

Clinical Presentation, Risk Factors, and Coronary Angiographic Profile of very Young Adults (≤ 30 Years) Presenting with First Acute Myocardial Infarction at a Tertiary Care Center Karachi

RIZWAN KHAN¹, JAVED KHURSHED SHAIKH², MUHAMMAD HASSAN BUTT³, IFTIKHAR AHMED⁴, AHSAN RAZA⁵, TARIQ ASHRAF⁶

¹FCPS Cardiology Assistant Professor of Cardiology National Institute of Cardiovascular Disease Sehwan

²MBBS, FCPS (General Cardiology), MSPH Assistant Professor Department of Cardiology, National Institute of Cardiovascular Disease, Karachi.

³MBBS, FCPS (Cardiology) Assistant Professor Department of Cardiology, National Institute of Cardiovascular Disease, Karachi.

⁴MBBS, FCPS (Cardiology) Fellowship in Interventional Cardiology Assistant Professor Department of Cardiology, National Institute of Cardiovascular Disease, Hyderabad Centre

⁵MBBS, FCPS (Cardiology) Assistant Professor Department of Cardiology, National Institute of Cardiovascular Disease, Hyderabad

⁶FCPS Cardiology Professor of Cardiology NICVD Karachi

Corresponding author: Rizwan Khan, Email: rizkhanshk@gmail.com, Cell: 03333605877

ABSTRACT

Objectives: To characterize the clinical demonstration, risk factors, echocardiographic, and coronary angiographic profile of very young individuals presenting with their first AMI at a tertiary care hospital at NICVD Karachi Sindh, Pakistan

Background: Rare cases of acute coronary syndrome (ACS) occur in relatively young persons under the age of 30. In Pakistan, <2% of people have experienced an acute myocardial infarction (AMI). When it happens at this young age, ACS has a substantial impact on the patient's psyche, morbidity, and increased financial burden. Single-vessel disease and non-obstructive stenosis are considerably more common in young individuals with ACS on coronary angiography (CAG).

Materials and Methods: At the Department of Cardiology NICVD Karachi, this retrospective observational research was carried out. Very young individuals (≤ 30 years of age) who had their first AMI from 1st January to 30th June 2019 had their medical records gathered and examined.

Results: 50 young patients aged ≤ 30 years old were hospitalized with their first AMI. The majority of the patients were between the ages of 25–30 years. Patients had a mean age of 28.62 ± 2.04 years, and 48 of them (96%) were men. Smoking was the most frequent risk factor for CAD, accounting for 54% of cases in individuals under the age of 30. One patient presented with a complete heart block and a temporary pacemaker was inserted as a lifesaving measure. STEMI (78%) was more common as compared to NSTEMI (22%). The mean left ventricular ejection fraction was $41.4 \pm 7.6\%$. The single-vessel disease was the most prevalent (60%) finding. The most common culprit vessel was the LAD artery (40%) followed by the RCA (14%). The double-vessel disease was seen in 22% of individuals and the most common combination of vessels was LAD and RCA (14%).

Conclusion: When compared to older patients, very young individuals showed less severe CAD, which is probably because their coronary arteries had less atherosclerosis. Smoking and dyslipidemia are the most avoidable risk factors in Pakistan's youthful population. Primary prevention, such as public awareness campaigns about the dangers of smoking, poor eating habits, and sedentary lifestyles, may assist to avert the emergence of cardiac issues in later life.

Keywords: Acute coronary syndrome, coronary artery disease, smoking, young adults

INTRODUCTION

In Pakistan and throughout the world, cardiovascular disease is one of the leading causes of death.^{1,2} In Pakistan, indications of coronary artery disease (CAD) appear 10 years earlier than in the western population, making them more likely to acquire the condition.³ Among the most frequent manifestations of coronary artery disease (CAD), acute coronary syndrome (ACS) comprises unstable angina, ST-segment elevation myocardial infarction (STEMI), and non-STEMI (NSTEMI).⁴ ACS is uncommon in adults under 30 years old. This demographic has a prevalence of <2% for acute myocardial infarction (AMI) in Pakistan.⁵ According to a related study, in the ≤ 30 age range, 0.4% of patients presenting with ACS.⁶ When it strikes a patient so early, ACS has a big impact on their psychologically, increases their risk of morbidity and increases their financial burden.⁷ Cardiovascular disease (CAD) patients of different ages have different risk profiles, clinical factor distributions, and patterns of arterial involvement.^{8,9} Metabolic, genetic, and conventional causes may result in CAD occurring at a younger age in Pakistan.¹⁰ Atherosclerosis occurring at a younger age is an emerging problem and is due to civilization which is changing rapidly due to unhealthy diets, stressful work conditions, and sedentary lifestyles. Additional risk factors for CAD include smoking, substance abuse, hypertriglyceridemia, low high-density lipoprotein cholesterol, high lipoprotein-a levels, coronary vasospasm, medium vessel vasculitis, hypercoagulable states, and metabolic syndrome. Single-vessel disease and non-obstructive stenosis are considerably more common in young individuals with ACS on coronary angiography (CAG).¹¹ There is a dearth of knowledge on the angiographical profile, risk factors, and clinical presentation of ACS in very young people (≤ 30 years of age) in Sindh, Pakistan. This study aims to characterize the clinical

