DOI: 10.7860/JCDR/2021/49377.14903

Original Article

Internal Medicine Section

Cross-sectional Study on Myocardial Infarction in Young Adults in the Emergency Department of a Rural Tertiary Care Hospital, Davanagere, Karnataka, India

CH KARTHIK REDDY[1], MAHESH KRISHNAMURTHY[2], ASHRAY VASANTHAPURAM[3], GIRISH NARAYAN[4], SS NARENDRA[5]

ABSTRACT

Introduction: The incidence of Acute Coronary Syndrome (ACS) in the young has been increasing globally. Research in the population has been limited in developed countries or urban areas in developing countries. Identifying the various epidemiologic features in this age group is crucial to understand the disease.

Aim: To describe the clinical characteristics of young adults presenting with ACS in a rural tertiary care hospital.

Materials and Methods: This cross-sectional study included 50 patients diagnosed with ACS. Data was collected from consecutive patients between the ages of 18 to 45 years diagnosed with ACS between January 2014 to January 2015 in the Emergency Medicine Department of a tertiary care hospital in Davanagere, India. Data was collected on demographic characteristics, risk factors, laboratory tests, and angiographic findings. Range, mean and percentages were calculated for continuous and categorical variables, respectively. A 95% confidence intervals were calculated for all variables.

Results: The mean age was 38.1±5.8 years with male preponderance 46 (92%). Risk factors were smoking 36 (72%), diabetes 17 (34%), hypertension 6 (12%) and Body Mass Index (BMI) >23 kg/m^2, 36 (72%). Anterior Wall Myocardial Infarction (AWMI) was observed in 35 (70%) of subjects with angiography revealing Single Vessel Disease (SVD) 28 (56%), Double Vessel Disease (DVD) 5 (10%), Triple Vessel Disease (TVD) 3 (6%) and Myocardial Infarction with Non-Obstructive Coronary Artery Disease (MINOCA) 11 (22%). Three patients died during their course of treatment before initiating an interventional procedure.

Conclusion: Smoking, diabetes mellitus and elevated BMI are associated with ACS among young patients. Interventions targeting these risk factors among younger individuals should be developed.

Keywords: Acute coronary syndrome, Coronary heart disease, Risk factor

INTRODUCTION

The ACS and Coronary Artery Disease (CAD) account for most mortality globally. CAD is the term used typically to address the diseases that result in narrowing or reduced calibre of the blood vessels supplying the heart. ACS occurs when there is a sudden reduction or blockage of blood flow to the heart itself. CAD frequently presents with ACS in all age groups. Depending on the Electrocardiography (ECG) characteristics that are seen at the time of presentation, ACS are characterised as ST-Elevation Myocardial Infarction (STEMI) or Non-STEMI (NSTEMI) [1-3]. However, it is not often described as a cause of death among young adults [1]. Research estimated that ACS incidence is 1-5% among those under the age of 50 years and that developing nations have a high burden.

In India, ACS incidence is estimated to be under 2%, and the prevalence of CAD ranges from 12-16% [2,3]. However, data is limited regarding the prevalence and incidence of CAD and ACS among the young adults [1,4]. CAD frequently presents with ACS in all age groups. Atherosclerotic causes of ACS are seen commonly in the elderly; additionally, non-atherosclerotic causes are seen among the young [1-3]. Based on the research in developed countries, it has been determined that males are predominantly affected [3,4]. Family history, diabetes and hypertension are the common risk factors for CAD in younger populations [3-5].

Smoking, a modifiable risk factor, has also demonstrated a high prevalence in younger people with CAD [2,3,5]. Angiographic data suggests that MINOCA is more common in the young and possibly in males [5,6]. Evidence regarding demography, risk factors and vessel involvement have been limited from the rural populace in the southern state of Karnataka in India. Data from the CAD in the Young (CADY) registry which collected data from predominantly Karnataka revealed that 72% of the study population were male and that family history of CAD, diabetes and hypertension ranged from 44% to 50%, but this study was done primarily in urban areas [7]. The present study aimed to fill this gap in knowledge in the understanding of ACS among individuals below 45 years from a primarily rural background. The speciality of Emergency Medicine has been established all over India only in the last decade. The aim of the study was to describe the clinical characteristics of young adults presented with ACS at a rural tertiary care hospital. Being Emergency Department (ED) based, this study provides a unique opportunity to study ACS from an emergency perspective.

