Prevalence and components of metabolic syndrome in HIV-infected patients at the Tiko Central Clinic and Cottage Hospital in Cameroon

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Received: 02 August 2020
Accepted: 05 September 2020

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ABSTRACT

Background: HAART and HIV related metabolic syndrome (MS) is associated with increased cardiovascular risk in aging HIV patients. This study was aimed at comparing the prevalence of MS between HIV-infected patients on HAART and apparently healthy HIV-uninfected individuals and identifying key MS components in these groups of subjects.

Methods: This was a hospital-based case-control study. The cases were HIV sero-positive individuals on HAART for at least 6 months and controls were HIV sero-negative individuals.

Results: 74/135 (54.8%) participants were females amongst which 53/75 (70.7%) and 21/60 (35%) were in the test and control groups respectively. The prevalence of MS was insignificantly higher in HIV-infected patients on HAART than in control subjects according to the IDF (22.7% versus 20%, p=0.834) and NCEP ATP III criteria (18.7% versus 18.3%, p=1.000) respectively. The most prevalent components of MS in HIV-infected patients on HAART were low HDL-c (100%), abdominal obesity (IDF: 68%, ATP III: 32%), and hypertension (28%). Multivariate analysis of MS components in HIV-infected patients on HAART revealed that hypertension (OR: 15.996, 95% CI: 3.385-75.585; p≤0.001) and high blood glucose (OR: 10.760, 95% CI: 1.642-70.505; p=0.013) were associated with MS. Significantly more HIV-infected females were seen with abdominal obesity than HIV-infected males (86.8% versus 4.5%, p≤0.001).

Conclusions: Abdominal obesity is a driving component of MS in HIV-infected patients particularly among females and hypertension is a prevalent and predictor component of MS among HIV patients.

Keywords: Abdominal obesity, HAART, HIV, Metabolic syndrome, Prevalence

INTRODUCTION

Highly active anti-retroviral therapy (HAART) used by human immunodeficiency virus (HIV) patients since the mid-1990’s has led to a significant drop in HIV related mortality.1 Nevertheless, metabolic disorders (hypertriglyceridaemia, reduced HDL cholesterol, abdominal obesity, hypertension, and insulin resistance) jointly termed metabolic syndrome is linked to HIV and HAART and associated with elevated cardiovascular disease risk in these patients as they age.2

A systematic review and meta-analysis study conducted in South Africa by Olamide and associates recently demonstrated that the prevalence of metabolic syndrome in sub-Saharan Africa is 12% for HIV-uninfected individuals and 21.5% for HIV infected subjects and this difference is statistically significant.3 This study further mentioned that most studies in Africa have reported hypertension and high triglycerides as common components of metabolic syndrome among HIV-infected patients.3 Kim et al in another systematic review and meta-analysis study conducted in Africa in 2016 showed...
that significantly more ART users had metabolic syndrome than non-ART users among HIV-infected individuals. Recent studies conducted out of Africa have reported that the driving components of metabolic syndrome in HIV patients on HAART are low HDL cholesterol and high triglycerides. In contrast, central obesity and high triglycerides were reported by Alfred et al in Kenya though the finding of Agete et al in Ethiopia is in support of findings reported out of Africa.

In Cameroon, HAART coverage has drastically risen from 26% in 2013 to 55% in 2018. However, limited information on the prevalence and most common components of metabolic syndrome in HIV-infected patients exists in Africa especially in Cameroon. The aim of this study was to compare the prevalence of metabolic syndrome between HIV-infected patients on HAART and HIV-uninfected individuals and identify the key components of metabolic syndrome in both groups of subjects attending the Tiko Central Clinic and Cottage Hospital in Cameroon. This study shall provide information on the most prevalent components of metabolic syndrome in HAART-experienced HIV patients and HIV-uninfected individuals in Cameroon in an attempt to reduce the rising burden of metabolic syndrome particularly in HIV sero-positive patients on HAART.

