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RESEARCH ARTICLE OPEN ACCESS

Clinical Characteristics, Risk Factors and Angiographic Profile of Patients with suspected coronary artery disease Undergoing Coronary Angiography in Ekiti, South-West, Nigeria

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Abstract
Objective: Coronary angiography is the mainstay for the diagnosis and management of individuals with significant or fluctuating chest pain symptoms or a high risk of coronary artery disease (CAD). The prevalence of coronary artery disease is rising in sub-Saharan Africa, prompting the progressive establishment of more facilities to enhance the disease's care and prevention. Afe Babalola University Multi-System Hospital (AMSH) is one of the few centres equipped with a catheterization laboratory in Nigeria. This study was done to analyze the clinical profile and angiographic pattern of CAD among patients who had undergone this procedure at AMSH.
Methods: Seventy-five consecutive patients presenting with suspected coronary artery disease were studied for clinical characteristics, risk factors and angiographic profile.
Results: Out of 75 patients, 73.33% were male. The mean age was 59.57±13.33 years. The commonest indications were abnormal ECG changes, angina and dyspnea. Hypertension and dyslipidemia were the most prevalent risk factors (69.3% and 58.67%, respectively). The prevalence of obstructive CAD was 36%. Single-vessel disease was the most prevalent obstructive CAD (51.85%), and the left anterior descending artery was the most commonly involved vessel (40.82%). Those who had obstructive coronaries were more likely to be hypertensive and with left ventricular systolic dysfunction compared to those with non-obstructive coronaries (P<0.05).
Conclusion: Hypertension and dyslipidemia were the most prevalent risk factors among the study population, and the majority of them had a non-severe disease. Single-vessel disease is the most prevalent obstructive CAD, and the left anterior descending artery is the most commonly involved vessel.

Keywords: Angiography, Coronary artery disease, Nigeria, Risk factors

Plain English summary: Coronary angiography is a procedure that combines X-rays and a specific dye (contrast material) to show how blood flows through the heart's arteries**.** This procedure helps to diagnose obstruction in heart arteries usually due to a build-up of fatty substances. The disease has been reported to be very common in developed countries due to lifestyle habits but is gradually becoming common among developing countries including sub-Saharan Africa. Catheterization laboratories where these procedures can be carried out are grossly deficient in Nigeria due to the high cost of setting them up. Additionally, only a few people can access this facility due to the high cost of the procedure and deficient comprehensive insurance to cover the expenses. As a result of the aforementioned, there is a dearth of information on

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patients in the nation having the procedure. Afe Babalola University Multi-System Hospital (AMSH) is one of the few centres equipped with a catheterization laboratory in Nigeria. To further our understanding of coronary artery disease in Nigeria, this study examined the patient health snapshot status and classification of the appearance of blood vessels of coronary artery disease in patients who have had this procedure done at AMSH. Our study showed that people with high blood pressure and high cholesterol are more likely to present for this procedure. Out of all the patients who did the procedure, 36% of them had significant vessel obstruction and the majority of them had significant obstruction affecting one major vessel supplying the heart. Those who had significant vessel obstruction were more likely to be those with high blood pressure and whose heart was not pumping blood properly.

Background:

Coronary artery disease (CAD) was once thought to be uncommon in sub-Saharan Africa, but due to unfavourable behavioural and lifestyle changes brought on by urbanization and the epidemiological transition, CAD and its accompanying morbidity may be becoming more common (1, 2). Given the increasing frequency of environmental, behavioural, and metabolic risk factors that predispose to CAD, the current burden of disease forecasts indicates that CAD will soon overtake all other causes of death in this region (3). Furthermore, while most populations are likely to be at risk for CAD due to traditional cardiovascular disease risk factors like smoking, high blood pressure, and elevated blood cholesterol, other risk factors and varying degrees of genetic–environmental interaction may be significant in other populations. Particularly of research interest in developing nations are the notable ethnic diversity in CAD symptoms and the diverse risk correlations in various populations. The gold standard test for evaluating coronary anatomy is invasive coronary angiography. It is also the mainstay for the diagnosis and management of individuals with significant or fluctuating chest pain symptoms or a high risk of CAD (4). In Nigeria and other developing nations, coronary angiography is increasingly becoming more common as a cardiovascular procedure due to the rising prevalence of CAD prompting the progressive establishment of more facilities to enhance the disease's care and prevention (2, 3). Few clinics perform this procedure in the country, and little is known about the clinical characteristics and angiographic outcomes of patients undergoing this procedure.

