

Original Article

Prevalence and Clinical Characteristics of Acute Coronary Syndrome in a Nigerian Tertiary Hospital

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Abstract

Background: Acute coronary syndrome (ACS) is increasingly recognized across sub-Saharan Africa due to rising cardiometabolic risk factors. However, contemporary data from Northwestern Nigeria remain limited. This study aimed to determine the prevalence, clinical characteristics, and risk factors of ACS among patients admitted to Aminu Kano Teaching Hospital (AKTH) in Kano, Northern Nigeria.

Methodology: A hospital-based, cross-sectional study was conducted over 13 months. Consecutive adult patients diagnosed with ACS according to ACC/AHA criteria were enrolled. Data on demographics, risk factors, presentation, and laboratory findings were collected using a semi-structured questionnaire. Prevalence was calculated with 95% confidence intervals (CI). Continuous variables were expressed as mean \pm standard deviation or median [interquartile range], and compared using Student's t-test or Mann-Whitney U test. Categorical variables were expressed as frequencies (percentages) and compared using Chi-square or Fisher's exact test. Statistical analysis was performed using SPSS software version 18.0, and a P-value <0.05 was considered significant.

Results: Among 2001 general medical admissions and 564 cardiovascular admissions, 55 patients had ACS, yielding prevalence rates of 2.8% (95% CI: 2.1–3.6%) and 9.8% (95% CI: 7.5–12.5%), respectively. The mean age was 60.5 ± 12.2 years, and 61.8% were male. Females were older than males (65.6 ± 11.2 vs. 57.4 ± 11.8 years, $P=0.014$). The predominant risk factors were hypertension (87.3%), physical inactivity (81.8%), dyslipidaemia (74.5%), and diabetes mellitus (40.0%). ST-segment elevation myocardial infarction (STEMI) was the commonest subtype (60%). Diabetes mellitus was associated with STEMI, while obesity was associated with unstable angina ($P<0.05$). Most patients (83.6%) presented beyond 12 hours after symptom onset.

Conclusions: ACS represents a significant proportion of cardiovascular admissions in Northwestern Nigeria, dominated by hypertension and metabolic disorders. There is an urgent need for public health interventions targeting modifiable risk factors and strategies to reduce pre-hospital delays.

Keywords: Acute coronary syndrome, prevalence, clinical characteristics, risk factors, Kano, Nigeria

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Introduction

Ischaemic heart disease (IHD) remains the leading global cause of morbidity and mortality, accounting for nearly 9 million deaths annually [1]. Acute coronary syndrome (ACS), comprising unstable angina, non-ST-segment elevation myocardial infarction (NSTEMI), and ST-segment elevation myocardial infarction (STEMI), represents the most severe clinical manifestation of IHD associated with short- and long-term mortality [2].

Diagnosis of ACS relies on symptoms, electrocardiographic changes, and elevated cardiac biomarkers in accordance with the Universal Definition of Myocardial Infarction [3]. Despite advances in diagnosis and management, outcomes remain poor in low- and middle-income countries due to delayed presentation, inadequate emergency care systems, and limited access to reperfusion therapy [4].

Multiple cardiovascular risk factors predispose individuals to ACS, including hypertension, diabetes, dyslipidaemia, obesity, physical inactivity, and smoking [1–4]. In sub-Saharan Africa (SSA), the burden of IHD is increasing as a result of epidemiological transition, urbanization, and rising prevalence of cardiovascular risk factors [1–8]. Nigeria reflects this shift, where non-communicable diseases like IHD contribute to morbidity and mortality amidst a persistent burden of communicable diseases [9]. However, contemporary data on the epidemiology of ACS remain sparse, especially from the northern region where diagnostic capacity, emergency medical services, and public awareness vary [7]. Existing Nigerian studies are single-centre, with varying methodologies, limiting the ability to gauge the true burden and inform policy [7,10,11]. Understanding local prevalence, clinical presentation, and risk factor patterns is essential for improving prevention strategies and optimizing acute care in resource-limited settings.

This study was therefore designed to determine the prevalence, clinical presentation, and risk factor profile of ACS patients at Aminu Kano Teaching Hospital (AKTH), a major referral centre in Northwestern Nigeria. The findings aim to provide insights for local healthcare planning, resource allocation, and preventive strategies.

Methods

Study Design and Setting:

This was a hospital-based, cross-sectional study conducted at the Aminu Kano Teaching Hospital (AKTH), a major tertiary referral center in Northwestern Nigeria. The study was carried out over a 13-month period (between January 2013 and January 2014).

