Original Article

Risk factor profile in patients who underwent coronary angiography at the Shisong Cardiac Centre, Cameroon

Peter Vanes Ebasone[1], Anastase Dzudie[1,2], Jean Claude Ambassa[3], Ba Hamadou[2], Liliane Kuate Mfekeu[2], Eugene Yeika[3], Sylvie Ndongo Amougou[2], Samuel Kingue[2]

[1]Clinical Research Education, Networking and Consultancy, Yaounde, Cameroon; [2]Faculty of Medicine and Biomedical Sciences, University of Yaounde 1, Yaounde, Cameroon; [3]Shisong Cardiac Centre, Kumbo, North West Region, Cameroon

Contributions: (I) Conception and design: PV Ebasone, A Dzudie, JC Ambassa, E Yeika, LK Mfekeu, SN Amougou, B Hamadou; (II) Administrative support: JC Ambassa, S Kingue, A Dzudie,; (III) Provision of study materials or patients: JC Ambassa, PV Ebasone, A Dzudie, E Yeika, S Kingue; (IV) Collection and assembly of data: B Hamadou, LK Mfekeu, SN Amougou, S Kingue; (V) Data analysis and interpretation: PV Ebasone, A Dzudie, B Hamadou, LK Mfekeu, SN Amougou, S Kingue; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Peter Vanes Ebasone. Clinical Research Education, Networking and Consultancy, 3787, Yaounde, Cameroon.
Email: petervanes2006@gmail.com.

Background: Coronary artery disease (CAD) is the leading cause of death worldwide. Although there has been a drop in the prevalence and mortality from CAD in the western world, the reverse is happening in developing countries. In sub-Saharan Africa, there is a paucity of studies to support the rising burden of CAD, thus this information is needed to assist health care and policies planning in the region. The aim of this study was to find the predictors of CAD in patients who underwent coronary angiography (CA), the gold standard diagnostic test at the unique cardiac catheterization center in Cameroon.

Methods: Medical files of all patients who underwent CA at Shisong Cardiac Centre (SCC) between March 2010 and February 2017 were analyzed for risk factors and CA results. Comparisons were made using the Chi-square and Fischer's exact tests for frequencies and student *t*-test for means. The logistic regression model was used for multivariate analysis. Data was collected and analyzed using Epi Info 7.2.1.0.

Results: Of 250 patients included in the study, 172 (68.80%) were males. Their mean age was 54.59±10.40 years. Most patients, 213 (85.20%) lived in an urban setting. The prevalence of CAD was 28.8%. The group of patients with CAD compared with those without CAD had a higher statistically significant proportion of males (86.11%, P<0.001), hypertension (70.83%, P<0.001), dyslipidemia (51.39%, P<0.001), diabetes (31.94%, P<0.001) and obesity (30.56% P=0.006). In multivariate analysis; diabetes, hypertension, dyslipidemia and male gender remained significant predictors of CAD. We, however, found no association between family history of CAD, smoking and age and CAD. Among patients with CAD, 33 (45.83%) had two cardiovascular risk factors (CVRFs), 20 (27.78%) had one CVRF, 14 (19.44%) had three CVRF and 2 (2.78%) had four CVRF.

Conclusions: In our study, CAD affects the generation of breadwinners, predominantly males living in urban areas. Diabetes, hypertension, male gender and dyslipidemia are strong predictors of CAD in Cameroon. With several studies showing a widespread prevalence of these risk factors in Cameroon, CAD might not be as rare as previously believed.

Keywords: Coronary artery disease (CAD); myocardial infarction; angiography; Africa; Shisong Cardiac Centre (SCC)

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Introduction

Coronary artery disease (CAD) is the number one cause of death globally, and yet is among the leading causes of disease burden in developing countries (1,2).

