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RESEARCH ARTICLE **OPEN ACCESS**

Acute Coronary Syndrome: A Retrospective Study of the Epidemiological and Evolutionary Profile of Patients Hospitalized at the Agadir Regional Hospital in Southern Morocco

Abderrahman Arechkik[1,2,*], Nadia Moussadak[2], Taoufiq Assafane[2], Abdelhak EL Yousoufi[2], Yassine ID Ouhazli[2], Mohamed Amin Baba[3,£] and Rachid Razine[1,4]

[1]*Laboratory of Biostatistics, Clinical Research and Epidemiology, Faculty of Medicine and Pharmacy of Rabat, Mohamed V University, Rabat-10100, Morocco*
[2]*Higher Institute of Nursing Professions and Technical Health, Agadir, Morocco*
[3]*Laboratory of Community Medicine, Preventive Medicine, Public Health and Hygiene, Faculty of Medicine and Pharmacy of Agadir, Ibn Zohr University, Agadir-80060, Morocco*
[£] *Present Address: Higher Institute of Nursing Professions and Technical Health, Agadir, Morocco*
[4]*Laboratory of Social Medicine (Public Health, Hygiene, and Preventive Medicine), Faculty of Medicine and Pharmacy of Rabat, Mohamed V University, Rabat-10100, Morocco*

Abstract:

Background: Acute coronary syndrome (ACS) is one of the leading causes of mortality worldwide. The diagnosis can be made based on the patient's history, the symptoms presented, the results of the electrocardiogram, and cardiac biomarkers. These elements help differentiate ST-elevation Myocardial Infarction (STEMI) from non-ST elevation acute coronary syndrome (NSTE-ACS). The aim of this work is to outline an epidemiological, clinical, and evolutionary profile of acute coronary syndrome treated at the Hassan II Regional Hospital Center in the Souss-Massa region.

Methods: This is a monocentric, retrospective epidemiological study with an analytical aim. The study focused on patients admitted to the cardiology center during the period from January 2019 to May 2022. Overall, 318 files of patients hospitalized for acute coronary syndrome in the cardiology department of the Souss-Massa Regional Hospital were analyzed. Aspecialized survey form was developed for this study to determine the socio-demographic, clinical, therapeutic, and evolutionary characteristics of the participants.

Results: The average age was 62.3 ± 13.3 years, with a male predominance of 64.5%. The most common antecedents were hypertension (41.2%), diabetes (40.5%), and smoking (31.5%). The main reason for consultation was chest pain (91.2%) along with other atypical signs, such as dyspnea (30.5%), epigastric pain (17.7%), vomiting (16.4%), and syncope (2.8%). The analysis of the ECG revealed that 64.2% of the cases of acute coronary syndrome had a STEMI, and 35.8% had an NSTEMI. About 98.4% of patients received thrombolytic treatment.The study revealed a significant association between ACS and the following risk factors: male sex (AOR= 3.12; CI 95% [1.71-5.70]), investigative methods, such as chest X-ray (AOR=0.15; CI95% [0.02-0.84]), treatment modalities, such as cardiac rehabilitation (AOR=0.07, CI95% [0.01-0.54]), statins (AOR=2.15; CI95% [1.20-3.85]) and favorable evolution (AOR=0.32; CI95%[0.13-0.77]). Mechanical complications were the most observed, with a percentage of 12.2%, and the in-hospital mortality rate was 5.3%.

Discussion: The findings validate the significant prevalence of STEMI and inadequately managed cardiovascular risk factors, aligning with global data. They emphasize the pressing necessity to enhance prevention and accessibility to specialized healthcare in Morocco. The conclusions are constrained by the study's single-center design, absent data, and retrospective methodology. A multicenter survey is essential to acquire a more representative national overview.

Conclusion: In summary, this study provides new insights into the epidemiology and management of ACS in the Souss-Massa region while highlighting the specific challenges associated with the local hospital setting. Enhancing cardiovascular healthcare infrastructure, increasing awareness of risk factors, and optimizing prehospital management strategies are essential to improving the prognosis of ACS patients in Morocco.

Keywords: Acute coronary syndrome, Epidemiological profile, Risk factors, STEMI, NSTEMI, Morocco.

* Address correspondence to this author at the Laboratory of Biostatistics, Clinical Research and Epidemiology, Faculty of Medicine and Pharmacy of Rabat, Mohamed V University, Rabat 10100, Morocco and Higher Institute of Nursing Professions and Technical Health, Agadir, Morocco; Tel: +2120677289155;
E-mail: abderrahman_arechkik@um5.ac.ma.

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1. INTRODUCTION

Cardiovascular diseases, particularly coronary diseases, are one of the leading causes of death worldwide [1]. The most common cardiac pathology responsible for all sudden cardiac deaths is attributed to coronary artery disease, according to assumptions based on epidemiological studies [2]. The World Health Organization estimates that by 2030, nearly 23.6 million people will die from cardiovascular diseases, with more than 80% of these deaths occurring in low- or middle-income developing countries [3]. These diseases impose a heavy economic toll, accounting for one-third of the projected $47 trillion in economic losses due to non-communicable diseases over the next 20 years [4]. In 2012, 17.5 million individuals globally succumbed to non-communicable diseases, including 7.5 million fatalities attributed to coronary heart disease [5]. In 2021, non-communicable diseases caused a minimum of 43 million fatalities, representing 75% of deaths not associated with pandemics globally. Cardiovascular illnesses accounted for at least 19 million fatalities, followed by malignancies with 10 million, chronic respiratory disorders with 4 million, and diabetes with over 2 million [6].