Study Population and Sampling:

The study included consecutive adult patients (≥ 18 years) admitted through the emergency unit or medical wards with a clinical diagnosis of ACS. Consecutive sampling ensured that every eligible patient was recruited, minimizing selection bias in a low-incidence condition. ACS was diagnosed according to the American College of Cardiology/American Heart Association (ACC/AHA) guidelines, incorporating clinical symptoms, electrocardiographic (ECG) changes, and elevated cardiac troponin levels [12,13]. However, patients with stable angina, prior admissions for ACS during the study period, post-procedural ACS (e.g., post-percutaneous coronary intervention), who declined consent, incomplete diagnostic data were excluded.

Sample Size Determination

The minimum sample size was calculated using Cochran's formula for single proportions: $n = (Z^2 * P * q / d^2)$. Using an estimated ACS prevalence (P) of 3.4% from a previous local study [7], a 95% confidence

level ($Z=1.96$), $q = 1-P$, and a margin of error (d) of 0.05, a minimum sample size of 50 was obtained. Anticipating a 10% attrition/ non-response rate, a final sample size of 55 was targeted. A total of 55 patients were ultimately recruited during the study period.

Data Collection Procedures:

We collected data using a semi-structured interviewer-administered questionnaire by two trained resident doctors to ensure standardization. The questionnaire underwent content validation by two cardiologists and pretesting among 10 patients (excluded from analysis). It captured socio-demographics, detailed medical and cardiovascular risk factor history, clinical presentation details, and laboratory findings. Anthropometric measurements, blood pressure, electrocardiography (ECG), and cardiac enzyme tests were performed for all patients. Anthropometry: Weight and height were measured using a standard scale and stadiometer (made by Hospitex, Switzerland). Body mass index (BMI) was calculated as weight (kg)/height (m²). Blood Pressure (BP): Measured using a calibrated mercury sphygmomanometer (Accoson, made in Germany) according to standard technique based on JNC 7 guideline [14]. Laboratory Investigations: Following informed consent, venous blood samples were collected at the time of hospital presentation. Analyses included: Cardiac Troponin T: Measured using a Cobas H 232 analyzer (Roche Diagnostics, Germany); a level ≥ 0.4 ng/ml was considered positive. A repeat sample was obtained 6–12 hours after presentation, and subsequently, as clinically indicated, to identify a rising/falling pattern of troponin as per diagnostic guidelines. Lipid Profile, fasting glucose after an 8–12-hour overnight fast: Fasting samples were analyzed for total cholesterol, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), triglycerides, and glucose using an auto-analyzer (Chiron Diagnostics). Other tests: Full blood count, serum electrolytes, urea, and creatinine. Electrocardiography (ECG): A 12-lead resting ECG was performed at presentation using a Bionet Cardio-Care ECG-2000 machine (made in South Korea), according to the recommendation of the AHA/ACC/Heart Rhythm Society scientific statement [15]. ECG was interpreted by a cardiologist. Echocardiography was performed using a standardized protocol by an experienced cardiologist.

Operational definitions

Hypertension: This was defined based on JNC – 7 criteria as a positive history of hypertension, use of anti-hypertensive drugs, or blood pressure $\geq 140/90$ mmHg measured using standard procedure [7].

Diabetic mellitus: This was defined based on World Health Organization (WHO) criteria as fasting blood sugar (FBS) ≥ 126 mg/dl (7.0mmol/l) and or random blood sugar (RBS) ≥ 200 mg/dl (11.1mmol/l). One abnormal blood sugar value in the presence of typical symptoms of Diabetic mellitus(DM), or at least two abnormal blood sugar values if there are no typical symptoms, was used for the diagnosis of DM. Previously diagnosed DM was considered even if glucose control had been achieved at the time of the study [7].

Dyslipidaemia: This was defined using Adult Treatment Panel III (ATP III) guidelines, when one or all of the following were found: Total cholesterol ≥ 200 mg/dl (5.2mmol/l), LDL-C ≥ 130 mg/dl (3.3mmol/l), triglycerides ≥ 150 mg/dl (1.7mmol/l) and HDL-C ≤ 40 mg/dl (1.03mmol/l) in men or ≤ 50 mg/dl (1.3mmol/l) in women [7].

Obesity: This was defined based on WHO guidelines as BMI ≥ 30 kg/m²[7].

Smoking: This was classified into: (a) current smokers were defined as those who smoked at least one cigarette per day or have stopped cigarette smoking during the past 12 months, (b) former smokers were defined as those who had stopped smoking for more than one year, (c) nonsmokers were defined as those who have never smoked cigarette in their life [11].

