

# Risk Factors Associated With Acute Coronary Syndrome among Patients Admitted to the Coronary Care Unit in the Military Cardiac Center - Sana'a-Yemen

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## Abstract

**Background:** Acute coronary syndrome (ACS) refers to a spectrum of symptoms compatible with acute myocardial ischemia. Worldwide acute coronary syndrome (ACS) is one of the main reasons for hospital admission and the leading cause of death. Several risk factors have been identified. However high blood pressure and hypercholesterolemia remain the most important risk factors in (ACS). **Objective:** To determine the risk factors associated with ACS among patients admitted to the coronary care unit (CCU) in the Military Hospital-Sana'a. **Methodology:** Study design according to a case-control study. Two groups of patients were included in this study, the first group was cases who have (ACS), and the second group was control cases admitted to CCU for other causes. All data were recorded in a special sheet including demographic, clinical presentation, investigation, and treatment plan. The data was entered into PC and analyzed statistically. **Results:** There were 124 patients with ACS versus 91 control patients without ACS. The majority of participants in the two groups were males (80 %). Their age ranged from 18 to 95 years old with a mean age of 53.9 ±13.6 years. (86.5 %) of them were 40 years old or above. The significant risk factors associated with ACS were hypertension, Khat chewing found in 71.6 %, 64.4%, of the patients, respectively. Another significant risk factor was dyslipidemia which was higher among ACS patients than the control group with a P-value of < 0.05. **Conclusion:** Preventing the program from avoiding risk factors that were associated with ACS may decrease the occurring of ACS and reduce the morbidity and mortality in Yemeni patients.

**Keywords:** Risk Factors, Acute Coronary Syndrome (ACS) Yemen.

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## INTRODUCTION

Acute coronary syndrome (ACS) refers to a spectrum of symptoms compatible with acute myocardial ischemia. It is one of the main reasons for hospital admission in western countries and the leading cause of death worldwide [1-3]. In 2010, it was estimated that cardiovascular diseases (CVD) caused 16 million deaths despite, a considerable number of these causes that can be prevented [4].

The clinical types of ACS include unstable angina and acute myocardial infarction (AMI) with or without ST-segment elevation. Several modifiable risk factors for (ACS) have been identified, including; smoking, dyslipidemia, hypertension, and diabetes, with obesity and metabolic syndrome, are commonly involved [6].

The incidence of ACS in younger people is much lower than in older people, although the incidence varies depending on the population's age, habit, and social changes [7-10]. A recent study in Spain found that people younger than 45 years of age accounted only for 6% of all hospital admissions with (ACS) in men and only 2% in women. However, the rates of hospital readmission were significantly higher among young ages than in the population in which the first event occurred at later ages [11].

Moreover, patients who have ACS at an early age are at risk for many potential years of life lost, and their post-event survival translates as substantial costs in terms of health and social resources consumed [12]. Like in other parts of the developing countries, the population in Yemen is progressively changing, resulting in increased admission of middle-aged

individuals and elderly with complicated cardiac diseases [13].

In recent decades there have been important changes in the exposure to risk factors for ACS, such as the increased prevalence of sedentary lifestyles, obesity, metabolic syndrome, and diabetes mellitus. Tobacco and obesity remain important contributors as well [14, 15].

Studies tailored to detect risk factors among Yemeni patients with (ACS) are lacking. Therefore this study was taken to determine possible risk factors in Yemeni patients presented into Cardiac Centre in the Military Hospital with ACS. Our objective to study the risk factors associated with acute coronary syndrome among Yemeni patients admitted to the coronary care unit in the Military Hospital - Sana'a Yemen. Also to determine the factors associated with ACS among cases in comparison to controls. As well as to assess mortality among cases in comparison to controls.

## MATERIALS AND METHOD

### Study location

The study took place in the CCU of the Cardiac Military Centre in Sana'a city – Yemen. The Coronary Care Unit (CCU) in this hospital is well equipped with the sophisticated system and intensive care machines and instruments. It is considered one of the most advanced governmental cardiac center in the country. In 2019, five hundred and sixty (560) cardiac patients were treated for ACA.

### Study Design

This study was a case-control study. It involved cases admitted to CCU with Acute coronary syndrome. Matching case-control were selected from cases admitted to the coronary care unit (CCU) for other medical diseases. Odds ratio (OR) was used as the outcome measure of association.

### Study Population and recruitment

All patients who were admitted to the coronary care unit of the cardiac center in the Military Hospital in Sana'a with the diagnosis of ACS during January, 1<sup>st</sup> - 30<sup>th</sup> June 2019. Were enrolled as cases. Matched controls were then selected from the CCU and cardiac department at the cardiac center but without a diagnosis of ACS or IHD. Age and sex matching aids in the elimination of confounding effects of age and sex in addition to providing optimal controls for neutral comparison.