While there have been drop-in death rates from CAD and other non-communicable diseases in the western world in the past two decades, the reverse has been the case in Africa (3). This is partly due to the rapid epidemiological and demographic transition in sub-Sahara Africa (SSA). In 1990, the proportion of Africans living in urban areas was 31%, it increased to 40% in 2014 and is projected to hit 56% in 2050, with an annual average rate of change of 1.1% (4). In parallel, the number of people with hypertension in SSA increased from 54.6 million in 1990 to 92.3 million in 2000, and 130.2 million in 2010 and is projected to hit 216.8 million by 2030 (5). These changes have increased tremendously the incidence of cardiovascular diseases, including stroke and CAD in SSA (3,6).

The INTERHEART Africa study which included a survey from 9 countries in Africa including Cameroon from 1999 to 2003 found out that hypertension, smoking, diabetes, abdominal obesity and dyslipidemia were the major risk factors of CAD in sub-Saharan Africa and they contributed a population-attributable risk of about 90% for acute myocardial infarction (6). These findings were consistent with those of the global INTERHEART study. This can be explained by the fact that risk factors are pathogenetically the same despite variations in vulnerabilities to CAD in different ethnic groups, hence its global affliction (3).

Despite the widely established CAD risk factor burden in SSA, there is still a lack of reliable data on its epidemiology. In Cameroon, Kingue and colleagues between 1992 and 1997 measured the prevalence of CAD at 1.53% (7). The CORONAFRIC study, a multicenter survey in 13 sub-Saharan African countries, found an incidence rate of 3.18% (103/3,243) (8). These studies amongst other earlier surveys on the topic give the impression that although the prevalence of CAD is rising, CAD is still relatively rare in SSA (7,9). Potential reasons for this relatively low prevalence include an early epidemiological transition towards non-communicable diseases (10,11) and under-diagnosis. Indeed, various diagnostic tests including conventional invasive coronary angiography (CA) used in the diagnosis of CAD are still luxurious, unavailable and unaffordable in SSA. Most of SSA suffers from lack of diagnostic facilities and an inadequate number of physicians, which are key to a proper diagnosis of CAD (3,10). Some have suggested that if a more intense approach, legislative changes and the control of risk factors is not made timely, Africa might be facing a CAD epidemic (12).

A better understanding of the epidemiology of CAD in SSA is important to refine strategies that would help prevent a CAD epidemic in this region of the world. We aim to investigate the predictors of CAD in patients who underwent CA at the current unique cardiac catheterization center in Cameroon.

Methods

Study design and duration

This was a hospital-based retrospective study carried out between February and April 2017.

Study setting

The study was carried out at the St. Elizabeth General Hospital Cardiac Centre (SGHCC), Kumbo in Cameroon. The Shisong Cardiac Centre (SCC) is the only cardio-surgical Centre in Central Africa, equipped with ultra-modern technologies and offers a wide range of cardiology services including cardiac catheterization.

Study population and sampling

A consecutive, non-probabilistic sampling method was used. We reviewed files of patients who underwent CA at the SCC between March 2010 and February 2017. The patients were grouped into those with CAD and those without CAD following CA. The group with CAD were those whose coronary angiograms showed a stenosis >50% on one or more epicardial coronary segments, while the group without CAD were those whose angiograms were normal.

Ethical approval

Ethical approval was obtained from the Institutional Review Board (IRB) of the Faculty of Health Sciences, University of Buea (Application number 494-04).

Study procedure and tools

Patient data were collected from inpatient hospital records, patient electronic records, referral forms, catheterization

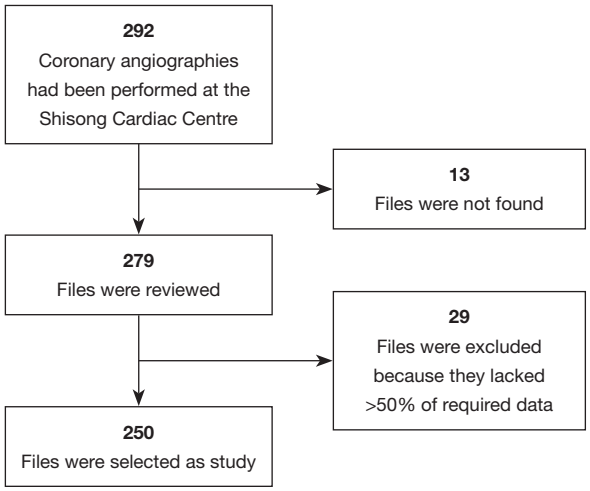

Figure 1 Flowchart of inclusion of participants.

registers and reports, and the electronic angiogram results.