Acute coronary syndrome encompasses a range of diseases of the coronary arteries, including unstable angina and myocardial infarction with or without ST-segment elevation. The in-hospital mortality rate for STEMI (often referred to as “Q-wave myocardial infarction”) in registry studies is between 7% and 10%. For non-ST elevation myocardial infarctions (NSTEMI; often referred to as “non-Q wave myocardial infarction”), it is around 5% [7]. The main cause of coronary heart disease is atherosclerosis and its sudden complications; it forms the almost exclusive substrate of coronary heart diseases [8]. The thrombotic complications of atherosclerosis cause patients to present in the most dramatic ways, such as with acute coronary syndromes (ACS) [9]. The principal risk factors include hypertension, diabetes, tobacco use, and hypercholesterolemia [10].

The prevalence of ischemic heart disease in the Middle East and North Africa (MENA) is under a remarkable surge. From 1990 to 2010, ischemic heart disorders came to displace lower respiratory infections as the primary cause of mortality in the Arab world, representing 14.3% of all deaths [11]. Given its high prevalence and fatality rate, coronary heart disease occupies a unique position among cardiovascular diseases in Morocco. Cardiovascular ischemia has emerged as the primary cause of death in Morocco, accounting for 31% of deaths as reported in the 2019 Global Burden of Diseases Study [12]. A study at Meknes' Mohamed V Hospital revealed the most common pathologies among 1112 cardiology patients. Ischemic heart disease led to 341 cases (30.66%), followed by heart failure (20.59%). Ischemic heart disease was more common in men ($p = 0.05$), while women were more affected by arterial hypertension ($p = 0.0096$), heart failure ($p = 0.06$), and venous thrombosis ($p < 0.05$) [13]. Another study including 316 patients with acute coronary syndrome hospitalized in the cardiology intensive care units at Mohammed V Military Training Hospital in Rabat from 2018 to March 2021 yielded numerous significant findings. The cohort consisted primarily of males (72.3%), with an average age of 61.1 years (ranging from 52 to 82 years). The average duration until presentation at the emergency department following chest discomfort was 28 hours. The primary cardiovascular risk factors included diabetes (83.4%), smoking (50%), dyslipidemia (44%), and hypertension (39%). The ECG indicated that all patients were in sinus rhythm. Biological assays indicated a notable inflammatory condition, characterized by a mean CRP of 109 mg/L and compromised renal function in 38.8% of cases. Transthoracic echocardiography indicated that 55.5% of patients exhibited involvement of the anterior area, with a mean left ventricular ejection fraction of 45.9% [14]. A recent meta-analysis identified smoking (20 to 45%) and hypertension (25 to 30%) as the most prevailing cardiovascular risk factors in the Moroccan population [15]. Concerning the Souss-Massa region, we noted a lack of research conducted in civil hospitals under the jurisdiction of the Ministry of Health and Social Protection despite our bibliographic survey uncovering one paper. A two-year study at Oued Eddahab Military Hospital in Agadir included 125 ACS patients (mean age: 61 years, M/F ratio: 2.78). STEMI was diagnosed in 33.6% of cases and NSTE-ACS in 66.4%, with delayed admission (>48h) in 60% of patients. Among 88 patients undergoing coronary angiography, 29.5% had single-vessel disease, 34.1% had two-vessel disease, and 27.3% had three-vessel disease. Primary PCI was performed in 95.5% of STEMI cases, while 80% of NSTEMI patients underwent culprit artery PCI. The main complications were LV dysfunction

(28.8%) and complete AV block (2.4%), with an in-hospital mortality rate of 1.25% [16]. This study seeks to examine the epidemiological, clinical, and evolutionary characteristics, along with the care of patients with acute coronary syndrome admitted to the Hassan II Regional Hospital in the Souss-Massa area of southern Morocco.

2. MATERIAL AND METHODS

2.1. Methodology and Setting of the Research

This study is a monocentric and retrospective epidemiological investigation with an analytical focus. Its objective was to identify and analyze the epidemiological, clinical, and evolutionary characteristics of acute coronary syndrome cases at the cardiovascular disease department of the Hassan II Regional Hospital Centre in the Souss-Massa region. This study specifically examined patients who were hospitalized in the cardiology department throughout the period from January 2019 to May 2022. This timeframe aligned with the COVID-19 pandemic, a period marked by several changes.

2.2. Population of Interest / Method of Sampling

Patients diagnosed with Acute Coronary Syndrome (ACS) and documented in the cardiovascular diseases department were the focus of this study. We performed exhaustive sampling, including all patients admitted during the study period, totaling 318 patients. The study incorporated all comprehensive patient records containing the essential information required for the investigation. Files with incomplete data or where the diagnosis of acute coronary syndrome was unclear or absent were excluded from the study.