MATERIALS AND METHODS

A cross sectional study was undertaken at the ED at SS Institute of Medical Sciences and Research Centre, Davangere, Karnataka from January 2014 to January 2015. The Institutional Ethics Committee approved (SSIMS & RC/IEC/153/2013) the study. Informed consent was obtained from all enrolled patients.

Inclusion criteria: All the patients diagnosed with STEMI or NSTEMI between 18 and 45 years within the study period were included.

Exclusion criteria: The exclusion criteria were defined as those discharged against medical advice or who refused to participate in the study.

The diagnosis of STEMI/NSTEMI was defined as chest pain or symptoms consistent with ACS with confirmatory electrocardiographic changes and, if required, elevated cardiac enzymes. The

electrocardiographic changes to diagnose STEMI were ST elevation in two contiguous leads or a pattern consistent with new-onset Left Bundle Branch Block (LBBB) [3,5]. This usually occurs when there is complete or partial blockage of any of the coronary vessels. NSTEMI was diagnosed when the electrocardiographic pattern did not reveal ST elevation but had ST depression or dynamic ST changes [3,5]. NSTEMI usually resulted from narrowing or transient occlusion of a coronary vessel with a thrombus. The cardiac enzymes used for diagnosis were either troponins or creatinine-kinase.

Fifty consenting adults satisfying the inclusion criteria were enrolled. Relevant clinical, demographic, laboratory and angiographic data was collected for analysis. BMI was categorised as per World Health Organisation (WHO) criteria [3,7]. Glycaemic status was categorised as normal (fasting plasma glucose levels <100 mg/dL), Impaired Fasting Glucose (IFG) (fasting plasma glucose levels 100 mg/dL to 125 mg/dL), and diabetes (random plasma glucose >200 mg/dL) based on American Diabetes Association (ADA) criteria [8]. Lipid profile of the patients was classified based on definitions from the ADA and American College of Cardiology consensus statement [9]. As the study population targeted were young, any history of current smoking or alcohol consumption were categorised as such. Pack years and quantity and duration of alcohol was not determined as well. Myocardial wall involvement and angiographic data were collected to identify whether the patients had single, double or triple vessel disease. All patients were admitted to the Coronary Care Unit (CCU) for monitoring and management after initial evaluation and stabilisation in the ED.

STATISTICAL ANALYSIS

Descriptive analysis was done for all variables. Continuous variables age and BMI were expressed as mean with a 95% confidence interval. They were subsequently categorised as required and expressed as frequency and percentage. Lipid profile levels were ranked based on appropriate cut-offs and expressed as frequency and percentage. Other dichotomous and categorical variables were expressed as counts and percentage. A 95% confidence intervals were calculated for all values. The analysis was done using statistical package Stata version 14.2.

RESULTS

The mean age of patients was 38.1±5.8 years and were primarily males (92%). Among risk factors, smoking was the most common 36 (72%). At presentation, only 6 (12%) and 8 (16%) patients knew they were hypertensive or diabetic, respectively. However, during treatment, 17 (34%) individuals were found to have IFG or diabetes each. The mean BMI in the study population was 23.9±2.1 kg/m^2 (range 19.5 to 28.7 kg/m^2). Regarding the symptomatic presentation of patients, the majority 47 (94%) of them presented with chest pain followed by 36 (72%) with sweating. In the study population, 19 (38%) (95% CI, 24.6-52.9%), had LDL levels above 100 mg/dL and 14 (28%) (95% CI, 16.2-42.5%) had hypercholesterolemia. Conversely, 41 (82%) (95% CI, 68.5-98.4%) had HDL levels less than 40 mg/dL [Table/Fig-1].

STEMI was diagnosed in 48 (96%) of patients and 35 (70%) involved the anterior wall. Angiograms were done on 47 of those enrolled in the study. Twenty-eight (56%) had a SVD. In 11 (22%) of patients, angiograms revealed no obstructive coronary lesions suggesting MINOCA. Three patients died during their course of treatment before initiating an interventional procedure [Table/Fig-2].

