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Electrocardiographic Analysis of Patients with Suspicion of Acute Coronary Syndrome in Yaounde, Cameroon

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Abstract

Background: Ischemic heart disease (IHD) is the leading cause of death worldwide. IHD was thought to be an extremely rare occurrence in Sub-Saharan Africa, but the increasing economic development with changes in lifestyle has led to an increase in IHD risk factors which has motivated the interest of our study. **Objectives:** The aim was to study a group of patients with suspicion of acute coronary syndrome (ACS), in order to determine those with and without electrocardiographic diagnosis of ACS. **Methods:** It was an observational cross-sectional descriptive study over a period of six months, which included concerned patients who presented with retrosternal or precordial chest pain of onset being less than two weeks with at least one cardiovascular risk factor, in the cardiology units of three reference hospitals in Yaounde. Ethical clearance and authorizations were obtained from the competent authorities. We used a preformed questionnaire to obtain information from the patients concerning the demographic data, clinical presentation and electrocardiographic findings. **Results:** We recruited 100 patients with suspicion of ACS. 56 patients presented with electrocardiographic diagnosis of ACS and 44 patients did not. The mean age was 60.6 ± 11.5 years with age limits of 32 - 85 years in patients with ACS and 55.3 ± 16.6 years with age limits of 19 - 90 years in patients without ACS. The predominant age group was 60 - 69 years in both groups. The sex ratio (male/female) was 0.6 in patients with ACS and 0.7 in patients without ACS. The main complaints presented in both groups were; chest pain, fatigue, dyspnea and palpitation. The frequent cardiovascular risk factors in both groups were hypertension, age and overweight/obesity. In patients with ACS, 55.4% presented with ST-segment elevated acute coronary

syndrome (STE-ACS) and 44.6% presented with non-ST-segment elevated acute coronary syndrome (NSTE-ACS). The Antero-Septal territory represented 77.4% of patients with STE-ACS and the lateral territory represented 56.0% of patients with NSTE-ACS. **Conclusion:** This study shows that 56.0% of patients with suspicion of ACS had an electrocardiographic diagnosis of ACS. Further studies should be undertaken to determine the prevalence of ACS in our community.

Keywords

Chest Pain, Cardiovascular Risk Factor, Electrocardiogram, Acute Coronary Syndrome

1. Introduction

Ischemic heart disease (IHD) is the leading cause of death worldwide [1] [2] [3], placing a major economic and resource burden on health and public health systems. Every year in the United States, approximately 1.1 million patients are admitted to hospitals with non-ST-segment elevated acute coronary syndrome (NSTE-ACS) as compared with approximately 300,000 patients with ST-segment elevated acute coronary syndrome (STE-ACS). Women comprise more than one-third of patients with NSTE-ACS, but less than one-fourth of patients with STE-ACS [4].

Sub-Saharan Africa has traditionally been viewed as a home of communicable diseases, and coronary artery disease was thought to be an extremely rare occurrence. The last few decades have witnessed considerable transition in epidemiology and with it came a change in the pattern of disease. Increasing urbanization and changing lifestyle profiles have triggered an exponential rise in the frequency of the historically absent traditional coronary artery disease risk factors in black Africans [5] [6]. A study carried out in Kenya including 111 patients diagnosed with ACS showed 56% presented with STE-ACS and 44% with NSTE-ACS [5]. Another study carried out in South Africa including 615 patients diagnosed with ACS revealed that 41% presented with STE-ACS and 59% with NSTE-ACS [7].

In Cameroon, a few studies have been carried out which put in evidence the existence of ACS. A study carried out including 30 patients with coronary artery disease showed 63% with ACS [8]. Due to the availability of few studies and an increase in economic development in Cameroon associated with an increase in cardiovascular risk factors, this motivated the interest of our study which has as its general objective to study a group of patients with suspicion of acute coronary syndrome in order to determine those with and without electrocardiographic diagnosis of acute coronary syndrome in the cardiology units of three reference hospitals in Yaounde.