### Inclusion Criteria

All adult patients with the diagnosis of ACS who meet the case definition. The case definition of ACS was patients who have at least two of the following criteria include Typical chest pain, ECG changes, and Positive cardiac enzymes.

ST-segment elevation myocardial infarction (STEMI) consists of chest pain, ST-segment elevation on ECG, and elevated cardiac enzymes. Non-ST-segment elevation myocardial infarction (NSTEMI) consists of chest pain, ST segment depression, and elevated cardiac enzymes. Unstable angina (UA) consists of chest pain, ST-segment depression, and normal cardiac enzymes. Patients with chronic inflammatory conditions e.g. systemic lupus erythematosus, rheumatoid arthritis, or vasculitis and patients younger than 18 years old were excluded from the study.

### Data Collection

Special questionnaires were designed to document demographic data such as age, sex, occupation, and location. All included patients were subjected to complete history, physical examination, comorbidities, electrocardiogram findings, and laboratory results. Laboratory results included lipid profile, PT, INR, PTT, CBC, troponin, LDH, liver, and renal function tests.

### Statistical Analysis

Data were verified, entered into PC, and analyzed using SPSS version 24.0. The Continuous data were analyzed using measures of central tendency, while categorical data were described in percent (%). For determining the associations between the variables Chi-square test, Fischer exact test, and Likelihood ratio were primarily used. The odds ratio was used as the outcome measure of association. Multiple logistic regression analysis was used to study the predictors of the dependent variable (acute coronary syndrome diagnosis).

## RESULTS

There were 124 patients with (ACS) versus 91 hospital-based control patients without ACS. The majority of participants in the two groups were males (80 %). Their age ranged from 18 to 95 years old with a mean age of  $53.9 \pm 13.6$  years. (86.5 %) of them were above 40 years old. There were no statistical differences between the study group and control group using the independent student t-test Table-1.

**Table-1: The mean age of the study group (cases) and the control group**

Participant	N (%)	Mean $\pm$ SD	t value	P. value
Cases	124	$54.8 \pm 11,6$	1.513	0.132
Controls	91	$15,9 \pm 15,9$		

Risk factors and characteristic behavior of both groups were examined and compared. The result

showed that hypertension was more frequent in the study group than the control group (71.6%) versus

(28.4%) ( $p=0.005$  %). Additionally, Khat chewing was more prevalent among the cases than the control group (64.4 %) versus (35.6%) with P value (0.001). Smoking was more prevalent among ACS than the control group

amounting to reach statistical significance with P-value 0.053. However, diabetes mellitus status failed to achieve statistical significance between ACS cases and the control group Table-2.

**Table-2: Risk Factors associated with ACS compared to control group**

Factor	Cases	Controls	$\chi^2$	p. value
Hypertension				
Hypertensive	48 (71.6 %)	19 (28.4 %)	7.8	0.005*
Normotensive	76 (51.4 %)	72 (48.6 %)		
Khat chewing				
Chews Khat	103 (64.4 %)	57 (35.6 %)	11.5	0.001*
Doesn't chew Khat	21 (38.2 %)	34 (61.8 %)		
Gender				
Male	105 (61 %)	67 (39 %)	4.1	0.045*
Female	19 (44.2 %)	24 (55.8 %)		
Smoking				
Smoke	90 (59.6 %)	61 (40.4 %)	3.73	0.053
Non smoke	34 (%)	30 (%)		
Diabetes (DM)				
Has DM	40 (64.5 %)	22 (35.5 %)	1.67	0.196
No DM	84 (54.9 %)	69 (45.1%)		

Variables that showed statistically significant association using the Chi-square test, were further analyzed for possible confounding using multiple logistic regression analysis to obtain factors predicting ACS. The prediction models and the calculated adjusted odds ratios (AOR), table (3). In comparison to

normotensive patients, the odds of having hypertension were 3.32 times greater among cases than controls. Similarly, the odds of being Khat chewer were 3.1 times greater among cases than controls. i.e. patients who had hypertension and/or chewed Khat had a higher risk of developing ACS.

**Table-3: The prediction models and the calculated adjusted odds ratios (AOR)**

Predictor	B	S.E	Wald	p. val	AOR	95 % CI	
						Lower	Upper
Blood pressure	1.17	0.401	8.54	0.003*	3.32	1.49	7.07
Hypertensive							
Normotensive							
Khat chewing	1.14	0.533	4.59	0.032*	3.1	1.1	8.9
Chews Khat							
[Doesn't chew Khat							

**AOR: adjusted odds ratio, CI: confidence interval, []: reference category, \* significant at  $p < 0.05$ .**

The lipid profile of both groups is shown in Table-4. It is obvious that total cholesterol, triglycerides, and low-density lipoproteins were higher among ACS cases than the control group with significant differences P-value of  $< 0.05$ . On the other

hand, high-density lipoproteins did not differ largely between cases and control and there was no statistically significant difference in the HDL mean between the two groups.