Family history of CVD: This was defined as a positive history of IHD in a first-degree relative before the age of 55 years for men and 65 years for women, history of cardiovascular risk factor in a first-degree relative, or history of sudden cardiac death before the age of 55 years for male and 65 years for female in first degree relative [7,11].

Excessive alcohol intake: Alcohol intake was considered to be excessive at levels above 21 units weekly (3 units/day) for men and 14 units weekly (2 units/day) for women. One unit contains approximately 9 grams of alcohol and is equivalent to half a pint of beer, a single measure of spirit, or a glass of wine [7,11].

Physical activity: This was graded according to occupation: (1) very active (carrying or lifting heavy loads, digging, or construction work). (2) Moderately active (work involving brisk walking or carrying light loads such as housework, trade work, and nursing). (3) Not active (sitting or reclining for most part of the day in a week, such as office work and unemployment) [11].

ST – segment elevation: This was defined as ST-segment elevation of ≥ 1 mm from the iso-electric line in two contiguous limb leads or ≥ 2 mm in two contiguous chest leads [12,13].

ST – segment depression: This was defined as ST-segment depression of ≥ 1 mm from the iso-electric line in two contiguous limb leads or ≥ 2 mm in two contiguous chest leads with T wave inversions [12,13].

Pathological Q waves: This was defined as when Q waves are ≥ 0.04 seconds in duration and $>$ one fourth of the R – wave in amplitude [12,13].

Presumed new LBBB: This was defined as a broad QRS complex of ≥ 0.12 seconds with the presence of a notched R wave in V_6 and a broad and deep S wave in V_1 in a patient previously known not to have LBBB [13].

STEMI: This was diagnosed when there is ST-segment elevation or presumed new LBBB on their ECG with elevated cardiac troponin T in the presence of ischaemic symptoms [13].

NSTEMI: This was diagnosed when there is elevated cardiac troponin T with ECG evidence of ST-segment depression or T wave inversion in the presence of ischaemic symptoms [12].

Unstable Angina: This was diagnosed when there are new or accelerated ischaemic symptoms and with ECG evidence of ST segment depression or T wave inversion in the absence of elevated cardiac troponin T [12].

Ischaemic symptoms: This was defined as typical chest pain, discomfort, heaviness that radiates to the arm, shoulder, neck, back, epigastrium which is exacerbated by exertion or stress and relieved by rest. Symptoms associated with shortness of breath, dyspepsia, palpitation, diaphoresis, weakness, nausea, vomiting, or light-headedness [1,2].

Positive troponin: This was defined as troponin T ≥ 0.4 ng/ml [1,2].

Localization of ACS (STEMI only): The site of infarct was localized as follows: Inferior wall MI (limb leads II, III and aVF), anterior wall MI (chest leads V₁ and V₂), lateral wall MI (lead I, aVL, V₅ and V₆), septal wall MI (chest leads V₃ and V₄), antero-septal wall MI (chest leads V₁ to V₄), extensive anterior wall MI (chest leads V₁ to V₆) [13].

Ethical Approval

Approval was obtained from the Aminu Kano Teaching Hospital Health Research Ethics Committee with reference number (NHREC/21/08/2008/AKTH/EC/942). Permission was also obtained from the hospital management. Written informed consent was obtained from all participants prior to enrollment. Confidentiality and anonymity of participants were maintained throughout the study. The study was conducted in accordance with the Declaration of Helsinki [16].

Statistical Analysis:

Data were analyzed using IBM SPSS Statistics for Windows, Version 18.0. The normality of continuous variables was assessed using the Shapiro-Wilk test. Normally distributed continuous variables were presented as mean \pm standard deviation (SD) and compared between two groups using the Independent Samples Student's t-test. Comparisons across more than two groups (e.g., ACS subtypes) were done using Analysis of Variance (ANOVA). Non-normally distributed continuous variables were presented as median [interquartile range, IQR] and compared using the Mann-Whitney U test or Kruskal-Wallis test, as appropriate. Categorical variables were presented as frequencies and percentages (n, %) and compared using the Chi-square test or Fisher's exact test. Binary logistic regression analysis was performed to identify factors independently associated with ACS subtypes (STEMI vs. NSTEMI/UA), with results expressed as adjusted odds ratios (aOR) and 95% confidence intervals (CI). A two-tailed P-value < 0.05 was considered statistically significant.

Results

Prevalence of ACS:

During the study period, there were 2001 general medical admissions and 564 cardiovascular admissions over the 13-month period of the study. A total of 55 patients were diagnosed with ACS, representing 2.8% (95% CI: 2.1–3.6%) of all general medical admissions and 9.8% (95% CI: 7.4–12.5%) of cardiovascular admissions.