2. Materials and Methods

2.1. Study Population and Setting

We carried out an observational cross-sectional descriptive study, over a period of six months from November 2017 to April 2018, in the cardiology outpatients and hospitalization units of the Yaounde University Teaching Hospital, Central Hospital and General Hospital. We included all patients who presented with retrosternal or precordial chest pain of onset being less than two weeks with at least one cardiovascular risk factor and have signed an inform concern form. The sampling technique was consecutive in nature. Ethical clearance was obtained from the Research Institutional Committee of Ethics of the Faculty of Medicine and Biomedical Sciences and authorizations from the directors of the three hospitals.

2.2. Data Collection and Analysis

We used 12 lead KISS, MAC 1200 and NIHON KOHDEN CardiofaxS type electrocardiograms in the cardiology units of the various above-mentioned hospitals, medical files of the patients involved in the study, a weight balance for measuring weight, a Certified Spirit Sphygmomanometer for blood pressure recording, a metal tape to measure height and a pre-establish questionnaire, to obtain information concerning the demographic data, presenting complaints, cardiovascular risk factors and electrocardiographic findings of the patient. We used the electrocardiogram without evaluation of cardiac enzymes to determine the diagnosis of acute coronary syndrome because the electrocardiogram is the first line of diagnosis [9] [10] [11]. The electrocardiographic standards for diagnosing acute coronary syndrome required that ST-segment elevation and depression be present in 2 or more contiguous leads. For men 40 years of age and older, the threshold value for abnormal J-point elevation was 0.2 mV (2 mm) in leads V2 and V3 and 0.1 mV (1 mm) in all other leads. For men less than 40 years of age, the threshold values for abnormal J-point elevation in leads V2 and V3 was 0.25 mV (2.5 mm). For women, the threshold value for abnormal J-point elevation was 0.15 mV (1.5 mm) in leads V2 and V3 and greater than 0.1 mV (1 mm) in all other leads. For men and women of all ages, the threshold value for abnormal J-point depression was −0.05 mV (−0.5 mm) in leads V2 and V3 and −0.1 mV (−1 mm) in all other leads. The threshold values for T-wave inversions were −0.3 mV (−3 mm), for Q wave was −0.2 mV (−2 mm) and for Left Bundle Branch Block (LBBB) was QRS complex > 0.12 s in DII, aVL, V5. Concerning cardiovascular risk factors; Age was considered as male older than 50 years and female older than 55 years. History of IHD in the family was considered as patients with a family history of IHD in either parents, or in siblings or first-degree relatives at the age of 50 years or younger for males and 55 years or younger for females. Hypertension was considered as patients who have been previously diagnosed by a physician, receiving medication to lower blood pressure, or recorded blood pressure > 140 mm Hg systolic or >90 mm Hg diastolic on two or more occasions. Diabetes was considered as patients who have been previously

diagnosed by a physician, receiving medication for diabetes or known fasting blood sugar of 126 mg/dl on two or more occasions. Dyslipidemia was considered as patients who have been previously diagnosed by a physician, receiving lipid lowering drugs, or either total cholesterol ≥ 2.50 g/l or triglyceride ≥ 1.60 g/l or low density lipoprotein (LDL) ≥ 1.80 g/l or high density lipoprotein (HDL) ≤ 0.40 g/l. Smoking was considered as patients who were current smokers (those individuals who smoked in the previous 12 months) and former smokers (those who had not smoked for a period of at least a year). Overweight/Obesity was considered as body mass index [BMI] ≥ 25 kg/m^2. The entering and analysis of data was done using Microsoft Excel 2007.

3. Results

3.1. Demographic Data

We recruited 100 patients with suspicion of Acute Coronary syndrome during a period of 6 months. 56 (56%) patients presented with electrocardiographic diagnosis of ACS and 44 (44%) patients did not. The mean age in patients with and without ACS were 60.6 ± 11.5 years with age limits of 32 - 85 years and 55.3 ± 16.6 years with age limits of 19 - 90 years respectively. The predominant age group was 60 - 69 years in both groups Table 1. The sex ratio (male/female) was 0.6, in patients with ACS (21 (37.5%) of males and 35 (62.5%) of females) and 0.7, in patients without ACS (18 (40.9%) of males and 26 (59.1%) of females) Table 1.

3.2. Clinical Presentations

The main complaints that patients with ACS presented with were; chest pain, fatigue, dyspnea and palpitation which represented 100.0%, 94.6%, 83.9%, and 64.3% respectively meanwhile, the main complaints that patients without ACS

Table 1. Demographic characteristics in the study population.