Risk factors assessed were: age, male gender, diabetes mellitus, hypertension, dyslipidemia, obesity, smoking, family history of CAD, prior history of angina, prior history of MI, and previous cardiac catheterization. This data was retrieved from case notes. Hypertension was defined as blood pressure ≥140/90 mmHg or self-reported use of antihypertensive medication. Positive family history for CAD was defined as ischemic heart disease in the father or a brother diagnosed before age 55 years and in the mother or a sister diagnosed before age 65 years. Dyslipidemia was based on the chronic use of anti-lipid drugs or previously documented diagnosis from medical records or established during the hospital stay by fasting low-density lipoprotein (LDL) level ≥130 mg/dL. Diabetic patients were those with the chronic use of anti-hyperglycemic drugs or previously documented diagnosis from medical records or established during the hospital stay by repeated fasting blood glucose estimation to be ≥126 mg/dL. Smoking was determined as the use of cigarette, either presently or in the past. A body mass index (BMI) >30.0 was considered as obesity. BMI was calculated as weight (kilograms) divided by height (square meters). BMI was used as an indicator of overall adiposity.

Angiographic data collected were analyzed and documented by the interventional cardiologist. The presence of CAD was defined as a stenosis >30% on one or more epicardial coronary segments and was diagnosed visually from the SIEMENS ACOM PC 6.0 VA03A System. Patients were grouped as having single vessel disease (SVD), double vessel disease (DVD) or triple vessel disease (TVD) according to the number of vessels involved. Patients were also grouped according to the type of artery involved. Stenosis of a vessel was categorized as mild (≤50%), moderate (51–70%) and severe (>70%).

Statistical analysis

Data were analyzed using Epi Info 7.2.1.0. Continuous variables were measured as means ± standard deviations and categorical data as percentages, with the corresponding 95% confidence intervals (CI). Comparisons of continuous data were made using the Student *t*-test, and those of categorical data using the Chi-square test or Fischer's exact test. Multivariate analysis was done using a logistic regression model and presented as odds ratio (OR) with 95% CI. Statistical significance level was set at <0.05.

Results

Inclusion of participants

In total, out of 292 files of patients who underwent CA between March 2010 and February 2017, 279 files were reviewed and 250 were included into the study, 29 files were excluded because they lacked more than 50% of required data (*Figure 1*). All patients underwent the procedure electively.

Indications for CA

Majority of patients underwent CA for suspicion of CAD (73.2%) followed by those who did it as pre-op workup for heart surgery (26%). In two cases, CA was done as an adjoin work up for pulmonary hypertension and abdominal aortic aneurysm.

General characteristics of the study population

Out of the 250 patients who underwent CA, 72 patients (28.8%) had CAD. Among patients who had CAD after CA, 69 (95.8%) were those with suspected CAD and 3 (4.17%) were those who did it as pre-op workup for surgery. For patients who underwent CA with an indication of suspected CAD, most patients had NSTEMI/UA 107 (58.57%), followed by STEMI 39 (21.43%), ischemic cardiomyopathy 18 (9.84%) and chronic stable angina 10 (5.46%).