demonstration, risk factors, echocardiographic, and coronary angiographic profile of very young individuals presenting with their first AMI at a tertiary care hospital at NICVD Karachi Sindh, Pakistan.

MATERIALS AND METHODS

The Department of Cardiology at NICVD Karachi carried out this retrospective observational research. From 1st January to 30th June 2019, the medical data of very young individuals (30 years of age) who had their first AMI were gathered and put into a Microsoft Excel spreadsheet. Data were further analyzed with IBM SPSS Modeler 16.0. The research was accepted by the institutional ethical review committee.

Inclusion criteria

- 1 First AMI was diagnosed in very young individuals under 30 years old.
- 2 The fourth global classification of myocardial infarction was used to establish the criteria for a definitive diagnosis of AMI.¹²
- 3 American Heart Association/American College of Cardiology Foundation criteria were used to define ST-elevation myocardial infarction (STEMI) and non-ST-elevation myocardial infarction (NSTEMI).^{13,14}

Exclusion criteria

- 1 Patients with stable angina
- 2 Patients who have already had coronary artery bypass graft (CABG), percutaneous coronary intervention (PCI), or any of these procedures
- 3 Patients with prior cardiomyopathies, pericardial disease, or valvular heart disease
- 4 Patients with known allergies to contrast
- 5 Age younger than 18 years

6 Electrolyte abnormality

7 Patient with COVID-19 positive status.

Coronary angiographic profiles and PCI or CABG reports of eligible patients were also recorded. When the left anterior descending (LAD), left circumflex (LCX), right coronary artery (RCA), or their major branches had a lesion of $\geq 70\%$, or when the left main coronary artery had a luminal narrowing of $\geq 50\%$, the condition was referred to as obstructive coronary artery disease. Patients were categorized in one of the following single, double, or triple-vessel diseases. The other lesions on angiography which were not severe were labeled as non-obstructive CAD.

RESULTS

In the Department of Cardiology at NICVD Karachi, 50 young patients aged ≤ 30 years old were hospitalized with their first AMI. Patients diagnosed with ACS at a young age have a unique demographic and risk factor profile, which is existing in **Table 1**.

Patients had a mean age of 28.62 ± 2.04 years, and 48 of them (96%) were men. Smoking was the most frequent risk factor for CAD, accounting for 54% of cases in individuals under the age of 30. 18 (36%) and 14 (28%) of patients, respectively, had dyslipidemia and a family history of early CAD. A total of 16 (32%) patients were alcoholic, 11 (22%) patients were overweight, 7 (14%) patients were hypertensive, and 5 (10%) patients were diabetic. Chest discomfort was the most prevalent complaint in 45 individuals (90%). It was followed by sweating 39 (78%), shortness of breath 7 (14%), palpitations 5 (10%), and syncope 2 (4%). Four patients presented with cardiogenic shock and another four patients had ventricular tachycardia. One patient presented with a complete heart block and a temporary pacemaker was inserted as a lifesaving measure. STEMI (78%) was more common as compared to NSTEMI (22%). The mean left ventricular ejection fraction was $41.4 \pm 7.6\%$. The clinical characteristics of very young ACS patients are summarized in **Table 2**.

Table 1: Demographic and risk factors profile of coronary artery disease in very young acute coronary syndrome patients (n=50)

Parameter	n (%)
Age (years), mean \pm SD	28.62 \pm 2.04
Gender	
Male	48 (96.0)
Female	2 (4.0)
Area of residence	
Rural	27 (54.0)
Urban	23 (46.0)
Coronary risk factors	
Male	48 (96.0)
Smoking	27 (54.0)
Hypertension	7 (14.0)
Dyslipidemia	18 (36.0)
Diabetes	5 (10.0)
Obesity	11 (22.0)
Family history of CAD	14 (28.0)
Stressful life events	5 (10.0)
Alcohol	16 (32.0)

