المجلس القومي السوداني للتخصصات الطبية
SUDAN MEDICAL SPECIALIZATION BOARD

Sudan Medical Specialization Board Council of

Internal Medicine

Clinical Characteristics and Coronary Angiography Findings in Patients with Acute Coronary Syndrome at Marawi Aldaman Hospital, 2025-2026

A Proposal thesis submitted in partial fulfillment for the requirements of the Degree of Clinical MD in Internal Medicine

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ABBREVIATIONS:

Term	Definition
ACS	Clinical presentation consistent with myocardial ischemia including STEMI, NSTEMI, or unstable angina, confirmed by ECG and troponin changes.
STEMI	ST elevation ≥1 mm in ≥2 contiguous leads or new LBBB with symptoms of ischemia.
NSTEMI	Elevated troponin with ischemic symptoms but without ST elevation.
Unstable Angina	Ischemic symptoms with normal troponin and/or transient ECG changes.
Single-Vessel Disease (SVD)	≥50% stenosis in one major epicardial coronary artery.
Double-Vessel Disease (DVD)	≥50% stenosis in two major epicardial arteries.
Triple-Vessel Disease (TVD)	≥50% stenosis in three major epicardial arteries.
Hypertension	Prior diagnosis or BP ≥140/90 mmHg or on antihypertensive therapy.
Diabetes Mellitus	Fasting glucose ≥126 mg/dL, HbA1c ≥6.5%, or on glucose-lowering therapy.
Dyslipidemia	Total cholesterol ≥200 mg/dL, LDL ≥130 mg/dL, or on lipid-lowering drugs.
Obesity	BMI ≥30 kg/m².

1. CHAPTER ONE INTRODUCTION

1.1 Background

Acute Coronary Syndrome (ACS) is a spectrum of clinical presentations resulting from reduced blood flow to the cardiac muscles, most commonly due to the rupture or erosion of an atherosclerotic plaque leading to coronary thrombosis[1]. It encompasses ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), and unstable angina. Despite significant advances in diagnostic and therapeutic modalities, ACS remains one of the leading causes of morbidity and mortality worldwide[2],[3]. Globally, cardiovascular diseases account for nearly one-third of all deaths, with ischemic heart disease being the major contributor[3].

In low- and middle-income countries, including Sudan, the incidence of ACS has been steadily increasing, largely due to changes in lifestyle and the rising prevalence of hypertension, diabetes, dyslipidemia, and smoking[4],[5],[6]. Early recognition and timely management of ACS are crucial to reducing complications such as heart failure, arrhythmias, and sudden cardiac death[7],[8].

In Sudan, the establishment of cardiac catheterization centers in major and regional hospitals has made coronary angiography more accessible. However, there remains a scarcity of published data describing the local clinical and angiographic profiles of Sudanese patients presenting with ACS, particularly in regional facilities such as Marawi Aldaman Hospital. Local data are essential to guide context-appropriate prevention strategies, optimize patient care, and improve outcomes[14],[15].

Clinical characteristics and angiographic findings of ACS patients can vary significantly between different populations because of differences in age distribution, gender, prevalence of risk factors (such as diabetes, hypertension, and smoking), healthcare access, and genetic factors[9],[10]. For example, studies show that multi-vessel disease becomes more common in older patients and those with multiple comorbidities, while younger populations often present with single-vessel involvement[6]. Regional studies indicate that the prevalence of hypertension, diabetes, and smoking can explain much of the variability observed in angiographic patterns across different countries and age groups[4],[5]. Local reports from Sudan and nearby African countries highlight similar trends, with hypertension and diabetes being dominant risk factors and multi-vessel disease increasing with advancing age[14],[15].

1.2 LITERATURE REVIEW

1.2.1 Global Overview

Acute Coronary Syndrome (ACS) comprises a range of conditions resulting from acute myocardial ischemia and infarction, typically due to plaque rupture, erosion, or thrombosis[1]. These include ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), and unstable angina[1]. Despite major advances in management, ACS remains a leading global cause of death and disability[2]. Worldwide, more than 15 million people are affected annually by ACS, with a significant burden in low- and middle-income countries[2,3]. Recent estimates show that cardiovascular diseases accounted for 19.4 million deaths globally in 2021, with coronary heart disease as a primary contributor[3].

Coronary angiography is widely regarded as the gold standard for evaluating the extent and severity of coronary artery disease (CAD)[4]. International registries and multi-center studies demonstrate that single-vessel disease (SVD) and multi-vessel disease (MVD) patterns are associated with patient demographics and risk-factor burden[5,6]. Key risk factors—including hypertension, diabetes, dyslipidemia, and smoking—are prevalent in ACS patients, and delayed presentation contributes to worse outcomes[6,7,8].

