7 (7.3%) female patients whereas 123 (11.5%) of male patients (P = 0.300). Spontaneous dissection was seen in 13 (13.7%) female patients compared to 8 (8.4%) male patients (P < 0.030). Normal coronaries were seen in 4 (4.3%) female patients and 51 (4.8%) of male patients (P = 0.430). Patients with diabetes had trend toward double vessel, multi-vessel and left main involvement in comparison to nondiabetic patients. DVD was seen in 41 (21.4%) of patients with diabetes and in 96 (10.4%) of patients without diabetes. TVD was present in 15 (7.8%) and 41 (4.5%) patients with and without diabetes, respectively (P = 0.040). LMCA was present in 7 (3.7%) and in 21 (2.3%) patients with and without diabetes, respectively (P < 0.050). In 799 (71.6%) patients who underwent PTCA, 945 stents were placed (43 bare metal stent in 40 patients and 902 drug eluting stents among 759 patients) with median of 1.18 stent per patient. Most of them had received everolimus-eluting stent (n = 378, 41.4%) followed by zotarolimus-eluting stent (n = 397, 44.4%), sirolimus-eluting stent (n = 109, 12.3%) and bioresorbable scaffold (n = 18, 1.9%). Lesion characteristics were type A (n = 336, 42%), type B (n = 175, 22%), and type C (n = 288, 36%). Median length of stented lesion was 28 ± 16 mm (Table 3).

Complication of acute coronary syndrome: About 166 (14.9%) patients developed complications during the acute MI phase (Table 5) including persistent chest pain in 26 (2.3%), pericarditis in 28 (2.5%), and heart failure in 114 (10.2%) patients.

Table 5. In-hospital outcome of the patients (n = 1116)

Variables	n (%)
Persistent chest pain	26 (2.3)
Pericarditis	28 (2.5)
Heart failure	114 (10.2)
Atrioventricular (AV) block	50 (4.5)
Arrhythmia	59 (5.2)
Mitral regurgitation	148 (13.2)
Mild to moderate	143 (96.7)
Severe	5 (3.3)
Ventricular septal rupture	4 (0.3)
Rupture of ventricular free wall	2 (0.17)
Cardiogenic shock	55 (4.9)
Pulmonary Edema	26 (2.3)
Intracranial bleed	08 (1.3)
Reinfarction	19 (1.7)
Retro peritoneal bleed	1 (0.1)
Survivor of cardiac arrest	33 (2.9)
Mortality	32 (2.9)

Heart failure was classified according to Killip-Kimball classification. Killip I was found in 21 (1.8%), Killip II in 29 (2.6%), Killip III in 39 (3.5%) and Killip IV in 26 (2.3%) patients. Pulmonary edema occurred in 26 (2.3%) patients of which 4

(4.2%) were female and 22 (95.8%) were male. Fifty-nine (5.3%) patients had severe rhythm disturbances: atrial fibrillation 13 (1.1%), junctional rhythm 16 (1.4%), idioventricular rhythm 7 (0.7%), ventricular tachycardia 19 (1.7%) or ventricular fibrillation 4 (0.3%). Fifty-five (4.9%) patients were in cardiogenic shock of which 5 (5.2%) were female and 50 (5.4%) were male. ventricular septal rupture (VSR) was seen in 4 (0.3%) patients and all were male. Two (0.17%) patients had free wall rupture, one male and one female. 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. 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. Echo based mitral regurgitation (MR) was noted in 148 (13.2%) patients of which 143 (12.3%) patients had mild to moderate MR whereas 5 (0.5%) had severe MR. Of severe MR, two were female and three were male. Intracranial bleeding were reported in 8 patients (1.3%) who had been thrombolysed.