METHODS

Study duration, setting, and sampling technique

This study was conducted over a four-month period, from March to June 2016, at the treatment center of people living with HIV/AIDS, at the Tiko Central Clinic and Cottage Hospital. Over 1500 patients receive their treatment at this center. The patients attend the clinic once a month for clinical evaluation and refill of antiretroviral therapy (ART). A consecutive sampling technique was employed to recruit eligible participants. The goals of the study, research procedure, risks and benefits of this research were explained to the study participants and only consenting individuals were included in the study.

Ethical considerations

Ethical approval was obtained from the Faculty of Health Sciences Institutional Review Board (FHSIRB) of the University of Buea, Cameroon (reference number: 2014-02-0514). Administrative authorizations were obtained from the following authorities: regional delegate of public health in Buea, district medical officer in Tiko, director of human resource in Limbe, and from the chief medical officer in Tiko.

Inclusion and exclusion criteria

The study population included all adult HIV sero-positive and HIV sero-negative persons attending the Tiko Central Clinic and Cottage Hospital for routine health assessment. We included all people living with HIV/AIDS PLWHA aged at least 25 years and excluded patients on highly active anti-retroviral therapy (HAART) for less than 6 months including defaulters of treatment regimen, pregnant and lactating women, those with documented hypertension, diabetes and dyslipidaemia before commencing HAART and those with any acute illness that required immediate medical/surgical treatment or admission. HAART was defined as the use of ≥2 nucleoside reverse transcriptase inhibitors (NRTIs) and at least one non-nucleoside reverse transcriptase inhibitor (NNRTI); or ≥2 NRTIs and at least one protease inhibitor (PI).

Administration of questionnaires

A structured questionnaire was used to collect socio-demographic data from the participants while their medical records were accessed to obtain clinical information such as their recent CD4+ T cell count, HIV status, type and duration of HAART regimen. Following a 10 minute resting period, while a participant was seated, 2 blood pressure measurements (systolic and diastolic) were taken in the left arm with an interval of 3 minutes using a wrist digital blood pressure monitor LD-732A (Scian, Shanghai, China). The average blood pressure reading was calculated and used as the participants’ actual blood pressure. Waist circumference (WC) was measured to the nearest 0.1 cm with patients wearing light clothing at the midpoint between the lowest rib and the iliac crest using an inelastic tape in light contact with but not compressing the skin. Hip circumference (HC) was also measured with an inelastic tape around the widest portion of the buttocks in light clothing to the nearest 0.1 cm. The waist-to-hip ratio was then calculated by dividing the WC by HC. The weight of each participant was measured using a Kinlee calibrated weighing scale (Healthometer, Florida, USA) in light clothing, with shoes off. Height was measured using a stadiometer to the nearest 0.1 cm.

Sample collection and analysis

Following this, 3 ml of venous blood was obtained, under strict aseptic conditions, after an overnight fast (8-12 hours). Fasting blood glucose was measured using the Accu Chek® Compact Plus glucometer (Roche Diagnostics GmbH, Mannheim, Germany) at the spot. Serum was then collected and stored in eppendorf tubes until analysis. Lipid profiles of the participants’ sera were later measured in batches using a MINDARY spectrophotometer, a BA-88A semi-auto chemistry analyser with touch-screen and pop-up keypad (Mindray Bio-Medical Electronics, Shenzhen, China) according to the manufacturer’s instruction. Triglycerides level was measured based on the Glycerol phosphate oxidase method. HDL-C level was measured based on the Chemical precipitation technique in the presence of phosphotungstic acid and Mg ions.
Definition of operational terms