1.2.2 Angiographic Findings and Clinical Patterns in International Studies

Numerous studies worldwide have characterized the clinical and angiographic features of ACS. For example, a review from South Asia found that smoking, dyslipidemia, and high BMI were dominant risk factors, and younger ACS patients most commonly had single-vessel involvement[9]. European registry data confirm that MVD and left main involvement increase with age and comorbidity[10]. In Japan, certain lesion types (e.g., left main, chronic total occlusion) are associated with extensive myocardial damage and higher risk clinical presentations[11]. These findings reinforce the prognostic value of both clinical characteristics and detailed angiographic assessment.

1.2.3 Regional Studies in South Asia

Studies from South Asia, including major centers in Pakistan, report that double- and triple-vessel disease predominate angiographically, with hypertension, diabetes, and smoking as predominant risk factors[12,13]. Younger ACS patients show marked male predominance and often present with single-vessel disease—typically earlier in the disease progression[6,14]. South Asian studies highlight earlier onset of ACS and more severe angiographic profiles in relation to traditional risk exposures[14,15].

1.2.4 Sudanese and Regional African Studies

In Sudan and neighboring countries, data are sparse but consistent with broader regional patterns. Sudanese studies report prevalent risk factors of hypertension, diabetes, and smoking, and note increased multi-vessel disease in older groups[14,15]. Facilities in Khartoum and El-Obeid have demonstrated feasibility of establishing and operating cardiac catheterization under challenging circumstances[14,15]. However, published data from Northern Sudan, including Marawi Aldaman Hospital, remain limited, underlining the need for region-specific clinical and angiographic

documentation[14,15]. Other African studies, such as those from Egypt and Nigeria, confirm similar trends, with risk-factor clustering and progressive severity of angiographic disease with advancing age[16,17].

1.3 Problem Statement:

Despite the increasing burden of cardiovascular disease in Sudan, limited data exist regarding the clinical presentation and angiographic patterns of ACS patients in regional hospitals[14,15]. Most available reports are from tertiary centers in Khartoum and other major cardiac centers that serve patients from all regions of Sudan, so these may not specifically reflect the population characteristics of Northern Sudan[14,15]. Therefore, this study provides insight into the ACS patient profile for the northern region[14,15]. Consequently, local health authorities and clinicians lack reliable data to guide early diagnosis and treatment prioritization. This study addresses this gap by systematically analyzing patient characteristics and coronary angiography results among ACS cases managed at Marawi Aldaman Hospital, thereby helping to inform diagnosis and management strategies for ACS patients in Northern Sudan[14,15].

1.4 Justification：

Most existing data on ACS are derived from studies in Western or Asian populations, which may not accurately represent Sudanese patients due to differences in demographics, risk-factor prevalence, healthcare access, and socioeconomic factors[2,3,9,16]. Regional studies in Sudan—such as those conducted in El-Obeid International Hospital and Omdurman Teaching Hospital—have provided valuable preliminary insights; however, because these major cardiac centers receive patients from all across Sudan, their findings may not accurately represent the population of the North region[14,15].

This study will contribute up-to-date local evidence by describing the clinical characteristics and coronary angiographic findings among ACS patients at Marawi Aldaman Hospital. Understanding these local patterns will support the development of targeted management protocols, enhance the use of percutaneous coronary intervention (PCI) services, and strengthen preventive cardiology strategies in the region[14,15,19].

1.5 Research Question:

What are the clinical characteristics and coronary angiographic findings among patients diagnosed with Acute Coronary Syndrome at Marawi Aldaman Hospital in 2025?

1.6 OBJECTIVES:

2.1 General Objective:

To determine the clinical characteristics, major risk factors, and coronary angiographic findings among patients diagnosed with Acute Coronary Syndrome at Marawi Aldaman Hospital in 2025.

2.2 Specific Objectives:

To determine the demographic characteristics of patients presenting with ACS.
To identify the presenting symptoms, types of ACS, and associated complications.
To evaluate the Frequency of major cardiovascular risk factors such as hypertension, diabetes mellitus, dyslipidemia, obesity, and smoking.
To describe the angiographic findings.

2. CHAPTER TOW METHODOLOGY

2.1 Study Design:

A descriptive cross-sectional hospital-based study will be conducted to assess the clinical characteristics and coronary angiography findings among patients diagnosed with Acute Coronary Syndrome (ACS) at Marawi Aldaman Hospital in 2025.

