

Comparative single-center study between young and old patients presenting with Acute Coronary Syndrome

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ABSTRACT

The most common presentation of Coronary artery disease (CAD) is acute coronary syndrome (ACS). The clinical and angiographic profile of young patients with CAD can differ significantly from those of older patients. Our objective was to study the clinicoangiographic profile and In-hospital outcomes of the patients presenting with acute coronary syndrome (ACS) to our center. Our study was a retrospective study and patients were enrolled from our center. We analyzed the medical records of the patients presenting with acute coronary syndrome (ACS) to our hospital for two years between 01.01.2022 and 01.01.2024. Our study showed obesity, smoking, family history of premature coronary artery disease (CAD), and substance abuse are common risk factors of acute coronary syndrome (ACS) in younger populations whereas in older patients hypertension and diabetes mellitus remain the most common risk factors. Anterior wall myocardial infarction is the most common presentation of ACS in young patients, and single vessel disease (SVD) is the most common CAD pattern on angiography. The In-hospital outcomes of younger patients are better as compared to the older patients.

Keywords: Acute coronary syndrome (ACS), Coronary artery disease (CAD), Premature coronary artery disease (CAD), Coronary angiography (CAG), Percutaneous coronary intervention (PCI)

Introduction

The most common presentation of Coronary artery disease (CAD) is acute coronary syndrome (ACS) {1}. It is rare below the age of 45 years {2}. Asian Indians have a higher risk of developing symptomatic CAD a decade earlier than the Western population. The clinical and angiographic profile of young patients with CAD can differ significantly from those of older patients {3}. In young patients coronary atherosclerosis and plaque rupture still remains the most common cause of ACS {4}. Other causes are atheroembolism, substance abuse, hypercoagulable states, vasospasm, spontaneous coronary artery dissection (SCAD), autoimmune disorders, and coronary artery vasculitis {4}. In our clinical practice, we have been seeing a significant proportion of young ACS patients having a history of substance abuse. Cocaine is a recognized cause of ACS {5}. Studies have shown amphetamine abuse as a cause of ACS {6}. A retrospective analysis has shown that there is history of cocaine and/or marijuana in upto 10% of patients with myocardial infarction (MI) at age ≤ 50 years {7}. These patients have worse all-cause and cardiovascular mortality {7}. Another retrospective study showed that 17% of the patients with age ≤ 50 years presenting as MI had a history of opiate, cannabis, and cocaine abuse {8}. The prevalence of substance abuse is increasing and it is an important cause of ACS in the young population. Our objective was to study the clinicoangiographic profile and outcomes of patients presenting with ACS to our center. Further, we assessed the prevalence of substance abuse in our cohort of young patients.

Materials and Methods

Our study is a retrospective study conducted at our center in which medical records of the patients presenting with the acute coronary syndrome (ACS) for two years between 01.01.2022 and 01.01.2024 were analyzed. 260 patients were enrolled.

Citation: Ishtiyag Masood, Bhupinder Singh Brar and Neeraj Singla (2024). Comparative single-center study between young and old patients presenting with Acute Coronary Syndrome.

DOI: <https://doi.org/10.51470/AMSR.2024.03.02.33>
Journal of American Medical Science and Research.

Received on: 13 September, 2024

Revised on: 18 October, 2024

Accepted on: 11 November, 2024

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The objective was to study the clinicoangiographic profile, technical details of percutaneous coronary intervention (PCI), and In-hospital outcomes in these patients. Further, a comparison was made between younger patients (≤ 45 years) and older patients (> 45 years).