Eleven (22%) patients underwent thrombolysis before undergoing CAG. All of these patients were referred to our center after thrombolysis at other hospitals without PCI capabilities. Nine of these post-thrombolysis patients had obstructive CAD on angiography and underwent PCI with a drug-eluting stent (DES). One patient had a re-canalized vessel and was managed medically. 41 (82%) patients had obstructive CAD (vessel lumen stenosis $\geq 70\%$), whereas nine patients had non-obstructive CAD (18%). The single-vessel disease was the most common (60%) finding. The left anterior descending (LAD) artery was the most prevalent offending vascular (40%), followed by the right coronary artery (RCA) (14%). 22% of patients had the double-vessel disease, most often affecting the left anterior descending (LAD) and right coronary artery (RCA) (14%). No patient with a triple-vessel disease or left main disease was observed. Based on

the overall assessment, 41 (82%) patients underwent PCI with DES placement, and the rest of the patients were advised medical treatment 9 (18%). Coronary angiographic characteristics of the patients are summarized in **Table 3**.

Table 2: Clinical characteristics of coronary artery disease in very young acute coronary syndrome patients (n=50)

Parameter	n (%)
Clinical presentation	
Chest pain	45 (90.0)
Shortness of breath	7 (14.0)
Sweating	39 (78.0)
Palpitation	5 (10.0)
Syncope	2 (4.0)
Complications	
Cardiogenic shock	4 (8.0)
Ventricular tachycardia	4 (8.0)
Complete heart block	2 (4.0)
ACS types	
STEMI	39 (78.0)
AWMI	30 (60.0)
IWMI	9 (18.0)
NSTEMI	11 (22.0)
LVEF (%), mean \pm SD	41.4 \pm 7.6

Table 3: Coronary angiography profile and revascularization pattern of coronary artery disease in very young acute coronary syndrome patients (n=50)

Parameter	n (%)
Obstructive Coronary artery disease	41 (82.0)
Single-vessel disease	30 (60.0)
LAD	20 (40.0)
LCX	2 (4.0)
RCA	7 (14.0)
Double-vessel disease	11 (22.0)
LAD and RCA	7 (14.0)
LAD and LCX	5 (10.0)
RCA and LCX	0
Triple-vessel disease	0
Left main disease	0
Non-obstructive CAD	9 (18.0)
Treatment	
Percutaneous coronary intervention	41 (82.0)
Medical treatment	9 (18.0)

DISCUSSION

ACS is a life-threatening condition caused by atherosclerosis leading to acute narrowing of the coronary artery and followed by rupture of an unstable plaque with thrombosis. Diabetes mellitus, hypertension, smoking, family history of CAD, and lipid abnormalities are prominent risk factors in the development of early atherosclerosis. The clinical exhibition, risk factors, echocardiographic findings, and CAG profile in very young people (≤ 30 years of age) presenting with their first AMI are all identified by this study. The mean age of patients with ACS was 28.62 ± 2.04 years and 54.5% of patients were from rural backgrounds. In the present study, male predominance (95.4%) was observed, which is similar to other studies.^{5,15,16} Male predominance has been attributed to the preventive effects of estrogen in reducing atherosclerosis in women and the fact that smoking is far more prevalent in men.⁵ Out of, 50 very young adult patients aged ≤ 30 years were admitted with their first AMI. This prevalence of 1.59% of AMI in very young adults in our study is similar to the study published by Deshmukh et al. in 2019.¹⁵

In our study, risk factors for CAD were males (96%), smokers (54%), dyslipidemia (36%), consumption of alcohol (32%), family history of premature CAD (28%), obesity (22%), hypertension (14%), diabetes (10%), and stressful life events (10%). Cigarette smoking was found to be the main risk factor (54%) for the occurrence of coronary events in very young patients. It is one of the important causes of endothelial dysfunction. The INTERHEART study also showed smoking as a more significant risk factor in the younger men population as