2.2 Study Area:

Marawi Aldaman Hospital is a regional referral center located in Marawi city, the administrative capital of Northern State, Sudan. The hospital lies along the Nile River, about 330 km north of Khartoum, serving Marawi city and surrounding rural areas—including communities bordering Egypt (to the north) and adjacent Sudanese states. The hospital houses a coronary care unit (CCU) and a modern cardiac catheterization laboratory capable of diagnostic angiography and selected percutaneous coronary interventions (PCI). As one of the few regional hospitals outside Khartoum with an active Cath-lab, Marawi Aldaman now accommodates a high volume of cardiac patients, providing emergency, inpatient, and outpatient cardiac services to the wider population.

2.3 Study Period:

The study will be conducted from October 2025 to February 2026.

2.4 Study Population:

All adult patients diagnosed with ACS who undergo coronary angiography during the study period at Marawi Aldaman Hospital.

2.5 Inclusion Criteria:

- Adults aged ≥18 years
- Confirmed ACS diagnosis
- Underwent coronary angiography during index admission
- Provided written informed consent

2.6 Exclusion Criteria:

- Incomplete data

- Declined participation/consent
- Critical illness

2.7 Sample Size Determination

The required sample size was calculated using the single-proportion formula:

n=Z2×p(1−p)e2n = \frac{Z^2 \times p (1-p)}{e^2}n=e2Z2×p(1−p)

$$n = \frac{Z^2 \times p \times (1 - p)}{e^2}$$

Where:

- Z=1.96Z = 1.96Z=1.96 (for 95% confidence level)
- p=0.5p = 0.5p=0.5
- e=0.05e = 0.05e=0.05

n=(1.96)2×0.5×0.5(0.05)2=384.16n = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.05)^2} = 384.16n=(0.05)2(1.96)2×0.5×0.5=384.16

$$n = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.05)^2} = 384.16$$

Rounded up → Sample size = ৩৮৫

2.8 Sampling Technique

Consecutive sampling will be used. All patients meeting inclusion criteria and undergoing coronary angiography for ACS during the study period will be enrolled consecutively until 385 cases are reached (or all eligible cases, if fewer). This minimizes selection bias and ensures a representative sample for descriptive study.

2.9 Data Collection Tools and Procedure

Data will be collected using a structured form. Information will be sourced from:

- Patient interviews (demographic and clinical history)
- Medical records (risk factors, labs, ECG)
- Angiography reports/images (vessel involvement, lesion location, severity)

Data Collected will include:

2.10 Study Variable

- **Independent Variables:**
  Sociodemographic: age, sex, residence, occupation
  Risk factors: hypertension, diabetes, smoking, dyslipidemia, obesity, family history
  Clinical features: presenting symptoms, type of ACS, symptom duration
  Angiographic findings: LAD, LCx, RCA, left main, number of vessels (SVD, DVD, TVD), lesion type, PCI performed

- **Dependent Variables:**
  Complications: arrhythmia, cardiogenic shock, heart failure
  In-hospital outcomes: mortality, reinfarction, post-PCI complications

2.11 Data Management and Analysis

Data will be analyzed using SPSS v28.0.

- Descriptive statistics: means ± SD (continuous), frequency/percentages (categorical)
- Bivariate: chi-square or Fisher's exact test (categorical)
- Multivariable: logistic regression for predictors of MVD and adverse outcomes, with results as adjusted odds ratios (aOR) at 95% CI.
- Statistical significance: $p < 0.05$

2.12 Ethical Considerations

Ethical clearance will be obtained from the SMSB Ethics Committee and the Marawi Aldaman Hospital IRB. Written informed consent will be gathered for each participant. Data confidentiality is ensured by anonymized records stored in password-protected files. No personal identifiers will appear in reports or publications.

3. Budget:

Item	Details / Purpose	Estimated Cost (SDG)
Printing & photocopying	Proposal drafts, data forms, and final thesis copies	100,000
Stationery & data forms	Paper, pens, folders, and labels for data collection	200,000
Data entry & statistical analysis	Laptop access, SPSS license/usage, and assistant support	400,000
Transportation	Local transport for data collection and meetings	300,000
Communication	Mobile, internet, and coordination with supervisor	150,000
Miscellaneous	Contingency and unforeseen costs	150,000
Total Estimated Budget		**1,300,000 SDG**

Note: Costs are estimates based on 2025 local prices in Northern Sudan and may vary slightly. No external sponsorship or pharmaceutical funding is involved.