Definitions

Acute myocardial infarction was defined as per the fourth universal definition of myocardial infarction {9}. ECG diagnosis of ST-elevation myocardial infarction (STEMI) was made when ECG showed new ST elevation ≥ 0.1 mV at the J point in two contiguous leads, except for V2 and V3, where ≥ 0.2 mV in men ≥ 40 years, ≥ 0.25 mV in men < 40 years, and ≥ 0.15 mV in women were used as the cut-off values. Left bundle branch block (LBBB) that was new-onset, and LBBB in patients who had clinical evidence suggestive of myocardial ischemia in the presence of positive Sgarbossa criteria were considered STEMI equivalents. STEMI was further broadly classified into anterior wall STEMI and Inferior wall STEMI based on the electrocardiographic findings. Non-ST-Elevation Acute Coronary Syndrome (NSTEMI) encompasses non-ST-elevation myocardial infarction (NSTEMI) and unstable angina and was defined as per the American Heart Association (AHA) 2014 definition {10}. Patients were considered to have family history of premature CAD if they had a history of CAD in a first-degree relative with males < 55 years and females < 65 years. The other risk factors assessed included smoking, dyslipidemia, hypertension, diabetes mellitus, and CKD. All of these risk factors were defined as per standard definitions.

Patient management, coronary angiography and revascularization was performed in accordance with established guidelines. The operator decided whether to use manual thrombosuction or glycoprotein IIb/IIIa inhibitors.

The time between hospital admission and lesion crossing with PTCA wire was defined as the door-to-balloon time. < 20% residual stenosis and restoration of TIMI 3 flow was considered as angiographic success. Cardiac death, repeat revascularization, and stroke constituted the major adverse cardiovascular events (MACE). Standard definition was used for stent thrombosis. Type 3 or 5 bleeding as per the Bleeding Academic Research Consortium (BARC) definition was considered as major bleeding.

Results

Baseline characteristics:

Baseline characteristics of our patient population are shown in the table 1. 185 (71.2%) patients were male. Overall, hypertension was the most common risk factor in 182 (70%) patients, followed by smoking, diabetes mellitus, dyslipidemia, and obesity. Obesity, smoking, family history of CAD, and history of substance abuse were more common in young patients compared to older patients. In comparison, hypertension and diabetes mellitus were more common in older patients. There was history of substance abuse in 7 (18.4%) young patients, whereas history of substance abuse was present in only 2 (0.8%) of the older patients.

Parameter	General population n (%)	≤ 45 years old n (%)	> 45 years old n (%)	P value
Male	185 (71.2%)	27 (71.1%)	158 (71.2%)	1.0
Females	75 (28.8%)	11 (28.9%)	64 (28.8%)	1.0
Age (years)	61±27	34±10	68±21	-
Obesity	65 (25%)	15 (39.5%)	50 (22.5%)	0.04
Hypertension	182 (70%)	14 (36.8%)	168 (75.7%)	<0.001
Diabetes mellitus	91 (35%)	6 (15.8%)	85 (38.3%)	0.009
Smoker	117 (45%)	30 (78.9%)	87 (39.2%)	<0.001
History of substance abuse	9 (3.5%)	7 (18.4%)	2 (0.8%)	<0.001
Family history of CAD	42 (16.2%)	12 (31.6%)	30 (13.5%)	0.009
Dyslipidemia	78 (30%)	8 (21.1%)	70 (31.5%)	0.25
Prior MI	26 (10%)	1 (2.6%)	25 (11.3%)	0.14
Prior PCI	29 (11.2%)	1 (2.6%)	28 (12.6%)	0.09
Prior CABG	5 (1.9%)	0 (0%)	5 (2.3%)	1.0
Stroke	7 (2.7%)	0 (0%)	7 (3.2%)	0.59
CKD	8 (3.1%)	0 (0%)	8 (3.6%)	0.61
LVEF	37 ± 19	34 ± 11	39 ± 13	-

Table 1 shows the baseline characteristics of our patient population. Note that Obesity, smoking, family history of CAD, and history of substance abuse were more common in younger patients, while hypertension and diabetes mellitus were more common in older patients. CAD: coronary artery disease; MI: myocardial infarction; PCI: percutaneous coronary intervention; CABG: coronary artery bypass grafting; CKD: chronic kidney disease.

