ORIGINAL ARTICLE

Pattern of Coronary Artery Disease in Patients Under 50 Years of Age with Acute Coronary Syndrome

Aneeqa Khan[1], Umar Javed[2], Qaiser Mehmood Saleem[3], Abdul Manan Bari[4], Usman Javed[5], Sohail Anjum[6]

ABSTRACT

Objective: To determine the angiographic patterns and severity of coronary artery disease (CAD) in patients aged ≤50 years presenting with acute coronary syndrome (ACS) at a tertiary care hospital.

Study Design: Hospital based cross sectional analytical study.

Place and Duration of Study: Department of Cardiology, PAEC General Hospital, Islamabad, from January 1 and June 30, 2025.

Materials and Methods: Consecutive patients aged 30–50 years presenting with STEMI, NSTEMI, or unstable angina who underwent coronary angiography were enrolled. Demographic characteristics, cardiovascular risk factors, and angiographic findings were recorded. Data were analyzed using SPSS version 26.0. Associations between risk factors and CAD severity were assessed using the chi-square test, with $p < 0.05$ considered statistically significant.

Results: Ninety patients were included (mean age 44.94 ± 3.94 years), with 67.8% males. STEMI was the most frequent presentation (74.4%), followed by unstable angina (16.7%) and NSTEMI (8.9%). After angiography single-vessel disease was observed in 37.8% of patients, double-vessel disease in 22.2%, triple-vessel disease in 11.1%, 28.9% had normal coronary arteries. Hypertension (55.6%) and smoking (40%) were the most prevalent risk factors.

Conclusion: Among young adults presenting with ACS, STEMI is the predominant clinical presentation, and single-vessel CAD is the most frequent angiographic pattern. A considerable proportion had normal coronary arteries, highlighting the need for further evaluation of non-obstructive mechanisms in young ACS patients.

Key Words: *Acute Coronary Syndrome, Coronary Artery Disease, Hypertension, Myocardial Infarction, ST-Elevation.*

Introduction

Coronary artery disease (CAD) is one of the most common causes of morbidity and mortality in Pakistan and worldwide[1]. Despite traditionally being considered a disease of older adults, there has been a noticeable rise in the incidence of premature CAD over the past two decades, particularly in low- and middle-income countries like Pakistan. Among young adults, the increase in the frequency of cardiovascular disorders is associated with more aggressive outcomes.[2]

An increased involvement of the genetic component has been discussed in young-aged patients with CAD.[3] Men are much more likely than women to experience CAD in the younger age group, and the bulk of these cases are associated with lower-middle-class socioeconomic structure.[4]

Acute Coronary Syndrome (ACS) represents a critical spectrum of cardiovascular emergencies—encompassing ST-elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI), and unstable angina (UA). Its primary etiology involves the acute disruption of an atherosclerotic plaque through rupture or erosion, causing a localized thrombotic cascade, resulting in varying degrees of coronary arterial occlusion.[5,6,17]

This occlusion of arteries leads to Myocardial ischemia, while the tissue damage varies according to the extent and duration of obstruction.[7] Recent data indicates a rising incidence of Acute Coronary

[1,3,4,6]*Department of Cardiology*
PACE Hospital Islamabad
[2]*Department of General Practitioner*
Combined Military Hospital, Rawalpindi
[5] *Department of General Dental Practice*
Mydentist Poulton-le-Fylde
Correspondence:
Dr. Aneeqa Khan
Post Graduate Resident
Department of Cardiology
PACE Hospital Islamabad
E-mail: nomi.jav786@gmail.com

Received: August 29, 2025; Revised: March 09, 2026
Accepted: March 11, 2026

https://doi.org/10.57234/jiimc.march26.2707

Syndrome (ACS) in young individuals, a demographic that typically presents with single-vessel disease and a higher prevalence of modifiable risk factors.[8,9,10]

Coronary artery disease (CAD) develops as a result of multiple interacting factors, including both modifiable and non-modifiable risk factors. Commonly recognized risk factors such as smoking, obesity, diabetes mellitus, dyslipidemia, and hypertension have been widely studied and are known to contribute significantly to the development of CAD.[11,12] In recent years, an increasing number of young adults in Pakistan have been presenting with premature CAD. Rapid urbanization reduced physical activity, unhealthy dietary habits, and rising tobacco use is considered important contributors to this growing burden of cardiovascular disease in younger populations.[18] Despite this trend, there is limited local evidence describing the angiographic patterns of coronary artery disease and associated risk factors among young patients presenting with acute coronary syndrome (ACS).

