

# A Study of Risk Factor Profile and Pattern of Coronary Artery Involvement in ACS in Young Patients.

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## ABSTRACT

- Aim:** To study the modifiable and non-modifiable risk factors, multiplicative effects of different combinations of different risk factors & the pattern of coronary artery involvement in young patients (<40 years of age).
- Methods:** The included 30 consecutive patients presenting with typical clinical symptoms of ACS (UA, NSTEMI & STEMI). All patients were subjected to detailed clinical history and were thoroughly evaluated by routine investigations along with cardiac biomarkers, ECG, echocardiography, and coronary angiography.
- Results:** The majority of patients (93.7%) were in the age group 31-40 years. Mean age was 36.8±3.3 years and 27 (90%) of the patients were males. All patients were symptomatic. 29 of 30 patients had STEMI and Anterior Wall MI (53.33%) was the most common MI in these young patients. Urbanisation (76.66%) and sedentary lifestyle (70%) were found as the common predisposing factor for CAD in young patients. Smoking (90%) was the most common risk factor in these patients, followed by hypertension (50%). Contrary to expectations the incidence of diabetes was low (6.66%). Central obesity (53.33%), hypertension (50%) and low - HDL (40%) were the most common components of metabolic syndrome. 29 (96.66 %) patients were found to have high-LDL. There were only 3 (10%) patients with normal CAG finding, in contrast to the old believe that a large number of younger patients have normal CAG finding. SVD (70%) was the most common angiographic finding with LAD (66.66%) as the most common coronary artery involved in the young patients.
- Conclusions:** Our study is a reflection of the profile of lower and lower-middle, semi-urban & urban population, which forms a huge population load in our country. This is a small descriptive study but breaks several myths possibly reflecting the rapid transformation. Larger multi-centric similar studies are needed to enable us to plan for primary and secondary preventive strategies in this large subset of our population.

**Key words:** **ACS** - Acute Coronary Syndrome, **UA** - Unstable Angina, **NSTEMI** - Non ST Elevation MI.

## Introduction

Acute coronary syndromes (ACS) are a major health problem and account for a large proportion of the total number of hospitalizations all over the world [1]. There is a general agreement on a multi-factorial etiology of CAD and the fact that incidence of CAD increases with age [2]. Nevertheless, it has been recognized in young age group more frequently in recent years [3-4]. Worldwide about 4% of the patients with myocardial infarction (MI) are younger than 40 years of age [5, 6]. CAD is the single largest cause of mortality in the developed world.

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While the death rates have been declining for the past 3 decades in the West, they are progressively rising in India [7]. CAD in Indians occurs at a younger age, is more severe and extensive, and follows a malignant course [8]. Asian Indians around the globe have the highest rates of coronary artery disease (CAD). Typically the first myocardial infarction (MI) occurs about 7-10 years earlier among Asian Indians than others [9, 10]. India has a higher proportion of young population with only 3% of the population >65yrs of age (compared to 13% in the US). By 2015, India is projected to have 62 million patients with CAD, of which 23 million will be <40 year of age and only 11 million above 60 years of age [11].

As found in recent studies, the pattern of CAD in India is different from the developed countries [12] in that it appears a decade earlier than in the developed countries, males are affected far more than the females, Hypertension and Diabetes mellitus (DM) are present in about 40% of all cases and heavy smoking is responsible etiology in many cases.

Keeping these in mind, the present study was planned to know the clinical profile, modifiable & non modifiable risk factors and pattern of coronary artery involvement in young patients (<40yrs of age).

## Material and Methods

30 consecutive patients, less than or equal to 40 years old presenting with Acute Coronary Syndrome (Unstable Angina - UA, Non ST Elevation Myocardial infarction – NSTEMI and ST Elevation Myocardial Infarction – STEMI) at departments of Cardiology and Medicine at Vardhman Mahavir Medical College and Safdarjung Hospital, New-Delhi between July 09 to October 10 were studied. Written informed consent was taken from all the patients and institutional ethics committee approved the study. The diagnosis of ACS was established as per the standard of ACC/AHA criteria - typical history of chest pain/discomfort, ECG changes, and increased myocardial biomarkers. Patients aged > 40 years, patients refusing indoor admission, having advance renal failure, having history of bleeding disorder and Patients with history of allergies to dye were excluded from the study.