Clinical presentation

Overall, the most common clinical presentation was Anterior wall myocardial infarction in 91 (35%) patients, followed by Inferior wall myocardial infarction in 78 (30%), NSTEMI in 52 (20%), and unstable angina in 39 (15%) patients (Figure 1). Younger patients (≤ 45 years) were more likely to have STEMI with Anterior wall myocardial infarction in 50% and Inferior wall myocardial infarction in 44.7% of patients. NSTEMI and unstable angina were more common in older patients (> 45 years) (Figure 2).

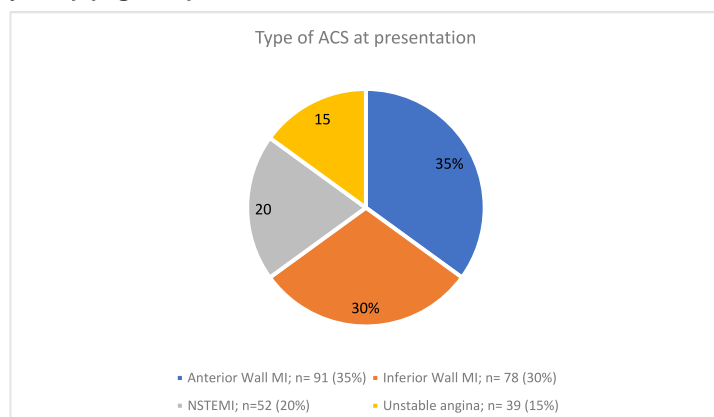


Figure 1 shows the type of ACS at presentation in our patients. ACS: Acute coronary syndrome; MI: myocardial infarction; NSTEMI: non-ST-elevation myocardial infarction.

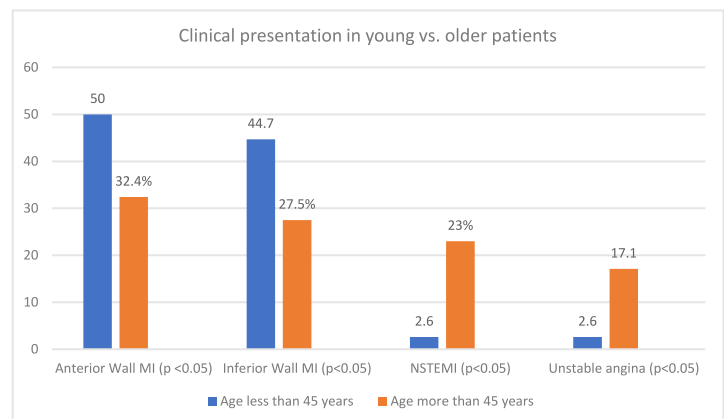


Figure 2 shows a comparison of clinical presentation in young (≤ 45 years) vs. older (> 45 years) patients. MI: myocardial infarction, NSTEMI: non-ST-elevation myocardial infarction.

Angiographic profile

Radial access was used in 221 (85%) patients. In our study Left anterior descending artery or diagonal (LAD/diagonal) was the most common culprit vessel in 143 (55%) patients, followed by the right coronary artery (RCA) in 75 (28.8%), left circumflex or an obtuse marginal (LCX/OM) in 34 (13.1%) and left main coronary artery (LMCA) in 8 (3.1%) patients (Table 2).

Procedural characteristics

Percutaneous coronary intervention (PCI) was done using a 6F guide catheter in 255 (98.1%) patients.

Direct stenting was done in 65 (25%) patients. Overall, 234 (90%) patients underwent stenting, while 26 (10%) patients underwent plain old balloon angioplasty (POBA) only. POBA was done in patients with diffusely diseased culprit vessels deemed inappropriate for stenting. Thrombus aspiration was done in 104 (40%) patients. It was done more in younger patients compared to older patients ($p=0.048$). The reason for thrombus aspiration being done more frequently in younger patients is the higher incidence of STEMI with higher thrombus grades in this subgroup. GpIIb/IIIa infusion was given in 84 (32.3%) patients. Younger patients received GpIIb/IIIa infusion more frequently ($p=0.002$). Intra-aortic balloon pump (IABP) was used as mechanical circulatory support in 10 (3.8%) (Table 2).