**Table-4: Lipid profile among cases and controls**

Lipid	Cases	Controls	MD	T	P. value
	Mean $\pm$ SD (mg/dl)				
Total cholesterol	163.5 $\pm$ 43.8	110.8 $\pm$ 41.5	52.7	4.35	$<0.001^*$
Triglyceride	153.2 $\pm$ 66.2	107.1 $\pm$ 52.8	46.2	2.6	0.012*
LDL	110.4 $\pm$ 25.5	70.6 $\pm$ 33.6	39.8	3.01	0.006*
HDL	34.8 $\pm$ 10.2	30.2 $\pm$ 10.2	4.6	1.01	0.32
Mean difference tested by independent t-test. t: t-value, SD: standard deviation.					
* Significant.					

Of 124 cases admitted with ACS 9 patients (7.3 %) died in CCU. While 115 (92.7 %) were transferred to ward with good condition. On the other hand, 27 in control patients (29.7 %) died and 64 (70.3 %) were

transferred to ward with good condition. This differences in mortality proportions were statistically significant.

## DISCUSSION

The majority of our patients presented with ACS were males (80 %), most of them (86.5 %) were 40 years old or above. Our findings are consistent with most studies conducted in Yemen in which the mean age of patients diagnosed with ACS ranged between 55.3 years to 56.8 years [16-18]. However, the incidence of ACS in the elderly is expected to rise due to improvements in prior ACS treatment in an aging population [19].

Regarding risk factors, we found that systemic hypertension is one of the major risk factors which is extensively prevalent in patients with ACS. It was known that increase blood pressure and uncontrolled hypertension can lead to endothelial dysfunction, increase the permeability of intima, left ventricular hypertrophy, and ultimately ischemic heart diseases with acute coronary syndrome [16-19].

Hypertension is also, associated with accelerated atherosclerosis, which contributes to the progression of myocardial infarction [20].

The unique finding in this study was that khat chewers were more vulnerable to ACS. Their risk to develop ACS was 3.1 times greater than the control group. This makes khat as an independent risk factor for the development of the acute coronary syndrome. Previously studied in Yemen found that Khat was a predisposing factor for heart ischemia and heart failure [17, 21].

In this study Lipid profiles such as total cholesterol, triglycerides, and low-density lipoproteins were higher among ACS cases than the control group. These findings were reported by studies done regionally and internationally [22-24]. Studies have shown that dyslipidemia was one of the prominent risk factors with ACS [25]. The higher the lipids the more severe it was the atherosclerosis [23]. A recent study from Brazil has reported that the main risk factors were arterial hypertension (68%), smoking (67%), and dyslipidemia (43%) [26].

It was worth to mentioning that in this study diabetes, and smoking was prevalent among ACS. But they failed to achieve statistically significant. This finding may be related to the type of study design where, our control group was hospital-based (patients admitted to CCU) with a high prevalence of diabetes and probably smoking habit, making a determination of a difference of these factors were unsatisfied, yet, such a defect can be solved in future studies through using population controls or adapting a cohort prospective study design.

The same draw note can be recognized in the mortality rate we found the mortality rate in the control group was higher than the control group. That was

because our control group was patients admitted into (CCU) because they had critical disease most of them suffered from multi-organ damages.

## CONCLUSION

Preventable risk factors were the major factors for ACS. Health education and prevention program is mandatory for avoiding risk factors associated with ACS. Such a program may be used to decrease the occurring of ACS and reduced the morbidity and mortality of cardiovascular diseases in Yemen.

## RECOMMENDATION

It is crucial to make an early and accurate diagnosis of ACS with risk stratification to guide therapy accordingly. It is necessary to provide training and prevention to prevent further cardiovascular disease through the educational class, mass media, and cyberspace in order to raise the level of awareness of people and reduce cardiovascular diseases. Countrywide studies related to cardiovascular diseases particularly ACS and locally risk factors are needed.

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## Authors' Contribution

Dr. Ahmed Kaid Salem, Dr. Nouradden Aljaber, Dr. Akram Al-Haj, Dr. Khairallah Abdulah Al-Matari, Prof Amin Ablrub, study concept and design, data acquisition, interpretation; manuscript drafting, study supervision, the idea of the manuscript, collection, analysis, writing and literature review by them.

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