In accordance with the US National Cholesterol Education Program, Adult Treatment Panel III (NCEP-ATP III) guidelines, abnormal lipid profile was defined as TC ≥ 200 mg/dl, HDL-c < 40 mg/dl, LDL-c ≥ 130 mg/dl, TG ≥ 150 mg/dl and TC/HDL-c ratio ≥ 5. Abdominal obesity was defined as WC >102 cm in men or WC >88 cm in women. Overweight was defined as body mass index (BMI) of 25-29.9 kg/m² and obesity, BMI of ≥ 30 kg/m². Hypertension was defined as SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg or current use of anti-hypertensive drug and diabetes was defined as FBS ≥ 126 mg/dl or diabetes mellitus; II) Elevated triglycerides: ≥150 mg/dl or treatment; III) reduced HDL-c: <40 mg/dl in men and <50 mg/dl in women; IV) Elevated blood pressure (hypertension): SBP ≥ 130 mmHg or DBP ≥ 85 mmHg or treatment.¹⁹ According to IDF criteria, metabolic syndrome was defined as having abdominal obesity (waist circumference of 80 cm in women and 94 cm in men or BMI ≥ 30 kg/m²) in addition to at least two of the following components: I) Elevated fasting glucose: ≥100 mg/dl or diabetes mellitus; II) Elevated triglycerides: ≥150 mg/dl or treatment; III) reduced HDL-c: <40 mg/dl in men and <50 mg/dl in women or treatment; IV) Elevated blood pressure (hypertension): SBP ≥ 130 mmHg or DBP ≥ 85 mmHg or treatment.¹⁹

Statistical analysis

Data analysis was performed on SPSS version 21.0 (IBM Corporation, New York) using Chi-square (χ²) test and multivariate logistic regression.

RESULTS

A total of 135 participants were recruited, 75 (55.6%) were HIV sero-positive amongst which 53 (70.7%) were females and 60 (44.4%) were HIV sero-negative amongst which 39 (65%) were males. The mean age was 42.04±9.61 years in the HIV sero-positive group and 39.00±11.3 years in the control group. The median duration on HAART was 42.0 (18-82) months (Table 1).

Table 1: Demographic characteristics of study population.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>HIV sero-positive group (n=75)</th>
<th>HIV sero-negative group (n=60)</th>
<th>Total (n=135)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>22 (29.3)</td>
<td>39 (65.0)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>53 (70.7)</td>
<td>21 (35.0)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>&lt;40 years</td>
<td>34 (45.3)</td>
<td>39 (65.0)</td>
</tr>
<tr>
<td></td>
<td>≥40 years</td>
<td>41 (54.7)</td>
<td>21 (35.0)</td>
</tr>
<tr>
<td>Occupation</td>
<td>Salary employed</td>
<td>43 (57.3)</td>
<td>45 (75.0)</td>
</tr>
<tr>
<td></td>
<td>Self employed</td>
<td>22 (29.3)</td>
<td>12 (20.0)</td>
</tr>
<tr>
<td></td>
<td>Unemployed</td>
<td>8 (10.7)</td>
<td>2 (3.3)</td>
</tr>
<tr>
<td></td>
<td>Retired</td>
<td>2 (2.7)</td>
<td>1 (1.7)</td>
</tr>
<tr>
<td>Marital status</td>
<td>Married/Cohabitation</td>
<td>38 (50.7)</td>
<td>33 (55.0)</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>32 (42.7)</td>
<td>23 (38.3)</td>
</tr>
<tr>
<td></td>
<td>Divorced</td>
<td>5 (6.7)</td>
<td>4 (6.7)</td>
</tr>
<tr>
<td>Level of education</td>
<td>No formal education</td>
<td>4 (5.3)</td>
<td>5 (8.3)</td>
</tr>
<tr>
<td></td>
<td>Primary</td>
<td>39 (52.0)</td>
<td>28 (46.7)</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>28 (37.4)</td>
<td>18 (30.0)</td>
</tr>
<tr>
<td></td>
<td>Tertiary</td>
<td>4 (5.3)</td>
<td>9 (15.0)</td>
</tr>
<tr>
<td>CD4+ T cell count* (cells/µl)</td>
<td>&lt;250</td>
<td>17 (23.6)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>250-500</td>
<td>27 (37.5)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>&gt;500</td>
<td>28 (38.9)</td>
<td>-</td>
</tr>
<tr>
<td>Duration of HIV infection (months)</td>
<td>Median (IQR)</td>
<td>63 (28-67)</td>
<td>-</td>
</tr>
<tr>
<td>Duration of HAART (months)</td>
<td>Median (IQR)</td>
<td>42 (18-82)</td>
<td>-</td>
</tr>
<tr>
<td>Type of HAART regimen</td>
<td>TDF+3TC+EFV</td>
<td>47 (62.7)</td>
<td>-</td>
</tr>
</tbody>
</table>

Continued.
The prevalence of metabolic syndrome was insignificantly higher in the HIV-infected patients on HAART than in the HIV-uninfected subjects according to the IDF (22.7% versus 20%, p=0.834) and NCEP ATP III criteria (18.7% versus 18.3%, p=1.000) respectively as shown in Table 2.