2.3. Methodology of Data Collection

To complete this study, we reviewed the hospitalization records and medical files of patients who were hospitalized in the cardiology department at Hassan II Regional Hospital Center in the Souss-Massa region. A specialized survey form was created for this study to efficiently accomplish its objective. It consists of five key sections: the first section collects sociodemographic data (age, sex, origin, *etc*.) and risk factors (medical, surgical, toxic, *etc*.); the second section includes clinical tables (pain, clinical picture); the third section specifies the diagnosis (invasive, non-invasive: electrocardiogram, cardiac MRI, scintigraphy, transthoracic echography, chest X-ray, transthoracic echocardiogram); the fourth section discusses the therapeutic modalities used based on the type of ACS (cardiac rehabilitation, statins, antihypertensive, anticoagulant, antiplatelet treatment); and the last section is reserved for monitoring the patients' condition and tracking its evolution (heart failure, mechanical complication, hemorrhagic shock, cardiogenic shock, thromboembolic complication, vascular dysfunction, arrhythmia, death).

2.4. Data Analysis

Qualitative variables were expressed using frequencies and percentages, while normally distributed quantitative variables were expressed using the mean plus or minus the standard deviation. For non-Gaussian distributed variables, the median (interquartile range, IQR) was used. To identify differences in the proportions of categorical variables, the chi-square test (Khi 2) or Fisher's exact test was conducted based on their respective application circumstances. Additionally, univariate and multivariate logistic regression analyses were performed to identify characteristics associated with acute coronary syndrome (STEMI, NSTEMI) in the study population. All independent variables with a p-value less than 0.250 in the univariate analysis were included in the multivariate logistic regression analysis. Statistical significance was defined as p-values below 0.05. Data management and statistical analysis were performed using the Jamovi program for Windows, version 2.3.

2.5. Ethical Considerations

The present work is a monocentric retrospective analysis conducted on hospital medical records. This research was carried out in compliance with established principles and regulations governing scientific research, including the Declaration of Helsinki of 1975, as revised in 2013 (http://ethics.iit.edu/ecodes/node/3931). The study obtained legal authorization from the health authorities of the delegation of the Ministry of Health and Social Protection of Agadir under number (782/22).

3. RESULTS

3.1. The Sociodemographic and Clinical Characteristics of the Study Participants

A total of 318 patient records were identified in this study. The mean age of patients was 62.3 ± 13.3 years. The age group between 55 and 75 years old was the most represented, accounting for 56%. Adult males comprised 64.5% (n = 205), and females made up 35.5% (n = 113). The majority of patients were from urban areas, accounting for 69.2%. A significant proportion of patients were unemployed (65.9%), married (79.2%), and had uncertain medical coverage status (69.2%). Among economically disadvantaged individuals, the coverage rate was 13.8% (Table **1**). Of the total 318 patients, 204 experienced ST-segment Elevation Myocardial Infarction (STEMI), while 114 had non-ST elevation Acute Coronary Syndrome (NSTEMI). Table **2** summarizes the clinical and medical features of the patients.

3.2. The Comparison of STEMI and NSTEMI Patients According to Sociodemographic Characteristics, Risk Factors, and Admission Modalities

The bivariate analysis revealed a statistically significant association between acute coronary syndrome and gender ($p < 0.001$), smoking ($p = 0.026$), chest X-ray findings, troponin levels, and atherosclerotic lesions. Most STEMI patients were male (n = 151, 47.5%), smokers (n = 73, 23.3%), had abnormal troponin levels (n = 145, 58.2%), and showed a higher prevalence of atherosclerotic pathologies (n = 204, 64.2%) (Tables **3** and **4**).

Table 1. Sociodemographic characteristics of patients with acute coronary syndrome at the hassan II regional hospital center in the souss-massa region (n=318).

Variables	n (%)
Sex	
Male	205 (64.5)
Female	113 (35.5)
Age	
[18 ;35]	11 (3.5)
[35; 55]	75 (23.6)
[55; 75]	178 (56)
≥75	54 (17)
The residence	
Urban	220 (69.2)
Rural	98 (30.8)
Professional status	
Civil servant	23 (7.3)
Worker	71 (22.4)
Without a profession	209 (65.9)
Retired	14 (4.4)
Marital status	
Single	42 (13.2)
Married	252 (79.2)
Divorced	11 (3.5)
Widower (ve)	13 (4.1)
Medical coverage	
Amo-tadamon (for the needy)	44 (13.8)
Mutual (for worker)	18 (5.7)
Without cover	36 (11.3)
Unknown	220 (69.2)

Table 2. Clinical and medical characteristics of patients with acute coronary syndrome at the regional hospital center of the souss-massa region (n=318).

Variables	n (%)
Typical Clinical Signs	
Yes	**290 (91.2)**
No	**28 (8.8)**
Atypical clinical signs	
Epigastric pain	
Yes	**56 (17.7)**
No	**261 (82.3)**
Dyspnea	
Yes	**97 (30.5)**
No	**221 (69.5)**
Syncope	
Yes	**9 (2.8)**
No	**309 (97.2)**
Vomiting	
Yes	**52 (16.4)**
No	**266 (83.6)**
Acute coronary syndrome	
With ST segment elevation	**204 (64.2)**
Without ST segment elevation.	**114 (35.8)**
Coronary scanner	
Yes	**3 (0.9)**

(Table 2) contd.....