Variables	n (%)	95% Confidence interval
Sex (Male)	46 (92)	81-98%
Age (Mean)	38.1 (23-45) years	36.4-39.8 years
Co-morbidities		
Smoking	36 (72)	57.5-83.8%
Alcohol consumption	16 (32)	19.5-44.7%
Past diabetes mellitus	8 (16)	8.6-31.4%
Past hypertension	6 (12)	4.5-24.3%
Family history (DM/IHD/HTN)	5 (1/2/2) (10)	3.3-21.8%
BMI (kg/m^2) (Mean)	23.9 kg/m^2	23.3-24.5 kg/m^2
Underweight <18.5	0	
Normal 18.5-22.9	14 (28)	16.2-42.5%
Overweight 23-24.9	25 (50)	35.5-64.5%
Pre-Obese 25-29.9	11 (22)	11.5-36%
Obese >30	0	
Symptoms		
Chest pain	47 (94)	83.4-93.7%
• Site (Retrosternal/Precordium)	32/15 (68.1/31.9)	
• Onset (Acute/Gradual)	39/8 (82.9/17.1)	
• Radiation (Present/Absent)	17/30 (36.1/63.9)	
Sweating	36 (72)	57.5-83.8%
Vomiting	14 (28)	16.2-42.5%
Breathlessness	6 (12)	4.5-24.3%
Giddiness	4 (4)	2.2-19.2%
Palpitations	0	
Glycaemic status		
Normal	16 (32)	19.5-46.7%
IFG	17 (34)	21.2-41.8%
DM	17 (34)	21.2-41.8%
Lipids		
Hypercholesterolemia (>200 mg/dL)	14 (28)	16.2-42.5%
Hypertriglyceridemia (>150 mg/dL)	31 (62)	47.1-75.3%
HDL (<40 mg/dL)	41 (82)	68.5-98.4%
LDL (>100 mg/dL)	19 (38)	24.6-52.9%

[Table/Fig-1]: Demographic and clinical characteristics of the study population.
DM: Diabetes mellitus; IHD: Ischemic heart disease; HTN: Hypertension

Variables	n (%)	95% Confidence interval
Acute coronary syndrome type		
STEMI	48 (96)	86.3-99.5%
NSTEMI	2 (4)	0.5-13.7%
Myocardium involved		
Anterior	35 (70)	55.4-82.1%
Inferior	15 (30)	17.9-44.9%
Posterior	0	
Angiogram		
Single Vessel Disease (SVD)	28 (56)	41.2-70.0%
Double Vessel Disease (DVD)	5 (10)	3.3-21.8%
Triple Vessel Disease (TVD)	3 (6)	1.2-16.5%
Non Obstructive Coronary Artery Disease (NOCA)	11 (22)	11.5-36.0%
Not done	3 (6)	1.2-16.5%

[Table/Fig-2]: Features of STEMI/NSTEMI.

DISCUSSION

Analysis of 50 young individuals with ACS showed that men were predominantly affected. Previous research in India also indicated the same, though proportions vary depending on sample size and cut-off age assumed as young [2,7]. Risk factor analysis suggests that smoking is the most common factor seen in young patients presenting with myocardial infarction. Studies in India, the Middle East, Southeast Asia and China also identified that smoking has a high prevalence in individuals who have had a cardiovascular event and are under 45 years [10-13]. In general, the following measures were undertaken to stabilise the patient in the ED in our institute:

antiplatelet medication, statins, opioid analgesics and nitrates to reduce chest pain and control blood pressure.

A study done by Bhandari M et al., in an urban population of Bangalore, a city in the same state as the present study, concluded that 72% of the young myocardial infarction adults were smokers, similar to the study population [2]. However, research from Nagpur revealed that only 29% were smokers when they presented with ACS [3]. The CADY registry revealed that only about 38.6% used tobacco, this was a composite of chewing and smoking tobacco, substantially lower than the number of smokers 36 (72%) seen in this study group [7].

The other modifiable risk factor encountered was alcohol consumption, which was seen in about a third of patients. Though alcohol consumption is not considered as a risk factor for CAD when moderately consumed, we decided to evaluate the frequency of subjects that consumed alcohol vis-à-vis smokers. Though alcohol consumption is considered as a risk factor for ACS among young adults as binge drinking is associated with coronary events, in published research it is hardly evaluated as a risk factor [3,7]. Considering the strong social association between smoking and alcohol consumption, we felt that this was a novel risk factor identified. Hypertension and diabetes mellitus was infrequently seen in the study population. Though they are independent risk factors for CAD, research indicates that they are seen less commonly in young patients [3,5,7]. The prevalence of diabetes detected among young patients with MI ranges from 2-25%, based on research in India [2,3,5,7,12]. Considering that the study was done in rural India, awareness of diabetes could be low and young individuals were unlikely to evaluate themselves.