This study aims to analyze the clinical profile and angiographic pattern of coronary artery disease among patients who had undergone this procedure at Afe Babalola University Multi-System Hospital (AMSH) and add to the body of knowledge of coronary artery disease in Nigeria.

Materials and Methods

Study design

This is an observational, retrospective, and descriptive study, using data from patients who underwent coronary angiography for suspected coronary artery disease at the AMSH, Ado-Ekiti Ekiti State Nigeria between May 2019 and January 2023. AMSH is a relatively new tertiary teaching Hospital and the only health facility in Ekiti State, Nigeria with a catheterization Laboratory (CATHLAB) equipped to perform coronary angiography. Cardiac catheterization started at AMSH in 2019 with referrals from within and outside the state. These patients were evaluated for their demographic data and the presence of established conventional risk factors for CAD.

Study population

The study included 75 patients of both sexes who underwent diagnostic coronary angiography for suspected CAD. Excluded from the study sample were patients with incomplete data and those who had coronary artery disease but did not undergo coronary angiography. The patient's medical records were the sources of data. A consecutive sampling procedure was used to enrol all those with eligibility criteria.

Coronary angiography

The diagnostic procedure was carried out following radial or femoral artery access puncture. Non-ionic contrast agent was injected selectively into the coronary arteries using pre-molded or moldable diagnostic catheters to enable angiographic characterization of coronary anatomy. Coronary angiography was performed by specialists (cardiologists), residents under supervision and CATHLAB technicians. The team was led by an interventional cardiologist.

The results of coronary angiography were considered obstructive CAD and non-obstructive CAD. Obstructive CAD was defined as a ≥50% diameter reduction in any coronary segment or fractional flow reserve ≤0.80 while non-obstructive CAD was defined as no epicardial vessel with a stenosis < 50% by quantitative coronary angiography. Nonobstructive lesions were additionally grouped as normal coronary vessels

(0% lumen stenosis in all vessels) and mild coronary stenosis (1–49% lumen stenosis in at least 1 vessel).

Statistical analysis

Baseline demographics characteristics, risk factors for CAD, and angiographic findings were entered in SPSS version 25 for Windows Statistical Software and analyzed. Clinical variables were compared between patients with or without obstructive CAD. Means and standard deviations were used for quantitative variables; qualitative variables were assessed using proportions and frequencies. The student's t-test was used to compare the means, and the Chi-square test or Fischer's exact test was used to compare the proportions between the two groups. A p-value ≤ 0.05 in the univariate analysis was considered statistically significant.

Result

A total of 75 participants were enrolled in this study. The mean age of the patient was 59.57±13.33 years. Most patients were male 73.33% with a male-to-female ratio is 3:1. The three commonest indications were abnormal ECG changes, angina and dyspnea (81.33% vs 69.33% vs 50.67% respectively). The most prevalent risk factors were hypertension (69.3%), dyslipidemia (58.67%), and obesity (56%) while diabetes as a risk factor constituted about 36%. The vast majority of the population had at least 1 risk factor (RF) (90.67%), and patients with 3 or more RF represented 81.4% of the population. Ischemic ECG changes and stable angina were the main reasons why patients were referred for coronary angiography. The baseline ejection fraction (EF) was 39.13±22.88 %. Thirty-nine (52%) patients had left ventricular (LV) systolic dysfunction at presentation. The above results are summarized in **Table 1.**

