THE PLANET

Original Article

Clinical and Angiographic Profile of Premature Coronary Artery Disease belowAge 40 Years in a Bangladeshi Tertiary Cardiac Center

Mohammed Iqbal Ahmed[1*], Sharif Uddin[2], Tahera Jannath[3], Razibur Rahman[4], Fahad Hasan[5]

ARTICLE INFO

Received: 21 September 2026
Accepted: 26 September 2026
Published Online: 3 October 2026

DOI: 10.5281/zenodo.23117964

Volume: 10, Number: 3, Page: 763-767

e-ISSN: 2789-5912
ISSN: 2617-0817

*Corresponding author

ABSTRACT

Introduction: Premature coronary artery disease (CAD) is an important cardiovascular problem in South Asian populations, where coronary disease often occurs at a younger age with more extensive angiographic involvement, yet locally generated Bangladeshi data remain limited. **Objectives:** To determine the risk-factor burden, clinical presentation, and coronary angiographic pattern among patients aged 18-39 years with confirmed CAD, and to identify factors independently associated with multivessel disease. **Methods & Materials:** This hospital-based, cross-sectional observational study was conducted in the Department of Cardiology, North East Medical College Hospital, Sylhet, from January to December 2025. A total of 150 consecutive patients aged 18-39 years with angiographically confirmed CAD were enrolled. Associations between risk factors and multivessel CAD were assessed using chi-square/Fisher's exact tests followed by multivariable logistic regression; $p<0.05$ was considered significant. **Results:** The mean age was 35.2 ± 3.8 years, and 88.0% were male. Current smoking (64.0%), dyslipidemia (52.7%), sedentary lifestyle (47.3%), and central obesity (44.7%) were the commonest risk factors. STEMI was the commonest presentation (48.0%). Single-vessel disease was seen in 52.0%, double-vessel disease in 28.7%, triple-vessel disease in 12.7%, and left main disease in 2.7%. The LAD was the most frequently involved artery (73.6%). Current smoking (adjusted OR 2.18), diabetes mellitus (adjusted OR 2.47), and dyslipidemia (adjusted OR 1.91) were independently associated with multivessel CAD (all $p<0.05$). **Conclusion:** Premature CAD in this population predominantly affected young men with a high burden of smoking, dyslipidemia, and sedentary lifestyle. Smoking, diabetes, and dyslipidemia were independently associated with multivessel involvement.

Keywords: *Premature coronary artery disease, Coronary angiography, Risk factors, Multivessel disease, Bangladesh*

1. *Associate Professor, Department of Cardiology, North East Medical College Hospital, Sylhet, Bangladesh (ORCID: 0009-0004-9562-2466)*
2. *Assistant Professor, Department of Cardiology, North East Medical College Hospital, Sylhet, Bangladesh*
3. *Medical Officer, Department of Cardiology, Al-Haramain Hospital Pvt. Ltd., Sylhet, Bangladesh.*
4. *Senior Medical Officer, Department of Cardiology, Popular Medical Centre & Hospital, Sylhet, Bangladesh*
5. *Assistant Registrar, Department of Cardiology, North East Medical College Hospital, Sylhet, Bangladesh*

INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of death worldwide, accounting for an estimated 19.8 million deaths in 2022, nearly one-third of all global mortality, with the majority occurring in low- and middle-income countries.[1] Coronary artery disease (CAD), the most common manifestation of CVD, has emerged as the leading cause of death in Bangladesh as the country undergoes a rapid epidemiological transition from communicable to non-communicable disease.[2] Unlike Western populations, in whom CAD typically manifests after the sixth decade of life, South Asians, including Bangladeshis, are known to develop coronary disease nearly a decade earlier, with a clinical course that is often more aggressive and angiographically more extensive.[2,3] This phenomenon, commonly termed premature CAD and generally defined as disease occurring at or before 40 years of age, disproportionately affects individuals in their most productive years of life, imposing a substantial socioeconomic burden on families and the health system alike.[3] Studies comparing native and expatriate Bangladeshi populations with other ethnic groups have further suggested that Bangladeshi ethnicity itself may be an independent risk factor for extensive, multivessel coronary involvement, even after adjusting for conventional risk factors.[4]The landmark INTERHEART study demonstrated that nine potentially modifiable risk factors, namely smoking, dyslipidemia, hypertension, diabetes mellitus, abdominal obesity, psychosocial stress, and inadequate intake of fruits, vegetables, and physical activity, together account for over 90% of the population-attributable risk of a first myocardial infarction, and that this relationship holds consistently across all regions of the world, including South Asia.[5] More recent, large-scale Bangladeshi data from the Bangladesh Risk of Acute Vascular Events (BRAVE) case-control study have confirmed the central role of cigarette smoking, elevated LDL-cholesterol, and hypertension in first-onset myocardial infarction in this population, while also highlighting regionally distinctive practices such as smokeless tobacco use and consanguineous marriage as additional contributors.[6] Hospital-based studies from Bangladesh have similarly reported that young patients with acute myocardial infarction carry a heavy burden of smoking, family history of premature CAD, and adverse dietary habits compared with their older counterparts.[7] A systematic review of young South Asian patients with CAD has shown that single-vessel disease predominates in this age group, with the left anterior descending artery being the most frequently affected vessel, and that smoking, dyslipidemia, and elevated body mass index are the risk factors most consistently implicated.[8] However, much of the available literature on premature CAD in Bangladesh is derived from small case series, immigrant cohorts studied abroad, or studies that do not specifically characterize the clinical, biochemical, and angiographic spectrum of disease in patients below 40 years of age presenting to a tertiary cardiac center within the country. Therefore, the study aimed to determine the risk-factor burden, clinical presentation, and coronary angiographic pattern among patients aged 18-39 years with confirmed CAD, and to identify factors independently associated with multivessel disease.

METHODS & MATERIALS

This was a hospital-based, cross-sectional observational study conducted in the Department of Cardiology, North East Medical College Hospital, Sylhet, Bangladesh, over a period of 12 months from January 2025 to December 2025. All patients aged 18-39 years who were

BDJOURNALS.ORG Copyright © 2026 The Planet. Published by Sher-E-Bangla Medical College, Barishal, Bangladesh. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

admitted with a diagnosis of coronary artery disease (CAD) and underwent coronary angiography during the study period were considered for enrolment. Patients were enrolled by consecutive sampling until the calculated sample size was achieved, and a total of 150 patients who fulfilled the inclusion and exclusion criteria and provided informed consent were included in the final analysis. Patients aged 18-39 years of either sex presenting with clinical and electrocardiographic features suggestive of acute coronary syndrome, including ST-elevation myocardial infarction, non-ST-elevation myocardial infarction, or unstable angina, or with stable angina subsequently confirmed by coronary angiography, were included. Patients with known congenital heart disease, valvular heart disease, cardiomyopathy unrelated to ischemia, prior coronary artery bypass grafting, coexisting malignancy, or those who did not consent to angiography or participation in the study were excluded. Data were collected using a pre-tested structured questionnaire through face-to-face interviews, review of hospital records, and clinical examination. Information regarding sociodemographic characteristics, cardiovascular risk factors including smoking, hypertension, diabetes mellitus, dyslipidemia, family history of CAD, sedentary lifestyle, and central obesity, as well as presenting clinical features, was recorded. Anthropometric measurements, including height, weight, and waist circumference, and blood pressure were measured using standard techniques. Fasting venous blood samples were collected for estimation of lipid profile, fasting blood glucose, and HbA1c. Transthoracic echocardiography was performed to assess left ventricular ejection fraction using Simpson's biplane method. All patients underwent coronary angiography through either the radial or femoral approach, and the angiograms were independently reviewed by a consultant cardiologist to determine the number of vessels involved, site and severity of stenosis, and other lesion characteristics. Premature CAD was defined as angiographically confirmed CAD in patients aged 40 years or younger. Acute coronary syndromes, including ST-elevation myocardial infarction, non-ST-elevation myocardial infarction, and unstable angina, were diagnosed according to the Fourth Universal Definition of Myocardial Infarction.[12] Hypertension was defined according to the 2018 ESC/ESH guidelines for the management of arterial hypertension,[13] diabetes mellitus according to the American Diabetes Association criteria,[14] and dyslipidemia according to the National Cholesterol Education Program Adult Treatment Panel III criteria.[15] Obesity was defined as a body mass index of ≥30 kg/m², while central obesity was defined according to ethnicity-specific waist-circumference cut-offs recommended for Asian populations by the WHO expert consultation.[16] Obstructive CAD was defined as ≥50% luminal diameter stenosis in at least one major epicardial coronary artery or its major branch on angiography, whereas significant stenosis was defined as ≥70% diameter narrowing, with ≥50% considered significant for the left main coronary artery. Single-, double-, and triple-vessel disease were defined according to the number of major epicardial coronary vessels demonstrating obstructive stenosis. Data were checked, cleaned, and analyzed using standard statistical software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The Chi-square test or Fisher's exact test, as appropriate, was used to compare categorical variables between patients with single-vessel and multivessel disease. Variables found to be statistically significant on bivariate analysis were entered into a multivariable logistic regression model to identify factors independently associated with multivessel CAD, and the results were expressed as adjusted odds ratios with 95% confidence intervals. A p-value of <0.05 was considered statistically significant. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethical clearance was obtained from the Institutional Review Board/Ethical Review Committee of North East Medical College Hospital, Sylhet, before commencement of the study. Written informed consent was obtained from all participants after explaining the study objectives, procedures, potential risks, and benefits, and confidentiality of patient information was maintained throughout the study.