Characteristics	With ACS n (%) N = 56	Without ACS n (%) N = 44	Total n (%) N = 100
Age group (years)			
<40	3 (5.4)	10 (22.7)	13 (13.0)
40 - 49	5 (8.9)	3 (6.8)	8 (8.0)
50 - 59	14 (25.0)	9 (20.5)	23 (23.0)
60 - 69	21 (37.5)	16 (36.4)	37 (37.0)
70 - 79	12 (21.4)	4 (9.1)	16 (16.0)
80+	1 (1.8)	2 (4.5)	3 (3.0)
Sex			
Female	35 (62.5)	26 (59.1)	61 (61.0)
Male	21 (37.5)	18 (40.9)	39 (39.0)

presented with were also; chest pain, fatigue, dyspnea and palpitation which represented 100.0%, 84.1%, 77.3% and 61.4% respectively Table 2. The most frequent cardiovascular risk factors in patients with ACS were; hypertension, age and overweight/obesity which represented 82.1%, 76.8% and 53.6% respectively meanwhile the most frequent cardiovascular risk factors in patient without ACS were also hypertension, age and overweight/obesity which represented 86.4%, 65.9% and 52.3% respectively Table 2.

3.3. Electrocardiographic Findings

We found out that 55.4% of patients presented with STE-ACS and 44.6% of patients presented with NSTE-ACS. The type of ACS most represented was the presence of Q wave (26.8%), followed by ST segment elevation and negative T wave ACS which represented 23.2% each. It should be noted that just 3 (5.4%) of the patients presented with new onset LBBB ACS Figure 1. Only negative T wave ACS was present in the <40 years age group. Q wave ACS was the most frequent in the 50 - 59 and 60 - 69 years age groups. ST segment depression ACS was most frequent in the 70 - 79 years age group Table 3. Negative T wave ACS was more frequent in females and ST segment elevation ACS was more frequent

Table 2. Clinical presentations in the study population.

Clinical characteristics	With ACS n (%) N = 56	Without ACS n (%) N = 44	Total n (%) N = 100
Presenting complaints			
Chest pain	56 (100.0)	44 (100.0)	100 (100.0)
Dyspnea	47 (83.9)	34 (77.3)	81 (81.0)
Fatigue	53 (94.6)	37 (84.1)	90 (90.0)
Syncope	2 (3.6)	2 (4.5)	4 (4.0)
Nausea	6 (10.7)	9 (20.5)	15 (15.0)
Diaphoresis	19 (33.9)	5 (11.4)	24 (24.0)
Palpitation	36 (64.3)	27 (61.4)	63 (63.0)
Dizziness	19 (33.9)	10 (22.7)	29 (29.0)
Cardiovascular risk factors			
Age > 50 years for male/55 years for female	43 (76.8)	29 (65.9)	72 (72.0)
History of IHD in the family	3 (5.4)	2 (4.5)	5 (5.0)
Hypertension	46 (82.1)	38 (86.4)	84 (84.0)
Diabetics	15 (26.8)	14 (31.8)	29 (29.0)
Dyslipidemia	18 (32.1)	6 (13.6)	24 (24.0)
Current/ex-smokers	9 (16.1)	7 (15.9)	16 (16.0)
Overweight/obesity (BMI ≥ 25 kg/m^2)	30 (53.6)	23 (52.3)	53 (53.0)

in males Table 3. The Anterio-septal territory was the most frequent localization in patients with STE-ACS representing 77.4% and the lateral territory was the most frequent localization in patients with NSTE-ACS representing 56.0% Table 4.

