Journal of Cardiovascular Disease Research

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 08, 2023

Original research article

Demographic and angiographic profile in premature cases of acute coronary syndrome

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Received Date: 06/05/2023, Accepted Date: 18/06/2023

Abstract

Background and Aims: Characteristics and clinical course of Acute Coronary Syndrome (ACS) have been studied extensively in older patients, however, this disease has rarely been analyzed in younger patients, because the incidence of ACS is much lower in younger individuals. There have been very limited data on the comparison of demographic and angiographic characteristics in young patients stratified according to the type of acute coronary syndrome. Therefore, the current study aims to find the determinants of premature acute coronary syndrome.

Methods: The current study was done in the Department of Cardiology, at SMS hospital, in Jaipur district of Rajasthan from February 2020 to December 2021. It is a Hospital based single centered, cross sectional observational study conducted on a sample of 230 participants estimated by scientific method. The age criteria for males was less than 45 years and for females it was less than 55 years.

Results: In our study young population living in urban areas is at risk of early-age ACS as compared to rural populations and this is statistically significant. Central obesity was present in significant number and is more prevalent in very young individuals (93% vs 72%). Chest pain was the most common symptom (91.4%) followed by diaphoresis (65.7%) seen in the patients followed by dyspnoea and palpitation and associated symptoms with chest pain are more prevalent in >30 years population group. The most common vessel found to be affected was the LAD which was alone or in combination with any other vessel affected in 116 (50.44%) followed by LCx obstruction in 53 (23.45%).

Conclusion: Our study suggests that the major modifiable risk factor for MI in very young patients appears to be central obesity due to urbanization and sedentary lifestyle habits. Hence focused efforts should be made to modify these risk factors in the population through education and behavioural modification.

Keywords: Acute coronary syndrome, younger age, Indian population, NSTEMI, STEMI, UA

Introduction

Acute coronary syndrome (ACS) is a collection of conditions that lead to reduction in blood to the heart [1]. It is by far the most important cardiovascular disease in India [2]. According to an estimate, more than half of death related to cardiovascular disease occurs in patients below the age of 50 years and one-fourth of acute myocardial infarction cases are being reported in patients under the age of 40 years [3]. Characteristics and clinical course of ACS have been studied extensively in older patients, however, this disease has rarely been analysed in younger patients, because the incidence of ACS is much lower in younger individuals. The few researches that are done are also focused on people aged 35 years and above. But in India, there is an unusual predisposition to premature coronary artery disease (CAD) [4]. Patients who have ACS at very early age are at risk for many potential years of life and their post-event survival translates into substantial costs in terms of both health and social resources. Earlier studies have indicated that patients with early onset of CAD exhibit preponderance of single vessel disease, and dominance of coronary risk factors such as hypercholesterolemia, and cigarette smoking as compared to older patients. However, there have been very limited data on the comparison of demographic and angiographic characteristics in young patients stratified according to the type of acute coronary syndrome. Therefore, the current study aims to find the determinants of premature acute coronary syndrome.

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 08, 2023

Objectives

- To identify the determinants of premature acute coronary syndrome.
- To identify the differences in risk factor profile among premature ACS patients presenting with ST-elevated myocardial infarction (STEMI), non-ST-elevated myocardial infarction (NSTEMI), or unstable angina (UA).
- To identify the differences in coronary angiographic profile among premature ACS patients presenting with ST-elevated myocardial infarction (STEMI), non-ST-elevated myocardial infarction (NSTEMI), or unstable angina (UA).

Materials and Methodology

The current study was done in the Department of cardiology, at a SMS hospital, in Jaipur district of Rajasthan from February 2020 to December 2021. It is a hospital based single centered, cross sectional observational study conducted on a sample of 230 participants estimated by scientific method. The age criteria for males was less than 45 years and for females it was less than 55 years. The patients posted for coronary angiography were included in the study by consecutive sampling technique.

Inclusion criteria

i) Patients admitted for STEMI, NSTEMI, or UA.
ii) Age less than 45 years in male and 55 years in female.
iii) Those who underwent coronary angiography.