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7. Appendices
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Clinical Characteristics and Coronary Angiography Findings in Patients with Acute Coronary Syndrome at Marawi Aldaman Hospital, Northern State, Sudan, 2025

Appendix 1: Arabic Version of Formal Consent

أنا الباحث د. أحمد عمر الريح، نائب أخصائي الطب الباطني، أقوم بهذا البحث بغرض دراسة الخصائص السريرية ونتائج تصوير الشرايين التاجية لدى المرضى المصابين بمتلازمة الشريان التاجي الحادة الذين تم علاجهم في مستشفى مروي الضمان، الولاية الشمالية، السودان في عام 2025.

الغرض:
دراسة الخصائص السريرية والعوامل المصاحبة ونتائج تصوير الشرايين التاجية لدى مرضى متلازمة الشريان التاجي الحادة في مستشفى مروي الضمان لعام 2025.

إجراءات الدراسة والخصوصية:
المشاركة في هذا البحث طوعية، وسيتم التعامل مع بياناتكم بسرية تامة، حيث يتم ترميز المعلومات وعدم تسجيل أي بيانات شخصية مباشرة مثل الاسم أو العنوان أو رقم الهاتف.

المخاطر:
لا توجد مخاطر متوقعة للمشاركين؛ وأن المعلومات تستخدم لأغراض البحث الطبي فقط، بهدف تحسين الرعاية المقدمة للمرضى في المستقبل.

الفوائد:
لا توجد فوائد مادية مباشرة للمشاركين، لكن نتائج البحث قد تساهم في تطوير المعرفة الطبية وتحسين جودة العلاج في المجتمع.

المشاركة والانسحاب:
المشاركة اختيارية، ويجوز لكم الانسحاب من البحث في أي وقت بدون إبداء أسباب، ولن يؤثر ذلك على مستوى الخدمة الطبية المقدمة لكم.

بيانات الباحث:
د. أحمد عمر الريح إبراهيم – نائب أخصائي الطب الباطني – مستشفى مروي الضمان
رقم الهاتف : 0999201209

نشكر لكم تعاونكم.
التوقيع بالموافقة : _____

Appendix 2:

Sudan Medical Specialization Board (S.M.S.B) Council of Internal Medicine

Clinical Characteristics and Angiographic Findings in ACS Questionnaire

Section A: Demographic Data

1. **Study ID: _____**
2. **Age (years): _____**
3. **Sex: □ Male □ Female**
4. **Residence: □ Urban □ Rural**
5. **Occupation: _____**

Section B: Clinical Presentation

6. **Date of admission: //202_**
7. **Presenting symptoms (check all that apply):**
    - **□ Chest pain**
    - **□ Dyspnea**
    - **□ Sweating**
    - **□ Nausea/Vomiting**
    - **□ Syncope**
    - **□ Other: _____**
8. **Symptom duration prior to hospital arrival: _____ hours**
9. **Type of ACS:**
    - **□ STEMI**
    - **□ NSTEMI**
    - **□ Unstable angina**

Section C: Risk Factors

10. **Smoking status: □ Current □ Former □ Never**
11. **Hypertension: □ Yes □ No □ Unknown**

12. Diabetes Mellitus: □ Yes □ No □ Unknown

13. Dyslipidemia: □ Yes □ No □ Unknown

14. Obesity (BMI ≥30): ☐ Yes ☐ No ☐ BMI: _____

15. Family history of CAD: □ Yes □ No □ Unknown

Section D: Medical History and Investigations

16. Previous MI: □ Yes □ No

17. Previous PCI/CABG: □ Yes □ No □ Details: _____

18. ECG findings on admission: _____

19. Troponin result: □ Positive □ Negative □ Not done

20. Other relevant labs (HbA1c, Lipids): _____

Section E: Angiographic Findings

21. Date of angiography: //202_

22. Arteries involved (tick all with significant stenosis ≥50%):

- **□ LAD**
- **□ LCx**
- **□ RCA**
- **□ Left Main**

23. Number of diseased vessels:

- **□ Single vessel**
- **□ Double vessel**
- **□ Triple vessel**

24. Lesion type:

- **□ Occlusive**
- **□ Stenotic (non-occlusive)**
- **□ Diffuse**

25. PCI Performed: □ Yes □ No □ Not applicable

Section F: Complications & Outcomes (In-hospital)

26. Complications developed (tick all):

- **□ Arrhythmia (specify type: _____)**
- **□ Cardiogenic shock**
- **□ Heart failure**
- **□ Reinfarction**
- **□ Post-PCI complication (specify: _____)**
- **□ None**

27. In-hospital mortality: □ Yes □ No

28. Date of discharge (or death): //202_

Section G: Additional Notes

29. Comments/Clinician notes: _____