Demographic Characteristics:

The cohort comprised 34 males (61.8%) and 21 females (38.2%), with a male-to-female ratio of 3:2. The mean age of the patients was 60.5 \pm 12.2 years (range: 36–85 years). Females were significantly older than males (65.6 \pm 11.2 versus 57.4 \pm 11.8 years, P = 0.014). The most frequent age groups were 50–59 years (30.9%) and 60–69 years (23.6%), as shown in Figure 1. The majority of patients, 49 (89.1%), were Hausa/Fulani, while 2 (3.6%) were Yoruba and 4 (7.3%) were from other tribes; only 1 (1.8%) patient was a foreign national (Indian). About 28 (50.9%) patients had some form of western education, and the remaining 27 (49.1%) patients had Quranic education. The western educational status includes secondary 6 (10.9%), tertiary 19 (34.5%), and postgraduate 3 (5.5%). Most of the patients, 23 (41.8%), were unemployed, 9 (16.4%) were trading and farming each, 6 (10.9%) were pensioners, 6 (10.9%) were civil service, and 2 (3.6%) were professionals.

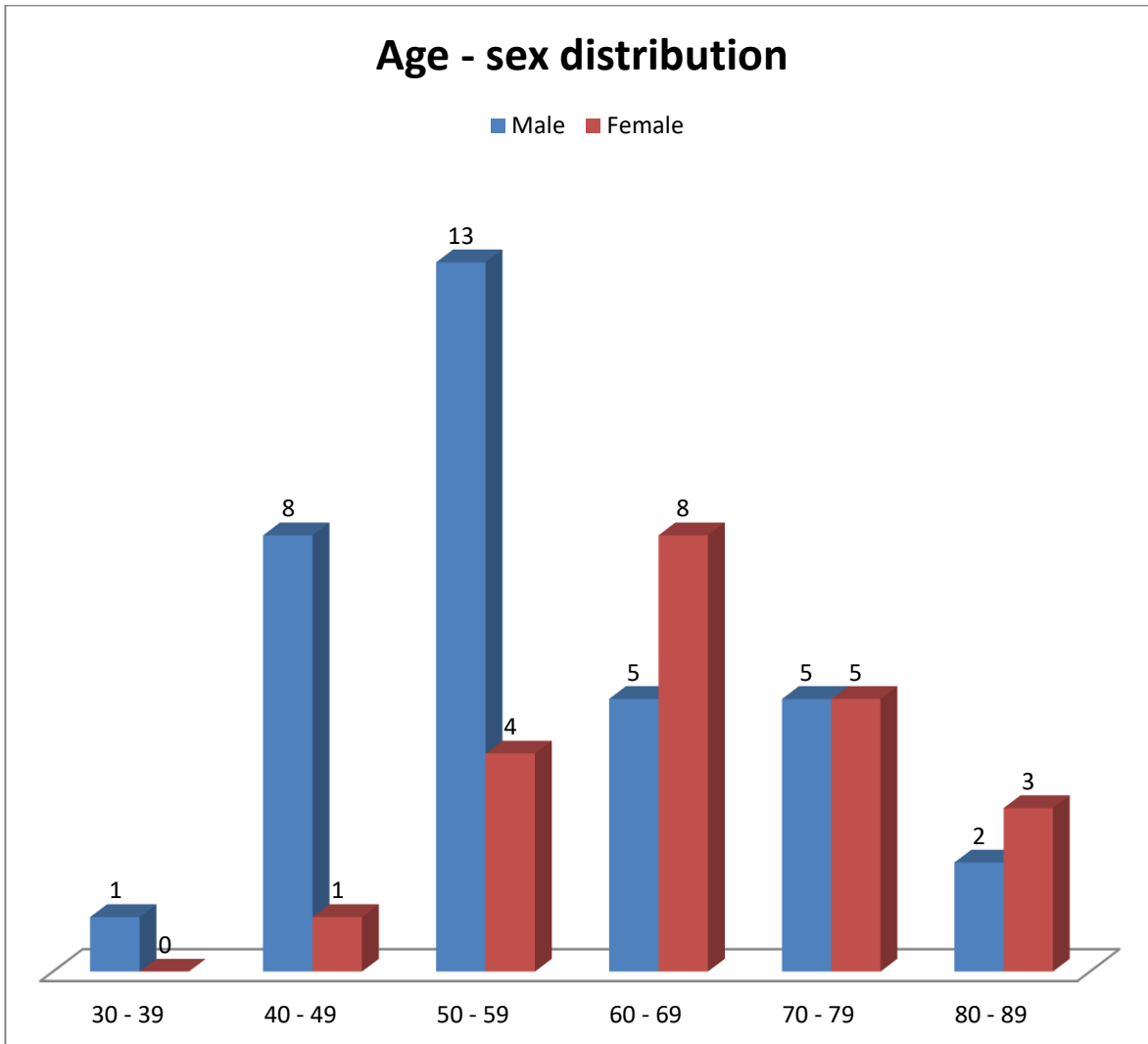


Figure 1: Bar chart showing age and sex distribution of 55 ACS patients in Aminu Kano Teaching Hospital.