Table 1: Clinical characteristics and risk factors of the study population

Variables	Mean
Age	59.57±13.33 years
Ejection fraction	39.13±22.88%
	N (%)
Risk factors	
HTN	52 (69.30)
Dyslipidemia	44 (58.67)
Obesity	42 (56.00)
LV systolic dysfunction	39 (52%)
Alcohol	35 (46.67)
Diabetes	27 (36.00)
Family history	17 (22.67)
CKD	8 (10.67)
Smoking	8 (10.67)
Number of risk factors	
None	7 (9.33)
One	1 (1.30)
Two	7 (9.30)
Three	15 (20.00)
Four	27 (36.00)
Five	17 (22.7)
Six	2 (2.70)
Reasons for referral	
Ischemic ECG changes	61 (81.33)
Angina	52 (69.33)
Dyspnea	38 (50.67)
Abnormal CT angiography result	16 (21.33)
Post MI angina	14 (18.67)
Valvular surgery evaluation	14 (18.67)
Self-referral	13 (17.33)
Syncopal attack	10 (13.33)

Results of coronary angiography and characteristics of the procedure

The most widely used arterial access route was femoral in 75% of cases. Of the 75 individuals who

had coronary angiography, 27 (36.00%) had obstructive CAD while 48 (64%) had non-obstructive CAD. Among the 48 patients with non-obstructive CAD, 34 (45.33%) had normal coronaries. Among the 27 patients with obstructive CAD, 51.85% (n = 14) had single-vessel disease; 37.04% (n = 10) had two-vessel disease and 11.11% (n = 3) had three-vessel disease lesions. The left anterior descending artery and left circumflex were the culprit vessels in 74 per cent and 44.44% respectively whereas the right coronary artery was involved in 40.7 per cent patients. Left main coronary artery stenosis was diagnosed in 6 (8.1%) cases among the 27 patients with obstructive CAD. The results are presented in **Table 2** below.

Table 2: Angiographic profile of the study population

Variables	N (%)
Access route	
Radial	18 (25.00)
Femoral	57 (75.00)
Coronary angiogram result	
Normal	34 (45.33)
Mild coronary stenosis	14 (18.67)
Obstructive	27 (36.00)
No of vessels involved (obstructive)	
One	14 (51.85)
Two	10 (37.04)
Three	3 (11.11)
Total significant lesions	49
Left main	6 (12.24)
LAD	20 (40.82)
LCx	12 (24.49)
RCA	11 (22.45)

A subset analysis presented in Table 3 and Table 4 showed that those who had obstructive coronaries were more likely to be hypertensive and with left ventricular systolic dysfunction compared to those with non-obstructive coronaries (P<0.05). However, the other risk factors were similar.

Table 3: Comparing the Baseline Characteristics of Non-obstructive Versus Obstructive CAD Patients

Characteristics	Non-Obstructive (48) Mean ± SD	Obstructive (27) Mean ± SD	p-value
Age (years)	58.58±14.65	61.33±10.59	0.359
HR (beats/min)	63.53±9.10	79.27±11.52	<0.001*
SBP (mmHg)	101.33±9.73	117.37±9.87	<0.001*
DBP (mmHg)	61.67±9.86	72.10±7.81	<0.001*

*- Significant

Table 4: Comparing the Baseline Characteristics of Non-obstructive Versus Obstructive CAD Patients

Characteristics	Non-Obstructive (48)		Obstructive (27)		Statistical indices
	N	%	N	%	
Hypertension	28	36	24	88.89	¥p = 0.008*
Diabetes	18	37.50	9	33.33	χ^2 = 0.130 p= 0.718
Chronic kidney disease	6	12.5	2	0.074	¥p = 0.703

Smoking	5	10.42	3	11.11	¥p = 0.703
Alcohol	25	52.08	10	37.04	χ^2 = 1.572 p= 0.210
Dyslipidemia	31	64.58	13	48.15	χ^2 = 1.925 p= 0.165
Family history	11	22.92	6	22.22	χ^2 = 0.005 p= 0.945
Obesity	28	58.33	14	51.85	χ^2 = 0.295 p= 0.587
Male	38	66.67	17	33.33	χ^2 = 2.320 p= 0.128
Left ventricular systolic dysfunction	20	41.67	19	70.37	χ^2 = 5.704 p= 0.017*