Exclusion criteria

Those having atypical chest pain, myocarditis, pericarditis, cardiomyopathies, congenital heart diseases, history of prior ACS/Coronary revascularization were excluded from the study.

Ethical clearance

The study was approved by the institutional ethical committee. Only those participants who gave written informed consent were included in the study.

Data collection

All the patients who underwent coronary angiography were included and data pertaining to age, gender, urban or rural domicile, BMI, and history of smoking, alcohol intake, diabetes, hypertension. All patients were subjected to electrocardiograms and biochemical investigations for lipid profile and cardiac markers.

Statistical analysis

Stratification was done based on type of ACS (Group 1: STEMI Group 2: NSTEMI/UA) and age with the cut off as 30 years to be divided into two groups. Data were expressed as mean ± standard deviation. Chi-square test was performed and Fischer's exact test was used when the expected frequency was less than 5. A two-tailed probability value (p-value) less than 0.05 was considered as significant. Results were checked using Statistical Package for Social Sciences (SPSS) version 17 program for Microsoft Windows.

Operational definition

Acute coronary syndrome was diagnosed as those who had STEMI, NSTEMI or unstable angina (UA). STEMI was diagnosed by having chest pain with elevated biochemical markers of myocardial necrosis and ECG changes demonstrating either: 1) ST segment elevation >1mm in two consecutive leads other than leads V2/V3. For leads V2/V3, the criteria taken was.> 0.2 mV in men >40 years, >0.25 mV in men <40 years or >0.15 mV in women or presumed new left bundle branch block along with ischemic symptoms (14). NSTEMI were cases of angina at rest without ST segment elevation to be categorized as NSTEMI if their cardiac troponin T (Trop T) levels exceeded 0.1 ng/ml, and as Unstable Angina if their Trop T levels were lower and had ECG finding of hyperacute T-wave, flattening of the T-waves, inverted T-waves, and ST depression. Hypertension was defined based on the 2018 AHA/ACC guidelines for hypertension (15) Diabetes mellitus was diagnosed as fasting glucose levels >126 mg/dL, or glycated hemoglobin levels >6.5%, or self-report of physician diagnosis of diabetes mellitus and/or use of anti-diabetic medications. Patients were categorized as smokers if they reported smoking/tobacco consumption within last one year of study enrolment. Positive Dyslipidemia was considered if total Cholesterol was ≥ 200 mg/dl, LDL Cholesterol ≥ 130 mg/dl, HDL Cholesterol < 40 mg/dl in men and <50mg/dl in women and Serum Triglycerides > 150 mg/dl or combination of these criteria. BODY MASS INDEX was calculated as per Quetlets formula (Wt. (kg)/ Ht. (m)2) and obesity was considered as a BMI ≥ 25. Waist Hip Ratio of > 0.9 and > 1 was taken as obesity in females and males respectively. A family history of premature CAD was defined as the documented CAD in a first-degree relative (male <55 years and female <55years) In-hospital risk assessment was done for ACS groups using

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 08, 2023

thrombolysis in myocardial infarction (TIMI) risk score. (16, 17) % Cardiogenic shock was defined as systolic blood pressure (SBP) measurements of<90 mmHg for >30 min or use of drugs or mechanical support for maintenance of SBP>90 mmHg (19) Alcohol dependence was determined based on ICD10 diagnostic guidelines for the dependence syndrome. (18) Coronary angiography: All the patients had undergone a standard coronary angiographic procedure using standard percutaneous techniques either via femoral or radial route after Allen's test. Angiographic severity was assessed in at least two orthogonal views using eye-balling. The obstructive CAD was defined as 70% lesion in one of the major epicardial arteries [viz., left anterior descending (LAD), left circumflex (LCx), and right coronary artery (RCA)], or their major branches, or 50% luminal narrowing of the left main coronary artery (LMCA). Accordingly, patients to be further classified as suffering from single-vessel (SVD), double vessel (DVD), or triple-vessel disease (TVD). All other lesions not amounting to the above-mentioned severity to be grouped together as non-obstructive CAD.