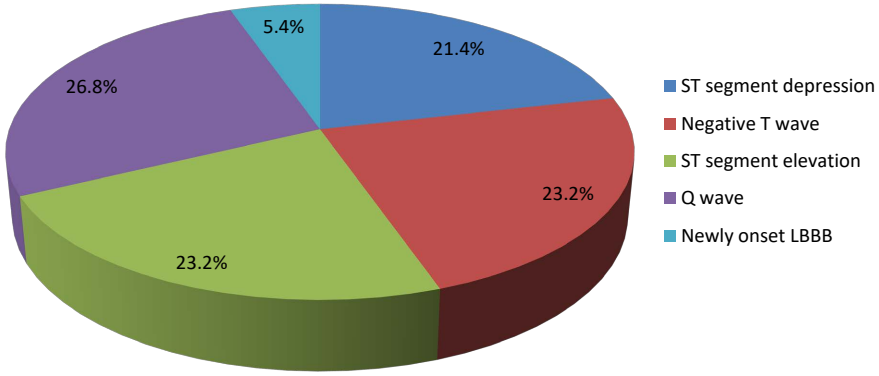

Figure 1. Distribution of type of ACS in patients with ACS.

Table 3. Distribution of type of ACS according to age and sex.

	ST segment depression n (%) N = 12	Negative T wave n (%) N = 13	ST segment elevation n (%) N = 13	Q wave n (%) N = 15	New onset LBBB n (%) N = 3	Total n (%) N = 56
Age group (years)						
<40	0 (0.0)	3 (5.4)	0 (0.0)	0 (0.0)	0 (0.0)	3 (5.4)
40 - 49	1 (1.8)	2 (3.6)	0 (0.0)	2 (3.6)	0 (0.0)	5 (8.9)
50 - 59	1 (1.8)	3 (5.4)	4 (7.1)	5 (8.9)	1 (1.8)	14 (25.0)
60 - 69	5 (8.9)	3 (5.4)	5 (8.9)	7 (12.5)	1 (1.8)	21 (37.5)
70 - 79	5 (8.9)	2 (3.6)	4 (7.1)	0 (0.0)	1 (1.8)	12 (21.4)
80+	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.8)	0 (0.0)	1 (1.8)
Sex						
Female	8 (14.3)	11 (19.6)	5 (8.9)	10 (17.9)	1 (1.8)	35 (62.5)
Male	4 (7.1)	2 (3.6)	8 (14.3)	5 (8.9)	2 (3.6)	21 (37.5)

Table 4. Location of ischemic territory in patients with ACS.

Ischemic territory	STE-ACS n (%) N = 31	NSTE-ACS n (%) N = 25	Total N = 56
Anterior extended	1 (3.2)	0 (0.0)	1 (1.8)
Anterio-septal	24 (77.4)	7 (28.0)	31 (55.4)
Lateral	1 (3.2)	14 (56.0)	15 (26.8)
Inferior	5 (16.2)	4 (16.0)	9 (16.0)
Posterior	0 (0.0)	0 (0.0)	0 (0.0)

4. Discussion

We recruited 100 patients with suspicion of Acute Coronary syndrome during a period of 6 months. 56% of patients presented with electrocardiographic diagnosis of ACS and 44% of patients did not. The mean age in patients with ACS was 60.6 ± 11.5 years with age limits of 32 - 85 years. This is closer to the mean age of 58.0 ± 12.1 years and 63.9 years found by Colins and col. in 2012 in South Africa and Jay and col. in 2012 in Kenya respectively [5] [7] but different from the mean age of 53.75 ± 8.84 year with limits of 37 - 69 years found by Boanga and col. in 1998 in Yaounde [8]. The mean age in patients without ACS was 55.3 ± 16.6 years with age limits of 19 - 90 years. The predominant age group in patients with ACS was 60 - 69 years which is different from 50 - 59 years found by Boanga and col. [8] and the predominant age group in patients without ACS was also 60 - 69 years. The sex ratio (male/female) was 0.6, with a female predominance in the patients with ACS (37.5%) of males and (62.5%) of females. This is different from the study of Baonga and col., Colins and col. and Vohod and col. who found males predominant representing 86.3%, 75.9% and 66.6% respectively [8] [9] [12]. The female predominant in our study was unexpected and needs further studies. Meanwhile the sex ratio (male/female) was 0.7, with a female predominance in the patients without ACS (40.9%) of males and (59.1%) of females.

