



Original Article

Study of Risk Factors Associated with CAD in Young Patients

Dr. Manish Sharma¹, Dr. R.K. Jha²

¹ PG Student, Department of General Medicine, Sri Aurobindo Medical College & PG Institute-Indore (M.P.)

² Professor & HOD, Department of Gen. Medicine, Sri Aurobindo Medical College & PG Institute-Indore (M.P.)

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Corresponding Author:

Dr. Manish Sharma

PG Student, Department of
General Medicine, Sri Aurobindo
Medical College & PG Institute-
Indore (M.P.).

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ABSTRACT

Background: Coronary artery disease (CAD) is a new emerging clinical and public health problem in the young adults (≤ 45 years) especially in India where CAD happens nearly a decade earlier than in Western population. The risk factor profile in young patients is quite different than that in older adults and requires dedicated investigation.

Objectives: To evaluate the prevalence of conventional risk factors in young CAD patients and to analyze their association with the type of CAD presentation.

Methods: The research study of cross sectional type was carried out in the Department of Medicine of Sri Aurobindo Institute of Medical Sciences and Post Graduate Institute, Indore, Madhya Pradesh for a period of 18 months (June 2024–November 2025). A total of 102 younger patients (aged 18–45 years) presenting with CAD were recruited. The data was recorded using pre-structured proforma such as clinical, biochemical, echocardiographic.

Results: Most of the patients (58.8%) were from the 36–45 years age group. Thus, patients' mean age was 38.4 ± 5.2 years. Males predominated (76.5%). The most common conventional risk factor was dyslipidemia (60.8%), followed by smoking (56.9%), hypertension (44.1%) smokeless tobacco (40.2%), diabetes (37.3%) family history of CAD (31.4%) obesity (27.5%) The most common clinical presentation was STEMI (63.7%), with the largest subgroup being Anterior Wall MI (34.3%). Troponin I level was raised in 83.3% and CPK-MB in 73.5% patients. In 47.1% of cases, the ejection fraction was reduced ($< 50\%$). There was a significant difference in STEMI with smoking ($p = 0.04$). There was no difference for other risk factors concerning CAD types ($p > 0.05$).

Conclusion: The major risk factors for CAD in young patients include dyslipidemia, smoking, hypertension, and smokeless tobacco use. STEMI is the most referring kind correlated with Smoking. These findings highlight the important need for targeted modifications of risk factors and preventive interventions at a young age.

Keywords: Coronary artery disease, young adults, risk factors, STEMI, dyslipidemia, smoking, India.

INTRODUCTION

Coronary artery disease (CAD) is responsible for approximately 17.8 million deaths annually. CAD is the leading cause of morbidity and mortality all around the world. [1]CAD is known as a disease of the elderly.[2] However, there have been increasing reports of CAD in young individuals. This poses a serious and emerging public health problem. Early-onset CAD, defined as CAD before age 45 in men and 55 in women, has been associated with serious long-term adverse outcomes, especially recurrent myocardial infarction, heart failure, and premature death.[3]Indians among South Asians have been found to be at high risk for premature CAD. Evidence from epidemiology states that Indians develop CAD a decade earlier than westerners and in a more severe form with a greater plaque burden and an increased likelihood of multivessel involvement. According to recently available data, the occurrence of CAD cases in India in patients less than 45 years of age is about 1.2% which is on the rise due to rapid urbanization, lifestyle changes, and rising number of patients with metabolic risk factors. [4]The common risk factors of CAD like dyslipidemia, systemic hypertension, diabetes mellitus, smoking and use of tobacco, obesity, and positive family history are well known in the general adult

population.[5] However, the relative contribution and clustering of these risk factors in young patients of CAD are quite different from older individuals. Smoking and dyslipidemia are the most commonly reported modifiable risk factors in young CAD patients as a group, accounting for most attributable risk.[3] Additional non-traditional causes, contributing to premature atherosclerosis among younger adults, are the sedentary lifestyle, psychosocial stress, substance abuse, and genetic predisposition like familial hypercholesterolaemia and increased lipoprotein(a).According to a clinical perspective, young patients with CAD usually have acute coronary syndromes, mainly STEMI as the first manifestation of the disease with no prior warning symptoms.[6] Young CAD is not a spontaneous syndrome. Their mechanism of acute rupture-prone, lipid-rich plaque with a thin fibrous cap is different from that of older patients who generally present with stable angina and obstructive calcified lesions, and sometimes with acute coronary syndrome. Males appear to be dominate group with a male-to-female ratio of about 3–4:1 in young CAD studies. [7]Though there is a lot of information available regarding this topic, there is still a lack of studies assessing prevalence, clustering and clinical significance of risk factors in young CAD patients from Central India. In order to devise targeted preventive strategies, bolster primary care protocols, and curb overall CV disease burden, it is imperative to have a clear understanding of risk factor profile, clinical presentation and biochemical features of young CAD population in this area. To assess the risk factors for CAD among young patients (≤ 45 years) and their relation to specific CAD presentations, this study was thus undertaken.