Results

The study was done on a sample size 230 participants, whose age ranged from 23 years to 53 years with the mean age of the participants was 34.5 (±5.7). Majority 184 (80%) were males. (Table: 1a) Among the females 34 (57.63%: p-value <0.001) had NSTEMI/UA. Females had more NSTEMI/UA and this was statistically significant distribution (Table: 1b) and majority of females fall in 30-55 years age group 41 out of 46, shows protective effect of estrogen against atherosclerosis in young females. In our study young population living in urban areas are at risk of early age ACS as compared to rural population and is statistically significant (*p* value - <0.001).

Table 1a: Showing socio-demographic profile of the participants. (N=230)

Socio-Demographic profile	Frequency (%)			p value
	Total	Age < 30 years	>30-45year men >30-55years women (183)	
Total	**230**	**47**	**183**	
Gender				
Male	184 (80)	42 (89.36)	142 (77.59)	>0.05
Female	46 (20)	5 (10.6)	41 (22.41)	
Mean Age	34.5 (±5.7)	27 (±1.8)	37(±4.1)	>0.05
Place of residence				
Rural	49 (21.3)	6(12.76)	71 (38.79)	<0.001
Urban	181 (78.7)	41(87.23)	112(61.21)	

*chi-square/Fischer exact test

Table 1b: Showing socio-demographic profile of the participants. (N=230)

Socio-Demographic profile	Frequency (%)			p value
	Total	Stemi	NSTEMI/UA	
Total	**230**	**171**	**59**	
Gender				
Male	184 (80)	159(92.98)	25(42.37)	<0.001
Female	46 (20)	12 (7.01)	34 (57.63)	
Mean Age	34.5 (±5.7)	42(±2.6)	36(±3.2)	>0.05
Place of residence				
Rural	49 (21.3)	21 (12.28)	28 (47.45)	<0.001
Urban	181 (78.7)	150 (87.72)	31 (52.54)	

*Chi-square/Fischer exact test

- **Risk factors:** Although smoking was present in 51% of total study population but it was only present in 23% of very young populations (<30 years) and it may be due to stigma of smoking. Central obesity was present in significant number and is more prevalent in very young individuals (93%vs 72%). In our study young population living in urban areas are at risk of early age ACS as compared to rural population and is statistically significant (p value -<0.001). This might be suggestive of urbanization or sedentary life style being a risk factor (Table-2b)

Table 2a: Showing risk factor profile for premature CAD (N=230)

Risk factor	Present (%)			p value*
	Total (230)	< 30 years (47)	>30-45year men >30-55years women (183)	
Smoking	119 (51.7)	11 (23.4)	108 (59.01)	>0.05
Alcohol	86 (37.4)	17 (36.17)	69 (37.70)	>0.05
Obesity	156 (67.8)	29 (61.70)	127 (69.39)	>0.05
Central obesity (WHR)	179 (77.8)	31 (65.95)	156 (85.24)	<0.05

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Dyslipidemia	39 (17)	6 (12.7)	33 (18.03)	>0.05
Pre-existing co morbidities				
Diabetes mellitus	34 (14.8)	7 (14.89)	27 (14.76)	>0.05
Hypertension	21 (9.1)	4 (8.52)	17 (9.28)	>0.05
Family history of premature CAD	15(6.5)	9(19.14)	6(3.28)	<0.001

*Chi-square/Fischer exact test

Table 2b: Showing risk factor profile for premature CAD (N=230)

Risk factor	Present (%)			p value*
	Total (230)	STEMI (171)	NSTEMI/UA (59)	
Smoking	119 (51.7)	87 (50.87)	32 (54.23)	>0.05
Alcohol dependence	86 (37.4)	50 (29.23)	36 (61.01)	<0.001
Obesity	156 (67.8)	102 (65.38)	54 (91.52)	<0.001
Central obesity (WHR)	179 (77.8)	127 (74.27)	52(88.14)	<0.05
Dyslipidemia	39 (17)	21 (12.29)	18 (30.51)	<0.05
Pre-existing co morbidities				
Diabetes mellitus	34 (14.8)	8 (4.67)	26 (44.06)	<0.001
Hypertension	21 (9.1)	6 (3.5)	15(25.42)	<0.005
Family history of premature CAD	15(6.5)	2(1.1)	13(22.03)	<0.001