Clinical Presentation:

The most common presenting symptom was chest pain (74.5%), followed by palpitations (18.2%) and worsening heart failure (18.2%). Time from symptom onset to hospital arrival was skewed on normality testing (Shapiro–Wilk $p < 0.001$), with a mean period of hospital presentation of 56.0 ± 37.4 hours; however, 83.6% of patients presented beyond 12 hours, outside the optimal reperfusion window (Table 1).

Table 1: Demographic and clinical characteristics of the patients

Variables	Total (N=55)	Male (n=34)	Female (n=21)	X ²	P value
Age (years)	60.5±12.2	57.4±11.8	65.6±11.2	-	0.014
Weight (Kg), mean±SD	77.5±18.2	80.7±19.1	72.2±15.7	-	0.082
BMI (Kg/m ²), mean±SD	27.7±5.7	28.0±6.90	27.3±5.3	-	0.648

WC (cm), mean±SD	103.0±17.3	105.1±16.9	99.7±17.7	-	0.261
SBP (mmHg), mean±SD	132.6±29.8	131.1±29.4	135.2±30.9	-	0.613
DBP (mmHg), mean±SD	83.1±17.9	82.4±18.4	84.3±15.0	-	0.673
Heart rate (bpm), mean±SD	97.6±20.6	93.4±17.0	104.6±24.3	-	0.049
Time of symptoms onset to hospital presentation (hours), mean±SD	56.0±37.4	52.7±36.3	61.3±39.3	-	0.412
Chest pain n(%)	41(74.5)	26(76.5)	15(71.4)	0.174	0.755
Palpitation n(%)	10(18.2)	5(14.7)	5(23.8)	0.723	0.480
Worsening HF n(%)	10(18.2)	4(11.8)	6(28.6)	2.465	0.116
Dyspnoea n(%)	8(14.5)	4(11.8)	4(19.0)	0.554	0.464
Dyspepsia n(%)	6(10.9)	4(11.8)	2(9.5)	0.067	0.796
Past hxs of Angina n(%)	15(27.3)	12(35.8)	3(14.3)	2.889	0.089
Past hxs of MI n(%)	4(7.3)	3(8.8)	1(4.8)	0.318	0.573

Key: **bold** = P value of statistical significant, HF= heart failure, MI= myocardial infarction, Past hxs= past history, BMI= body mass index, WC= waist circumference, SBP= systolic blood pressure, DBP= diastolic blood pressure, bpm= beat per minute, Kg= kilogram, Kg/M²= kilogram per meter square, cm= centimeter, mmHg= millimeter of mercury, ≥ = greater than or equal to, n(%) = number (percentage), mean±SD= standard deviation.

Cardiovascular Risk Factors:

The most prevalent risk factors were hypertension (87.3%), physical inactivity (81.8%), dyslipidaemia (74.5%), and type 2 diabetes mellitus (40.0%). Current cigarette smoking was exclusively reported by males (29.4% of males vs. 0% of females, P = 0.005). The distribution of risk factors by gender is shown in Table 2.

Table 2: Risk factors of ACS based on gender

Variables	Total (N=55)	Male (n=34)	Female (n=21)	X ²	P value
Hypertension n(%)	48(87.3)	30(88.2)	18(85.7)	0.074	0.785
Physical inactivity n(%)	45(81.8)	26(76.5)	19(90.5)	1.712	0.287
Dyslipidaemia n(%)	41(74.5)	25(73.5)	16(76.2)	0.048	0.826
Family history of CVD n(%)	31(56.4)	16(47.1)	15(71.4)	3.135	0.098
Diabetic mellitus n(%)	22(40.0)	12(35.3)	10(47.6)	0.822	0.407
Obesity n(%)	21(38.2)	12(35.8)	9(42.9)	0.315	0.583

Current cigarette smoker n(%)	10(18.2)	10(29.4)	0(0)	10.515	0.005
Alcohol n(%)	1(1.8)	1(2.9)	0(0)	0.629	0.428