Mortality data: Among 1116 patients, 32 (2.9%) patients died during index hospitalization (5.0 ± 2.1 days) (Table 5 and Figure 1). Mortality was more in 25-30 years age group compared with 20-25 years age group (P = 0.350). Mortality was more in male patients (30 out of 1021, 2.9%) compared to female patients (2 out of 95, 2.1%) with P < 0.01 with similar mean age. In-hospital mortality was more in the group of patients with diabetes (7 out of 191, 3.7%) compared to the group of patients without diabetes (25 out of 925, 2.7%, P = 0.040). There were three deaths (1.76%) in primary PCI group (two had ostial LAD lesion and one had DVD with proximal LAD lesion) of which one had no reflow, one had acute, and another had subacute stent thrombosis. All of them had extensive AWMI with severe left ventricle dysfunction and one was in cardiogenic shock. Sudden cardiac death was noted among 11 patients (1.7%) because of ventricular tachycardia or fibrillation which were though cardioverted but could not be revived. There were seven deaths (2.2%) in those who had presented late (n = 320, 27.8%) of which free wall rupture (n = 2), ventricular septal rupture (n = 4), and sudden death (n = 1) were the reasons. Among eight patients (1.3%) who developed intracranial bleeding, four deaths were observed in thrombolytic group (n = 620). Three had received streptokinase, three had tenecteplase, and two were thrombolysed with reteplase. There were six deaths in pharmaco-invasive PCI group (n = 629, 1%) of which retroperitoneal bleeding (n = 1), stent thrombosis (n = 2), progressive pump failure (n = 1), sepsis (n = 1) and intracranial hemorrhage (n = 1) were the reasons. One who had intracranial hemorrhage had received prasugrel after PCI. One death after CABG surgery was attributed to multi-organ failure.

Discussion

With rising prevalence of CAD in India, World Health Organization (WHO) estimates that by the end of 2020, India will be the cardio-diabetic capital of the globe. CVD tends to be more aggressive and starts manifesting at a younger age[14] which was also noted in our study. One of the most consistently demonstrated risk factors for CAD is male sex. The skewed gender distribution among males (95.1%) vs females (4.9%) of the study population is attributed to the protective effects of estrogens in preventing atherosclerosis and prevalence of smoking which was much more common amongst male that has been clearly demonstrated in various epidemiological studies.[15] It manifests decades earlier than western population as in GUSTO trial in which mean age was 62 ± 5 years as conducted by Hochman et al.[16] Atypical presentation which is also common amongst female has also got a role to play; a feature noted in INTERHEART study (overall male, 76%) and its South Asian cohort (85%).[17]

MI without prodromal symptoms is more common in younger patients with CAD[18] as seen in our study. Histopathological studies have shown that these plaques contain more lipid with relative lack of cellular scar tissue and are present for a shorter period of time or develop more quickly than plaques seen in older patients. These vulnerable plaques are prone to rupture that attributes for more STEMI at younger age than chronic stable angina.[19] High prevalence of stressful life events (29.6%) may have accounted for the instability of the plaque leading to its rupture culminating into STEMI. The relatively high prevalence of DVD (21.4%) and TVD (7.8%) in patients with diabetes when compared with those free of diabetes (10.4% and 4.5%, respectively) confirms the role of diabetes as a risk factor in CAD.[19]

Hypertension is another conventional risk factor for CAD. In our study, 20.5% of the patients had

hypertension which was lower than South Asian cohort of INTERHEART study (31.1%) as population subgroup were different.[17]

Following age, cigarette smoking is the most important and consistent risk factor for CAD with contribution ranging from 62% to 90%[20,21] in various studies. Like previous studies, smokers comprised 78.5% of the population.[22] It adversely affects all phases of atherosclerosis by hastening thrombotic process, endothelial dysfunction, and coronary vasoconstriction, induces proinflammatory effects and ultimately creats a thrombotic milieu. Smoking cessation should be started as primordial prevention. There should be a strong legislation as well to prevent its uptake as it will cut down the major risk.

Obesity was the infrequent cause in all the earlier studies with incidence of 3.3%–20%.[20] Physical inactivity was present in 53.5% patients. The prevalence of obesity was 39.1% in our study which was similar to South Asian cohort of INTERHEART study (44.2%).[17] Lakka et al. in have reported that abdominal obesity is an independent risk factor for acute coronary syndrome in middle-aged men and in combination with smoking, the risk of coronary events increases by 5.5 times.[22] Central obesity, an important component of metabolic syndrome is more frequent in persons of Indian origin.

