

ORIGINAL ARTICLE

PATTERN OF CORONARY ARTERY DISEASES IN PATIENTS UNDER 40 YEARS OF AGE WITH ACUTE CORONARY SYNDROME

Iram Jehan Balouch¹, Iftikhar Ahmed¹, Faiza Farooq², Syed Ahsan Raza¹, Najia Aslam Soomro³, Muhammad Nauman Khan², Jawaid Akbar Sial², Musa Karim²¹Hyderabad Satellite Center of National Institute of Cardiovascular Disease, Pakistan, ²National Institute of Cardiovascular Diseases, Karachi, Pakistan, ³Liaquat National Hospital, Karachi, Pakistan

Objectives: To determine the pattern of coronary artery diseases (CAD) in patients under 40 years of age with acute coronary syndrome (ACS) presenting at Hyderabad Satellite Center of National Institute of Cardiovascular Disease (NICVD), Pakistan.

Methodology: This cross-sectional study was conducted at cardiology department of the NICVD, Hyderabad Satellite Center. Both male and female patients, between 18 to 40 years of age, diagnosed with acute coronary syndrome (ACS), and undergone coronary angiography were included in this study. Angiographic patterns in terms of extent of the disease (number of diseased vessels and localization of lesion) were assessed.

Results: Total of 220 young patients included. Patients were predominantly male (91.8%) with the mean age of 35.3 ± 5 years. Smoking was observed 30.5% followed by hypertension (24.5%) and positive family history of CAD (19.1%). A majority of the patients (79.1%) were diagnosed as with ST-elevation myocardial infarction (STEMI) with anterior wall myocardial infarction (MI) as the most common (57.3%) type of MI. Most of the patients (70%) had single vessel diseases (SVD) with left anterior descending artery (LAD) as the most commonly diseased vessel (53.6%). Nine (4.1%) patients had significant left main disease and 6.4% had non-obstructive CAD.

Conclusion: The common clinical presentation of ACS in younger patients is STEMI. Smoking is the commonest risk factor followed by hypertension and family history of CAD. More than 2/3rd of the young patients are expected to have single vessel diseases with LAD as the most commonly diseased vessel.

Keywords: STEMI, Acute Coronary Syndrome, Angiography

Citation: Balouch IJ, Ahmed I, Farooq F, Raza SA, Soomro NA, Khan MN, Sial JA, Karim M. Pattern of Coronary Artery Diseases in Patients Under 40 Years of Age with Acute Coronary Syndrome. Pak Heart J. 2021;54(02):144-147. DOI: <https://doi.org/10.47144/phj.v54i2.2089>

INTRODUCTION

Once considered to be the disease of the old, ischemic heart disease (IHD) in young population, also termed as premature coronary artery disease (CAD), remains a rising public health concern in our society.¹ The frequency of IHD in South Asian population is more than that of population in the western world. Necropsy studies have demonstrated that atherosclerotic changes initiated in the blood vessels in early life and become symptomatic after 40 years of life.² The increase frequency of cardiovascular disorders in young generation is an alarming public health issue.³ In younger patients with IHD, a greater participation of the genetic component has been discussed.⁴ The incidence of younger age group was significantly higher in men compared to women and majority of those sufferings belong to lower middle class socioeconomic structure of the society.⁵ It is unclear that the pathophysiology of myocardial infarction at a young age is same as same observed in older patients. MI is mainly owing to congenital coronary

anomaly, coronary spasm, premature atherosclerosis, and drug induced. Some researchers reported that drug induced myocardial infarction is related with atherogenic consequences in young individuals due to long term abuse of drugs.⁶ The data regarding risk factors and coronary angiographic findings in young adults with ACS in Pakistan is limited. Despite the fact that few studies have been carried out in subcontinent there is expected variability in the results in our population due to socioeconomic and cultural diversity. Hence this study was conducted with aim to determine the pattern of CAD in patients under 40 years of age with ACS. The current study aims not only to contribute to the scientific understanding of the disease but also helps in the development of appropriate strategies of screening such patients at an appropriate age so to prevent IHD among young population.