Parameter		General population n (%)	≤ 45 years old n (%)	> 45 years old n (%)	P value
Access	Radial access	221 (85%)	34 (89.5%)	187 (84.2%)	0.62
	Femoral access	39 (15%)	4 (10.5%)	35 (15.8%)	0.62
Culprit vessel	Left main	8 (3.1%)	0 (0%)	8 (3.6%)	-
	LAD/diagonal	143 (55%)	22 (57.9%)	121 (54.5%)	>0.05
	LCX/OM	34 (13.1%)	6 (15.8%)	28 (12.6%)	>0.05
	RCA	75 (28.8%)	10 (26.3%)	65 (29.3%)	>0.05
Catheter diameter	6F	255 (98.1%)	37 (97.4%)	218 (98.2%)	0.55
	7F	5 (1.9%)	1 (2.6%)	4 (1.8%)	0.55
Details of PCI	Stenting	234 (90%)	34 (89.5%)	200 (90.1%)	1.0
	POBA	26 (10%)	4 (10.5%)	22 (9.9%)	1.0
	Thrombosuction	104 (40%)	21 (55.3%)	83 (37.4%)	0.048
	Direct stenting	65 (25%)	13 (34.2%)	52 (23.4%)	0.16
	Postdilatation	208 (80%)	29 (76.3%)	179 (80.6%)	0.51
	GpIIb/IIIa infusion	84 (32.3%)	21 (55.3%)	63 (28.4%)	0.002
	Procedure duration	65.21 ± 12.93	66.21±12.92	63.64±13.31	0.27
	Fluoroscopy time	23.59 ± 5.32	23.18±4.74	24.09±6.12	0.38
	Door to balloon time	75.62 ± 35.23	73.45±18.05	79.33±58.05	0.53
Number of stents	01	156 (60%)	26 (68.4%)	130 (58.6%)	0.29
	02	104 (40%)	92 (41.4%)	12 (31.6%)	0.29
Type of stents	Drug-eluting stents (DES)	234 (90%)	34 (89.5%)	200 (90.1%)	>0.05
MCS	IABP	10 (3.8%)	1 (2.6%)	9 (4.1%)	-

Table 2 shows the angiographic profile and procedural characteristics of our patient population. Note that younger patients (≤ 45 years) were treated with thrombosuction and GpIIb/IIIa infusion more frequently compared to older (> 45 years) patients. Older (> 45 years) patients required mechanical circulatory support (IABP) more frequently. LAD: left anterior descending artery; LCX: left circumflex; OM: obtuse marginal; RCA: right coronary artery; POBA: plain old balloon angioplasty. MCS: mechanical circulatory support; IABP: intra-aortic balloon pump.

CAD pattern

Table 3 shows the CAD pattern in our patient population. Single vessel disease (SVD) was more common in young patients compared to old patients.

Parameter	General population n (%)	≤ 45 years old n (%)	> 45 years old n (%)	P value
SVD	153 (58.9%)	32 (84.2%)	121 (54.5%)	0.01
DVD	51 (19.6%)	3 (7.9%)	48 (21.6%)	>0.05
TVD	56 (21.5%)	3 (7.9%)	53 (23.9%)	>0.05

Table 3 shows the CAD pattern in our patient population. SVD: single vessel disease; DVD: double vessel disease; TVD: triple vessel disease.

In-hospital Outcomes

Table 4 shows In-hospital outcomes in our patient population. Angiographic success was achieved in 237 (91.2%) patients. MACE rate, mortality, reinfarction, stroke, stent thrombosis, and major bleeding were numerically higher in older patients.

