Prevalence of Metabolic Syndrome among Chronic Kidney Disease patients attending a tertiary hospital in Nigeria – a Cross - Sectional Study

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Abstract

Objective: Metabolic syndrome and chronic kidney disease are major public health challenges. This study aimed at determining the prevalence of metabolic syndrome among chronic kidney disease patients.

Methods: One hundred and sixty patients were enrolled. Glomerular filtration rates were estimated using the Cockcroft Gault formula. Metabolic syndrome was defined by the presence of ≥3 of the following: Central obesity (waist circumference of >102 cm in males or >88 cm in females); Hypertriglyceridemia >150 mg/dL, low HDL cholesterol (<40 mg/Dl in males and <50 mg/dL in females), Hypertension (>130/85mmHg), Fasting plasma glucose >100 mg/dL**.**

Results: The overall prevalence of metabolic syndrome was 67.5%, CKD stage 5 had the highest prevalence (85.1%) ($p = 0.165$). Prevalence among diabetics was 82% ($p < 0.000$). CKD stage and number of metabolic syndrome criteria positively correlated.

Conclusion: approximately seven out of every 10 CKD patients had metabolic syndrome. It was more associated with advanced CKD. Diabetics compared to non-diabetics were 1.5 times more predisposed.

Key words: Metabolic syndrome, chronic kidney disease, diabetes mellitus

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Received: June 24, 2018 *Accepted: August 4, 2018* *Published: September 30, 2018*

http://dx.doi.org/10.4314/rejhs.v6i3.2

Prévalence du syndrome métabolique chez les patients atteints d'insuffisance rénale chronique fréquentant un hôpital tertiaire au Nigeria - Une étude transversale.

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Abstrait

Objectif: Le syndrome métabolique et les maladies rénales chroniques constituent des défis majeurs en matière de santé publique. Cette étude visait à déterminer la prévalence du syndrome métabolique chez les patients atteints d'insuffisance rénale chronique.

Méthodes: Cent soixante patients ont été recrutés. Les taux de filtration glomérulaire ont été estimés à l'aide de la formule de Cockcroft Gault. Le syndrome métabolique était défini par la présence de ≥3 des cas suivants: obésité centrale (tour de taille> 102 cm chez les mâles ou> 88 cm chez les femelles); Hypertriglycéridémie> 150 mg / dL, cholestérol HDL faible (<40 mg / Dl chez les hommes et <50 mg / dL chez les femmes), hypertension (> 130/85 mmHg), glycémie plasmatique à jeun> 100 mg / dL.

Résultats: La prévalence globale du syndrome métabolique était de 67,5%, le stade 5 de la maladie rénale chronique était le plus élevé (85,1%) (p = 0,165). La prévalence chez les diabétiques était de 82% (p <0,000). Stade CKD et nombre de critères du syndrome métabolique corrélés positivement.

Conclusion: environ 7 patients atteints de néphropathie chronique sur 10 avaient un syndrome métabolique. Il était plus associé à la maladie rénale chronique. Les diabétiques comparés aux non-diabétiques étaient 1,5 fois plus prédisposés.

Mots-clés: syndrome métabolique, maladie rénale chronique, diabète sucré

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INTRODUCTION

The metabolic syndrome (MetS) and chronic kidney disease (CKD) are two major public health challenges. Metabolic syndrome is a cluster of biochemical and physical abnormalities which include central obesity, hypertriglyceridemia, low HDL cholesterol, hypertension, and Type 2 diabetes .The presence of the metabolic syndrome confers a risk for cardiovascular disease on an individual as its individual components are risk factors in themselves for cardiovascular events. The National Cholesterol Education Program/Adult Treatment Panel (NCEP ATP) III 2001 criteria defines the metabolic syndrome as the presence of >3 of the following: Central obesity (waist circumference of >102 cm in males or >88 cm in females); Hypertriglyceridemia >150 mg/dL, low HDL cholesterol (<40 mg/Dl in males and <50 mg/dL in females), Hypertension (>130/85mmHg), Fasting plasma glucose >100 mg/dL or previously diagnosed Type 2diabetes or being on specific medications for these conditions (1).