A 16% of patients were aware that they had diabetes, but the total number of diabetics was 17 (34%), almost double upon further evaluation. The CADY registry showed that 44.2% of study subjects had diabetes and were aware of the same; contrastingly, Deshmukh PP et al., only found 2.4% of their population with the same co-morbidity [3,7]. The wide range seen in research in India suggests that further research is needed to evaluate diabetes and myocardial infarction in young individuals. Concerning hypertension, smaller studies suggest that hypertension is seen in only 8-12% of study subjects, consistent with the finding in the analysis [3,5]. Conversely, the CADY registry, done in multiple centres across India, identified that almost 49% of young individuals presenting with myocardial infarctions were identified to be hypertensive [7]. This suggests a possible sample bias in the study population as well.

Compared to Vasavi C, who found that only 8% of patients were obese, this study population was much higher at 22% [5]. Deshmukh PP et al., found substantially higher obese study population (34%) [3]. The increasing prevalence of obesity and higher body mass index among young adults has mirrored AMI's rising incidence worldwide [1,12]. Almost three-fourths of the study population had a BMI higher than 23 kg/m^2, indicating that a higher prevalence of overweight individuals was an issue even in rural India, contrary to what was previously assumed. In India, the CADY registry observed that 56% of their young subjects had a BMI above 23 kg/m^2 [7].

The AWMI were the most common, consistent with other studies [3,14]. SVD, DVD and TVD were similar to previous research in India [2-5,14]. Sinha SK et al., identified that 71.5% of their young ACS patients had SVD. Only 12.2% were diagnosed with MINOCA, which was quite different from the percentages seen in the current study [14]. MINOCA was seen in 22% of patient comparable to the incidence observed in the Acute Coronary Treatment and Intervention Outcomes Network (ACTION) Registry at 18%, but the Variation in Recovery: Role of Gender on Outcomes of Young AMI Patients (VIRGO) study had an incidence at 11% [6,15]. Though the CADY registry was one of India's largest studies on ACS in young adults, they did not provide results regarding the occurrence of MINOCA in their study population. The main strengths of the study are that it was an ED based study and based in a rural area.

Limitation(s)

The study design was cross-sectional, and the sample size was small, limiting the study's capacity to evaluate any potential associations between risk factors and AMI. A single-centre study was done in a tertiary care hospital primarily among rural young individuals, limiting its generalisability to populations from urban areas and other hospitals. The small study population generates a significant bias in the study's capacity to project its estimates on the population at large. As there was no comparison group, the analysis could not differentiate risk factors and angiographic features between individuals above and below 45 years of age.

CONCLUSION(S)

The study identified that AWMI is common among young ACS patients from rural areas. Smoking and alcohol are modifiable risk factors frequently seen in these patients. Further research is warranted in the latter. Diabetes mellitus and elevated BMI are also seen in young patients presenting with ACS. The relevance of angiographic data revealing the occurrence of MINOCA in young individuals must be followed-up for future implications. Advocacy for healthier lifestyles, awareness of CAD and preventive strategies regarding smoking, diabetes, and obesity should be undertaken among them. Aggressive therapeutic strategies should be evaluated, particularly in ACS occurring in the young as death or morbidity would have social ramifications on the rest of their family. Emergency physicians should undertake research to identify ED-based clinical factors that would affect patients' prognosis in rural India. Currently, CAD and ACS medical care is skewed either towards urban or elderly populations. Focused ED strategies and protocols need to be developed and evaluated towards treating a rural younger population. Emergency research and therapy must continuously evolve side-by-side in ACS management in young adults.

REFERENCES

[1] Anghel L, Prisacariu C, Sascău R, Macovei L, Cristea EC, Prisacariu G, et al. Particularities of acute myocardial infarction in young adults. Journal of Cardiovascular Emergencies. 2019;5(1):25-31.

[2] Bhandari M, Singh V, Venkatraman D. A study of risk factors for acute myocardial infarction in patients below 35 years in eastern India. Nigerian Journal of Cardiology. 2017;14(2):84-91.