*Chi-square/Fischer exact test

Clinical features

Majority 201 (87.4%) presented with more than one symptom of acute coronary syndrome. Chest pain was the most common symptom (91.4%) followed by diaphoresis (65.7%) seen in the patients followed by dyspnea and palpitation and associated symptoms with chest pain are more prevelant in >30 years population group (Table 3 a).

Based on electrocardiogram finding and Troponin T levels it was seen that majority [107(46.5%)] had STEMI and there was a significant relation between the type of acute coronary syndrome and age category. (Table 4) Higher proportion of people in the STEMI group had symptoms. (Table: 3b). Within 30 min. only 4 patients are received and within 120 min 16 patients are received and within-12 hrs 64 patients are received 36.53%of patients received-within 12 hrs. Among them 32.61% of patients underwent thrombolysis. young patients with age group of <30 years incidence of primary VT is more as compared to >30years group (8.52vs 1.09 p value <.05). STE-ACS was more common as compared to NSTE-ACS. Few patients had the cardiogenic shock and left ventricular failure at presentation. Median TIMI Score among the study population was 2(0-6) while those with cardiogenic shock were 7(4-10). Among STE-ACS AWMI was the most common presentation.

Table 3a: Showing symptoms of ACS (N=230)

Symptom/Signs Complications	Present (%)			p value*
	Total (230)	< 30 years (47)	>30-45year men >30-55 years women (183)	
Chest pain	210 (91.4)	46(97.87)	164(89.7)	>0.05
Diaphoresis	151 (65.7)	23 (48.93)	128 (69.94)	<0.001
Dyspnea	103 (44.8)	14 (29.78)	89 (48.63)	<0.001
Palpitation	45 (19.6)	8 (17.02)	37 (20.21)	>0.05
Syncope	26 (11.3)	6 (12.76)	20 (10.92)	>0.05
Killip class	164(71.30)	42(89.36)	122(66.67)	<0.05
I				
II	48(20.86)	4(8.51)	44(24.05)	
III	10(4.34)	2(4.2)	8(9.69)	
IV	8(3.47)	1(2.21)	7(3.82)	
Cardiogenic shock	8(3.74)	1(2.21)	7(3.82)	>0.05
Primary ventricular tachycardia	6(2.6)	4(8.52)	2(1.09)	<0.05
Complete heart block	18(7.82)	4(8.51)	14(7.65)	>0.05
Time to FMC (in min) <30 min	4(1.74)	1(2.13)	3(1.64)	>0.05
30-120 min	16(6.96)	4(8.52)	12(6.56)	
120-43,200 min	64(27.83)	19(40.42)	45(24.6)	
>43,200min	146(63.48)	23(48.9)	123(67.21)	
Thrombolysis	75(32.61)	18(38.29)	57(31.14)	>0.05
LVEF	50(21.73)	4(8.51)	46(25.14)	<0.001
Normal (50-70)				
MILD (40-49%)	77(33.48)	27(57.45)	50(27.33)	
MODERATE (30-39%)	91(39.57)	15(31.91)	76(41.53)	
SEVERE <30%	12(5.21)	1(2.13)	11(6.02)	

*Chi-square/Fischer exact test

Table 3b: Showing symptoms of ACS (N=230)

Symptom	Present (%)	p value*

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	Total (230)	STEMI (171)	NSTEMI/UA (59)	
Chest pain	210(91.4)	168(98.24)	40(67.79)	**<0.001**
Diaphoresis	151 (65.7)	97 (56.72)	54 (91.52)	**<0.001**
Dyspnea	103 (44.8)	56 (32.74)	47 (79.66)	**<0.001**
Palpitation	45 (19.6)	29 (16.95)	16 (27.11)	>0.05
Syncope	26 (11.3)	14 (8.18)	12 (20.33)	**<0.05**

*Chi-square/Fischer exact test.