*- Significant, ¥= Fisher's exact test, χ^2= chi square

Discussion

The patient's mean age in this study is 59.57±13.33 years which is similar to findings in earlier research with mean ages of 56 ± 13 years and 58± 11 years (3, 5). The predominant male gender in our study is a well-established risk factor for CAD which is also reported in other studies (6, 7). In our analysis, dyslipidemia and hypertension were the most common risk factors. Other studies have also found that dyslipidemia is the most common risk factor for CAD (8, 9). In contrast to our study, which identifies hypertension as the most common risk factor, prior research has revealed that smoking is one of the most common risk factors for CAD (as high as 76%) (8, 9, 10).

The lower prevalence of smoking as a risk factor for CAD in our study may also be explained by the fact that smoking prevalence in Nigeria and other sub-Saharan African (SSA) countries is generally lower than the present global smoking rates (11). Additionally, Edafe *et al*. found that among Nigerians with CAD, smoking prevalence was 27.3% which is comparatively lower than results obtained outside SSA countries (10). It was unsettling to see that there were so many modifiable risk factors in our study, which indicated that community preventive initiatives needed to be intensified.

The prevalence of non-obstructive lesions at angiography was 64%, which was similar to the 68 per cent prevalence reported by another study conducted at a different tertiary hospital in Nigeria (10). In another study, published by Costa Filho *et al.,* 830 individuals with suspected stable CAD who were referred for elective coronary angiography were examined in a similar middle-income nation in Brazil and 31.2% of the patients had obstructive CAD (12). This value is also comparable to the prevalence reported in our study. However, in a tertiary hospital in Bangladesh, Ahsan *et al*. found a noticeably greater prevalence of obstructive CAD among their research participants, at 63% (6). This indicates the disease is still less burdensome in low- and middle-income countries like Nigeria.

In our study, 51.85% of patients had a single disease (SVD), 37.04% had two-vessel disease (TVD) and 11.11% had three-vessel disease (TVD). Regardless of the mean age of the study population, prior research has documented the same pattern of vessel involvement with varying prevalences of SVD ranging from 37% to 94% (13, 14, 15). Edafe *et al.* in a study in Nigeria also reported an SVD prevalence of 63.6% among Nigerian patients (10). Research has however indicated that young persons with ACS have a relatively higher prevalence of SVD. Ali *et al.* reported a high prevalence (70.7%) of single vessel disease in a study involving young people with acute coronary syndrome (ACS) who were 40 years of age or younger (16). Mahjoob and Yang *et al.* also noted that young adults have less severe coronary disease in their research (13, 17). According to a study by Prajapati *et al*., older patients were more likely to have a relatively higher prevalence of DVD and TVD than younger patients (18). The prevalence of DVD and TVD in our study was 37.04% and 11.11%, respectively, which is comparable to other studies that have been done among elderly people and range from 3.8% to 45% (13, 14, 15). The left anterior descending artery is usually the most commonly involved vessel reported in studies (19, 20) and our study is not an exception. This study showed that patients with obstructive disease were more likely to have hypertension, similar to the study by Pizzi et al (21). However, in contrast to other studies, perhaps

because of our study's smaller sample size, dyslipidemia, advancing age, male sex, diabetes, CKD, and smoking history were not associated with obstructive CAD (21, 22, 23).

Study limitations
It is a single-centre retrospective study with a small sample size; hence the data may not reflect the true picture of coronary angiographic pattern in the study populace.

Conclusion
The majority of the study population had non-severe disease, and the two most common risk factors were hypertension and dyslipidemia. The most often affected vessel is the left anterior descending artery, and single-vessel disease is the most common kind of obstructive CAD.