A better understanding of the angiographic characteristics and related risk factors in this age group is important for early identification of high-risk individuals and for improving preventive and management strategies. Therefore, the present study was conducted to determine the angiographic patterns and severity of coronary artery disease in patients aged less than 50 years presenting with acute coronary syndrome at a tertiary care hospital in Islamabad.

Materials and Methods

A Hospital based cross-sectional analytical study was conducted in the Cardiology Department of PAEC General Hospital, Islamabad between J*anuary 1, 2025, to June 30, 2025*. Ethical approval for the study was obtained from the Institutional Review Board of PAEC General Hospital (Approval No.: PGHI-IRB(DME)-RCD-06-041).

Consecutive patients aged ≤50 years, presenting with ACS (STEMI, NSTEMI, or unstable angina) and undergoing coronary angiography, were eligible for inclusion. This age group was selected to focus on premature CAD, as CAD occurring before 50 years is considered early onset[19].

Patients of 50 years and above, with a prior history of coronary artery bypass grafting (CABG), or who did not consent were excluded. All eligible patients were informed about the objective of study and verbally informed consent was obtained prior to enrolment as approved by the IRB while ensuring confidentiality.

Based on previous studies of premature CAD and recruitment feasibility, a minimum sample size of 80 patients was targeted. Ultimately, 90 eligible patients were enrolled during the study period.

A structured proforma was used to collect demographic data (age, sex), clinical presentation, along with each patient's clinical presentation, cardiovascular risk factors, and angiographic findings. The focused risk factors included hypertension, diabetes mellitus, smoking status, and family history of premature coronary artery disease (CAD). Hypertension was defined to have a systolic reading of 140 mmHg or higher and/or a diastolic reading of 90 mmHg or higher, or history of hypertension or taking antihypertensive medication. Diabetes Mellitus was defined as fasting blood glucose level of 126 mg/dL or more or ongoing treatment with anti-diabetic drugs.[20] Smoking was defined as either current or past use of cigarettes. A positive family history of premature CAD was noted if a first degree relative, such as a parent or sibling having CAD before the age of 55 in men or before 65 in women.[20]

Angiographic severity was classified into four categories: normal coronaries, single-vessel disease (SVD), double-vessel disease (DVD), and triple-vessel disease (TVD). For the purpose of this study, significant coronary artery disease was defined as ≥50% luminal stenosis in at least one major epicardial vessels(LAD, LCX or RCA). This threshold is widely used in angiographic studies and epidemiological research to define obstructive CAD and allows for consistent comparison with published literature.[1,21] Multi-vessel disease was defined when more than one artery met the stenosis criteria.

Data analysis was performed using SPSS version 26. Continuous variables are presented as mean ± SD, whereas categorical variables are presented as frequencies and percentages. The association between cardiovascular risk factors and CAD severity was evaluated by using the Chi-square test or Fisher's exact test, where appropriate.

To identify predictors of coronary artery disease,

binary logistic regression analysis was performed with the presence of CAD (≥50% stenosis) versus normal coronary arteries as the dependent variable. Independent variables included age, gender, smoking status, diabetes mellitus, and hypertension. Secondly, ordinal logistic regression analysis was conducted to evaluate predictors of increasing CAD severity, where angiographic severity was categorized as normal, single-vessel disease (SVD), double-vessel disease (DVD), and triple-vessel disease (TVD). The same variables entered into the regression model including age, gender, smoking, diabetes mellitus, and hypertension.

Model fit was assessed using the Hosmer–Lemeshow test, where a p-value >0.05 indicated adequate model calibration. For all other analyses, a p-value of <0.05 was considered statistically significant.

Results

A total of 90 patients aged less than 50 years presenting with acute coronary syndrome (ACS) were included in the analysis. The mean age was 44.94 ± 3.94 years. Males comprised 67.8% (n = 61) of the study population, while females accounted for 32.2% (n = 29).

Among ACS presentations, STEMI was most common (74.4%, n = 67), followed by unstable angina (16.7%, n = 15) and NSTEMI (8.9%, n = 8). Cardiovascular risk factors included hypertension (55.6%, n = 50), smoking (40%, n = 36), family history of premature CAD (26.7%, n = 24), and diabetes mellitus (17.8%, n = 16) (Table I). Angiographic patterns revealed: single-vessel disease (SVD) in 37.8% (n = 34), Double vessel disease (DVD) in 22.2% (n = 20), Triple vessel disease (TVD) in 11.1% (n = 10), and normal coronaries in 28.9% (n = 26).