Table 4: Classifying ACS based on ECG criteria and Troponin T levels. (N=230)

Coronary Artery Disease	Present (%)			p value*
	Total (230)	< 30 years (47)	>30-45 year men >30-55 years women (183)	
STEMI	171 (74.34%)	43(91.48)	128(69.94)	**<0.05**
AWMI	141(82.45)	39(90.7)	102(79.69)	
IWMI		3(6.38)	24(13.12)	
LWMI	27(15.78)	1(2.12)	2(1.09)	
	3(2.13)			
NSTEMI	34 (14.78)	3(6.38)	31(16.94)	
Unstable angina	25 (10.9)	1(2.18)	24(13.12)	

Coronary angiographic profile

Normal vessels were found in 10 (4.34%) in total and 4 person < 30 years of age. The most common vessel found to be affected was the LAD which was alone or in combination with any other vessel affected in 116(50.44%) followed by LCx obstruction in 53 (23.45%). (Table 5a) Those having STEMI had higher prevalence of obstructive CAD and this was clinically significant. (Table: 5b). Obstructive CAD is more common in >30 years group (83.60 vs 61.70) and non -obstructive and normal coronaries are more common in <30 years group. TVD and LM are more prevelant in >30 years group and among nstemi /UA group. Some of our patients also had spontaneous coronary artery dissection 6(2.75%).

Table 5a: Distribution of cases based on the type of vessel affected. (N=230)

Coronary Angiographic profile	Frequency (%)			p value*
	Total (230)	< 30 years (47)	>30-45year men >30-55years women (183)	
Obstructive CAD	182 (79.13)	29 (61.70)	153 (83.60)	**<0.05**
Single vessel disease	130(71.42)	22 (75.86)	108 (70.58)	
1. LAD	86(66.15)	17(77.27)	69 (63.88)	
2. LCx	23(17.69)	2 (9.09)	21 (19.45)	
3. RCA	21(16.15)	3(13.36)	18 (16.67)	
Double vessel disease	39 (21.42)	5(17.24)	34 (22.23)	
1. LAD + LCX	24(61.53)	2(40)	22 (64.71)	
2. RCA + LCx	9(23.08)	2(40)	7 (20.58)	
3. LAD + LCx	6 (15.39)	1(20)	5 (14.71)	
Triple vessel disease	8(4.39)	1 (3.44)	7 (4.57)	
Left main disease	5(2.74)	1(3.44)	4(2.61)	
Non obstructive CAD	38 (16.52)	14(29.79)	24 (13.12)	
Normal coronaries	10 (4.34)	4(8.52)	6(3.27)	
Spontaneous coronary artery dissrction	6(2.60)	4(8.52)	2(1.09)	**<0.05**

Table 5b: Distribution of cases based on the type of vessel affected. (N=230)

Coronary Angiographic profile	Frequency (%)			p value*
	Total (230)	Stemi (171)	Nstemi/UA (59)	
Obstructive CAD	182 (79.13)	139(81.28)	43(72.89)	<0.001
Single vessel disease	130(71.42)	110(79.14)	20(46.510	
4. LAD	86(66.15)	72(65.46)	14(70)	
5. LCx	23(17.69)	19(17.27)	4(20)	
6. RCA	21(16.15)	19(18.19)	2(10)	
Double vessel disease	39 (21.42)	26(18.70)	13(30.23)	
4. LAD + LCX	24(61.53)	14(53.84)	10(76.92)	
5. RCA+ LCx	9(23.08)	7(26.93)	2(15.38)	
6. LAD+ LCx	6 (15.39)	5(19.24)	1(7.6)	
Triple vessel disease	8(4.39)	2(1.43)	6(13.95)	
Left main disease	5(2.74)	1(0.71)	4(9.30)	
Non obstructive CAD	38 (16.52)	30(17.54)	8(13.56)	
Normal coronaries	10 (4.34)	2(1.16)	8(13.56)	

*Chi-square/Fischer exact test

Discussion

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 08, 2023

Our study was done on a sample size 230 participants, whose age ranged from 23 years to 45 years with a mean age of the participants was 34.5 (±5.4). Majority 184 (80%) were males. (Table: 1a) Among the females 34 (57.63%: p-value <0.001) had NSTEMI/UA. Females had more NSTEMI/UA and this was statistically significant distribution (Table: 1b) and majority of females fall in 30-45 years age group 41 out of 46, show protective effect of estrogen against atherosclerosis in young females. Although smoking was present in 51% of total study population but it was only present in 23% of very young populations (<30 years).