METHODOLOGY

This descriptive cross-sectional study was performed at the cardiology department of National Institute of Cardiovascular Disease (NICVD), Hyderabad Satellite Center during January 2020 to June 2020. All patients between the 20-40 years of age were included in this study considering the inclusion and exclusion criteria. Inclusion criteria were both male and female patients, age between 18 to 40 years, diagnosed with acute coronary syndrome (ACS), and undergoing percutaneous coronary intervention (PCI). Exclusion criteria were patient with prior history of ACS, history of any cardiac surgery, or refused to give consent for participation.

Approval of ethical review committee of NICVD was taken prior to the data collection (ERC-02/2020). Consecutive patients fulfilling the inclusion/exclusion criteria were included. Prior to inclusion the purpose, and benefits of the study were explained to all participants and verbal informed consent was taken by the principal investigator from all patients regarding their participation in the study and publication of obtained data while maintaining confidentiality.

Demographic detail such as gender and age (years), and history of the patients were taken regarding hypertension, diabetic mellitus, family history, and obesity. A baseline 12-lead electrocardiogram (ECG) was obtained for all the patients and type and location of myocardial infarction was classified. Percutaneous coronary intervention (PCI) was performed in all the patients and angiographic patterns in terms of extent of the disease (number of diseased vessels, localization of diseases and stenosis (%), left ventricular ejection fraction (LVEF), initial TIMI flow grade, and thrombus grade) and procedural characteristics (use of export, pre balloon used, and tirofiban infusion, type of stent, and final TIMI flow grade) were recorded. Localization of diseases and stenosis (%) was assessed as ostial, proximal, mid, or distal for all major coronary arteries namely left main (LM), left anterior descending artery (LAD), left circumflex artery (LCX), right coronary artery (RCA), obtuse marginal (OM), and ramus intermedius.

Data will be entered and analysis using SPSS version-21 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp). Continuous variables were expressed using descriptive statistics such as mean \pm standard deviation (SD) or median [interquartile range (IQR)] appropriately. Frequency and percentages were calculated for categorical variables.

RESULTS

A total of 220 young patients between the 20 to 40 years of age were included in this study. Patients were predominantly male (91.8%) with the mean age of 35.3 ± 5 years. Smoking was found to be the most common (30.5%) co-morbid followed by hypertension (24.5%) and 19.1% of the patients had positive family history of CAD. A majority of the patients (79.1%) were diagnosed with STEMI at presentation with anterior wall MI as the most common (57.3%) type of MI. Baseline demographic and clinical characteristics are presented in Table 1.

Table 1: Demographic and Clinical Features

Characteristics	Total
Subjects (N)	220
Gender	
Male	91.8% (202)
Female	8.2% (18)
Age (years)	35.3 \pm 5
20 to 30 years	19.1% (42)
31 to 40 years	80.9% (178)
Risk Factors	
Hypertension	24.5% (54)
Diabetes mellitus	9.1% (20)
Smoking	30.5% (67)
Obesity	7.7% (17)
Dyslipidemia	3.2% (7)
Family history of coronary artery diseases	19.1% (42)
Acute coronary syndrome (ACS)	
STEMI	79.1% (174)
NSTEMI	20% (44)
Unstable angina (UA)	0.9% (2)
Type of myocardial infarction (MI)	
Inferior Wall	35.5% (78)
Posterior Wall	20.9% (46)
Anterior Wall	57.3% (126)
Lateral Wall	7.7% (17)
High Lateral Wall	3.2% (7)

STEMI = ST elevation myocardial infarction, NSTEMI = Non-ST elevation myocardial infarction

Table 2: Cardiac Catheterization

Characteristics	Total
Subjects (n)	220
Vessels involved	
Single vessel diseased (SVD)	70% (154)
Two vessels diseased (2VD)	24.1% (53)
Three vessels diseased (3VD)	5.9% (13)
Diseased vessels	
Left main (LM)	4.1% (9)
Left anterior descending artery (LAD)	53.6% (118)
Left circumflex artery (LCX)	26.4% (58)
Right coronary artery (RCA)	26.8% (59)
Obtuse marginal (OM)	0.5% (1)
Ramus intermedius	1.8% (4)
Non Obstructive	6.4% (14)
Left ventricular ejection fraction (LVEF)	
20-25%	4.5% (10)
25-30%	29.1% (64)
30-35%	8.6% (19)
35-40%	6.8% (15)
40-45%	31.8% (70)
45-50%	13.6% (30)