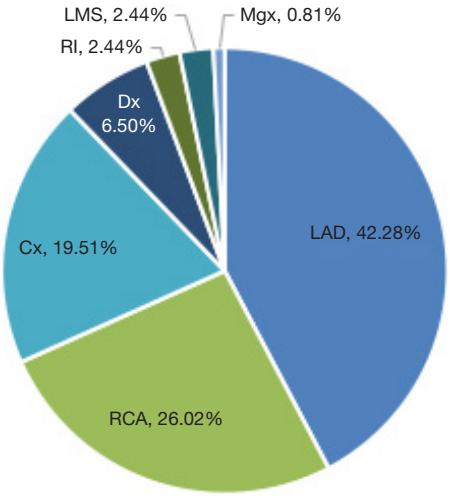

Figure 2 Distribution of lesion by the arteries involved. Dx, diagonal artery; LMS, left main stem; RCA, right coronary artery; Cx, circumflex artery; LAD, left anterior descending artery; Mgx, marginal artery; RI, ramus intermedius.

There was a male predominance of 172 (68.8%). There was no statistically significant difference in mean age between patients with 55.32±8.59 and without CAD 54.32±11.06. Majority of the patients, 213 (85.20%) were from an urban setting, most patients came from the towns of Yaounde, Douala and Bamenda.

Angiographic findings

Out of the 123 vessels affected, the most common were: left anterior descending 52 (42.28%), right coronary artery 32 (26.02%) and circumflex artery 24 (19.51%) (*Figure 2*).

Assessing severity based on the number of vessels affected, SVD was found in 34 (46.58%) patients and DVD in 23 (31.51%), TVD in 13 (18.05%) and left main disease in 3 (4.17%).

Based on the degree of luminal stenosis in the 123 lesions identified, 102 (82.93%) were severe (>70%), 13 (10.57%) were mild (<50%) and 7 (5.69%) were moderate (≥50–69%).

Distribution of risk factors in the overall population and comparison between patients with and without CAD

Overall, prevalent risk factors identified in our study population were hypertension (120; 48.00%), dyslipidemia (55; 22.00%), diabetes (41; 16.40%), obesity (50; 20.00%), smoking (5; 2.00%) and family history of CAD (3; 1.20%). Thirty-six (14.40%) patients presented with prior history of angina, prior history of MI was noted in 15 (6.00%) cases, and prior history of coronary angioplasty in 6 cases (2.40%) (*Table 1*).

In univariate analysis, comparing risk factors between patients with and without CAD, diabetes, hypertension, dyslipidemia, obesity, prior history of angina, prior history of MI, prior history of coronary angioplasty and male gender, were significant predictors of CAD. We, however, found no association between smoking and age and CAD (*Table 1*).

Diabetes (OR =4.59, 95% CI: 1.99–10.62), dyslipidemia (OR =9.72 95% CI: 4.59–20.64), male gender (OR =3.90, 95% CI: 1.65–9.19) and hypertension (OR =2.47, 95% CI: 1.24–4.93) all remained significant predictors of CAD in multivariate analysis (*Table 2*).

Global risk factor assessment

Traditional cardiovascular risk factors assessed in the study were hypertension, diabetes, dyslipidemia, obesity and smoking. In patients with CAD, the majority had two CVRFs (33; 45.83%), one CVRF (20; 27.78%) and three CVRF (14; 19.44%). Among patients without CAD, most patients (90; 50.56%) had no CVRF, (49; 27.53%) had one CVRF and (32; 17.98%) had two CVRF (*Figure 3*).

Discussion

Although CAD is the leading cause of death worldwide, there is still a lot of uncertainty about the extent to which the disease affects sub-Saharan Africans. Previous studies (7,8,13,14) indicated that the disease is rare in our milieu but more recent studies (6) have shown a remarkable increase in the prevalence of this condition. With the established increase in the prevalence of CAD risk factors and the rapid epidemiological transition in SSA, it is expected that the prevalence of CAD should proportionately rise as well. It is even suggested that uncontrolled cardiovascular risk factors have a greater influence on the burden of cardiovascular disease in Africa compared to elsewhere (6).

In this study, we sought to find the predictors of CAD in patients who underwent CA at the SCC.