Details of pain including duration, mode of onset, nature/character, frequency, severity, pattern of recurrences, location, radiation, aggravating & relieving factors were noted. Presence of other cardinal symptoms such as shortness of breath, palpitation, diaphoresis, syncope, nausea & vomiting were also enquired.

Besides routine physical examination, height, weight, waist: hip ratio, body mass index were noted. Routine investigations (complete hemogram, renal function test, liver function test, blood sugar-fasting/postprandial, urine-routine/microscopy), fasting lipid profile, cardiac biomarkers, ECG, echocardiography were done. The patients were managed as per the standard hospital protocols and underwent coronary angiography (CAG) during the management. The patients were evaluated as per the NCEP -ATP 2001 criteria for metabolic syndrome

[18] as listed in the table 1.

As per the NCEP - ATP 2001 - Presence of 3/ $\geq$ 3 of the risk factors is required for the diagnosis of metabolic syndrome. Lipids were measured within 24 hours of admission.

## Cardiac bio-marker Trop-I

Troponin I test was done by a rapid, one step immunochromatographic test device (Immucheck Troponin I Test device) to ascertain the myocardial necrosis. **CPK-MB:** The test was done by fully automated chemistry analyzer Hitachi 912, using commercially available kit, if indicated.

## Electrocardiogram

The standard 12 lead ECG was done, using Cardiart 8010 machine. The paper speed was kept at 25 mm/sec.

**Echocardiography** was performed on PHILIPS (SONOS-5500) system. The standard para-sternal long-axis, short-axis & apical 4/5 chamber views were taken for M-mode & 2D - measurements.

**Coronary angiography** was performed in eligible patients by femoral approach, at least 4 standard orthogonal views were taken for Left and 2 for Right coronary artery respectively. The lesions were classified for severity on the basis of diameter stenosis using standard AHA criteria ( $\geq$  50% stenosis of Left main coronary artery and  $\geq$  70% stenosis in LAD/ LCX/ RCA were considered as significant). Non-ionic contrast agent was used in all patients.

## RESULTS

A total of 30 patients were admitted during the study period. The mean age (SD) of the patients was 36.8 $\pm$ 3.38 years and the maximum number of patients (93.7%) were in the age group of 31-40 yrs. Majority 27 (90%) of the patients were males. (Table 2)

**Table 1: Criteria for Metabolic Syndrome (MS)**

Risk Factors	Criteria
<b>Central obesity (waist circumference)</b>	Male >102cm, female >88cm. (according to International Diabetes Forum for Asians, Chinese, ethnic south & central Americans ; male $\geq$ 90cm, female $\geq$ 80cm )
<b>Triglycerides</b>	>150mg %
<b>HDL</b>	Male< 40mg %, female < 50mg%
<b>Blood pressure</b>	$\geq$ 130/85 mm hg
<b>Fasting plasma glucose</b>	>100 mg%

**Table 2: Distribution of ACS in different age groups**

AGE	MALE(n=27)	FEMALE(n=3)	TOTAL(n=30)
21-30 YEARS	1(3.7%)	1(33.3%)	2(6.7%)
31-40 YEARS	26(96.3%)	2(66.6%)	28(93.7%)
TOTAL (%)	27 (90%)	3 (10%)	30(100%)

The other important observations and results are listed in tables 2, 3 and 4.

**Characteristics of Acute Coronary Syndrome Patients In The Present Study (table 2)**

	MALE(n=27)	FEMALE(n=3)	TOTAL (n=30)
Age (mean)	37.04±2.91 years	34.66±5.44 years	36.8±3.38 years
BMI( mean)	25.47±3.32 kg/m <sup>2</sup>	22.2±2.14 kg/m <sup>2</sup>	25.14±3.42kg/m <sup>2</sup>
W:H Ratio ( mean)	0.97±0.06	0.92±0.74	.97±0.06
<b>Lipid Profile</b>			
TG-	139±15.04mg%	138±10.8mg%	139.07±14.93mg%
HDL-	40.7±3.3mg%	41.66±4.07mg%	40.8±3.47mg%
LDL-	139.48±20.68mg%	122.66±20.81mg%	137.8±21.66mg%
T.CH-	209.33±21.43mg%	190.33±24.5mg%	207.4±22.87mg%
Current Smoker (%)	26 (96.29%)	1 (33.33%)	27(90%)
Hypertensive (%)	14 (51.85%)	1 (33.33%)	15 (50%)
Diabetic Mellitus (%)	2 (7.4%)	0 (0%)	2 (6.66%)
Family history of premature CAD (%)	4 (14.8%)	1 (33.33%)	5 (16.66%)
<b>CAG finding</b>			
• SVD	21(77.77%)	0	21(70%)
• DVD	5(18.52%)	1 (33.33)	6(20%)
• Normal/ insignificant	1 (3.7%)	2 (66.66%)	3 (10%)