50%+	5.5% (12)
Initial thrombolysis in myocardial infarction (TIMI) flow grade	
0	33.6% (74)
I	25% (55)
II	23.6% (52)
III	17.7% (39)
Thrombus Grade	
0	5.9% (13)
I	3.2% (7)
II	15.5% (34)
III	12.7% (28)
IV	33.6% (74)
V	29.1% (64)
Export used	45.5% (100)
Pre balloon used	45% (99)
Type of stent	
Drug-eluting stents (DES)	86.4% (190)
Bare-metal stent (BMS)	10.9% (24)
Plain old balloon angioplasty	2.7% (6)
Tirofiban Infusion	47.7% (105)
Final TIMI flow grade	
0	0.9% (2)

I	6.4% (14)
II	54.5% (120)
III	38.2% (84)

Most of the patients (70%) had single vessel coronary artery diseases with LAD as the most commonly diseases vessel (53.6%) followed by RCA (26.8%), and LCX (26.4%). Nine (4.1%) patients had significant left main disease and 6.4% had non-obstructive coronary artery diseases. In this cohort we observed a significant thrombus burden with thrombus grade V in 29.1% and IV in 33.6% of the patients. Export was used in 45.5% of the patients, DES was deployed in 86.4%, and final TIMI flow grade II-III was observed in 92.7% of the patients. Characteristics and finding of cardiac catheterization are presented in Table 2. Distribution of localization of disease is presented in Table 3.

Table 3: Localization of Diseases

	LM	LAD	LCX	RCA	OM	RAMUS
Total (N)	9	118	58	59	1	4
Stenosis (%)	56.7 ± 13.2	92 ± 7.4	85.2 ± 9.1	92.1 ± 8.4	100 ± 0	90 ± 8.2
Characteristics						
Ostial	0 (0%)	25 (21.2%)	2 (3.4%)	3 (5.1%)	0 (0%)	0 (0%)
Proximal	0 (0%)	48 (40.7%)	14 (24.1%)	31 (52.5%)	1 (100%)	4 (100%)
Mid	0 (0%)	48 (40.7%)	42 (72.4%)	22 (37.3%)	0 (0%)	0 (0%)
Distal	9 (100%)	4 (3.4%)	0 (0%)	1 (1.7%)	0 (0%)	0 (0%)

LM = left main, LAD = left anterior descending artery, LCX = left circumflex artery, RCA = right coronary artery, OM = obtuse marginal, RAMUS = ramus intermedius

DISCUSSION

ACS in young adults has to be taken as a serious public health issue in Pakistan, more efforts and resources are needed to understand the development and progression CVD in this population. Therefore, in present study our aim was to evaluate the pattern of CAD in young (≤40 years) patients presented with ACS. Patients were predominantly male with smoking as a most common conventional risk factor followed by hypertension and positive family history of CAD. More than 2/3rd of the patients had single vessel diseases (SVD) with LAD as the most commonly diseased vessel followed by RCA, and LCX and around 80% of them were diagnosed with ST-segment elevation myocardial infarction (STEMI) at presentation. Significant left main disease was not that common observed in about 4.1% of the patients and a significant thrombus burden was observed with thrombus grade IV or higher in more than 60% of the patients.