The most complaints that the patient with ACS presented with were; chest pain, fatigue, dyspnea and palpitation which represented 100.0%, 94.6%, 83.9%, and 64.3% respectively. This is in line with most literature reviews and the most complaints that the patients without ACS presented with were also; chest pain, fatigue, dyspnea and palpitation which represented 100.0%, 84.1%, 77.3% and 61.4% respectively. The most frequent cardiovascular risk factors in patients with ACS were; hypertension, age and overweight/obesity which represented 82.1%, 76.8% and 53.6% respectively. This is similar to obesity, age and hypertension representing 80.0%, 70.0% and 60.0% respectively, found by Baonga and col. [8]. Meanwhile the most prevalent cardiovascular risk factors in patients without ACS were also hypertension, age and obesity which represented 86.4%, 65.9% and 52.3% respectively.

We found out that 55.4% of patients presented with STE-ACS which comprises ST-segment elevation, Q wave and new onset LBBB ACS and 44.6% of patients presented with NSTE-ACS which comprises ST-segment depression and negative T wave ACS. This is similar to the results of Jay and col. who found 56.0% of patients with STE-ACS and 44.0% with NSTE-ACS but different from the results of Colins and col. who found 41.1% of STE-ACS and 58.9% of NSTE-ACS [5] [7]. The type of ACS most represented was the presence of Q wave (26.8%), followed by ST-segment elevation and Negative T-wave ACS which represented 23.2% each. This is different from the results of Vohod and col. in 1992 in Yaounde who found out that negative T-wave, ST-segment elevation and ST-segment depression were the most frequent representing 26.8%,

24.4% and 19.5% respectively [12]. It should be noted that just 5.4% of the patients presented with new onset LBBB ACS. Only negative T-wave ACS was present in the <40 years age group. Q wave ACS was the most frequent in the 50 - 59 and 60 - 69 years age groups. ST-segment depression ACS was the most frequent in the 70 - 79 years age group. Negative T wave ACS was most frequent in females and ST segment elevation ACS was most frequent in males. Antero-Setal territory was the most frequent localization in patients with STE-ACS representing 77.4%. This result is comparable to that of Baonga and col. who found antero-septal territory being most frequent representing 46.2% [8]. The lateral territory was the most frequent localization in patients with NSTE-ACS representing 56.0%.

5. Conclusion

It can be seen from this study that 56.0% of patients with chest pain and at least a cardiovascular risk factor suspected to have an ACS had an electrocardiographic diagnosis of ACS and there was also female predominant. Further studies using electrocardiography, cardiac biomarkers, echocardiography and coronarography should be undertaken to determine the prevalence of ACS and its associated risk factors with an explanation of why the female is predominant in our community.

6. Limitations

Due to the absence of studies on the prevalence of acute coronary syndrome in Cameroon, it was difficult to obtain an ideal sample size. Also, it should be noted that there are other diseases that can have a similar electrocardiographic presentation like acute coronary syndrome.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Annex

QUESTIONNAIRE

THEME: ELECTROCARDIOGRAPHIC ANALYSIS OF PATIENTS WITH SUSPICION OF ACUTE CORONARY SYNDROME IN YAOUNDE

Questionnaire No…….

I. IDENTIFICATION

Age: …… Sex: ……..

Ethnic: …… Occupation: ……

Resident: …… Marital status: ……

Weight: …….. Height: ……

WC: …… BMI: ……

II. PRESENTING COMPLAIN

No	Symptom	Yes	No
1	Chest pain		
2	Dyspnea		
3	Fatigue		
4	Syncope		
5	Nausea		
6	Diaphoresis		
7	Palpitation		
8	Dizziness		
9	Others		

III. CARDIOVASCULAR RISK FACTORS

No	Risk factor	Yes	No
1	Age: Male > 50 years/Female > 55 years		
2	History of IHD in the family		
3	Hypertension		
4	Diabetes		
5	Dyslipidemia		
6	Smoking		
7	Overweight/Obesity		

IV. LOCATION OF ISCHEMIA ON ELECTROCARDIOGRAM

No	Location on ecg	Yes	No
1	Anterior extended: V1 - V6		
2	Antero-Septal: V1 - V4		
3	Lateral: D1, aVL, V5, V6		
4	Inferior: DII, DIII, aVF		
5	Posterior: R wave in V1 - V3 with ST depression V1 - V3		

V. TYPE OF ACUTE CORONARY SYNDROME

ST segment elevation ☐	Q wave ☐	New onset LBBB ☐
ST segment depression ☐	Negative T wave ☐	