**Table 3: ACS Patients and Their Clinical Presenting Complaints**

PRESENTING COMPLAINTS	MALE (n=27)	FEMALE (n=3)	TOTAL(n=30)
1. Chest pain	27 (100%)	3 (100%)	30(100%)
2. Shortness of breath	4 (14.8%)	1 (33.33%)	5(16.66%)

The mean BMI was 25.14±3.42kg/m<sup>2</sup> (25.47± 3.32 kg/m<sup>2</sup> in males and 22.2±2.14 kg/m<sup>2</sup> in females). The mean Waist : Hip ratio (WHR) was 0.97 ±0.06 in these patients. The mean total cholesterol was 207.4±22.87mg% in these patients ( 209.33± 21.43 mg % for males and 190.33±24.5 mg% in female patients). The mean LDL was 137.8±21.66 (139.48±20.68 mg% and 122.66±20.81 mg% in male and female patients respectively). The mean HDL was 40.8±3.47mg% (40.7±3.3 mg% in male patients and 41.66±4.07 mg% in female patients). 27 (90%) of these patients were smokers (26 males and 1 female). 15 (50%) patients among these were hypertensive. Only 2 (6.66%) patients were diabetic. The family history of premature CAD was found in 5 (16.66%) patients. SVD

(70%) was the most common CAG finding in young ACS patients.

Chest pain (100%) was the presenting clinical symptom in all patients whether male or female . The chest pain was accompanied by shortness of breath in 4 males (14.8%) and 1 female (33.3%) patient respectively in this study.

Among male patients; smoking (96.3%) was the commonest risk factor followed by hypertension (51.8%), dyslipidemia (33.33%), family history of CAD (18.5%), diabetes (7.4%) and obesity (3.7%) as other risk factors; while in female patients; dyslipidemia (100%) is the most common risk factor followed by

smoking (33.3%), hypertension (33.3%) and family history of premature CAD (33.3%).

Among the lifestyle risk factors urbanization and sedentary lifestyle were dominant risk factors in the young ACS patients (76.66% and 70% respectively).

#### **Metabolic Syndrome - MS (Tables 4a and 4b)**

Central obesity (53.33%) was the most frequent component of MS in these patients followed by hypertension (50%), low-HDL (40%), hypertriglyceridemia (20%) and diabetes (6.66%).

In male patients; hypertension (51.85%) and central obesity (51.85%) were observed as the most common components of MS followed by low-HDL (33.3%), hypertriglyceridemia (22.2%) and DM (7.4%); while in female patients; low-HDL (100%) is the most common component of MS followed by central obesity (66.6%) and hypertension (33.3%). There was no female patient with DM and hypertriglyceridemia.

20% patients had MS(18.5% males and 33.3% females).

In male patients; 4 (14.8%) patients had only one component of MS, 12 (44%) patients had two and 5 (18.5%) patients had e"3. Among female patients; there were 33.3% each with one, two and three components of MS respectively.

#### **Clinical Presentation (Table 5)**

AWMI (53.33%) was the most common clinical diagnosis in these patients, followed by ALWMI (30%).Among the male patients; AWMI is the most common clinical diagnosis (55.55%) followed by ALWMI (29.6%); while in female patients; AWMI, ALWMI and UA were observed in each 33.3% of patients.

#### **Coronary Angiography (Table- 6 )**

It was observed that; there were 70% patients with Single Vessel Disease (SVD), 20% with double Vessel Disease (DVD) and 10% with normal/insignificant coronary stenosis.