The MI is more common in South Asian populations as compared to the western population and the South Asians, are unduly prone to develop CAD in young patients.⁷⁻⁹ The clinical proportion of premature MI is reported to be 2-12% of total STEMI.^{1,10,11} Some ACS studies reported similar male predominance in younger patients with CVD.^{12,13} CAD is less common in premenopausal women due to the protective effects of estrogen but the risk is enhancing in menopause.¹⁴ In

general, various risk factors are considered to play a significant role in development of CAD is younger adults. We have observed that smoking, hypertension, family history of CAD were the leading conventional risk factors in this population, while, other conventional risk factors such as diabetes, obesity, and dyslipidemia were not that common. Similar to our study various studies in the past have highlighted sedentary lifestyle, smoking, and positive family history as a key risk factors of CAD is younger population.^{13,15-17} A recent study by Ahmed S et al.¹⁸ compared outcomes of primary PCI in young smokers and non-smoker patients without any other conventional risk factors of CAD and reported no significant differences in disease pattern and immediate clinical outcomes after primary PCI. Further they argued the need of understanding and identification of risk factors other than conventional risk factors and timely risk stratification in these patients. Similarly, Ashraf T et al.¹⁹ also highlighted need of a population-specific risk stratification system for primary prevention in this population.

Multivessel disease (MVD) was less common in young patients, it account for only about 1/3rd of the total patients, which was smaller than some of the past studies on STEMI patients in Pakistani population. Muhammad AS et al.²⁰ reported MVD in 40.1% of the patients with STEMI under 45 years of age. Similarly, in a study by

Batra MK et al.¹ MVD was reported in 38% of young (≤ 40 years) patients with STEMI. The proportion of MVD in young patients is reported to be ranging from 16 to 56% in studies conducted in various populations of the world.²¹⁻²⁵

A single center non-comparative study are the key limitation of this study. Further studies are needed to identify risk factors, in addition to the conventional risk factors of CAD, aggravating the cardiovascular diseases in young population.

CONCLUSION

The common clinical presentation of ACS in younger patients is STEMI. Smoking is the commonest risk factor followed by hypertension and family history of CAD. More than 2/3rd of the young patients are expected to have single vessel diseases with LAD as the most commonly diseased vessel followed by RCA, and LCX.

AUTHORS' CONTRIBUTION: IJB: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. IA, FF, SAR, NAS, MNK, JAS, MK: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

Conflict of interest: Authors declared no conflict of interest.