This is in consistent with the study by Chabbra ST, *et al*., [8] where proportion of smokers was relatively less and this might be due to the stigma associated with smoking. Dyslipedimia was also not found in many in our study but was a conventional risk factor in other studies [7]. More prevalent in Nstemi/UA group as compared to STEMI (30%vs 12%) Pre-existing comorbidities like Diabetes mellitus and hypertension was not present in majority and similar finding was seen in reports of Deshmukh PP, *et al*. [7]. But in contrast other studies showed that the major comorbidities were hypertension and diabetes mellitus [12]. As in our study, few other studies also showed that obesity was a risk factor [8, 13]. Central obesity was present in significant number and is more prevalent in very young individuals (93% vs 72%). In our study young population living in urban areas are at risk of early age ACS as compared to rural population and is statistically significant (p value -<0.001). This might be suggestive of urbanization or sedentary life style being a risk factor. Results of different studies in literature are compared with the present study in table 6.

Limitations of study

This is the first study of very young patients with MI from Jaipur region. However, small sample size, single-centre study, and lack of follow up results both in hospital and later on, are major limitations of this study.

The results cannot be generalized to other populations.

Conclusion

Our study suggests that the major modifiable risk factor for MI in very young patients appears to be central obesity due to urbanization and sedentary lifestyle habits. Hence focused efforts should be made to modify this risk factors in the population through education and behavioral modification. Further, a significant improvement in health-care delivery systems at all levels is required to improve management of very young subgroup of patients which could have major societal implications. The findings of this study should set the stage for a larger registry which will provide greater insights into the unique profile of CAD in India in general and young CAD in particular.

Table 6: Comparison of different studies

Study	Mean age	Male	STACS VS NSTEMI	Thrombolysis	Normal coronaries	Cardiac shock	Risk factors	Risk factors Urban vs rural	Family H/O CAD
Deora *et al*., (n=820), 2016 [7]	35+_18	93%	75%vs 26%	NA		NA	Smoking	NA	7.9%
							Smoking Obesity Physical inactivity		46.8%
Chabbra *et al*., (n=114) 2018 [8]	NA	92%	76.3%vs 23.7%	77.77%	42.1% Including Insignificant Disease	NA	Smoking Obesity Drug abuse	76.3%vs 23.7%	NA
Deshmukh *et al*., (n = 41), 2019 [5]	27+_2.8	95%	100% STACS	61%	7.3%	NA	Smoking Dyslipid- emia Obesity tobacoo chewer	NA	9.8%
Gupta *et al*., (n= 102), 2020 [15]	28.52+_4.18	97%	91% VS 8.8%	32.3%	3.1%	1%	Smoking	84%vs16%	27.5%
							Smoking Alcohol	50.5%vs 49.9%	18.2%
Our study N=230	34.4+_7	80%	74.34% Vs 25.64	32.61%	4.34%	3.74%	Central obesity Urban population	78.7% Vs 21.3%	15%

Funding

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 08, 2023

The authors received no external funding for this work. Their institutional resources were used to carry out this investigation.

Conflict of Interest
There is no financial conflict of interest to declare for any of the authors in association with the publication of this manuscript.

Acknowledgements
We are most grateful to the patients who contributed to the study.

Author Contributions
All authors had access to the study data. Contributed to the study concept and design, data collection, data analysis and interpretation, and drafting of the manuscript. All authors reviewed and approved the final version of the manuscript before submission.

Supplementary Data
No other supplementary data is available.

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