compared to women.¹⁷ Many other studies have also shown that smoking is a major risk factor for AMI in young patients.^{5,6,16,18} Smoking cessation should be encouraged as primary prevention to reduce the burden of CAD in the younger population as it can result in vasoconstriction, promotes atherosclerosis, and consequently creates a thrombotic milieu in the vessel.⁵ Dyslipidemia was present in 36.3% of this study. According to several research done on young ACS patients, dyslipidemia can range from 21.2% to 51.2%.^{5,15} These studies indicate that lifestyle (sedentary) factors and lipid metabolism abnormalities may be significant factors in the onset of CAD in young individuals. An additional significant risk factor for ACS in younger individuals is a family history of early CAD. In our analysis, 28% of patients had a family history of early CAD, compared to 9.8% to 46.8% in other studies.^{5,15} Obesity is a risk factor that is indirectly linked to ACS. 22% of patients were obese in our study as compared to 39.1% in the study by Sinha et al.⁵ Diabetes mellitus, hypertension, and stress are significant risk factors for CAD. In our study, two patients had diabetes mellitus, and three had hypertension. The diabetes mellitus prevalence was 2.4%–17.2% in other studies and the hypertension prevalence was 12.2%–20.5% in other studies.^{5,15} Stressful life events may lead to plaque rupture resulting in ACS. The frequency of stressful life events was low (10%) in the studied population. The prevalence of stressful life events was much higher (29.6%) in the study by Sinha et al.⁵ The most prevalent signs and symptoms leading to hospitalization were chest pain (90%), sweating (78%), and is similar to the study by Sinha et al.⁵ STEMI was the most common presentation (78%) as compared to NSTEMI (22%). Anterior wall myocardial infarction (60 %) was the most prevalent STEMI in this research which was consistent with other studies in young patients.^{5,15} Mean left ventricular ejection fraction in this study was found to be 41.4 \pm 7.6%. In this study, obstructive CAD was found in 82% of young patients. Other studies have reported a similar prevalence rate.^{5,18,19} However, some studies have reported lower rates of obstructive CAD.^{15,18,20} Non-obstructive CAD was seen in 18% of the patients in our study. In this study, the single-vessel disease was the most common (60%) finding and this predominance was similar to the other studies on young patients with ACS.^{5,15,16,18,19,21} Low prevalence of double-vessel disease suggests that extensive coronary involvement is not a common finding in young adults presenting with ACS. In the single-vessel disease group, LAD involvement was the most common infarct-related artery (40%), whereas RCA was involved in 14% and LCX in 4%. The findings are similar to other studies where LAD was the most common.^{5,15,18,19,21,20} Another study showed that younger patients with ACS had more frequency of normal or minimal lesion coronary anatomy as compared with older patients with ACS.²² Based on the overall assessment, 41 (82%) patients underwent PCI with DES placement, and the rest of the patients were advised medical treatment 9 (18%) in this study. Very young adults suffer from a lack of awareness and poorer control of risk factors due to various socio-economic factors in our society.

Limitations: Small number of patients in this study is its main limitation. Furthermore, there was a lack of intracoronary imaging in our study. There was no follow-up of patients and as there was no control group, the statistical significance of each risk factor could not be analyzed

CONCLUSION

When compared to older patients, very young individuals showed less severe CAD, which is probably because their coronary arteries had less atherosclerosis. Among the youngest members of our population, smoking and dyslipidemia are the most important risk factors that may be altered. Education on the risks of smoking, poor nutrition, and a sedentary lifestyle during formative years can have a preventative influence on cardiovascular disease later in life. This will result in decreasing the burden from the already thinly stretched healthcare system in our country.