Gender-specific patterns were as follows: **SVCAD**—males 24 (26.7%) vs. females 10 (11.1%); **DVD**—males 16 (17.8%) vs. females 4 (4.4%); **TVD**—males 8 (8.9%) vs. females 2 (2.2%); normal coronaries—males 13 (14.4%) vs. females 13 (14.4%). The association between gender and CAD severity was not statistically significant ($\chi^2 = 5.94$, df = 3, p = 0.115) (Table II). Chi-square analysis demonstrated a significant association between hypertension and CAD severity ($\chi^2 = 10.52$, df = 3, p = 0.0146), while smoking showed no statistically significant association ($\chi^2 = 6.34$, df = 3, p = 0.096), diabetes mellitus ($\chi^2 = 0.20$, df = 3, p = 0.977) and family history ($\chi^2 = 4.96$, df = 3, p = 0.178) were also not significantly associated with CAD severity (Table IV).

Binary logistic regression identified hypertension (OR = 9.51, p = 0.001) and male gender (OR = 6.55, p = 0.014) as significant independent predictors of CAD (Table V). Ordinal logistic regression confirmed that hypertension (OR = 5.04, p < 0.001) and male gender (OR = 2.83, p = 0.045) were associated with increasing CAD severity. Smoking showed increased odds but did not reach statistical significance (OR = 1.89, p = 0.183) (Table VI).

Table I: Socio-Demographic and Clinical Characteristics (N = 90)

Variables	Mean (SD)	n	%
Age (years)	44.94 (3.94)	–	–
Gender			
Male	–	61	67.8
Female	–	29	32.2
ACS Presentation			
STEMI	–	67	74.4
Unstable Angina	–	15	16.7
NSTEMI	–	8	8.9
Risk Factors			
Smoking	–	36	40.0
Hypertension	–	50	55.6
Diabetes Mellitus	–	16	17.8
Family History of CAD	–	24	26.7

Table II: Gender vs. CAD Severity (N = 90)

Gender	Normal	SVD	DVD	TVD	Total
Male	13	24	16	8	61 (67.8%)
Female	13	10	4	2	29 (32.2%)
Total	26	34	20	10	90 (100%)

Chi-square = 5.94; df = 3; p = 0.115

Table III: Distribution of Coronary Artery Involvement

Risk Factor	Chi-square (χ^2)	df	P-value
Smoking	6.335	3	0.0964
Diabetes Mellitus	0.204	3	0.9770
Hypertension	10.524	3	0.0146*
Family History	4.961	3	0.178

*Statistically significant at p < 0.05

https://doi.org/10.57234/jiimc.march26.2707

Table IV: Chi-Square Association Between Risk Factors and CAD Severity

Risk Factor	Chi-square (χ^2)	df	*P*-value
Smoking	6.335	3	0.0964
Diabetes Mellitus	0.204	3	0.9770
Hypertension	10.524	3	0.0146*
Family History	4.961	3	0.178

Table V: Binary Logistic Regression (Predictors of CAD)
(CAD = any stenosis ≥50% vs. normal)

Predictor	β Coefficient	P-value	Odds Ratio (OR)
Intercept	-0.3525	0.912	0.70
Age	-0.0260	0.710	0.97
Gender	1.8801	0.014	6.55
Smoking	0.1189	0.866	1.13
Diabetes Mellitus	0.8679	0.275	2.38
Hypertension	2.2521	0.0007	9.51

TABLE VI: Ordinal Logistic Regression (Normal → SVD → DVD → TVD)

Predictor	β Coefficient	p-value	Odds Ratio (OR)
Age	-0.0212	0.687	0.98
Gender	1.0413	0.045	2.83
Smoking	0.6366	0.183	1.89
Diabetes Mellitus	0.3763	0.474	1.46
Hypertension	1.6168	0.0002	5.04

Discussion

This study evaluated angiographic patterns and predictors of CAD among young adults (<50 years) presenting with ACS. The mean age was 44.9 years, and males predominated (67.8%). This was consistent with prior studies from Pakistan as well other South Asian populations, which have shown a higher prevalence of premature CAD in men due to hormonal, behavioral, and lifestyle differences.[1,2] Rehman et al. found a similar male-to-female ratio in their study in which men were affected more severely and earlier than women.[14]

Acute coronary syndrome presenting in the fourth decade reflects premature disease onset, a pattern increasingly seen in South Asian populations[5,10]. STEMI was the most common presentation in our study (74.4%), consistent with previous reports in young adults.[8,9] This likely reflects the tendency of younger patients to develop sudden plaque rupture rather than gradual erosion, often with fewer protective collateral vessels, leading to complete artery blockage. Delayed presentation to healthcare facilities may also contribute, as ischemia progresses to infarction before patients receive timely care. NSTEMI was less frequent in our cohort (8.9%), possibly due to referral or visit bias.