Parameter	General population	≤ 45 years old	> 45 years old	P value
Angiographic success	237 (91.2%)	35 (92.1%)	202 (91%)	1.0
MACE	13 (5%)	1 (2.6%)	12 (5.4%)	0.70
Death	5 (1.9%)	0 (0%)	5 (2.3%)	1.0
Reinfarction	5 (1.9%)	0 (0%)	5 (2.3%)	1.0
Stroke	3 (1.2%)	0 (0%)	3 (1.4%)	1.0
Stent thrombosis	5 (1.9%)	0 (0%)	5 (2.3%)	1.0
Major bleeding	3 (1.2%)	0 (0%)	3 (1.4%)	1.0

Table 4 shows the In-hospital outcomes of our patient population. Note that younger patients have numerically lower MACE rates, death, reinfarction, stroke, stent thrombosis, and major bleeding. MACE: major adverse cardiovascular events.

Discussion

Our study includes a total of 260 patients, of which 38 (14.6%) were young (≤ 45 years). We found that obesity, smoking, family history of CAD, and history of substance abuse were more common in younger patients compared to older patients. Obesity, smoking, family history of CAD and history of substance abuse was present in 15 (39.5%), 30 (78.9%), 12 (31.6%) and 7 (18.4%) young patients respectively. These risk factors were present in 50 (22.5%), 87 (39.2%), 30 (13.5%) and 2 (0.8%) of the older patients respectively. The p values were suggestive of statistical significance as shown in the table 1. Hence obesity at a younger age was a strong risk factor for ACS in our study. This is consistent with other studies done from the Indian subcontinent [11,12]. Hypertension and diabetes mellitus were more common in older patients. 168 (75.7%) and 85 (38.3%) older patients were hypertensive and diabetic respectively, whereas 14 (36.8%) and 6 (15.8%) younger patients were hypertensive and diabetic respectively. The p value were suggestive of statistical significance as shown in table 1. There was family history of premature CAD in 12 (31.6%) young patients, and 30 (13.5%) older patients. This is consistent with a few other Indian studies showing a prevalence ranging from 30 to 47%. [11,13]. 30 (78.9%) young patients were smokers, and 87 (39.2%) older patients were smokers. Smoking is a major CAD risk factor, and it is associated with higher mortality [14]. The mean LVEF in our study was $37 \pm 19\%$ (Table 2). Anterior wall myocardial infarction and Inferior wall infarction were more common in younger patients, and NSTEMI and unstable angina were more common in older patients. This is consistent with other studies as well [11,12,15]. Coronary angiography was done in all of our patients. Young patients had single vessel disease (SVD) more frequently compared to older patients. DVD and TVD were low in younger patients, consistent with other studies [11,13,15,16]. LAD was the most common culprit artery. One patient who was young had a spontaneous coronary artery dissection as a cause for NSTEMI. He was treated by PCI with DES. Thrombosuction use and GpIIb/IIIa infusion were used more frequently in younger patients. This is due to the higher prevalence of high-grade thrombus in younger patients and STEMI presentation. Overall, direct stenting was done in 65 (25%) patients and post dilatation was done in 208 (80%) patients. Direct stent may avoid distal embolization and prevent slow flow during primary PCI [17]. The procedure duration was 65.21 ± 12.93 , fluoroscopy time was 23.59 ± 5.32 and door-to-balloon time was 75.62 ± 35.23 . 156 (60%) patients received a single drug-eluting stent whereas 104 (40%) received two drug-eluting stents. IABP was used as mechanical circulatory support in 10 (3.8%) patients. All cause death was 1.9% and MACE rate was 5%. In-hospital outcomes were significantly better in younger compared to older patients as shown in table 4.

Limitations

It was a retrospective single-center study with no long-term outcome data. There was a small number of younger patients, and the data cannot be extrapolated to the whole community. Quantitative coronary angiography (QCA) and Intravascular imaging were not used in our study.

Conclusion

Obesity, smoking, family history of premature CAD, and substance abuse are risk factors for ACS in the younger population whereas hypertension and diabetes mellitus remain the most common risk factors in older patients.

AWMI is the most common presentation of ACS in young patients and SVD is the most common CAD pattern on angiography. Younger patients have better In-hospital outcomes compared to older patients.

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