RESULT

The mean age of the study population was 35.2 ± 3.8 years (*Table I*). The majority of patients were aged 35-39 years (64.7%) and were male (88.0%). Urban residents accounted for 60.7% of the participants. A family history of premature CAD was reported in 27.3% of patients.

Table I
Sociodemographic and Baseline Characteristics of the Study Population (*n* = 150).

Variables	Frequency (n)	Percentage (%)
Age (years), mean ± SD	35.2 ± 3.8	—
Age 18-29 years	18	12.0
Age 30-34 years	35	23.3
Age 35-39 years	97	64.7
Male	132	88.0
Female	18	12.0
Urban residence	91	60.7
Rural residence	59	39.3
Family history of CAD	54	36.0
Family history of premature CAD	41	27.3

SD, standard deviation; CAD, coronary artery disease.

Current smoking was the most common cardiovascular risk factor (64.0%), followed by dyslipidemia (52.7%) and sedentary lifestyle (47.3%) (*Table II*). Central obesity was present in 44.7% of patients, while hypertension and diabetes mellitus were observed in 28.0% and 20.7%, respectively.

Table II
Cardiovascular Risk Factors Among the Study Participants (*n* = 150).

Risk Factors	Frequency (n)	Percentage (%)
Current smoking	96	64.0
Dyslipidemia	79	52.7
Sedentary lifestyle	71	47.3
Central obesity	67	44.7
Hypertension	42	28.0
Family history of premature CAD	41	27.3
Diabetes mellitus	31	20.7
Obesity (BMI ≥30 kg/m²)	28	18.7
Previous CAD/MI	12	8.0

STEMI was the most common clinical presentation (48.0%), followed by NSTEMI (26.0%) and unstable angina (18.0%) (*Table III*). Typical chest pain was the most frequent presenting symptom (87.3%), followed by sweating (40.7%) and dyspnea (32.0%).

Table III
Clinical Presentation and Presenting Symptoms of the Study Population (*n* = 150).

Clinical Characteristics	Frequency (n)	Percentage (%)
STEMI	72	48.0
NSTEMI	39	26.0
Unstable angina	27	18.0
Stable angina	12	8.0
Typical chest pain	131	87.3
Sweating	61	40.7
Dyspnea	48	32.0
Palpitation	19	12.7
Syncope/presyncope	8	5.3

Elevated LDL-C was observed in 48.7% of patients, while low HDL-C and elevated triglycerides were present in 38.7% and 31.3%, respectively (*Table IV*). Left ventricular systolic function was reduced (EF <50%) in 25.3% of patients.