[3] Deshmukh PP, Singh MM, Deshpande MA, Rajput AS. Clinical and angiographic profile of very young adults presenting with first acute myocardial infarction: Data from a tertiary care centre in Central India. Indian Heart J. 2019;71(5):418-21.

[4] Al-Khadra AH. Clinical profile of young patients with acute myocardial infarction in Saudi Arabia. International Journal of Cardiology. 2003;91(1):09-13.

[5] Vasavi C. Study on acute myocardial infarction in young adults in a tertiary care hospital, Guntur. IJBAMR. 2015;5:510-15.

[6] Smilowitz NR, Mahajan AM, Roe MT, Hellkamp AS, Chiswell K, Gulati M, et al. Mortality of myocardial infarction by sex, age, and obstructive coronary artery disease status in the ACTION Registry-GWTG (Acute Coronary Treatment and Intervention Outcomes Network Registry-Get With the Guidelines). Circ Cardiovasc Qual Outcomes. 2017;10(12):01-08.

[7] Iyengar SS, Gupta R, Ravi S, Thangam S, Alexander T, Manjunath CN, et al. Premature coronary artery disease in India: Coronary artery disease in the young (CADY) registry. Indian Heart J. 2017;69(2):211-16.

[8] American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2010;33(10):62-69.

[9] Brunzell JD, Davidson M, Furberg CD, Goldberg RB, Howard BV, Stein JH, et al. Lipoprotein management in patients with cardiometabolic risk: Consensus conference report from the American Diabetes Association and the American College of Cardiology Foundation. J Am Coll Cardiol. 2008;51(15):1512-24.

[10] Wong CP, Loh SY, Loh KK, Ong PJ, Foo D, Ho HH. Acute myocardial infarction: Clinical features and outcomes in young adults in Singapore. World J Cardiol. 2012;4(6):206-10.

[11] Shah N, Kelly AM, Cox N, Wong C, Soon K. Myocardial infarction in the "young": Risk factors, presentation, management and prognosis. Heart Lung Circ. 2016;25(10):955-60.

[12] Faisal A BA, Ali A, Mosa A, Akram A, Amani A, Hani M, et al. Acute coronary syndrome among young patients in Saudi Arabia (Single centre study). J Cardiol Curr Res. 2019;12(3):60-63.

[13] Jamil G JM, Alkhazraji H, Haque A, Chedid F, Balasubramanian M, Khairallah B, et al. Risk factor assessment of young patients with acute myocardial infarction. Am J Cardiovasc Dis. 2013;16(3):170-74.

[14] Sinha SK, Krishna V, Thakur R, Kumar A, Mishra V, Jha MJ, et al. Acute myocardial infarction in very young adults: A clinical presentation, risk factors, hospital outcome index, and their angiographic characteristics in North India-AMIYA Study. ARYA Atheroscler. 2017;13(2):79-87.

[15] Safdar B, Spatz ES, Dreyer RP, Beltrame JF, Lichtman JH, Spertus JA, et al. Presentation, clinical profile, and prognosis of young patients with Myocardial Infarction With Nonobstructive Coronary Arteries (MINOCA): Results from the VIRGO study. J Am Heart Assoc. 2018;7(13):01-14.

PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Emergency Medicine, St. John's Medical College, Bangalore, Karnataka, India.
2. Assistant Professor, Department of Emergency Medicine, Institute of Gastroenterology Sciences and Organ Transplant, Bangalore, Karnataka, India.
3. Assistant Professor, Department of Emergency Medicine, St. John's Medical College, Bangalore, Karnataka, India.
4. Associate Professor, Department of Emergency Medicine, St. John's Medical College, Bangalore, Karnataka, India.
5. Professor, Department of Emergency Medicine, S.S. Institute of Medical Sciences and Research Center, Davanagere, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Girish Narayan,
Department of Emergency Medicine, St. John's Medical College Hospital,
Koramangala, Bangalore-560034, Karnataka, India.
E-mail: girishn.md@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Apr 14, 2021
- Manual Googling: Apr 28, 2021
- iThenticate Software: Apr 30, 2021 (11%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Mar 10, 2021**
Date of Peer Review: **Apr 06, 2021**
Date of Acceptance: **Apr 30, 2021**
Date of Publishing: **May 01, 2021**