Key: **Bold**= P value of statistical significant, CVD= Cardiovascular disease, n(%)= number(percentage)

Diabetes mellitus was significantly more frequent in the STEMI group (51.5%) compared to NSTEMI (36.4%) and UA (9.1%) ($P = 0.044$). Conversely, obesity was most prevalent in the UA group (72.7%) compared to NSTEMI (45.5%) and STEMI (24.2%) ($P = 0.014$). Other risk factors showed no significant difference across ACS subtypes (shown in Table 3). On binary logistic regression (STEMI vs. Non-STEMI/UA), diabetes mellitus remained independently associated with STEMI (aOR: 4.12, 95% CI: 1.25–13.58, $P=0.020$), after adjusting for age, sex, and hypertension.

Table 3: Risk factors of ACS based on ACS types

Variable	STEMI (n=33)	NSTEMI (n=11)	UA (n=11)	X ²	P value
Hypertension n(%)	28(89.8)	10(90.9)	10(90.9)	0.437	0.804
Physical inactivity n(%)	27(81.8)	10(90.9)	8(72.7)	1.222	0.543
Dyslipidaemia n(%)	25(75.8)	8(72.7)	8(72.7)	0.064	0.969
Family history of CVD n(%)	20(60.6)	6(54.5)	5(45.5)	0.789	0.674
Diabetic mellitus n(%)	17(51.5)	4(36.4)	1(9.1)	6.263	0.044
Obesity n(%)	8(24.2)	5(45.5)	8(72.7)	8.525	0.014
Current cigarette smoker n(%)	7(21.2)	2(18.2)	1(9.1)	1.698	0.791
Alcohol n(%)	1(3.0)	0(0)	0(0)	0.679	0.712

Key: **Bold**= P value of statistical significant, CVD= Cardiovascular disease, n= number, %= percentage

The laboratory parameters of the study population did not differ significantly among males and females except serum creatinine (168.9 ± 148.6 versus $103.8 \pm 48.5 \mu\text{mol/l}$; $P=0.023$) and total white blood cell counts ($13.1 \pm 7.3 \times 10^9/\text{l}$ versus $8.8 \pm 5.4 \times 10^9/\text{l}$; $P=0.005$) as in Table 4.

Table 4: Laboratory parameters of the study patients

Variables	Total (N=55)	Male (n=34)	Female (n=21)	P value
TC (mmol/l)	5.2±1.2	5.0 ±1.2	5.4±1.2	0.329
LDL (mmol/l)	3.3±1.2	3.1±1.1	3.6±1.2	0.138
HDL (mmol/l)	1.1±0.5	1.1±0.4	1.1±0.3	0.768

TG (mmo/l)	1.4±0.5	1.4±0.5	1.4±0.5	0.621
RBS (mmol/l)	10.6±5.6	10.5±5.6	10.6±5.7	0.986
Troponin (ng/ml)	2.6±3.0	2.9±2.3	2.3±3.5	0.477
Urea (mmol/l)	10.0±8.6	11.5±9.9	7.5±5.6	0.065
Creatinine (µmol/l)	144.0±124.0	168.9±148.6	103.8±48.5	0.023
Hb (g/dl)	12.9±2.1	12.8±2.5	13.2±1.5	0.452
WBC x10 ⁹ /l	11.3±6.8	13.1 ±7.3	8.8±5.4	0.005
Neutrophils (%)	68.9±15.7	71.1±17.2	65.8±13.4	0.324

Key: **Bold**= P value of statistical significance, TC= Total cholesterol, LDL= Low density lipoprotein, HDL= High density lipoprotein, TG= Triglyceride, RBS= Random blood sugar, Hb= Haemoglobin, WBC= white blood cell, mmol/l= millimole per liter, ng/ml= nonogram per milliliter, µmol/l= micromole per liter, g/dl= gram per deciliter, %= percentage, mean±standard deviation.

STEMI was the most frequent ACS subtype (60%), followed by NSTEMI (20%) and UA (20%). Antero-septal (40%) and extensive anterior (33%) locations were most common among STEMI patients, as shown in Figure 2.