Variables	n (%)
No	**315 (99.1)**
Cardiac MRI	
Yes	**1 (0.3)**
No	**317 (99.7)**
Scintigraphy	
Yes	**0 (0.0)**
No	**318 (100)**
Trans thoracic echocardiogram	
Yes	**139 (43.7)**
No	**179 (56.3)**
Chest X-ray	
Yes	**300 (94.3)**
No	**18 (5.7)**
Thoracic TDM	
Yes	**2 (0.6)**
No	**316 (99.4)**
Troponins	
Anormal	**206 (82.7)**
Normal	**43 (17.3)**
Creatinine clearance	
Yes	**221 (69.5)**
No	**97 (30.5)**
Cholesterol	
Yes	**188 (59.1)**
No	**130 (40.9)**

3.3. The Comparison of STEMI and NSTEMI Patients According to Therapeutic Modalities and their Evolution

Acute coronary syndrome was found to be significantly associated with the following factors in the bivariate analysis: statin use (p = 0.032), cardiovascular rehabilitation (p = 0.008), favorable outcome (p = 0.001), heart failure (p = 0.009), cardiogenic shock (p = 0.016), and mortality (p = 0.033). Indeed, patients with ST-elevation Myocardial Infarction (STEMI) had a higher proportion receiving statins (n = 149, 46.5%), lower participation in cardiac rehabilitation (n = 2, 0.6%), a greater incidence of heart failure (n = 11, 3.5%), increased occurrence of cardiogenic shock (n = 10, 3.1%), and a higher mortality rate (n = 15, 4.7%) (Table **5**).

Table 3. Comparison of patients with acute coronary syndrome based on sociodemographic characteristics and risk factors (n= 318).

Variables	Acute Coronary Syndrome		
	STEMI (n=204)	NSTEMI (n=114)	*p*-value
Age (year)			0.803*
[18 ;35]	6 (1.9)	5 (1.6)	
[35; 55]	46 (14.5)	29 (9.1)	
[55; 75]	117 (36.8)	61 (19.2)	
≥75	35 (11)	19 (6.0)	
Sex			<0.001
Male	151 (47.5)	54 (17.0)	
Female	53 (16.7)	60 (18.9)	
Profession			0.879
Civil servant	13 (4.1)	10 (3.2)	
Worker	45 (14.2)	26 (8.2)	
Without a profession	136 (42.9)	73 (23.0)	
Retired	9 (2.8)	5 (1.6)	

(Table 3) contd.....

Variables	Acute Coronary Syndrome		
	STEMI (n=204)	NSTEMI (n=114)	*p*-value
Marital status			
Single	29 (9.1)	13 (4.1)	
Married	162 (50.9)	90 (28.3)	0.658*
Divorced	6 (1.9)	5 (1.6)	
Widower (ve)	7 (2.2)	6 (1.9)	
Medical coverage			
Amo-tadamon (for the needy)	24 (7.5)	20 (6.3)	
Mutual	12 (3.8)	6 (1.9)	0.557
Without cover	24 (7.5)	12 (3.8)	
Unknown	144 (45.3)	76 (23.9)	
Diabetic			0.44
Yes	86 (27.0)	43 (13.5)	
No	118 (37.1)	71 (22.3)	
Arterial hypertension			0.151
Yes	78 (24.5)	53 (16.7)	
No	126 (39.6)	61 (19.2)	
Dyslipidemia			0.91
Yes	33 (10.4)	19 (6.0)	
No	171 (53.8)	95 (29.9)	
History of ischemic heart disease			0.413
Yes	37 (11.6)	25 (7.9)	
No	167 (52.5)	89 (28.0)	
Angioplasty history			0.293
Yes	1 (0.3)	2 (0.6)	
No	203 (63.8)	112 (35.2)	
Tobacco use			0.026
Yes	73 (23.0)	27 (8.5)	
No	131 (41.2)	87 (27.4)	
Alcoholism			0.752*
Yes	8 (2.5)	3 (0.9)	
No	196 (61.6)	111 (34.9)	
Family history			0.68
Hereditary heart disease	4 (4.2)	4 (4.2)	
Heart disease/valvular heart disease	17 (17.7)	13 (13.5)	
Ischemic heart disease	7 (7.3)	3 (3.1)	
Diabetes	32 (33.3)	16 (16.7)	

*: Fisher's exact test.

Table 4. Comparison of individuals diagnosed with acute coronary syndrome according to key features and methods of admission (n=318).

Variables	Acute Coronary Syndrome		
	STEMI (n=204)	NSTEMI (n=114)	*p*-value
Typical Clinical Profile			0.222
Yes	189 (59.4)	101 (31.8)	
No	15 (4.7)	13 (4.1)	
Epigastric pain			0.727
Yes	37 (11.7)	19 (6.0)	
No	166 (52.4)	95 (30.0)	
Dyspnea			0.954
Yes	62 (19.5)	35 (11.0)	
No	142 (44.7)	79 (24.8)	
Syncope			0.498*
Yes	7 (2.2)	2 (0.6)	

(Table 4) contd.....

Variables	Acute Coronary Syndrome		
	STEMI (n=204)	NSTEMI (n=114)	*p*-value
No	197 (61.9)	112 (35.2)	
Vomiting			0.074
Yes	39 (12.3)	13 (4.1)	
No	165 (51.9)	101 (31.8)	
Transthoracic echocardiogram			0.845
Yes	90 (28.3)	49 (15.4)	
No	114 (35.8)	65 (20.4)	
Chest X-ray			0.024
Yes	188 (59.1)	112 (35.2)	
No	16 (5.0)	2 (0.6)	
Troponin			<0.001
Anormal	145(58.2)	61 (24.5)	
Normale	8 (3.2)	35 (14.1)	
Creatinine clearance			0.481
Yes	139 (43.7)	82 (25.8)	
No	65 (20.4)	32 (10.1)	
Cholesterol			0.925
Yes	121 (38.1)	67 (21.1)	
No	83 (26.1)	47 (14.8)	
Atherosclerotic lesions			<0.001
Obstructive	204 (64.2)	1 (0.3)	
Non-obstructive	0 (0.0)	113 (35.5)	

*: Fisher's exact test.