List of Abbreviations
CAD: Coronary artery disease
AMSH: Afe Babalola University Multi-System Hospital
CATHLAB: Catheterization Laboratory
SVD: Single vessel disease
DVD: Double vessel disease
TVD: Triple vessel disease

Declarations
Ethical approval and consent to participate
The study was approved by the Research and Ethics Committee, Afe Babalola University Multi-System Hospital (AMSH) under the reference number AMSH/REC/24/081.

Consent for publication
All the authors gave consent for the publication of the work under the Creative Commons Attribution-Non-Commercial 4.0 license.

Availability of data and materials
The data and materials associated with this research will be made available by the corresponding author upon reasonable request.

Competing interests
The authors declare that they have no competing interests.

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Author contributions
All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by OOE, ORO, NFC and OF. The first draft of the manuscript was written by OOE and OB). All authors commented on previous versions of the manuscript, read and approved the final manuscript.

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References
1. Biritwum RB, Amoah AGB, Pobee JOM. Cardiovascular diseases in sub-Saharan Africa. Accra, Ghana: ASCOM Publishers, 2005.
2. Mensah GA. Ischaemic heart disease in Africa. Heart. 2008. 94: 836-843. https://doi.org/10.1136/hrt.2007.136523
3. Reddy KS, Yusuf S. Emerging epidemic of cardiovascular disease in developing countries. Circulation 97. 1998: 596- 601. https://doi.org/10.1161/01.CIR.97.6.596 .
4. Cesar LA, Ferreira JF, Armaganijan D, Gowdak LH, Mansur AP, Bodanese LC, *et al*. Guideline for Stable Coronary Artery Disease. Arq Bras Cardiol. 2014; 103(2 Suppl 2):1-56. https://doi.org/10.5935/abc.2014S004
5. Fournier JA, Sánchez A, Quero J, Fernández-Cortacero JA, González-Barrero A. Myocardial infarction in men aged 40 years or less: a prospective clinical angiographic study. Clin cardiol. 1996. 19: 631-636. https://doi.org/10.1002/clc.4960190809
6. Ahsan MM, Haque SMS, Sultana S, Sarker AC, Hossain MdS, Siddiquiet MKR *et al.* Clinical Characteristics, Risk Factors and Angiographic Profile of Patients Undergoing Coronary Angiography in A Tertiary Care Hospital. Cardiology and Cardiovascular Medicine. 2023. 7: 1-4.
7. Bansal BL, Akshata PJ. Clinical profiles and angiographic patterns in patients of coronary artery disease in a tertiary care centre, Chattisgarh. Evolution Med. Dent Sci 5. 2016: 7638-7648. https://doi.org/10.14260/Jemds/2016/1724
8. Zimmerman FH, Cameron A, Fisher LD, Ng G. Myocardial infarction in young adults: Angiographic characterization, risk factors and prognosis (Coronary Artery Surgery Study Registry). J Am Coll Cardiol. 1995; *26*: 654-61. https://doi.org/10.1016/0735-1097(95)00254-2
9. Chen L, Chester M, Kaski JC. Clinical factors and angiographic features associated with