The most prevalent components of metabolic syndrome in the HIV-infected participants were low HDL-c (100%), abdominal obesity (IDF: 68%, ATP III: 32%), and hypertension (28%). However, only low HDL-c (100% versus 70%, p≤0.001) and abdominal obesity (IDF: 68% versus 35%, p≤0.001) were significantly higher in the HIV-infected participants than in those without HIV respectively (Table 3).
The most prevalent components of metabolic syndrome in HIV sero-positive females were low HDL-c (100%), abdominal obesity (86.8%), and hypertension (22.6%). Nevertheless, significantly more HIV-infected females were seen with solely abdominal obesity than in HIV-infected males (86.8% versus 4.5%, p<0.001). High blood glucose was more frequently detected in HIV-infected females relative to HIV-uninfected males with no statistical significance (86.8% versus 4.5%, p=0.866)

Table 4. Multivariate analysis of the components of metabolic syndrome in HIV-infected patients on HAART revealed that hypertension and high blood glucose were the only components associated with metabolic syndrome. HIV patients with hypertension had a higher odds of metabolic syndrome (OR: 15.996, 95% CI: 3.385-75.585) compared to those with high blood glucose (OR: 10.760, 95% CI: 1.642-70.505) Table 5.

Table 5: Multivariate analysis of metabolic syndrome components in the HIV infected participants.

<table>
<thead>
<tr>
<th>Metabolic syndrome components</th>
<th>HIV-infected Without MS (n=57)</th>
<th>HIV-infected With MS (n=18)</th>
<th>Total (n=75)</th>
<th>OR (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>High blood glucose</td>
<td>3 (5.3)</td>
<td>8 (44.4)</td>
<td>11 (14.7)</td>
<td>10.760 (1.642-70.505)</td>
<td>0.013</td>
</tr>
<tr>
<td>Hypertension</td>
<td>9 (15.8)</td>
<td>12 (66.7)</td>
<td>21 (28.0)</td>
<td>15.996 (3.385-75.585)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Low HDL-c</td>
<td>57 (100)</td>
<td>18 (100)</td>
<td>75 (100)</td>
<td>2.221 (2.221-2.221)</td>
<td>-</td>
</tr>
<tr>
<td>High TG</td>
<td>2 (3.5)</td>
<td>1 (5.6)</td>
<td>3 (4.0)</td>
<td>2.407 (0.094-61.780)</td>
<td>0.596</td>
</tr>
<tr>
<td>Abdominal obesity (IDF criteria)</td>
<td>33 (57.9)</td>
<td>18 (100)</td>
<td>51 (68.0)</td>
<td>65471356.87 (0.000-no value)</td>
<td>0.990</td>
</tr>
</tbody>
</table>

Abbreviations: MS, Metabolic Syndrome; IDF, International Diabetes Federation; TG, Triglyceride; HDL-c, High Density Lipoprotein cholesterol.

**DISCUSSION**

This study reveals an insignificantly higher prevalence of metabolic syndrome in HIV-infected patients on HAART than in HIV-uninfected persons. Moreover, it demonstrates that the most common components of metabolic syndrome in HIV sero-positive patients are low HDL-c, abdominal obesity and hypertension among which only hypertension is a predictor component. Lastly, it is highlighted in this research that more HIV-infected females have high blood glucose and abdominal obesity compared to HIV-infected males with a significant difference observed only for abdominal obesity.