CKD on the other hand, is defined as a glomerular filtration rate (GFR) less than 60mL/min/1.73m^2 and/or kidney damage determined by abnormal findings in urine, such as proteinuria, albuminuria, haematuria, abnormal imaging, and/or histology, lasting for 3 months or more (2). It has also been noted to be a cardiovascular risk factor. Mortality in CKD patients is reported to be higher than in the general population (3).

The relationship between CKD and MetS may be two way as MetS may contribute to the progress of CKD and therefore make the risk of CVD in CKD at any stage, higher (4,5). MetS in return consists of components which are risk factors for CKD. All component of MetS has been associated with both CKD incidence and progression.A study in Okinawa Japan (6) showed that the relationship between the number of metabolic syndrome components and the prevalence of CKD is linear, the same linear relationship was noticed amongst the Chinese (7), hence the presence of MetS in CKD confers a worse prognosis and would indeed increase the mortality rate from cardiovascular events (8).

Studies have shown the prevalence rate of MetS in CKD to range from 37.5 –65 % (9-11). A study carried out in the US over a 5 year period amongst 3,939 CKD patients revealed a MetS prevalence of 65%, with a prevalence as high as 87.5% in the diabetics and 44.3% in the non-diabetics (11). This was higher than the prevalence of MetS in the general population in another US study in which the prevalence of MetS in the general population ranged between 22 – 35 % (10).

Given the previously reported relationship between MetS and CKD, this study aimed at determining the prevalence of MetS in CKD at our facility.

MATERIALS AND METHODS

This was a hospital-based cross-sectional analytical study conducted at the University of Benin Teaching Hospital (UBTH). Patients with CKD were consecutively recruited upon presentation to either the Nephrology clinic, Dialysis, or Accident and Emergency units of the hospital. Informed consent was obtained from all participants. Ethical approval was obtained from the Ethics Committee of University of Benin Teaching Hospital.

Patients were stratified based on the stage of CKD using the NKF/KDOQI staging (4).One hundred and sixty newly diagnosed or previously known CKD patients on conservative management or renal replacement therapy (RRT) were recruited.
The primary outcome of this study was the estimation of the prevalence of the metabolic syndrome among CKD patients.

A researcher-administered questionnaire was used to collect data. The waist circumference in centimetres before breakfast was measured in the horizontal plane at the level of the natural waist-line (taken to be at the umbilicus). A non-stretchable tape was used. All subjects were instructed to observe an overnight fast for 10-12 hours before blood sample collection. Each subject had their age noted, weight taken and serum creatinine measured from which GFR was estimated using the

Cockcroft-Gault formula. Fasting blood glucose (FBG), and fasting serum lipids were also measured.

Data obtained were entered into SPSS version 17 and analysed. Continuous variables were presented as means and standard deviation (SD) while discrete variables were presented as percentages. Student's t test, cross-tabulation, and Chi square test were used as appropriate. The confidence interval was set at 95% limit, with the level of significance being p values< 0.05.

RESULTS

The participants consisted of 101 males (63.1%) and 59 females (36.9%) with age ranging from 18 -80 years. The mean age was 45.9 ± 16.0 years for men and 42.09 ± 14.9 years for women; participants older than 60 years accounted for 22.5%. Thirty- nine (24.4%) participants had diabetes mellitus, 116 (72.5%) had hypertension, 106 (66.2%) hadhypertriglyceridemia and low HDL cholesterol was seen in 117(73.1%) patients. Fifty-five (34.3%) patients had central obesity. This is as shown in table 1

MetS was found in 108 (67.5%) participants with a greater percentage of the female 42 (71.2%) having the syndrome.

Metabolic syndrome was noted in 82% of the diabetic patients, and in 53% of the non-diabetics. This was statistically significant ($p < 0.001$).

The association between stage of CKD and the number of metabolic syndrome components present, using the Spearman's rank order correlation is shown in table 2.

There was a weak positive correlation between CKD stage and number of metabolic syndrome components present. This was however not statistically significant (rho = 0.147, p= 0.064).

There was a linear trend in MetS prevalence with increasing CKD stage as shown in table 3.