Among the patients with SVD, LAD (46.66%) was the most common coronary involved and in the patients with DVD (20%); LAD+ LCX (16.66%) was the most common angiography finding. Overall LAD (in 20 patients; 66.66%) was the commonest artery involved in this cohort of young ACS patients (<40 years of age).

#### **Lipid Profile and Nature of CAD (Table- 7)**

High-LDL (in 29 patients; 96.66%) was the commonest lipid disorder; followed by low-HDL (40%) and hypertriglyceridemia (20%). It is also observed that among male patients with SVD; 95.24% had high-LDL, 38.1% had low-HDL and 28.57% had hypertriglyceridemia and those with DVD; 100% had high-LDL, 20% had low-HDL. Among females 100% patients had low-HDL and high-LDL.

#### **Discussion**

A study on Acute Coronary Syndromes (ACS) in the young is very relevant to our country since India has a high proportion of young population. Our study reveals several facts which are similar to other small similar studies and many which are different from them.

There has been a great hype in the lay and medical media about the very young (say - less than 30 years old) getting Myocardial Infarction (MI). Our study shows that such patients are still uncommon and formed only 6.7% of the present cohort of young people less than 40 years of age.

**Table - 4 ACS and Their Association with Risk Factors**

RISK FACTORS	MALE (n=27)	FEMALE (n=3)	TOTAL (n=30)
Current Smoker	26(96.3%)	1(33.3%)	27(90%)
Hypertension / On Anti-Hypertensive Drugs	14(51.8%)	1(33.3%)	15(50%)
Dyslipidemia (HDL< 40 mg/dl for men &< 50mg/dl for women )	9(33.3%)	3(100%)	12(40%)
Diabetes / On Medication For DM	2(7.4%)	0(0%)	2(6.66%)
Obesity ( BMI>30 kg/ m <sup>2</sup> )	1(3.7%)	0(0%)	1(3.33%)
Family History Of premature CAD	5(18.5%)	1(33.3%)	6(20%)

**Table-4 (a): ACS Patients and their Association with Metabolic Syndrome**

Factors Of Metabolic Syndrome	Male (n=27)	Female (n=3)	Total (n=30)
Hypertension/ On Anti-Hypertensive Drugs	14(51.85%)	1(33.3%)	15(50%)
Fasting Plasma Glucose > 100mg per dl / On Drugs For DM	2(7.4%)	0	2(6.66%)
Central obesity (waist circumference ≥ 90cm for male/ ≥80cm for female)	14(51.85%)	2(66.6%)	16(53.33%)
Hypertriglyceridemia (>150mg / dl)	6(22.2%)	0	6(20%)
Low HDL (<40mg/dl For Male &< 50mg/dl For Female)	9(33.3%)	3(100%)	12(40%)
Metabolic syndrome ( presence of ≥3 factors)	5(18.5%)	1(33.3%)	6(20%)

**Table-4 (b)**

Components Of MS	MALE(n=27)	FEMALE(n=3)	TOTAL(n=30)
0	6(22.2%)	0	6(20%)
1	4(14.8%)	1(33.3%)	5(16.66%)
2	12(44.4%)	1(33.3%)	13(43.33%)
≥3	5(18.5%)	1(33.3%)	6(20%)

**Table-5 : ACS Patients and their Clinical Diagnosis**

CLINICAL DIAGNOSIS	MALE (n=27)	FEMALE (n=3)	TOTAL (n=30)
UNSTABLE ANGINA	0	1(33.3%)	1(3.3%)
AWMI	15(55.55%)	1(33.3%)	16(53.33%)
LWMI	2(7.4%)	-	2(6.66%)
ALWMI	8(29.6%)	1(33.3%)	9(30%)
IWMI	2(7.4%)	-	2(6.66%)

**Table - 6: ACS Patients and Severity of Coronary Involvement**

CAG FINDINGS	MALE(n=27)	FEMALE(n=3)	TOTAL(n=30)
SVD	21(77.77%)	0	21(70%)
• LAD	14(51.85%)	0	14(46.66%)
• LCX	5(18.51%)	0	5(16.66%)
• RCA	2(7.47%)	0	2(6.66%)
DVD	5(18.51%)	1(33.3%)	6(20%)
• LAD+LCX	5(18.51%)	0	5(16.66%)
• LAD+RCA	0	1	1(3.33%)
Normal / Insignificant CAG finding*	1(3.7%)	2(66.6%)	3(10%)