Table 5. Comparison of patients diagnosed with acute coronary syndrome based on the chosen treatment methods and their corresponding results (n=318).

Variables	Acute Coronary Syndrome		
	STEMI (n=204)	NSTEMI (n=114)	*p*-value
Antiplatelet treatment			0.128*
Yes	204 (64.2)	112 (35.2)	
No	0 (0.0)	2 (0.6)	
Anticoagulant			0.164*
Yes	199 (62.6)	114 (35.8)	
No	5 (1.6)	0 (0.0)	
Antihypertensive			0.377
Yes	179 (56.3)	96 (30.2)	
No	25 (7.9)	18 (5.7)	
Statins			0.032
Yes	149 (46.5)	70 (22.0)	
No	55 (17.3)	44 (13.8)	
Cardiac rehabilitation			0.008
Yes	2 (0.6)	7 (2.2)	
No	202 (63.5)	107 (33.6)	
Evolution			0.001
Favorable	135 (42.5)	95 (29.9)	
unfavorable	69 (21.7)	19 (6.0)	
Heart failure			0.009
Yes	11 (3.5)	0 (0.0)	
No	193 (60.7)	114 (35.8)	
Mechanical complication			0.156
Yes	29 (9.1)	10 (3.1)	
No	175 (55.0)	104 (32.7)	
Hemorrhagic shock			1.000*

(Table 5) contd.....

Variables	Acute Coronary Syndrome		
	STEMI (n=204)	NSTEMI (n=114)	*p*-value
Yes	2 (0.6)	1 (0.3)	
No	202 (63.5)	113 (35.5)	
Cardiogenic shock			0.016*
Yes	10 (3.1)	0 (0.0)	
No	194 (61.0)	114 (35.8)	
Thromboembolic complication			0.391*
Yes	10 (3.1)	3 (0.9)	
No	194 (61.0)	111 (34.9)	
Vascular dysfunction			0.358*
Yes	204 (64.2)	113 (35.5)	
No	0 (0.0)	1 (0.3)	
Arrythmia			0.296
Yes	15 (4.7)	5 (1.6)	
No	189 (59.4)	109 (34.3)	
Death			0.033
Yes	15 (4.7)	2 (0.6)	
No	189 (59.4)	112 (35.2)	

*: Fisher's exact test

Table 6. The characteristics associated with acute coronary syndrome in patients admitted to the cardiology department at the Hassan II regional hospital center in Agadir, Souss-Massa Region.

Variable		Univariate Analysis	Multivariate Analysis	
	OR (CI95%)	*p*-value	AOR (CI95%)	*p*-value
Age (year)				
[35-55] (ref: [18-35])	1.32 (0.37-4.73)	0.668		
55-75 (ref: [18-35])	1.60 (0.46-5.45)	0.454		
≥75 (ref: [18-35])	1.54 (0.41-5.70)	0.522		
Sex				
Male-female	3.16 (1.95-5.13)	<0.001	3.12(1.71-5.70)	<0.001
Profession				
Civil servant (ref: retired)	0.72 (0.18-2.84)	0.641		
Worker (ref: retired)	0.96 (0.29-3.18)	0.949		
Without a profession (ref: retired)	1.03 (0.33-3.20)	0.952		
Residence				
Urban- rural	1.36 (0.83- 2.22)	0.218		
Marital status				
Married (ref: Single)	0.80 (0.39- 1.63)	0.55		
Widowed (ref: Single)	0.52 (0.14-1.87)	0.318		
Divorced (ref: Single)	0.53 (0.13-2.09)	0.37		
Medical coverage				
Mutual (ref: RAMED)	1.67 (0.53- 5.24)	0.382		
Without cover (ref: RAMED)	1.67 (0.66- 4.15)	0.272		
Unknown (ref: RAMED)	1.58 (0.82-3.04)	0.172		
Diabetic				
Yes – no	1.20 (0.75-1.92)	0.44		
Arterial hypertension				
Yes- no	1.40 (0.88-2.23)	0.152		
Dyslipidemia				
Yes-no	0.96 (0.52-1.79)	0.965		
Cardiomyopathy				
Yes- no	0.78(0.44-1.39)	0.414		

(Table 6) contd.....