We found that hypertension, diabetes, dyslipidemia and male gender were significantly associated with CAD. The prevalence of CAD in patients undergoing CA in Cameroon was 28.8%. Our study is the first in the Central

Table 1 Univariate analysis

Variable	Total (N=250) (%)	With CAD (n=72) (%)	Without CAD (n=178) (%)	P value
Mean age	54.59±10.40	55.23±8.59	54.32±11.06	0.532
Urban	213 (85.20)	65 (90.28)	148 (83.15)	0.150
Male gender	172 (68.80)	62 (86.11)	110 (61.80)	<0.001
Diabetes	41 (16.40)	23 (31.94)	18 (10.11)	<0.001
Dyslipidaemia	55 (22.00)	37 (51.39)	18 (10.11)	<0.001
Hypertension	120 (48.00)	51 (70.83)	69 (38.76)	<0.001
Obesity	50 (20.00)	22 (30.56)	28 (15.73)	0.006
Smoking	5 (2.00)	3 (4.17)	2 (1.12)	0.145
Family history CAD	3 (1.20)	2 (2.78)	1 (0.56)	0.200
Prior history of Angina	36 (14.40)	22 (30.56)	14 (7.87)	<0.001
Prior history of MI	15 (6.00)	10 (13.89)	5 (2.81)	<0.001
Prior history of CABG,	1 (0.40)	1 (1.39)	0	0.121
Prior history of coronary angioplasty	6 (2.40)	5 (6.94)	1 (0.56)	0.001

CAD, coronary artery disease; MI, myocardial infarction; CABG, coronary artery bypass graft.

Table 2 Multivariate analysis

Variable	Odds ratio	95% CI	P value
Diabetes	4.59	1.99–10.62	<0.001
Dyslipidaemia	9.72	4.59–20.64	<0.001
Hypertension	2.47	1.24–4.93	0.010
Male gender	3.90	1.65–9.19	<0.001

CI, confidence interval.

African Region to evaluate these risk factors in patients who underwent CA. This will foster the understanding of the role of traditional risk factors in CAD in this area.

The four risk factors identified to be predictive of CAD in our study are amongst the five risk factors identified by the INTERHEART Africa study to be responsible for a population-attributable risk of about 90% for acute MI in sub-Saharan Africa (6). These risk factors are also consistent with those found by the global INTERHEART Study (15). Similar risk factors have earlier been described in Yaoundé by Kingue *et al.* (7), in Kenya by Shavadia *et al.* (16) and in Ivory Coast by N'Guetta *et al.* (17). Most patients (85.2%) who underwent CA were from an urban environment where there is a remarkably higher level of westernization of lifestyles, a longer life expectancy and a lower level of physical activity. Therefore, the prevalence of these risk factors in our study is not surprising especially in the group of patients with CAD. Compared with earlier findings (7), our study suggests an increasing trend in the relationship between traditional risk factors and CAD in Cameroon.

The strong association between diabetes and CAD are in keeping with previous findings that insulin resistance, hyperinsulinemia and glucose intolerance appear to promote atherosclerosis (18-20). For example, in the Framingham Heart Study diabetes, impaired glucose tolerance, and high normal levels of glycosylated hemoglobin were powerful contributors to atherosclerotic cardiovascular events (21).

Hypertension being predictive of CAD is not a surprise as hypertension is a significant coronary risk factor with a prevalence of 20.8% in urban settings in Cameroon (22).

The relationship between dyslipidemia and CAD was significant, and this is consistent with western data. This finding concurred with the Framingham Heart Study, which found that the higher the cholesterol level, the greater the risk of CAD (21). A stratified analysis of the various types of dyslipidemia could not be drawn from this study, because the data was retrospective.