In our study, hyperhomocysteinemia was seen in 58.5% of the patients with MI which was consistent with the study by Masoomi et al.[23] reporting a prevalence of 49.4%. These observations are important for primary prevention in India. The mechanisms include its effect on the vascular endothelium, platelets and its role in increasing the risk of thrombosis.[24]

In our study TG was directly and HDL-C was inversely related with relative risk of MI, a finding similarly shown by Hughes et al. among Asian Indians in contrast with western world where increased low-density lipoprotein (LDL) is more responsible for CAD.[25] Another finding which emerged from our study was that non-HDL-C may also be an implicating factor.

AWMI was the most common STEMI in our study which was similar to earlier studies among those ≤ 35 years.[16] Angiographic data in very young patients of STEMI is sparse as only a very small percentage of young patients undergo angiography. Regarding the extent of coronary lesions, our study revealed a preponderance of SVD followed by DVD and TVD among both sexes, which had also been reported by another study.[26] Among various studies among patients < 35 years of age, significant CAD was seen in 73.3% to 78% of the patients following the first MI[18,27] and TVD in 42% which is similar to our study although incidence of TVD in our study was much lower. Our finding is consistent with the other studies carried among Indian population but angiography was carried in a smaller fraction of patients than ours.[3,16,19] Also, the rate of total occlusion was quite high as acute thrombosis of a single lesion as a cause of infarction in patients with SVD and otherwise normal coronary arteries.[20] This was also our finding as 15.3% of patients underwent primary PCI and 55.4% of patients underwent PCI after thrombolysis meaning that all these lesions were amenable for PCI. Only a small fraction of patients received primary PCI as it was more expensive. Also, cath-lab is nonoperational at night and many patients were admitted during night-time and therefore the majority received pharmaco-invasive treatments. Similarly, in the daytime, when expected door to balloon time was ≥ 90 min, thrombolysis was offered and subsequently PCI was performed. The extent of disease was also advanced as two third had either type B or C lesion. Left main involvement was higher (3.2%) than previous studies which implies different atherosclerotic behavior and burden than western population. Another interesting finding in our study was anomalous origin of coronary arteries from opposite sinus (2.8%) and single origin of all three coronary arteries in 4 cases which in itself is exceedingly rare. Incidence of angiographically normal coronary arteries in patient < 35 years in various studies were 9% to 17% which appears little higher than ours (5.2%)[20,28] but most of these studies are from the western world. Causes could be coronary spasm, spontaneous recanalization or thrombosis with reperfusion.[29] Rupture of an insignificant plaque promoting thrombosis may have caused infarction and subsequent lysis may then leave lumen intact. Without intravascular ultrasound, possibility of Glagov phenomenon cannot be ruled out. High prevalence of complex lesions (25.9%) observed in our study suggests that premature CAD is associated with rapid disease progression rather than a gradually evolving process.[30] Left main disease were significantly higher in view of diabetes. Unstable left main and those with mechanical complication were urgently referred for CABG surgery and those who were not amenable for PCI were referred for staged CABG surgery. Spontaneous dissection as cause of STEMI was significantly higher in women.

Complications as VSR, cardiogenic shock, free wall rupture and pulmonary edema were more common in women and in patients with diabetes as explained by other studies.[31] Late presentation, atypical presentation and underlying TVD or left main involvement were the reasons. Increased awareness and education will be of great importance to cut down these complications. Local site complication was slightly higher in femoral route. In-hospital mortality was also significantly higher among patients with diabetes and multivessel disease in our study but the overall outcome was fair.

Conclusion

AWMI owing to LAD occlusion is the most common presentation of STEMI among the Indian population < 30 years which manifests decades earlier compared to Western population. Smoking, family history of premature CAD, hyperhomocysteinemia and obesity were the most common risk factors. Multivessel disease and complication were more in diabetic population but had favorable in-hospital outcome overall. Primordial prevention about smoking cessation and life style modification in cutting down obesity will be important epidemiological tool. Awareness on this topic, importance of golden hour and early diagnosis and treatment will have huge economic impact as sizeable number of patients present late.

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Conflict of Interests

Authors have no conflict of interests.

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