Variable		Univariate Analysis	Multivariate Analysis	
	OR (CI95%)	*p*-value	AOR (CI95%)	*p*-value
Angioplasty history				
Yes- no	0.27 (0.02-3.08)	0.295		
Other surgical history				
Yes- no	0.36 (0.09-1.30)	0.12		
Alcoholism				
Yes- no	1.51 (0.39-5.81)	0.549		
Tobacco use				
Yes- no	1.80 (1.07-3.01)	0.027		
Family history				
Hereditary heart disease (ref: diabetic)	0.50(0.11-2.26)	0.368		
Heart disease/valvular heart disease (ref: diabetic)	0.65 (0.25-1.67)	0.375		
Ischemic heart disease (ref: diabetic)	1.16 (0.26-5.12)	0.838		
Typical clinical profile				
Yes- no	1.62 (0.74-3.54)	0.225		
Epigastric pain				
Yes- no	1.11 (0.60-2.05)	0.727		
Dyspnea				
Yes- no	0.98 (0.59-1.62)	0.986		
Syncope				
Yes- no	1.99 (0.40-9.74)	0.396		
Vomiting				
Yes- no	1.84 (0.93-3.61)	0.077		
Transthoracic echocardiogram				
Yes- no	1.05 (0.65-1.66)	0.845		
Chest X ray				
Yes- no	0.21 (0.04-0.93)	0.04	0.15(0.02-0.84)	0.031
Cholesterol				
Yes – no	1.02 (0.64-1.63)	0.925		
Atherosclerotic lesions				
Obstructive- non obstructive	1.29e+12 (0.00-inf)	0.995		
Antiplatelet treatment				
Yes – no	3.86e+6 (0.00-inf)	0.981		
Anticoagulant				
Yes – no	3.30e+6(0.00-inf)	0.982		
Antihypertensive				
Yes – no	0.74 (0.38-1.43)	0.378		
Statins				
Yes- no	0.58 (0.36-0.95)	0.032	2.15(1.20-3.85)	0.01
Cardiac rehabilitation				
Yes- no	0.15 (0.03-0.74)	0.02	0.07(0.01-0.54)	0.01
Evolution				
Favorable- unfavorable	0.39 (0.22-0.69)	0.001	0.32(0.13-0.77)	0.011
Heart failure				
Yes – no	19.24e+6(0.00- inf)	0.982		
Mechanical complication				
Yes- no	1.72 (0.80-3.68)	0.16		
Hemorrhagic shock				
Yes- no	1.12 (0.10-12.48)	0.927		
Cardiogenic shock				
Yes- no	9.20e+6 (0.00-inf)	0.983		
Thromboembolic complication				
Yes- no	1.91 (0.51-7.08)	0.334		

(Table 6) contd.....

Variable		Univariate Analysis	Multivariate Analysis	
	OR (CI95%)	*p*-value	AOR (CI95%)	*p*-value
Vascular dysfunction				
Yes- no	2.62e-7 (0.00-inf)	0.986		
Arrhythmia				
Yes- no	1.73 (0.61-4.89)	0.301		
Death				
Yes- no	4.44(0.99-19.80)	0.05		

• OR: Odds ratio.
• AOR: Adjusted odds ratio.
• Ref: Reference level.

3.4. Factors Associated with Acute Coronary Syndrome in the Study Population

The findings from the simple logistic regression indicate that sex (OR= 3.16; 95% CI [1.95-5.13]), smoking status (OR= 1.80; 95% CI [1.07-3.01]), chest X-rays (OR= 0.21; 95% CI [0.04-0.93]), troponin level (OR= 10.40; 95% CI [4.56-23.71]), statin therapy (OR= 0.58; 95% CI [0.36-0.95]), cardiac rehabilitation (OR= 0.15; 95% CI [0.03-0.74]), and disease progression (OR= 0.39; 95% CI [0.22-0.69]) were significantly associated with acute coronary syndrome in the studied population. However, the outcomes of multiple logistic regression indicated that the variables associated with acute coronary syndrome in our study sample were as follows: sex (AOR= 3.12; 95% CI [1.71-5.70]), chest X-rays (AOR= 0.15; 95% CI [0.02-0.84]), statin therapy (AOR= 2.15; 95% CI [1.20-3.85]), cardiac rehabilitation (AOR= 0.07; 95% CI [0.01-0.54]), and disease progression (AOR= 0.32; 95% CI [0.13-0.77]) (Table **6**).

4. DISCUSSION

The primary aim of this study was to determine the epidemiological and clinical characteristics of patients diagnosed with acute coronary syndrome at the regional hospital in the Souss-Massa region. This analysis highlights similarities with international studies while also revealing local specificities that warrant further discussion.

4.1. Epidemiological Profiles and Risk Factors

Among the patients included in our study, 16.4% were below the age of 50. This same proportion (16.2%) was also documented in the study conducted by Chen *et al.*, which analyzed 1982 instances of acute coronary syndrome and found that this age group accounted for just 16.2% [17]. The number of STEMI and NSTEMI patients was 204 (64.2%) and 114 (35.8%) respectively; however, in another study conducted in Sudan, the STEMI and NSTEMI cases were 51 (42.5%) and 41 (34.2%), respectively [18]. Regarding risk factors, the study revealed a significant association between ACS and gender (AOR=3.12; CI95% [1.71-5.70]; p ≤ 0.001), which aligns with the study by Khraishah *et al.*, which found that the prevalence and impact of ACS risk factors differ between men and women. The Global Registry of Acute Coronary Events includes more than 7,000 women and over 19,000 men from 14 countries who underwent coronary angiography between 1999 and 2006. This can be elucidated by the fact that women with ACS were older (median age: 69 years compared to 62 years) and had higher rates of hypertension (70% compared to 55%) and diabetes (29% compared to 22%) [19]. However, in Morocco, socio-cultural factors may also contribute, as men are more likely to engage in high-risk behaviors, such as smoking, and may have better access to healthcare compared to women, who often present at later stages of the disease. The second risk factor detected in our investigation was tobacco use (OR=1.80; CI 95% [1.07-3.01]; p=0.027). Furthermore, the research undertaken by Hubacek *et al.* carried out in Czechia, Lithuania, and Kazakhstan revealed that smoking was the primary risk factor for ACS (odds ratio [OR] 3.85 in the Czech study and 5.76 in the Lithuanian publication) [20]. In Agadir, tobacco use is widespread, particularly among younger populations, due to its social acceptance and limited public health interventions. The increased risk of ACS among smokers is well-documented, as smoking accelerates atherosclerosis and increases thrombotic risk, which explains the high proportion of STEMI patients who are smokers (23.0%).