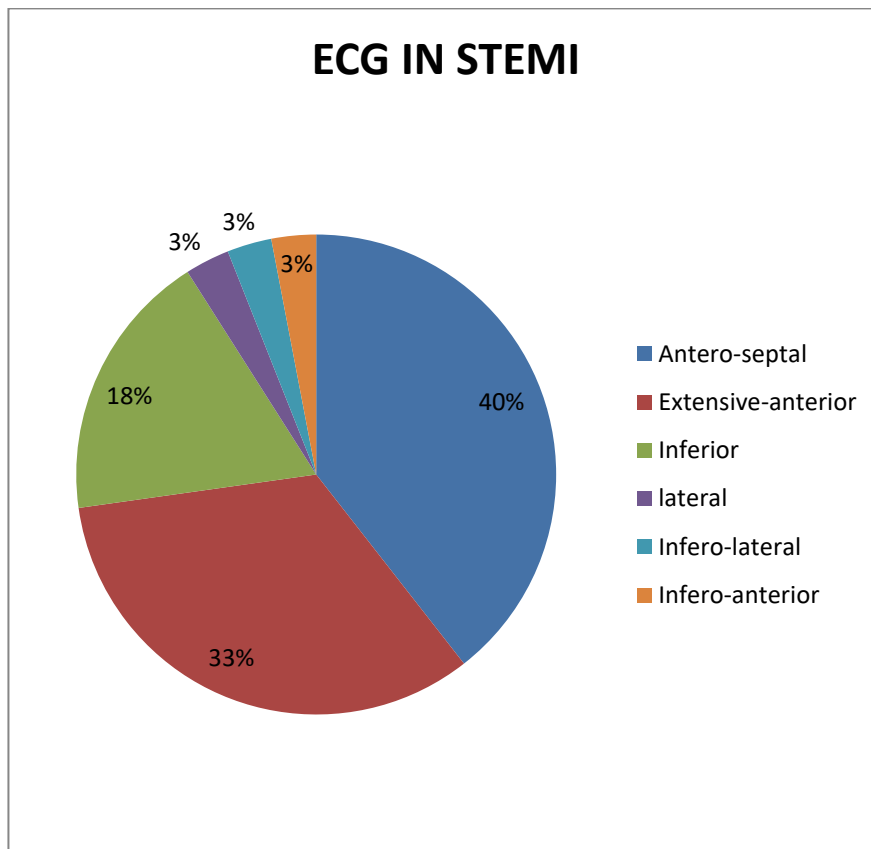


Figure 2: Piechart showing Electrocardiographic localization in STEMI

Discussion

This study provides the prevalence, clinical characteristics, and risk profile of patients diagnosed with ACS at a major referral centre in Northwestern Nigeria. ACS constituted nearly one-tenth of cardiovascular admissions, with a prevalence of 2.8% among general medical admissions. The prevalence of ACS among medical admissions in this study (2.8%) aligns with prior reports from other Nigerian centres, which have documented prevalence ranging between 1.4% and 4.2% [5–6], but aligns closely with the 2.7% found in the recent RACE-Nigeria registry [10]. When restricted to cardiovascular admissions, ACS accounted for 9.8%, which is similar to recent tertiary hospital data from Southern Nigeria and other West African countries [4,18]. These findings reinforce the observation that ACS, once considered rare in sub-Saharan Africa, is now increasingly encountered in hospital settings due to epidemiologic transition and improved diagnostic capacity.

The male predominance (61.8%) and the significantly older age of female patients (65.6 vs. 57.4 years) are consistent with global ACS epidemiology [18,19]. The delayed onset of ACS in women is often attributed to the cardio-protective effects of endogenous estrogen in pre-menopausal women, highlighting the importance of maintaining a high clinical suspicion for ACS in older female patients, who may also present with more atypical symptoms [20,21].

The mean age of ACS patients in this study (60.5 years) is comparable to findings from other African studies but younger than in developed countries, where the mean age is typically above 65 years [11,22]. This younger age at presentation signifies a more aggressive disease process, poorer control of cardiovascular risk factors, and loss of productive life-years within our population, highlighting the need for earlier prevention strategies [9,19].

Chest pain was the predominant presenting symptom, which is consistent with classic ACS presentations globally [10]. However, the proportion of patients presenting with angina equivalents (24.5%) was notable, which can obscure diagnosis, causing delayed pre-hospital visit, and a similar finding is noted in the Nigerian registry [10]. The alarmingly prolonged delay from symptom onset to hospital presentation (56 hours) observed in our cohort is a critical finding, similar to reports from Ethiopia, Ghana, Kenya, and South Africa, where pre-hospital delays commonly exceed 24 hours [23–25]. In contrast, median delays in high-income countries have reduced to less than 3–6 hours due to organized emergency medical systems [26]. This delayed presentation, which far exceeds the therapeutic window for optimal reperfusion, is a multifaceted issue rooted in limited public awareness of ACS symptoms, reliance on alternative care providers, financial constraints, and inadequate emergency medical services, ultimately leading to higher rates of complications at presentation [27,28]. This delay likely contributes to the high proportion of STEMI (60%) and the significant complication rates observed at presentation, emphasizing an urgent need for public education and improved acute care pathways.