premature coronary artery disease. Chest. 1995; *108*: 364-9. https://doi.org/10.1378/chest.108.2.364
10. Edafe EA, Khanna NN, Akpa MR. Clinical and Angiographic Profile of Patients with Coronary Artery Disease among Nigerians and Indians. J Angiol Vasc Surg. 2023. 8: 110. https://doi.org/10.24966/AVS-7397/100110
11. Adeloye D, Auta A, Fawibe A, Gadanya M, Ezeigwe N, Mpazanje RG *et al.* Current prevalence pattern of tobacco smoking in Nigeria: a systematic review and meta-analysis. BMC Public Health. 2019; 19(1):1719.. https://doi.org/10.1186/s12889-019-8010-8
12. Costa FF Filho, Chaves ÁJ, Ligabó LT, Santos EM, Silva DT, Puzzi MA, et al. Efficacy of Patient Selection for Diagnostic Coronary Angiography in Suspected Coronary Artery Disease. Arq Bras Cardiol. 2015;105(5):466-71. https://doi.org/10.5935/abc.20150099
13. Mahjoob MP, Sadeghi S, Khanaman HF, Naderian M, Khaheshi I. Comparison of coronary risk factors and angiographic findings in younger and older patients with significant coronary artery disease. Rom J Intern Med. 2018; 56(2):90-95. https://doi.org/10.1515/rjim-2017-0048
14. Meda JR, Kusima H, Magitta NF. Angiographic characteristics of coronary artery disease in patients undergoing diagnostic coronary angiography at a tertiary hospital in Tanzania. BMC Cardiovasc Disord. 2024.24:125. https://doi.org/10.1186/s12872-024-03773-7.
15. El-Rabbat K, Zarif B., Elhafeez MS, Saeed, M. Pattern of Coronary Angiography in Young Adults versus Older Adults Presented by Coronary Artery Disease in Correlation to Their Risk Factors with 1-year Follow-up of Their Clinical Outcome. Research in Cardiovascular Medicine. 2024: 13(2); 35-41. https://doi.org/10.4103/rcm.rcm_24_24
16. Ali M, Butt UM, Khan RSAT, Qureshi MA, Akram Z. Coronary artery disease in young Pakistanis: risk factors and pattern of disease. Ann King Edward Med Uni. 2021;27(1)30-36. https://doi.org/10.47144/phj.v55iSupplement1.2430
17. Yang J, Biery DW, Singh A, Divakaran S, DeFilippis EM, Wu WY *et al*. Risk Factors and Outcomes of Very Young Adults Who Experience Myocardial Infarction: The Partners YOUNG-MI Registry. Am J Med. 2020;133(5):605-612.e1. https://doi.org/10.1016/j.amjmed.2019.10.020
18. Prajapati J, Joshi H, Sahoo S, Virpariya K, Parmar M, Shah K. Age-related Differences of Novel Atherosclerotic Risk Factors and Angiographic Profile Among Gujarati Acute Coronary Syndrome Patients. J Clin Diagn Res. 2015;9(6):OC05-OC09. https://doi.org/10.7860/JCDR/2015/11709.6000 .
19. Swain L, Routray PN. Demographic and clinic-angiographic profile of coronary artery disease in young adults: a retrospective observational study. International Journal of Research in Medical Sciences. 2018; 6:2264-2270. https://doi.org/10.18203/2320-6012.ijrms20182428
20. Colkesen AY, Acil T, Demircan S, Demircan S, Sezgin AT, *et al*. Coronary lesion type, location, and characteristics of acute ST-elevation myocardial infarction in young adults under 35 years of age. Coronary artery disease. 2008; 19:345-347. https://doi.org/10.1097/MCA.0b013e3283030b3b .
21. Pizzi C, Xhyheri B, Costa GM, Faustino M, Flacco ME, Gualano MR, *et al.* Nonobstructive Versus Obstructive Coronary Artery Disease in Acute Coronary Syndrome: A Meta-Analysis. J Am Heart Assoc. 2016. 16;5(12):e004185. https://doi.org/10.1161/JAHA.116.004185 .
22. Beka G, Demissie Z, Alemayehu B. Predictors and Prevalence of Obstructive Coronary Artery Disease in Patients Who Underwent Elective Invasive Coronary Angiography for Chronic Coronary Syndrome at Catheterization Laboratory of Tikur Anbessa Specialized Hospital and Gesund Cardiac and Medical Center, Addis Ababa Ethiopia: Retrospective Study. Research Reports in Clinical Cardiology. 2024;15:5-16. https://doi.org/10.2147/RRCC.S450756
23. Rio P, Ramos R, Pereira-da-silva T, Barbosa C, Cacela D, Fiarresga A, *et al.* Yield of contemporary clinical strategies to detect patients with obstructive coronary artery disease. *Heart Int*. 2016; 10(1): e12–e19. https://doi.org/10.5301/heartint.5000224