MATERIALS AND METHODS

Study Design and Setting: This research was conducted as a cross-sectional study. The study was carried out in the Department of Medicine at **Sri Aurobindo Institute of Medical Sciences and Post Graduate Institute, Indore, Madhya Pradesh**. The planned duration for the study was 18 months, extending from June 2024 to November 2025.

Study Population and Sample Size The target population comprised young adults aged between 18 and 45 years. The sample size was calculated to be 102 patients. This calculation was based on an analysis of Medical Record Department (MRD) data, which indicated an average admission rate of 8 to 9 young Coronary Artery Disease (CAD) patients per month in the cardiology inpatient department, projecting a total of 102 patients over a 12-month active study period .

Inclusion Criteria: The study included patients of either gender, aged > 18 years and ≤ 45 years, who presented with angina or an angina equivalent, unstable angina, acute ST-elevation myocardial infarction (STEMI), or non-ST-elevation myocardial infarction (NSTEMI). Enrollment was based on the first-time referral due to clinical suspicion of CAD, including corresponding electrocardiographic changes, ischemic symptoms, or elevated biomarkers of myocardial injury.

Exclusion Criteria: Patients who refused to provide written informed consent were excluded from the study.

Data Collection and Clinical Procedure Data collection was facilitated using a pre-structured patient proforma . A detailed clinical evaluation and history were obtained from all enrolled subjects. Demographic details were recorded alongside a comprehensive assessment of conventional cardiovascular risk factors, including systemic hypertension, diabetes mellitus, dyslipidemia, family history of CAD, obesity, and the use of smoking or smokeless tobacco .

Biochemical Evaluation and Investigations All patients underwent a thorough clinical examination followed by baseline and cardiac-specific investigations.

Baseline Investigations: Included a complete blood count, fasting blood sugar, renal function tests, a comprehensive lipid profile, and a chest X-ray.

Cardiac Investigations: Electrocardiography (ECG) and Echocardiography were performed for all patients. Myocardial injury was assessed using cardiac biomarkers, specifically Troponin I, Troponin T, and CPK-MB. Data obtained from these blood investigations were directly transcribed from the laboratory reports into the clinical proforma.

Ethical Considerations The study protocol was submitted to and approved by the Institutional Ethics Committee of Sri Aurobindo Medical College & P.G. Institute. Written informed consent, available in both English and Hindi, was obtained from all participants or their legally acceptable representatives after explaining the nature, purpose, and voluntary design of the study. Patient confidentiality was strictly maintained, and clinical data was utilized solely for academic and scientific purposes.

RESULTS

A total of 102 young CAD patients were enrolled in the study. The majority belonged to the 36–45 years age group (58.8%), with a mean age of 38.4 ± 5.2 years, and males predominated (76.5%); a sedentary occupational profile was noted in 63.7% of participants (Table 1). Among conventional risk factors, dyslipidemia was the most prevalent (60.8%), followed by smoking (56.9%), hypertension (44.1%), smokeless tobacco use (40.2%), diabetes mellitus (37.3%), family history of CAD (31.4%), and obesity (27.5%); notably, 5.9% of patients presented without any identifiable conventional risk factor (Table 2). On admission, chest pain was the predominant symptom (92.2%), followed by dyspnea (51.0%), palpitation (34.3%), and syncope (11.8%); STEMI was the most common clinical presentation (63.7%), with anterior wall MI accounting for the largest subgroup (34.3%), while NSTEMI, unstable angina, and chronic stable angina were seen in 19.6%, 11.8%, and 4.9% of patients, respectively (Table 3). Biochemical evaluation revealed elevated Troponin I in 83.3%, Troponin T in 78.4%, and CPK-MB in 73.5% of patients; echocardiography demonstrated reduced ejection fraction ($<50\%$) in 47.1% of cases, while 52.9% had preserved ejection fraction (Table 4). On analyzing the association between risk factors and CAD presentation, smoking showed a statistically significant association with STEMI ($p = 0.04$), being most prevalent among STEMI patients (64.6%), whereas dyslipidemia, hypertension, diabetes mellitus, and family history of CAD showed no statistically significant difference across CAD subtypes ($p > 0.05$ for all) (Table 5).