**Table-7: CAG Findings of ACS Patients and their Lipid Profile**

LIPID PROFILE	MALE (n=27)			FEMALE(n=3)			TOTAL (n=30)
	SVD (n=21)	DVD (n=5)	N (n=1)	SVD (n=0)	DVD (n=1)	N (n=2)	
Low-HDL (<40mg/dl for male & <50mg/dl for female)	8 38.1%	1 20%	-	-	1 100%	2 100%	12(40%)
Hypertriglyceridemia (>150mg/dl)	6 28.57%	-	-	-	-	-	6(20%)
High-LDL (>100mg/dl)	20 95.24%	5 100%	1 100%	-	1 100%	2 100%	29(96.66%)

The mean age in the present study was 36.8 years which is quite close the mean age in similar studies from India . [13,14]. Another major concern is regarding CAD in women. In our study, 90% patients were males giving a M:F ratio of 9:1. Similar studies have shown ratios of 10:1 and 19:1 respectively, suggesting that incidence of CAD especially ACS in women continues to be low. [13,14].

In our study, smoking (90%) was the most common risk factor followed by hypertension (50%), dyslipidemia (40%), family history of premature CAD (20%), diabetes (6.66%) and obesity (3.33%) in these patients. Among the lifestyle risk factors urbanisation (76.66%) and sedentary lifestyle (70%) were show predominance in these young ACS patients. This contrast with study by Mohammed Mustafa et al where there were 41.6% hypertensive, 33.4% diabetic, 20.4% smoker, 18% were dyslipidemic patients and 21.2% had family history of CAD. <sup>15</sup> Sengottuvelu et.al in their study observed that 43.75% had type 2 diabetes mellitus, 18.75% had hypertension and 75% had dyslipidemia. Out of 29 men, 11 patients (37.9%) were smokers. [13]

A look at the metabolic syndrome (MS) reveals that central obesity (53.33%) was as the most frequent component of MS in these patients followed by hypertension (50%), low- HDL (40%), hypertriglyceridemia (20%) and diabetes (6.66%) hence revealing that our fears that obesity is a major problem in our country. A glaring difference between components of MS was presence of low HDL in all women compared to only 33% of men. This may be a chance finding considering that 90% patients were men or it may be a highly significant finding awaiting further studies. Obesity was an issue in 2/3<sup>ths</sup> of women and is again an important finding. Overall nearly one in five patients had metabolic syndrome.

All but one patient in the present study presented with Acute MI and none presented with Non ST Elevation MI (NSTEMI) or Unstable Angina. This is contrasts with the study by Alappatt et al from Kerala who showed that 64.9

% males and only 38.5% females presented with AMI. [15]. All patients in our study presented with chest pain and only 4/30 had associated dyspnea . Interestingly, in Alappatt's study also all patients had chest pain or discomfort as the presenting feature. This quite contrasts with the overall and elderly people where a third or more patients have atypical symptoms.

90% of the patients had anterior wall or anterolateral MI and only 2/3 had inferior MI. This is quite at variance with the findings of Sengottuvelu et.al who found inferior MI and NSTEMI in about 22% cases each. M.A. Srilakshmi et.al. had inferior MI and NSTEMI in 17% and 10% respectively. This may reflect changing patterns as the studies were earlier in time.

There were only 3 (10%) patients with normal coronaries, in contrast to the old belief that a large number of younger patients have normal coronaries. Single Vessel Disease (70%) was the commonest finding with LAD (66.66%) being the commonest coronary artery involved.

## Conclusion

Ours is a small descriptive study. Several myths of previous studies on young CAD patients appear to be questioned and newer findings are suggested e.g. in majority of the previous studies, diabetes and dyslipidemia were the major risk factors. In our study smoking (90%), central obesity (53.33%) and hypertension (50%) were the most common risk factors. Our study is a reflection of the changing profile of lower and lower-middle, semi-urban & urban population, which form the major chunk of population of our country. Larger multi-centric similar studies are apparently needed to enable us to plan for primary and secondary preventive strategies in this large population of our country.

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**Ethics:** There is no ethical violation as it is based on voluntary anonymous interviews

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