4.2. Clinical Presentation and Diagnostic Investigations

Concerning the symptomatology, most patients exhibited a common clinical presentation, such as chest discomfort; hence, unusual symptoms were minimal. In the study conducted by Bhatt *et al.*, it was found that resting chest discomfort was the predominant symptom of Acute Coronary Syndrome (ACS), impacting around 79% of males and 74% of females with ACS. Approximately 40% of males and 48% of females displayed non-specific symptoms, such as shortness of breath, either alone or, more commonly, in conjunction with chest discomfort [21]. An Identical outcome was found in a separate investigation [22], underscoring the need for increased vigilance to avoid diagnostic errors, particularly in diabetic and elderly patients. An Electrocardiogram (ECG) was performed on all patients, and scientific literature highlights the ECG as a crucial tool for evaluating the presence, extent, and severity of myocardial ischemia in acute coronary syndrome [23, 24]. Due to its importance in diagnosis and prognosis, most patients in this study underwent troponin testing, following the approach used

by Antman *et al.* [25]. The implementation of high-sensitivity troponin tests to precisely quantify extremely low troponin concentrations and baseline levels at the onset of acute coronary syndrome, which are linked to the likelihood of experiencing recurrent cardiac events and adverse long-term outcomes, has already sparked debates [26, 27].

The analysis of patients with Acute Coronary Syndrome (ACS) in our sample indicated that atherosclerotic lesions are predominantly obstructive in composition (64.2% in patients with ST-elevation myocardial infarction). The study conducted by Dziedzic *et al.* included 966 patients and found a correlation between the diagnosis and the Systemic Inflammatory Response Index (SIRI). The highest values were recorded in patients diagnosed with acute coronary syndrome (ACS), specifically ST-elevation myocardial infarction (STEMI) [28]. A study by Karthikeyan et al. reported similar findings, indicating that atherosclerosis of the coronary arteries is the primary cause of the spectrum of coronary artery diseases, including acute coronary syndrome [29]. This may be attributed to delays in seeking medical care, limited access to primary prevention, and suboptimal management of cardiovascular risk factors in the region.

4.3. Therapeutic Management and Outcomes

The therapy employed in our investigation included the administration of antiplatelet medications, anticoagulants, antihypertensives, and statins. Another study has shown that individuals with ST-segment elevation myocardial infarction (STEMI) can be treated with fibrinolysis; however, this treatment is not recommended for patients experiencing acute coronary syndrome without ST-segment elevation (NSTEMI) [30]. Additionally, a separate study noted that antiplatelet medications were prescribed in 91.3% of cases, with statins prescribed in 85.7%. Furthermore, it noted that women had a significantly higher frequency of medication use, except for nitrates [31].

The higher proportion of statin use among STEMI patients (46.5%) aligns with international guidelines recommending statins for secondary prevention in Acute Coronary Syndrome (ACS). However, this percentage remains suboptimal, likely due to variations in prescription practices, patient adherence issues, or limited availability of medications in certain cases. Additionally, some patients may not have received statins due to delays in diagnosis or financial constraints. In regards to cardiovascular rehabilitation, the very low participation rate (0.6%) reflects the limited availability of structured rehabilitation programs in Agadir. In Morocco, cardiac rehabilitation is not widely integrated into routine post-ACS care due to a lack of specialized centers, financial barriers, and low awareness among patients and healthcare providers. This gap may contribute to poorer long-term outcomes, as rehabilitation plays a crucial role in secondary prevention and functional recovery. The evolution was accompanied by a favorable progression in 72.3% of our cohort, while an unfavorable progression was observed in 27.7% of the instances. The research conducted by Mboup *et al.* unveiled a significantly higher optimal hospital evolution rate of approximately 47.4% [32]. The predominant complications documented include mechanical consequences (12.9%), arrhythmia (6.9%), thromboembolic complications (4.4%), and cardiac failure (3.8%). A separate study found that arrhythmias and conduction abnormalities are prevalent consequences of Sudden Cardiac Arrest (SCA) and are most often seen in patients with unstable hemodynamics [33].