The high proportions of STEMI patients indicate the need for acute recognition and acute intervention among young adults as delays can lead to significant myocardial loss and early heart failure. Hypertension emerged as the most prevalent risk factor (55.6%), followed by smoking (40%), which is consistent with findings from previous studies from Pakistan and India.[8] Ashiq et al., emphasized blood pressure screening and anti-smoking campaigns as key prevention strategies.[11] Binary and ordinal regression confirmed hypertension and male gender were independently associated with CAD severity, consistent with Tabei et al. and Wang et al.[12,15]

Angiographic patterns showed SVD as the most common (37.8%), followed by DVD and TVD, with LAD involvement being predominant (54.4%), similar to Yagel et al.[10] The predominance of SVD suggests that young people typically present with atherosclerotic involvement limited to a single coronary artery, rather than the multivessel disease seen in older populations. Regardless, it has significant clinical implications to have even a single vessel occluded, which is the case typically with the LAD, as morbidity often occurs without timely interventional measures. Approximately 28.9% of patients had normal coronary angiography, likely reflecting coronary vasospasm, microvascular disease, or endothelial dysfunction, consistent with reports of ACS with non-obstructive CAD in young adults.[13,14]

Logistic regression showed that hypertension and male gender were independent predictors of CAD which is consistent with the global literature. The strength of association regarding hypertension (OR 9.51) in our dataset suggests a possible association that warrants further investigation in larger cohorts. Male gender (6.55), the second predictor, was significant in both binary and ordinal logistic regression reflecting both biological and behavioral risk differences between genders that require gender-specific management and preventive efforts on population health.

The findings from this present study can be

anticipated in the region, but also demonstrates a trend defining the Pakistani population where traditional risk factors like smoking, poor diet, and uncontrolled hypertension exist among patients with premature CAD.[3,9,15,16] With the disease developing at a younger age, this contributes to the burden of disease and preventable costs in the socioeconomic scope, as many patients are typically in their early career stage, where the disease is often experienced. Public health policy that includes preventative measures related to lifestyle modification, blood pressure monitoring, and community education are crucial to mitigating these effects.

Limitations include the single center design, small sample size, underrepresentation of NSTEMI, and absence of biochemical or genetic profiling. Future multicenter studies with larger cohorts and molecular analyses could validate and expand these findings.

Conclusion:

In young adults presenting with ACS, STEMI is the predominant clinical manifestation, with single-vessel CAD being the most common angiographic pattern. Hypertension and male gender appear to be associated with greater CAD severity in this population. Given the single-center design, larger multicenter studies are needed to confirm these findings and guide preventive strategies.

Acknowledgment: We extend our sincere gratitude to all the participants and the contributors who made this research possible.