STEMI was the most common subtype, affecting 60% of the patients, followed by NSTEMI (20%) and unstable angina (20%), a distribution that mirrors findings from other Nigerian and African studies where STEMI predominance ranges between 55% and 70% [7,17,22]. This contrasts with trends in high-income countries, where NSTEMI has become more common than STEMI due to earlier detection and better risk factor management [26]. The high STEMI proportion in this study likely reflects delayed presentation and limited access to early diagnostic ECG. Anterior and antero-septal infarcts were most frequent, a pattern consistent with other regional cohorts [7,10,29].

Hypertension, physical inactivity, dyslipidemia, and diabetes mellitus were the most prevalent cardiovascular risk factors, echoing trends seen across the African continent [7,9,11]. The significant association between diabetes mellitus and STEMI (51.5%, $P=0.044$) underscores the potent role of dysglycemia in precipitating major coronary events and plaque instability [21]. Conversely, obesity was more common in patients with unstable angina (72.7%, $P=0.014$), a finding that may suggest an association of obesity with unstable angina, which reflects its pro-inflammatory state contributing to early plaque rupture or erosion [30].

A stark gender disparity was observed in smoking, with no female smokers compared to 29.4% among males ($P=0.005$). This pattern is a direct reflection of the deep-seated socio-cultural norms in Northern Nigeria that strongly discourage tobacco use among women [31]. Nonetheless, the high smoking rate among males remains a significant public health concern given its status as a powerful, modifiable risk factor for ACS [32].

Laboratory results revealed significantly higher renal burden (serum creatinine) and higher inflammatory (white blood cell counts) among males, which may indicate a more severe clinical phenotype at presentation. These findings are prognostically relevant, as both renal impairment and leukocytosis at presentation have been independently associated with adverse outcomes in ACS [33,34].

Overall, the findings highlight a persistent gap in ACS patterns between sub-Saharan Africa and high-income countries. Key drivers of this disparity include: Fragmented emergency medical systems, low public awareness of ACS symptoms, limited availability of troponin assays and timely ECG in some facilities, absence of PCI-capable centres in many regions, and high burden of untreated cardiometabolic risk factors, among others. Recent work from the South African ACCESS registry, the West African HEARTS initiative, and the Pan-African Society of Cardiology (PASCAR) underscores similar challenges and emphasizes the need for coordinated ACS care pathways across the continent [24,35,36]. Addressing these challenges requires a multi-pronged approach, including community-based health education, the development of rapid referral systems, and strategic investments in emergency cardiac care infrastructure.

Key Novel Contributions of This Study

This study fills an important knowledge gap by providing: One of the few contemporary ACS datasets from Northwestern Nigeria, evidence of extremely prolonged delays in presentation in this region, a high burden of modifiable risk factors, consistent with rapid epidemiological transition, and ACS Subtype distribution relevant for regional clinical planning.

Study Limitations:

A limitation of our study is the cross-sectional design, which limits causal inferences. Being a hospital-based study, the results may not capture the true community prevalence of ACS, as many cases likely go unrecognized or do not reach a tertiary facility. The single-center nature limits the generalizability of the findings. Furthermore, the lack of coronary angiography for definitive confirmation of coronary artery disease represents a significant infrastructural constraint. The sample size, though adequate for prevalence, limited the power for more complex multivariate analyses to identify independent predictors of ACS subtypes. Long-term outcomes such as 30-day or 1-year mortality were not assessed, limiting insight into post-discharge prognosis.

Implication of the study

Despite these limitations, this study highlights a substantial burden of ACS from a region with scarce ACS data, often affecting individuals in their economically productive years, which carries negative implications for national development and also identifies critical gaps in acute cardiac care.

Conclusion And Recommendation

This study highlights that ACS is a significant and growing health problem in Northwestern Nigeria, characterized by a high burden of modifiable risk factors, particularly hypertension and diabetes, critically long pre-hospital delays with STEMI as the most common presentation, and the presence of atypical symptoms, which can obscure diagnosis. We therefore recommend: The prioritization of hospital protocols for the rapid triage and management of ACS, particularly STEMI. Strengthen primary prevention through community-based screening and management of hypertension and diabetes. Public awareness campaigns to improve recognition of ACS symptoms and reduce care-seeking delays. Investment in protocol-driven hospital care for ACS, including reliable thrombolysis services for STEMI. Future prospective, multi-centre studies with angiographic correlation are needed to further characterize disease patterns and outcomes in the region.

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