Table IV
Laboratory and Echocardiographic Findings (*n* = 150).

Variables	Frequency (n)	Percentage (%)
Elevated LDL-C	73	48.7
Low HDL-C	58	38.7
Elevated triglycerides	47	31.3
HbA1c ≥6.5%	31	20.7
Left ventricular EF <50%	38	25.3
Left ventricular EF ≥50%	112	74.7

LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol; EF, ejection fraction.

Single-vessel disease was the predominant angiographic pattern (52.0%) (*Table V*). Double-vessel and triple-vessel disease were observed in 28.7% and 12.7% of patients, respectively. Left main coronary artery disease was identified in 2.7% of patients.

Table V
Coronary Angiographic Profile of the Study Population (*n* = 150).

Angiographic Findings	Frequency (n)	Percentage (%)
Single-vessel disease	78	52.0
Double-vessel disease	43	28.7
Triple-vessel disease	19	12.7
Left main coronary artery disease	4	2.7
Non-obstructive CAD	6	4.0
Total	150	100.0

The LAD was the most frequently involved coronary artery (73.6%), followed by the RCA (50.0%) and LCX (37.5%) (*Table VI*). Severe stenosis (≥70%) was observed in 70.1% of patients with obstructive CAD. Proximal LAD involvement was present in 42.4%.

Table VI
Individual Coronary Artery Involvement and Lesion Characteristics Among Patients with Obstructive CAD (n = 144).

Angiographic Characteristics	Frequency (n)	Percentage (%)
LAD involvement	106	73.6
RCA involvement	72	50.0
LCX involvement	54	37.5
Left main involvement	4	2.8
Stenosis 50-69%	43	29.9
Stenosis ≥70%	101	70.1
Proximal LAD involvement	61	42.4
Multisegment disease	37	25.7
Long lesion	29	20.1
Calcified lesion	18	12.5
Chronic total occlusion	11	7.6

In *Table VII*, multivessel disease was more frequently observed among current smokers, patients with diabetes mellitus, and those with dyslipidemia. The corresponding associations were statistically significant.

Table VII
Association of Major Cardiovascular Risk Factors with Single- Versus Multivessel CAD (*n* = 150).

Risk Factor	Single-vessel n (%)	Multivessel n (%)	Total
Current smoker	43 (44.8)	53 (55.2)	96
Non-smoker	35 (64.8)	19 (35.2)	54
Diabetes present	10 (32.3)	21 (67.7)	31
Diabetes absent	68 (57.1)	51 (42.9)	119
Dyslipidemia present	33 (41.8)	46 (58.2)	79
Dyslipidemia absent	45 (63.4)	26 (36.6)	71

In the multivariable model (*Table VIII*), current smoking, diabetes mellitus, and dyslipidemia showed statistically significant associations with multivessel CAD. Hypertension, family history of premature CAD, and obesity were not statistically significant in this model.

Table VIII
Multivariable Logistic Regression for Factors Associated with Multivessel CAD.

Variable	Adjusted OR	95% CI	p-value
Current smoking	2.18	1.08-4.41	0.030
Diabetes mellitus	2.47	1.05-5.80	0.038
Dyslipidemia	1.91	1.01-3.63	0.047
Hypertension	1.54	0.72-3.28	0.265
Family history of premature CAD	1.63	0.79-3.36	0.185
Obesity	1.38	0.59-3.22	0.449

DISCUSSION

This study characterizes the clinical, biochemical, and angiographic profile of patients with premature coronary artery disease (CAD) presenting to a tertiary cardiac center in Bangladesh. The findings are broadly consistent with the well-documented pattern of early-onset, aggressive CAD reported among South Asian populations.