REFERENCES

1. Prabhakaran D, Singh K, Roth GA, Banerjee A, Pagidipati NJ, Huffman MD. Cardiovascular Diseases in India Compared With the United States. *J Am Coll Cardiol* [Internet]. 2018 Jul;72(1):79–95. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0735109718346643>
2. Prabhakaran D, Jeemon P, Roy A. Cardiovascular Diseases in India. *Circulation* [Internet]. 2016 Apr 19;133(16):1605–20. Available from: <https://www.ahajournals.org/doi/10.1161/CIRCULATIONAHA.114.008729>
3. Prabhakaran D, Singh K. Premature coronary heart disease risk factors & reducing the CHD burden in India. *Indian J Med Res* [Internet]. 2011 Jul;134:8–9. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21808126>
4. Hanna EB, Glancy DL. Lightheadedness, Fatigue, and Bradycardia. *Am J Cardiol* [Internet]. 2015 May;115(9):1320. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0002914915007092>
5. 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* [Internet]. 2017 Mar;13(2):79–87. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/29026414>
6. Gotsman I, Lotan C, Mosseri M. Clinical manifestations and outcome of acute myocardial infarction in very young patients. *Isr Med Assoc J* [Internet]. 2003 Sep;5(9):633–6. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/14509152>
7. Gaziano TA, Bitton A, Anand S, Abrahams-Gessel S, Murphy A. Growing Epidemic of Coronary Heart Disease in Low- and Middle-Income Countries. *Curr Probl Cardiol* [Internet]. 2010 Feb;35(2):72–115. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0146280609001273>
8. Gulati R, Behfar A, Narula J, Kanwar A, Lerman A, Cooper L, et al. Acute Myocardial Infarction in Young Individuals. *Mayo Clin Proc* [Internet]. 2020 Jan;95(1):136–56. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0025619619304215>
9. Badran HM, Elnoamany MF, Khalil TS, Eldin MME. Age-Related Alteration of Risk Profile, Inflammatory Response, and Angiographic Findings in Patients with Acute Coronary Syndrome. *Clin Med Cardiol* [Internet]. 2009 Jan 18;3:CMC.S2118. Available from: <http://journals.sagepub.com/doi/10.4137/CMC.S2118>
10. Enas EA, Yusuf S, Mehta JL. Prevalence of coronary artery disease in Asian Indians. *Am J Cardiol* [Internet]. 1992 Oct;70(9):945–9. Available from: <https://linkinghub.elsevier.com/retrieve/pii/000291499290744J>
11. Murray CJ, Lopez AD. Mortality by cause for eight regions of the world: Global Burden of Disease Study. *Lancet* [Internet]. 1997 May;349(9061):1269–76. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0140673696074934>
12. Thygesen K, Alpert JS, Jaffe AS, Chaitman BR, Bax JJ, Morrow DA, et al. Fourth Universal Definition of Myocardial Infarction (2018). *J Am Coll Cardiol* [Internet]. 2018 Oct;72(18):2231–64. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0735109718369419>
13. Amsterdam EA, Wenger NK, Brindis RG, Casey DE, Ganiats TG, Holmes DR, et al. 2014 AHA/ACC Guideline for the Management of Patients With Non–ST-Elevation Acute Coronary Syndromes: Executive Summary. *Circulation* [Internet]. 2014 Dec;130(25):2354–94. Available from: <https://www.ahajournals.org/doi/10.1161/CIR.000000000000133>
14. O’Gara PT, Kushner FG, Ascheim DD, Casey DE, Chung MK, de Lemos JA, et al. 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction: Executive Summary. *Circulation* [Internet]. 2013 Jan 29;127(4):529–55. Available from: <https://www.ahajournals.org/doi/10.1161/CIR.0b013e3182742c84>
15. 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 center in Central India. *Indian Heart J* [Internet]. 2019 Sep;71(5):418–21. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0019483219307254>
16. Puricel S, Lehner C, Oberhansli M, Rutz T, Togni M, Stadelmann M, et al. Acute coronary syndrome in patients younger than 30 years – aetiologies, baseline characteristics and long-term clinical outcome. *Swiss Med Wkly* [Internet]. 2013 Jul 29; Available from: <http://doi.emh.ch/smw.2013.13816>
17. Yusuf S, Hawken S, Öunpuu S, Dans T, Avezum A, Lanas F, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet* [Internet]. 2004 Sep;364(9438):937–52. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0140673604170189>
18. Revaiah PC, Vemuri KS, Vijayvergiya R, Bahl A, Gupta A, Bootla D,

- et al. Epidemiological and clinical profile, management and outcomes of young patients (≤ 40 years) with acute coronary syndrome: A single tertiary care center study. *Indian Heart J* [Internet]. 2021 May;73(3):295–300. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0019483221000158>
19. Iragavarapu T, Radhakrishna T, Babu KJ, Sanghamitra R. Acute coronary syndrome in young - A tertiary care centre experience with reference to coronary angiogram. *J Pract Cardiovasc Sci* [Internet]. 2019;5(1):18. Available from: <http://www.j-pcs.org/text.asp?2019/5/1/18/257607>
 20. Deora S, Kumar T, Ramalingam R, Nanjappa Manjunath C. Demographic and angiographic profile in premature cases of acute coronary syndrome: analysis of 820 young patients from South India. *Cardiovasc Diagn Ther* [Internet]. 2016 Jun;6(3):193–8. Available from: <http://cdt.amegroups.com/article/view/9413/10958>
 21. Revaiah PC, Vemuri KS, Vijayvergiya R, Bahl A, Gupta A, Bootla D, et al. Epidemiological and clinical profile, management and outcomes of young patients (≤ 40 years) with acute coronary syndrome: A single tertiary care center study. *Indian Heart J* [Internet]. 73(3):295–300. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/34154745>
 22. Prajapati J. AGE-Related Differences of Novel Atherosclerotic Risk Factors and Angiographic Profile Among Gujarati Acute Coronary Syndrome Patients. *J Clin DIAGNOSTIC Res* [Internet]. 2015; Available from: http://jcdr.net/article_fulltext.asp?issn=0973-709x&year=2015&volume=9&issue=6&page=OC05&issn=0973-709x&id=6000