DISCUSSION

Metabolic syndrome in CKD was common in this study accounting for 67.5 %. Approximately seven out of every ten CKD patient that was seen in hospital had MetS. Our finding was comparable to recent data from the Chronic Renal Insufficiency Cohort (CRIC) study carried out in the US in which the prevalence was 65% (11). A similar by Ogbu *et al* in Calabar in which 168 participants were studied however, reported a lower prevalence of 41%. Previous studies also found that each component of MetS was independently associated with both CKD incidence and progression (4). Like our findings, Ogbu *et al* reported an elevated systolic blood pressure as the commonest component of MetS (prevalence of 72.5% Vs 72.6% respectively) with the least prevalent component being hyperglycemia. This was in variance with the CRIC study in which the most and least prevalent components were hypertension and raised triglyceride levels respectively (11). Variations in the prevalence of diabetes mellitus in the different populations may explain the different prevalence reported.

Elevated BP is an aetiological as well as a progressive factor for CKD. Hypertension has been shown to be the strongest risk factor for individuals with MetS to develop CKD (12).

The number of MetS components seen in an individual was shown to increase the risk of developing CKD (13). Our study showed a positive correlation between number of MetS components present and the stage of CKD. In all stages, majority of the participants had at least 3 components of MetS. All the CKD patients had at least one component of MetS. A linear association has been noted between the number of MetS components and the prevalence of CKD in previous studies (14).

Our study revealed that the prevalence of MetS increased as CKD progressed and was noted in 85% of patients in stage 5 CKD. This was much higher than the prevalence of MetS obtained from other studies of patients on hemodialysis (41.7% - 50%) (1, 4).

Diabetic patients had a higher prevalence of MetS when compared with the non-diabetics. This could be explained by the fact that MetS is also associated with incident

overt type 2 diabetes and given the fact that insulin resistance is common to MetS and type 2 DM (15,16).

CONCLUSION

In conclusion, our study showed that approximately seven out of every ten CKD patients had metabolic syndrome and it was more associated with advanced CKD. Diabetics compared to non-diabetics were 1.5 times more predisposed. Screening for MetS in CKD may reduce associated cardiovascular mortality.

Acknowledgements: We thank the management and staff of UBTH for their assistance in the course of this study. We also appreciate our patients who participated in the study.

Conflict of interest: The authors declare no conflicts of interest.

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Table 1: Sociodemographic characteristics and metabolic syndrome components among study participants.

CHARACTERISTICS	MEAN ± SD
AGE Male	45.9 ± 16.0
Female	42.09 ±14.9
	FREQUENCY (%)
SEX	
Male	101 (63.1%)
Female	59 (36.9%)
COMPONENTS OF METS	
Hyperglycemia	39 (24.4%)
Hypertension	116 (72.5%)
Hypertriglyceridemia	106 (66.2%)
Central obesity	55 (34.3%)
	117 (73.1%)
	Reduced HDL-C

HDL-C High Density Lipoprotein Cholesterol

Table 2: Association between stage of CKD and the number of metabolic syndrome components present

NO. OF COMPONENTS OF METABOLIC SYNDROME N (%)						
CKD STAGE		1	2	3	4	5
	1	0(0.0)	2(66.7)	1(33.3)	0(0.0)	0(0.0)
	2	1(33.3)	1(33.3)	1(33.3)	0(0.0)	0(0.0)
	3	5(9.6)	13(25.0)	20(38.5)	11(21.2)	3(5.8)
	4	3(3.7)	24(29.6)	35(43.2)	18(22.2)	1(1.2)
	5	0(0.0)	3(14.3)	10(47.6)	7(33.3)	1(4.8)

Table 3: The prevalence of MetS by CKD stage amongst study participants

CKD STAGE	PRESENCE OF MetS FREQUENCY(%)	ABSENCE OF MetS
1	1 (33.3)	2 (66.7)
2	1 (33.3)	2 (66.7)
3	34 (65.4)	18 (34.6)
4	54 (66.7)	27 (33.3)
5	18 (85.1)	3 (14.3)

df = 4, p = 0.165