Conflict of Interest: None

Funding Disclosure: None

REFERENCES

1. Liaquat A, Khan A, Shah SU, Iqbal H, Iqbal S, Rana AI, et al. Evaluating the use of coronary artery calcium scoring as a tool for coronary artery disease (CAD) risk stratification and its association with coronary stenosis and CAD risk factors: a single-centre, retrospective, cross-sectional study at a tertiary centre in Pakistan. BMJ open. 2022;12(7):e057703. doi:10.1136/bmjopen-2021-057703
2. Allen N, Wilkins JT. The urgent need to refocus cardiovascular disease prevention efforts on young adults JAMA. 2023; 329(11):886-7. doi:10.1001/jama.2023.2308.
3. Kawsar D, Bhuyan AI. Clinical Characteristics, Risk Factors and Angiographic profile of patients undergoing coronary angiography: a review article. Saudi J Med Pharm Sci. 2024;10(12):947-52. doi:10.36348/sjmps.2024.v10i12.010
4. Zaman MH, Yaqoob N, Ilyas M, Zeb F, Khalid F, Ali N. Scrutinizing the ritual of coronary artery diseases in middle-aged acute coronary syndrome patients. Pak J Med Health Sci. 2022;16(11):775. doi:10.53350/pjmhs20221611775.
5. Joshi P, Dahiya A, Thakur M, Sinha RP, Wardhan H. 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 in Rajasthan, India. Heart India. 2022;10(1):21-5. doi:10.4103/heartindia.heartindia_4_22
6. Noothi SK, Ahmed MR, Agrawal DK. Residual risks and evolving atherosclerotic plaques. Mol Cell Biochem. 2023;478(12):2629-43. doi:10.1007/s11010-023-04689-0
7. Gherasie FA, Popescu MR, Bartos D. Acute coronary syndrome: Disparities of pathophysiology and mortality with and without peripheral artery disease. J Pers Med. 2023;13(6):944. doi:10.3390/jpm13060944
8. 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. 2019;5(1):18-25. doi:10.4103/jpcs.jpcs_3_23
9. Bush N, Syal A, Khera R, Sinha A, Arora P, Roy A, et al. Comparison of demographic profile, risk factors, and in-hospital outcome in young and old patients with acute coronary syndrome: A single-center experience. J Family Med Prim Care. 2021;10(2):871-6. doi:10.4103/jfmpc.jfmpc_1975_20
10. Yagel O, Novack L, Herscovici G, Wolak A, Assali A, Vaknin-Assa H, et al. Long-term prognosis in young patients with acute coronary syndrome treated with percutaneous coronary intervention. Vasc Health Risk Manag. 2021;17:153-9. doi:10.2147/VHRM.S298436
11. Ashiq S, Ashiq K, Shabana S, Shahid SU, Qayyum M, Sadia H. Prevalence and role of different risk factors with emphasis on genetics in development of pathophysiology of coronary artery disease. Pak Heart J. 2019;52(4):279-87
12. Tabei SM, Senemar S, Saffari B, Ahmadi Z, Haqparast S. Non-modifiable factors of coronary artery stenosis in late-onset patients with coronary artery disease in southern Iranian population. J Cardiovasc Thorac Res. 2014;6(1):51-5. doi:10.5681/jcvtr.2014.010
13. Al-Khlaiwi T, Habib SS, Bayoumy N, Al-Khliwi H, Meo SA. Identifying risk factors and mortality rate of premature coronary artery disease in young Saudi population.Sci Rep. 2024;14(1):12727. doi:10.1038/s41598-024-62970-8
14. Rehman MU, Ahmed I, Alam F, Sadiq MW, Mustafa A, Hussain Z, et al. Pattern of coronary artery disease in young patients with acute coronary syndrome. J Health Rehabil Res. 2023;3(2):1068-72. doi:10.61919/jhrr.v3i2.296
15. Wang H, Liu Z, Shao J, Jiang M, Lu X, Lin L, et al. Pathogenesis of premature coronary artery disease: Focus on risk factors and genetic variants. Genes Dis. 2022;9(2):370-80. doi:10.1016/j.gendis.2020.11.003
16. Roberts R, Chang C, Hadley T. Genetic risk stratification: A paradigm shift in prevention of coronary artery disease. JACC Basic Transl Sci. 2021;6(3):287-304. doi:10.1016/j.jacbts.2020.09.004

17. Cabrera Estrada EA, Mestre Sequeda ER, Barcinilla Barros JE, Caballero Ríos JA, et al. Acute coronary syndrome: Definition, pathophysiology, diagnosis, and management. World J Adv Res Rev. 2024;21(01):2537–48. doi: 10.30574/wjarr.2024.21.1.0352
18. Ali M. Coronary artery disease in young Pakistanis: risk factors and pattern of disease. Pak Heart J. 2022;55(Suppl 1):S14. doi: 10.47144/phj.v55iSupplement1.2430
19. Neifert AR, Su D, Sumpio BE. Characteristics and demographics of patients younger than 50 with atherosclerotic cardiovascular disease. J Vasc Dis. 2025;4(3):31. doi: 10.3390/jvd4030031
20. Arnett DK, Blumenthal RS, Albert MA, Buroker AB, et al. 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease: A Report of the ACC/AHA Task force on Clinical Practice Guidelines. Circulation. 2019;140(11):e596–e646. doi: 10.1161/CIR.0000000000000678.
21. Serruys PW, Morice MC, Kappetein AP, Colombo A, Holmes DR Jr, Mack MJ, et al. Percutaneous coronary intervention versus coronary-artery bypass grafting for severe coronary artery disease. N Engl J Med. 2009;360(10):961-72. doi: 10.1056/NEJMoa0804626.

CONFLICT OF INTEREST

Authors declared no conflicts of Interest.

GRANT SUPPORT AND FINANCIAL DISCLOSURE

Authors have declared no specific grant for this research from any funding agency in public, commercial or nonprofit sector.

DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon request.