The predominance of male patients (88.0%) and the concentration of cases in the 35-39-year age band reflect the recognized tendency of South Asians to develop CAD nearly a decade earlier than Western populations, with a disproportionate burden among men of productive working age.[3,8] Current smoking emerged as the leading modifiable risk factor in our cohort (64.0%), a finding that closely parallels earlier Bangladeshi hospital-based data showing that the majority of young patients with coronary heart disease were current or past tobacco users, with an approximately four-fold increased risk among ever-smokers.[9] The global INTERHEART study similarly identified smoking as one of the strongest and most consistent risk factors for myocardial infarction across all regions, including South Asia.[5] The high prevalence of smoking in our series, together with dyslipidemia (52.7%) and a sedentary lifestyle (47.3%), underscores that behavioral and metabolic risk factors, rather than genetic predisposition alone, continue to drive the early onset of CAD in this population.[3,8]

Hypertension (28.0%) and diabetes mellitus (20.7%) were less prevalent than smoking but remained clinically important, mirroring the risk-factor hierarchy reported in the large Bangladesh Risk of Acute Vascular Events (BRAVE) case-control study, in which cigarette smoking carried the highest population-attributable fraction, followed by elevated LDL-cholesterol and hypertension.[6] A family history of premature CAD was present in 27.3% of our patients, reinforcing evidence that genetic and shared-environment susceptibility compounds the effect of conventional risk factors in South Asian families.[6]

STEMI was the most frequent clinical presentation (48.0%) in our cohort, consistent with findings from a Bangladeshi tertiary center where young patients with acute myocardial infarction presented with ST-elevation events more frequently than older patients, often together with a higher prevalence of smoking and family history of myocardial infarction.[7] The predominance of typical chest pain as the presenting symptom, together with a relatively preserved left ventricular ejection fraction in most patients (74.7%), suggests that despite aggressive coronary involvement, myocardial damage at presentation may still be limited in a substantial proportion of young patients, possibly reflecting better collateral circulation or earlier care-seeking behavior in this age group.

Angiographically, single-vessel disease was the predominant pattern (52.0%), and the left anterior descending artery was the most frequently involved vessel (73.6%), findings that closely replicate reports from young South Asian cohorts in Pakistan and Bangladesh, where single-vessel disease and left anterior descending artery predominance have been consistently described as hallmark angiographic features of premature CAD.[10,11] Nevertheless, more than 40% of our patients had multivessel or left main disease, indicating that a considerable minority present with advanced coronary involvement despite their young age.

In the present analysis, current smoking, diabetes mellitus, and dyslipidemia were independently associated with multivessel disease, while hypertension, family history, and obesity were not statistically significant after adjustment. This pattern is in keeping with previous South Asian data suggesting that the clustering of major modifiable risk factors, rather than any single factor, drives the transition from single-vessel to more extensive coronary involvement in young patients.[8,10] These observations have direct clinical implications: aggressive, population-level tobacco control, early screening for dysglycemia and dyslipidemia, and lifestyle modification targeting sedentary behavior and central obesity could meaningfully reduce the burden of premature, multivessel CAD in Bangladesh.

This study should be interpreted considering its single-center, cross-sectional design, which limits causal inference and generalizability to the wider Bangladeshi population. Larger, multicentric, prospective studies are warranted to validate these associations and to inform targeted preventive strategies for premature CAD in South Asia.

LIMITATION

The single-center, cross-sectional design limits causal inference and generalizability of the findings to the wider Bangladeshi population.

CONCLUSION

Premature CAD represents an important cardiovascular problem among young adults in Bangladesh, with most affected patients being men in their late thirties and presenting with a substantial burden of modifiable cardiovascular risk factors. Smoking and dyslipidemia were particularly prevalent, while STEMI was the most common clinical presentation. Although single-vessel disease predominated, more than 40% of patients had multivessel or left main disease, demonstrating that significant coronary involvement can occur at a relatively young age. The reported analysis identified current smoking, diabetes mellitus, and dyslipidemia as significant factors associated with multivessel CAD. These findings highlight the importance of early identification and management of cardiovascular risk factors in young adults.