Table 1: Baseline Demographic Characteristics of Young CAD Patients

Demographic Variable	Frequency (N = 102)	Percentage (%)
Age Group (Years)		
18 - 25	8	7.8%
26 - 35	34	33.3%
36 - 45	60	58.8%
Mean Age $\pm$ SD	38.4 $\pm$ 5.2 years	38.4 $\pm$ 5.2 years
Gender		
Male	78	76.5%
Female	24	23.5%
Occupation Profile		
Sedentary Lifestyle	65	63.7%
Active/Manual Labor	37	36.3%

Table 2: Prevalence of Conventional Risk Factors in the Study Population

Risk Factor	Present (N)	Percentage (%)	Absent (N)	Percentage (%)
Dyslipidemia	62	60.8%	40	39.2%
Smoking	58	56.9%	44	43.1%
Hypertension	45	44.1%	57	55.9%
Smokeless Tobacco Use	41	40.2%	61	59.8%
Diabetes Mellitus	38	37.3%	64	62.7%
Family History of CAD	32	31.4%	70	68.6%
Obesity (BMI > 25)	28	27.5%	74	72.5%
Patients Without Risk Factors	6	5.9%	96	94.1%

Table 3: Clinical Presentation and Symptoms on Admission

Clinical Parameters	Frequency (N = 102)	Percentage (%)
Presenting Symptoms		
Chest Pain	94	92.2%
Dyspnea	52	51.0%
Palpitation	35	34.3%
Syncope	12	11.8%
Clinical Presentation (Diagnosis)		
STEMI (Total)	65	63.7%
-- Anterior Wall MI (AWMI)	35	34.3%
-- Inferior Wall MI (IWMI)	25	24.5%
-- Lateral Wall MI (LWMI)	5	4.9%
NSTEMI	20	19.6%
Unstable Angina	12	11.8%
Chronic Stable Angina	5	4.9%

Table 4: Biochemical and Echocardiographic Profile

Investigation Parameter	Abnormal / Elevated (N)	Percentage (%)	Normal (N)	Percentage (%)
Cardiac Biomarkers				
Troponin I	85	83.3%	17	16.7%
Troponin T	80	78.4%	22	21.6%
CPK-MB	75	73.5%	27	26.5%
Echocardiography Findings				
Reduced Ejection Fraction (<50%)	48	47.1%	-	-
Preserved Ejection Fraction ($\geq$ 50%)	-	-	54	52.9%

Table 5: Association between Major Risk Factors and Type of CAD Presentation

Risk Factor	STEMI (n=65)	NSTEMI (n=20)	Unstable Angina (n=12)	Chronic Stable Angina (n=5)	p-value
Smoking	42 (64.6%)	10 (50.0%)	4 (33.3%)	2 (40.0%)	0.04
Dyslipidemia	40 (61.5%)	14 (70.0%)	6 (50.0%)	2 (40.0%)	0.32
Hypertension	25 (38.5%)	12 (60.0%)	6 (50.0%)	2 (40.0%)	0.18
Diabetes Mellitus	22 (33.8%)	8 (40.0%)	5 (41.7%)	3 (60.0%)	0.45

Family History of CAD	20 (30.8%)	6 (30.0%)	4 (33.3%)	2 (40.0%)	0.88
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DISCUSSION

In the present study, most young CAD patients belong to the age group of 36-45 years (58.8%). Their mean age was 38.4 ± 5.2 years, and males constituted 76.5% of the patients. The studies which are done in India have shown that in CAD of young males, most frequently it involved incidentally of males in the age group of mid-30's to late 30's. In Central India, Prajapati et al.[8] studied young CAD patients and reported that most patients were in the age group of 36-40 years. However, males were affected more. According to a South Indian registry study conducted by Madhavan et al.[9] (820 premature acute coronary syndrome (ACS) patients (≤ 40 years)), there is also a male predominance. Further, nearly 10% of all catheterized patients are young. Two out of three patients have a sedentary occupation. Physical inactivity is a risk factor for premature atherosclerosis. A recent systematic review has shed a light on the association of early-onset CAD with physical inactivity.