REFERENCES

- Batra MK, Rizvi NH, Sial JA, Saghir T, Karim M. Angiographic characteristics and in hospital outcome of young patients, age up to 40 versus more than 40 years undergoing primary percutaneous coronary intervention. *J Pak Med Assoc.* 2019;69(9):1308-12.
- Tuzcu EM, Kapadia SR, Tutar E, Ziada KM, Hobbs RE, McCarthy PM, et al. High prevalence of coronary atherosclerosis in asymptomatic teenagers and young adults: evidence from intravascular ultrasound. *Circulation.* 2001;103(22):2705-10.
- Bonow RO, Smaha LA, Smith Jr SC, Mensah GA, Lencant C. World Heart Day 2002: the international burden of cardiovascular disease: responding to the emerging global epidemic. *Circulation.* 2002;106(13):1602-5.
- Mansur AdP, Mattar AP, Rolim AL, Yoshi FR, Marin JF, César LAM, et al. Distribution of risk factors in parents and siblings of patients with early coronary artery disease. *Arq Bras Cardiol.* 2003;80(6):582-4.
- Cheng C-I, Yeh K-H, Chang H-W, Yu T-H, Chen Y-H, Chai H-T, et al. Comparison of baseline characteristics, clinical features, angiographic results, and early outcomes in men vs women with acute myocardial infarction undergoing primary coronary intervention. *Chest.* 2004;126(1):47-53.
- Zimmerman F, Cameron A, Fisher L, Ng G. Myocardial infarction in young adults: angiographic characterization, risk factors and prognosis (Coronary Artery Surgery Study Registry). *J Am Coll Cardiol.* 1995;26(3):654.
- Sharma M, Ganguly NK. Premature coronary artery disease in Indians and its associated risk factors. *Vasc Health Risk Manag.* 2005;1(3):217.
- Joshi P, Islam S, Pais P, Reddy S, Dorairaj P, Kazmi K, et al. Risk factors for early myocardial infarction in South Asians compared with individuals in other countries. *JAMA.* 2007;297(3):286-94.
- Islam AM, Majumder A. Coronary artery disease in Bangladesh: A review. *Indian Heart J.* 2013;65(4):424-35.
- Rallidis LS, Pavlakis G. The fundamental importance of smoking cessation in those with premature ST-segment elevation acute myocardial infarction. *Curr Opin Cardiol.* 2016;31(5):531-6.
- Singh B, Singh A, Goyal A, Chhabra S, Tandon R, Aslam N, et al. The prevalence, clinical spectrum and the long term outcome of ST-segment elevation myocardial infarction in young-a prospective observational study. *Cardiovasc Revasc Med.* 2019;20(5):387-91.
- El-Menyar A, Ahmed E, Albinali H, Al-Thani H, Gehani A, Singh R, et al. Mortality trends in women and men presenting with acute coronary syndrome: insights from a 20-year registry. *PLoS One.* 2013;8(7):e70066.
- Puricel S, Lehner C, Oberhänsli M, Rutz T, Togni M, Stadelmann M, et al. Acute coronary syndrome in patients younger than 30 years—etiologies, baseline characteristics and long-term clinical outcome. *Swiss Med Wkly.* 2013;143:w13816.
- Maas AH, Appelman YE. Gender differences in coronary heart disease. *Neth Heart J.* 2010;18(12):598-603.
- Schoenenberger AW, Radovanovic D, Stauffer J-C, Windecker S, Urban P, Niedermaier G, et al. Acute coronary syndromes in young patients: presentation, treatment and outcome. *Int J Cardiol.* 2011;148(3):300-4.
- Nadeem M, Ahmed SS, Mansoor S, Farooq S. Risk factors for coronary heart disease in patients below 45 years of age. *Pak J Med Sci.* 2013;29(1):91.
- Rallidis LS, Pavlakis G, Foscolou A, Kotakos C, Katsimardos A, Drosatos A, et al. High levels of lipoprotein (a) and premature acute coronary syndrome. *Atherosclerosis.* 2018;269:29-34.
- Ahmed S, Khawaja S, Khawaja S, Ashraf T, Aamir K, Batra MK, et al. Differences in angiographic profile and immediate outcome of primary percutaneous coronary intervention in otherwise risk-free young male smokers. *Cureus.* 2020;12(6).
- Ashraf T, Mengal MN, Muhammad AS, Tareen AK, Khan MN, Kazmi KA, et al. Ten years risk assessment of atherosclerotic cardiovascular disease using Astro-CHARM and pooled cohort equation in a south Asian sub-population. *BMC Public Health.* 2020;20:1-6.
- Muhammad AS, Ashraf T, Mir A, Alishan S, Farooq F, Ammar A, et al. Comparative assessment of clinical profile and outcomes after primary percutaneous coronary intervention in young patients with single vs multivessel disease. *World J Cardiol.* 2020;12(4):136.
- Esteban MR, Montero SM, Sánchez JJ, Hernández HP, Pérez JJ, Afonso JH. Acute coronary syndrome in the young: clinical characteristics, risk factors and prognosis. *Open Cardiovasc Med J.* 2014;8:61.
- Deora S, Kumar T, Ramalingam R, Manjunath CN. Demographic and angiographic profile in premature cases of acute coronary syndrome: analysis of 820 young patients from South India. *Cardiovasc Diagn Ther.* 2016;6(3):193.
- Waziri H, Jørgensen E, Kelbæk H, Stagmo M, Pedersen F, Lagerqvist B, et al. Short and long-term survival after primary percutaneous coronary intervention in young patients with ST-elevation myocardial infarction. *Int J Cardiol.* 2016;203:697-701.
- Ge J, Li J, Yu H, Hou B. Hypertension Is an Independent Predictor of Multivessel Coronary Artery Disease in Young Adults with Acute Coronary Syndrome. *Int J Hypertens.* 2018;2018.
- Anjum M, Zaman M, Ullah F. Are Their Young Coronaries Old Enough? Angiographic Findings In Young Patients With Acute Myocardial Infarction. *J Ayub Med Coll Abbottabad.* 2019;31(2):151-5.

Address for Correspondence:

Dr. Iram Jehan Balouch, Assistant Professor at National Institute of Cardiovascular Disease, Hyderabad, Pakistan.

Email: drebalouch@gmail.com