The association between obesity and CAD in this study is consistent with findings by Kamadjeu *et al.* In a large survey of adults aged ≥15 years in four main Cameroonian

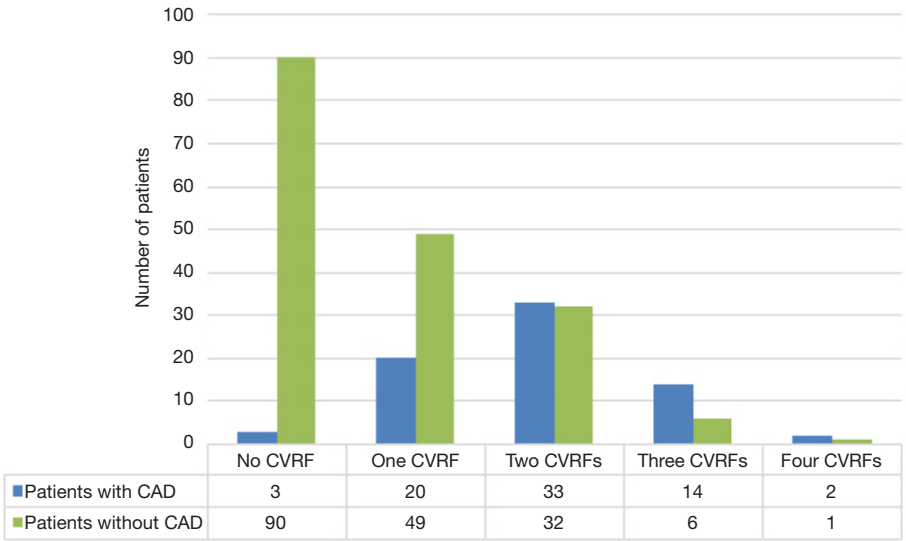

Figure 3 Number of risk factors per patient in the general study population and among patients with CAD. CVRF(s), cardiovascular risk factor(s), CAD, coronary artery disease.

towns (Yaoundé, Douala, Garoua and Bamenda), they found that greater than 25% of urban men and almost half of the urban women were either overweight or obese, with 6.5% of men and 19.5% of women being obese (23). These results were also consistent with those found in Yaoundé by Kingue *et al.*, obesity was the most common CAD risk factor, with a prevalence of 80% (7).

The indifference of smoking and family history of CAD between the two groups is probably due to the very low prevalence of these risk factors in the study population. This could also be due to the fact that the unavailability and the cost of diagnostic facilities would have made it more difficult to know about the family history of CAD in relatives of the affected patients.

The mean age in patients with CAD of 54.59±10.40 was similar to 53 and 54.37 observed in Yaoundé and Nairobi respectively (7,24). The mean age of our patients was about 10 years younger than that earlier observed in studies in the developed world (25).

With a prevalence of 28.8%, this value is lower than 36.1% and 75.7% found in similar studies in Nairobi and Ethiopia respectively (24,26).

Study strengths and limitations

Some limitations were inherent in this study, by default or due to its very design. First, the evaluation method of the actual coronary angiograms and the subsequent classification as normal, or abnormal. The coronary angiogram remains the gold standard diagnostic test for the evaluation of epicardial atherosclerotic CAD. The standard method of interpreting the severity of stenosis continues to be visual assessment or "eyeballing" and may affect diagnosis. However, the subjective measurement applied equally to both groups studied, such that it did not affect the comparison results. Also, the high technical quality of experts in our centre, as well as diagnostic equipment, contributed to a better and reproducible assessment of the coronary angiograms. Another limitation is the retrospective nature of the study and the possibility of having missed information from the previous medical records. Despite the aforementioned limitations, this study provides useful data that could be used in setting new research agendas as well as assist in tailoring health policies in the country.

Conclusions

CAD in our environment affects largely urban dwellers in their 5th decade, occurring predominantly in males. Risk factors that were most prevalent and strongly associated with the presence of CAD in this population were classical including hypertension, diabetes, dyslipidaemia and male gender. These findings are vital for the formulation of cost-

saving strategies to best manage the rising figure of CAD in Cameroon.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/jxym.2019.06.01). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was approved by the ethical committee of the Faculty of Health Sciences of the University of Buea (2017/003/UB/SG/IRB/FHS), application number 494-04. The study was carried out in accordance with the declarations of Helsinki (as revised in 2013).

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