RECOMMENDATION

Routine cardiovascular risk assessment should be strengthened among young adults, particularly those with smoking exposure, dyslipidemia, diabetes mellitus, or a family history of premature CAD. Tobacco-control interventions, early screening for dyslipidemia and abnormal glucose metabolism, promotion of regular physical activity and healthy dietary practices, and timely evaluation of cardiovascular symptoms should be emphasized. Larger multicenter prospective studies involving diverse Bangladeshi populations are also recommended to validate these findings and better define the determinants and long-term outcomes of premature CAD.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

FUNDING

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

REFERENCES

1. World Health Organization. Cardiovascular diseases (CVDs) [Internet]. Geneva: World Health Organization; 2025 [cited 2026 Sep 20]. Available from: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)
2. Islam AKMM, Majumder AAS. Coronary artery disease in Bangladesh: A review. Indian Heart J. 2013;65(4):424-35.
3. Ahmed ST, Rehman H, Akeroyd JM, Alam M, Shah T, Kalra A, et al. Premature coronary heart disease in South Asians: burden and determinants. Curr Atheroscler Rep. 2018;20(1):6.
4. Vasudev R, Shah P, Patel J, Naranjo M, Hosein K, Rampal U, et al. Should Bangladeshi race be considered as an independent risk factor for multi vessel coronary artery disease? Vasc Health Risk Manag. 2020;16:143-7.
5. Yusuf S, Hawken S, Ounpuu 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. 2004;364(9438):937-52.
6. Chowdhury R, Naheed A, Monower MM, Shahzad S, Raqib R, Tasmin I, et al. Conventional and regionally distinctive risk factors for first-onset myocardial infarction: the Bangladesh Risk of Acute Vascular Events (BRAVE) case-control study. Lancet Reg Health Southeast Asia. 2024;100519.
7. Karim MA, Majumder AAS, Islam KQ, Alam MB, Paul ML, Islam MS, et al. Risk factors and in-hospital outcome of acute ST segment elevation myocardial infarction in young Bangladeshi adults. BMC Cardiovasc Disord. 2015;15:73.
8. Agrawal A, Lamichhane P, Eghbali M, Xavier R, Cook DE, Elsherbiny RM, et al. Risk factors, lab parameters, angiographic characteristics and outcomes of coronary artery disease in young South Asian patients: a systematic review. J Int Med Res. 2023;51(8):1-16.
9. Rahman MA, Zaman MM. Smoking and smokeless tobacco consumption: possible risk factors for coronary heart disease among young patients attending a tertiary care cardiac hospital in Bangladesh. Public Health. 2008;122(12):1331-8.
10. Balouch IJ, Ahmed I, Farooq F, Raza SA, Soomro NA, Khan MN, et al. Pattern of coronary artery diseases in patients under 40 years of age with acute coronary syndrome. Pak Heart J. 2021;54(2):144-7.
11. Silbiger JJ, Stein R, Roy M, Nair MK, Cohen P, Shaffer J, et al. Coronary artery disease in South Asian immigrants living in New York City: angiographic findings and risk factor burdens. Ethn Dis. 2013;23(3):292-5.
12. Thygesen K, Alpert JS, Jaffe AS, Chaitman BR, Bax JJ, Morrow DA, White HD, et al. Fourth universal definition of myocardial infarction (2018). Eur Heart J. 2019;40(3):237-69.
13. Williams B, Mancia G, Spiering W, Agabiti Rosei E, Azizi M, Burnier M, et al. 2018 ESC/ESH Guidelines for the management of arterial hypertension. Eur Heart J. 2018;39(33):3021-104.
14. American Diabetes Association. 2. Classification and diagnosis of diabetes: standards of medical care in diabetes-2021. Diabetes Care. 2021;44(Suppl 1):S15-33.
15. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Executive Summary of The Third Report of The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III). JAMA. 2001 May 16;285(19):2486-97. doi: 10.1001/jama.285.19.2486. PMID: 11368702.
16. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004;363(9403):157-63.