Nevertheless, the study conducted by Bougrini *et al.* did not report any instances of mechanical problems [34]. In Hassan II Hospital, as in many regional centers, the absence of 24/7 primary Percutaneous Coronary Intervention (PCI) services means that some patients may not receive timely reperfusion, increasing their risk of left ventricular dysfunction and hemodynamic instability. Concerning mortality, the study found that the mortality rate linked to acute coronary syndrome among Moroccan patients was 5.3%. Among these patients, 4.7% were diagnosed with STEMI and 0.6% were diagnosed with NSTEMI. In contrast, the figure reported by Gheini *et al.* indicated a death rate of 7.1% [35]. Another study undertaken in Chad over a span of 5 years revealed an even greater mortality rate of 15.63% [36]. A noteworthy association was observed in our study between the specific form of acute coronary syndrome (STEMI and NSTEMI) and mortality. The findings of our study align with the research conducted by Mc Manus *et al.*, which also found a significant association between ACS and mortality. However, while the NSTEMI group had a far higher incidence of deaths in their study, our sample only registered 0.6% [37]. This elevated mortality may be attributed to several factors, including delays in patient transport, limited access to optimal revascularization strategies (such as Percutaneous Coronary Intervention (PCI)), and the high burden of comorbidities.

Additionally, STEMI patients often experience more extensive myocardial damage, which increases their risk of fatal complications. Hassan II Hospital serves a large and diverse population, including patients from rural areas where healthcare accessibility is a major challenge. Many ACS patients arrive late to the hospital, limiting the effectiveness of acute interventions. Moreover, the hospital's infrastructure constraints, including the limited availability of intensive cardiac care units and advanced interventional cardiology, may influence patient outcomes. To reduce morbidity and mortality in ACS patients, several strategies should be considered:

- ♦ Expanding access to cardiac rehabilitation programs to improve post-ACS recovery.
- ♦ Strengthening early detection and referral pathways to reduce delays in treatment.
- ♦ Enhancing primary and secondary prevention programs, particularly for high-risk groups.
- ♦ Improving access to reperfusion therapies, either through better coordination with tertiary centers or by increasing local PCI capabilities.

4.4. Study Limitations

This study has several limitations to consider. First, its single-center design limits the generalizability of the findings to the entire Moroccan population. A multicenter study would provide a more representative picture of the epidemiological and clinical profiles of ACS in the country. Second, missing data were considered, primarily due to hospital archive management, which could introduce selection or classification bias. Third, our study relied on retrospective data, which may limit the accuracy of certain information, particularly regarding treatment delays and acute phase interventions.

CONCLUSION

Acute coronary syndrome is a prominent contributor to world mortality caused by cardiovascular illnesses. Atherosclerotic lesions, smoking, and male preponderance are among the characteristics identified in the current study that raise the chance of its development. To make an accurate diagnosis of ACS, it is necessary to carefully assess clinical symptoms, the patient's medical background, the findings of several physical examinations, notably the ECG, and cardiac biomarker testing, particularly troponin, to identify and distinguish individuals with STEMI from those with NSTEMI. Therefore, early risk stratification using well-established scores such as GRACE, KILLIP, TIMI, and HEART is beneficial for identifying high-risk patients, thereby helping to minimize complications and mortality rates. Therapeutic management should begin with medical therapy and revascularization tailored to the ACS classification. Broadly, this study demonstrated that the primary treatment modalities were antiplatelet medications (99.4%), anticoagulants (98.4%), antihypertensives (86.5%), and statins (68.5%). The study also found that patients with STEMI had a higher fatality rate of 4.7% compared to 0.6% in those with NSTEMI, highlighting the need for more appropriate treatment strategies.

Further advancements are needed in the timing of medical interventions to improve morbidity and mortality rates associated with Acute Coronary Syndrome (ACS). In public health settings, managing ACS requires reducing pre-hospital care response times and increasing public awareness about the importance of seeking medical attention promptly at the onset of symptoms. Enhancing cardiac rehabilitation appears to be an essential need, with enhanced access to reperfusion treatments, collaboration with tertiary centers, and an expansion of local PCI capability. Novel studies on the timing of medical intervention and disparities in prognosis have the potential to elevate the standard of healthcare.

AUTHORS' CONTRIBUTIONS

The authors confirm their contributions to the paper as follows: Study conception and design: AA; concep - tualization: RR; data collection: NM, TA, and AY; investigation: YO; draft manuscript: MAB. All authors reviewed the results and approved the final version of the manuscript.

LIST OF ABBREVIATIONS

ACS	=	Acute Coronary Syndrome
AOR	=	Adjusted Odds Ratio
AV block	=	Atrioventricular Block
Cardiac MRI	=	Cardiac Magnetic Resonance Imaging
CI	=	Confidence Interval
CRP	=	C-Reactive protein
ECG	=	Electrocardiogram
LV dysfunction	=	Left Ventricular Dysfunction
MENA	=	Middle East and North Africa
OR	=	Odds Ratio
NSTEMI	=	Non-ST-Elevation Myocardial Infraction
PCI	=	Percutaneous Coronary Intervention
STEMI	=	ST- Elevation Myocardial Infraction

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The present work is a monocentric retrospective analysis conducted on hospital medical records. The present study has obtained legal authorization from the health authorities of the delegation of the Ministry of Health and Social Protection of Agadir, Morocco under number (782/22).

HUMAN AND ANIMAL RIGHTS

This research was carried out in compliance with the established principles and regulations governing scientific research, including the Declaration of Helsinki of 1975, as revised in 2013 (http://ethics.iit.edu/ecodes/node/3931).

CONSENT FOR PUBLICATION

Informed consent for the study has been obtained.

STANDARDS OF REPORTING

STROBE guidelines were followed

AVAILABILITY OF DATA AND MATERIAL

The data sets used and/or analysed during this study are available from the corresponding author [A.A] upon request.

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None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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