The reported insignificantly higher prevalence of metabolic syndrome in the HIV-infected on HAART than in HIV sero-negative persons is in conformity with the findings (17/76 22.4% versus 14/70 20.0%) reported by Jyothi et al in India and inconsistent with the findings reported by: Herbert et al in Cameroon in 2014 who reported the prevalence of metabolic syndrome in ART exposed HIV patients, ART naïve HIV patients and sero-negative individuals, South African investigators in 2019 who reported the prevalence rates of metabolic syndrome and its components in HIV patients and HIV-uninfected subjects in a systematic review and meta-analysis study, and Paolo et al in 2007 in Italy who compared the prevalence of metabolic syndrome (MS) in HIV-positive patients with that from a sample of a general Italian population. This could be due to the differences in sample size.

Our study demonstrated that low HDL-c, abdominal obesity and hypertension are the most prevalent components of metabolic syndrome in HIV-infected patients. This finding is in support of the findings revealed by Gibson et al in 2014 who estimated the prevalence and risk factors for metabolic syndrome (MetS) among HIV positive patients on antiretroviral therapy (ART) in Tanzania. Conversely, our finding is not in line with findings estimated by: Henriette et al in Cameroon whose reports in 2014 on the prevalence of metabolic syndrome and its individual components among HIV-infected Cameroonians revealed that hypertriglyceridaemia, low HDL-c and abdominal obesity are the most prevalent components of metabolic syndrome; Alfred et al in 2018 in Kenya who reported central obesity, high triglycerides, and high blood glucose after assessing the prevalence and risk factors for MetS among ART-naive and ART-experienced HIV-infected adults without preexisting cardiometabolic disorders in Western Kenya; Girma et al in 2020 in Southern Ethiopia who revealed hypertension, high blood glucose and central obesity after estimating and evaluating the magnitude of MS among ART exposed and ART naïve HIV-infected patients; and Herbert and colleagues in Cameroon in 2014 who reported hyperglycaemia, abdominal obesity and low HDL-c for HIV patients on first line ART and low HDL-c, abdominal obesity, and hyperglycaemia for those on second line ART after estimating the prevalence of MS in Cameroonian HIV-infected subjects receiving different combinations of HAART as well as HIV patients who had never received antiretroviral drugs. The observed differences might have stemmed from the following differences existing in our study: most HIV patients on HAART were exposed to efavirenz, shorter study duration, absence of HAART naïve HIV patients, smaller sample size, and younger HAART experienced HIV patients. Moreover, our finding is contradictory to findings reported out of...
Africa: Alvarez et al in Latin America revealed high triglycerides, low HDL-cholesterol, and high blood pressure (HBP); Laiz et al in Brazil reported low HDL-c, high triglycerides, and elevated waist-circumference; Paolo and colleagues in Italy reported high triglycerides, low HDL-c and hypertension; Sarita and associates in India revealed low HDL-c, high triglycerides, and high blood glucose. The difference in race between HIV patients on HAART within and without Africa might account for the discordant findings.

The sample size of HIV patients on HAART in this study was limited due to a short study duration and small number of these patients who visited the HIV/AIDS treatment center daily. Capillary blood glucose was measured by point of care testing and the use of Accu Chek® Compact Plus glucometer at the spot (Point Of Care) for the determination of blood glucose could slightly affect the results especially at low glucose concentration. Despite these limitations, this study is the first in Cameroon (to the best of our knowledge) which shows that Abdominal obesity is a driving component of metabolic syndrome in HIV-infected patients particularly among females and hypertension is a prevalent and predictor component of metabolic syndrome among HIV patients on HAART.

CONCLUSION

Metabolic syndrome is insignificantly more common in persons living with HIV than in those without HIV. Abdominal obesity is a driving component of metabolic syndrome in HIV-infected patients on HAART particularly among females and hypertension is a prevalent and predictor component of metabolic syndrome in these patients. HIV patients on HAART should be screened for these metabolic syndrome components and treated accordingly in order to reduce the risk of developing a cardiovascular disease.

ACKNOWLEDGEMENTS

The authors appreciate the contributions made by the Chief Medical officer and laboratory staff at the Tiko Central Clinic and Cottage Hospital. We are also grateful for the collaboration of the HAART treated HIV infected and HIV sero-negative participants in Tiko Central Clinic and Cottage Hospital.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Faculty of Health Sciences Institutional Review Board (FHSIRB) of the University of Buea in Cameroon

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