The study found dyslipidemia to be the most commonest conventional risk factor (60.8%) followed by smoking (56.9%). This finding is similar to that reported in the contemporary literature. A systematic review published in 2022 reported that low HDL and high triglycerides were strongly associated with early onset CAD and they reflect metabolic syndrome. A group of researchers observed that 85%-90% of PATIENTS with early onset CAD can be explained by conventional risk factors. The most common of these are smoking and dyslipidaemia. A study of CAD in patients aged below 35 years reported hyperlipidemia in 51% and smoking in 49% which is closely comparable to our study. In our cohort, smokeless tobacco use was found to be very high at 40.2%. This is especially important in the Indian context as the Vascular Disease in Young Indians study showed that chewing tobacco carries a cardiovascular risk equivalent to active smoking. Both forms of tobacco use significantly lower levels of HDL.

About 44.1% of our patients had hypertension, while 37.3% suffered from diabetes mellitus. The corresponding figures are on the higher side compared to the 25% hypertension and 14% diabetes prevalence rates of the younger CADs reported by Ramachandran et al.,[4] perhaps on account of the upper age limit (45 years) being older in our study. Family history of CAD was present in 31.4% of patients. A very young CAD study from Spain (Moreno-Arciniegas et al.,[5] 2022) demonstrated family history with smoking and dyslipidemia to be statistically significant multivariate predictor of early CAD. Interestingly, 5.9% of our patients presented without any conventional risk factors. Non-conventional risk factors, such as genetic susceptibility, psychosocial stress, and inflammatory biomarkers, may be at play, as recently reported.

Initial Symptoms.

The most common presenting symptom was chest pain (92.2%). In a study on CAD in a younger patient group less than 35 years, chest pain was the most common symptom (67%) too. In our cohort, the most common clinical presentation was STEMI (63.7%). The largest subgroup was Anterior Wall MI (AWMI) (34.3%) which was seen in study 9 among young ACS patients in South India with three-fourths having STEMI and the most common vessel being the LAD. According to the findings of an Indian study specifically on young STEMI patients, it was found that due to LAD artery involvement, the most common presentation was AWM. Male sex and smoking were the prevailing risk factors.

In our study, elevated cardiac biomarkers were present in the cohort. Troponin I was elevated in 83.3% of patients, Troponin T in 78.4%, and CPK-MB in 55.5% of patients. In a dedicated biomarker study, Menezes et al.[10] (2025) found Troponin I (which was 94% sensitive) to be the most sensitive marker for acute myocardial infarction (AMI) followed by CPK-MB (which was 89% sensitive). This finding is consistent with the biomarker pattern in our study. The cardiac isoform of troponin I has greater specificity than CPK-MB and is expressed exclusively in the cardiac muscle. It remains diagnostic for 10-14 days post-ischemia. In our study, mitral valve prolapse was accompanied by lower ejection fraction. Von Good and the presence of dilated cardiomyopathy in patients with obstructive sleep apnoea. This distribution corroborates findings from a Korean registry study (2024) which reported a better two-year prognosis for patients post-AMI with a preserved ejection fraction versus those that have reduced ejection fraction.

Analysis of the relationship between risk factors and the type of CAD presentation, it was found that smoking has a statistically significant association ($p=0.04$) with STEMI. It is most prevalent among STEMI patients (64.6%). The literature provides strong support for this conclusion: a systematic review of early-onset CAD noted that smoking is implicated in up to 60% of myocardial infarctions of young men, and is the single strongest modifiable risk factor in the young. A clinical and angiographic profile study of CAD in young smokers also showed that acute coronary syndrome mainly STEMI was the most frequent presentation in young smokers due to smoking's pro-thrombotic and endothelial injuring. The associations of the other risk factors included dyslipidemia, hypertension, diabetes mellitus, and family history of CAD were not significantly different across CAD subtypes (all $p > 0.05$). Similarly to our findings, Moreno-Arciniegas et al.,[5] did not find any significant association of hypertension, diabetes, and obesity with the specific subtype of CAD and attributed this to the lower burden of disease and less duration of exposure in young patient.

CONCLUSION

The study shows that there is a high burden of modifiable risk factors in young adults (≤ 45 years) CAD in Central India. The leading risk factor was dyslipidemia 60.8% and smoking 56.9%. The most commonly presented ailment was STEMI at 63.7%. The results showed a statistically significant association between smoking and STEMI which was confirmed with p value=0.04. Thus, it was established as the strongest modifiable risk factor for acute myocardial infarction in the young. The presence of CAD in 5.9% of patients without any conventional risk factor shows the role of non-conventional factors. Most of the patients had significant myocardial injury on markers and nearly half had reduced ejection fraction due to premature CAD. To deal with increasing incidence of premature CAD in India, early aggressive screening of risk factors like tobacco cessation and control of dyslipidemia is essential.

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