academicJournals

Vol. 8(5), pp. 45-50, May 2016
DOI: 10.5897/IJMMS2016.1229
Article Number: DC07D6E58501
ISSN 2006-9723

http://www.academicjournals.org/IJMMS

International Journal of Medicine and Medical Sciences

Full Length Research Paper

Pattern of renal impairment among hypertensive subjects in Umuahia, South East, Nigeria

Nwachukwu Daniel C[1]*, Uchenna Francis Agu[2] and Nkiru Zuada Nwachukwu[3]

[1]Department of Physiology University of Nigeria, Enugu Campus, Nigeria.
[2]Nephrology Unit, Abia State Specialist Hospital, Umuahia, Abia State, Nigeria.
[3]Department of Ophthalmology, University of Nigeria Teaching Hospital, Enugu, Nigeria.

Received 8 February, 2016; Accepted 15 April 2016

Hypertension is a cause and consequence of chronic kidney disease (CKD). The present study investigated the patterns of renal impairment among hypertensive subjects in Umuahia, South East, Nigeria. A cross-sectional study involving 262 subjects comprising equal number of hypertensive and non-hypertensive was used. Questionnaires were administered; medical, socio-demographic and anthropometric profiles were obtained. Blood samples were taken for creatinine determination and glomerular filtration rate (GFR) was estimated using the modification of diet in renal disease (MDRD) equation. The GFR in hypertensive group was 87.4±30.2 ml/min/1.73 m^2 compared to 99.9 ±32.3 ml/min/1.73 m^2 in the non-hypertensive. In the hypertensive group, 30.5, 29.0 and 0.8% had mild, moderate and severe renal impairment respectively whereas in the non-hypertensive group, the values were 28.2, 14.5 and 0.8% respectively. The prevalence of CKD in hypertensive subjects was 29.8% while that in the non-hypertensive was 15.3%. 55.6% of male hypertensive subjects had mild to moderate renal impairment compared to 23.5% in the non-hypertensive group; the difference between hypertensive and non-hypertensive in females was not statistically significant. More females had CKD than their male counterparts. Hypertension might have increased incidence of renal impairment and prevalence of CKD in Nigeria. This underscores the need for screening for CKD in the general population.

Key words: Essential hypertension, glomerular filtration rate, chronic kidney disease.

INTRODUCTION

Hypertension is a leading risk factor for the development and increased prevalence of chronic kidney disease (CKD) (Tedla et al., 2011). The prevalence of both hypertension (20% to above 40%) and CKD (8-16%) has been on the increase globally (Vivekanand et al., 2013). CKD is the presence of kidney damage or decreased kidney function, which is progressive (from three or more months to years) irrespective of clinical diagnosis (Levey et al., 2013). Hypertension is defined as systolic blood pressure (SBP)/diastolic blood pressure (DBP) of

*Corresponding author. E-mail: daniel.nwachukwu@unn.edu.ng.

≥140/90 mmHg (JNC-7, 2003). Essential hypertension remains the most common cause of cardiovascular disease among black Africans, and it is a significant cause of adult morbidity and mortality (Akinkugbe, 2003). The excess mortality in blacks due to heart disease, renal failure, and stroke is directly related to the excess burden of hypertension (Laragh, 2001). The high prevalence of hypertension in Nigerian and Sub -Saharan Africa may be attributed to lifestyle changes such as urbanization and adoption of western lifestyle, sedentary lifestyle and consumption of fast foods in the cities (Agaba et al., 2009). Hypertension is both a cause and a consequence of chronic kidney disease, but the prevalence of chronic kidney disease throughout the diagnostic spectrum of blood pressure has not been established (Diedra et al., 2010). Current data indicate that cases of hypertension and CKD seen in the hospital are just a tip of the iceberg. The submerged portion of the iceberg represents the larger, hidden and undiagnosed mass of the disease. The poorest populations are at the highest risk. Screening of individuals at risk will ensure early detection of CKD and timely intervention to prevent progression to end-stage renal disease (ESRD). Screening and intervention can prevent chronic kidney disease, and where management strategies have been implemented the incidence of end-stage kidney disease has been reduced (Vivekanand et al., 2013). Dialysis and kidney transplant, which are renal replacement options for end stage renal disease (ESRD), are expensive and self-funded in Nigeria.

Understanding the burden of CKD in hypertensive individuals will help promote preventive strategies, initiate measures to reduce the prevalence of both CKD and hypertension and reduce the progression of CKD to ESRD whose cost of treatment is beyond the reach of most Nigerians. Estimation of GFR is one of the reliable means of investigation of renal function and provides information about the functional status of the kidneys. The present study investigated the patterns of renal impairment in hypertensive patients in a tertiary hospital in Umuahia, South East, Nigeria.

METHODOLOGY

A cross-sectional study was adopted; 262 subjects comprising of equal number of hypertensive and non-hypertensive (131 each) were recruited for the study over a period of 5 months. Hypertensive subjects were recruited from the cardiology clinic of Federal Medical Centre (FMC) Umuahia, Abia State, Nigeria while non-hypertensive subjects were recruited both from those resident in and outside the town. The hospital is a tertiary Health Care Institution owned by the Federal Government of Nigeria. Umuahia is the capital of Abia State, located in South East, Nigeria. It has a population of about 359,230 people and the inhabitants are predominantly civil servants, traders and farmers.

Inclusion criteria

1. Newly diagnosed hypertensive patients with no clinical evidence of CKD were recruited.
2. Hypertensive patients taking anti-hypertensive drugs were also recruited.
3. Age matched non-hypertensive subjects were recruited.

The subjects were adequately briefed about the study and signed informed consent forms.

Exclusion criteria

Patients with risk factors for CKD such as diabetes mellitus, sickle cell anemia, congestive heart failure, family history of kidney disease, HIV, those on herbal medication and very sick patients were excluded from the study.

Ethical clearance

Ethical clearance was obtained from the Health Research and Ethics Committee of FMC, Umuahia, Abia State (FMC/QEH/G.596/ VOL.10/132).

Data collection

Questionnaires were administered and medical history, socio-demographic and anthropometric parameters were obtained. Serum creatinine was measured and GFR estimated using MDRD equation.

Measurements

Blood pressure (BP) was measured using a mercury sphygmomanometer (Acusson, England). Two consecutive readings were taken from each subject at 5 min interval and the average taken as mean BP. Hypertension was defined as systolic blood pressure (SBP) ≥140 mmHg and diastolic blood pressure (DBP) ≥90 mmHg (JNC-7, 2003). Weight (to the nearest 0.1 kg) and height (to the nearest 0.1cm) were measured using a seca stadiometer (Birminghan, UK) and body mass index (BMI) calculated using the formula: Weight(kg)/height (m^2) (Nwachukwu et al., 2010).

Laboratory measurement

Venous blood (5 ml) was withdrawn from medial cubital vein into a vacutainer and allowed to stand undisturbed for 25 min. The clot formed was removed by centrifuging at 2000 rpm for 10 min. The resulting supernatant (serum) was transferred to a clean polypropylene tube using Pasteur pipette. Serum creatinine was determined using Jaffe's method (Pesce and Kaplan, 1987). Random blood sugar (RBS) was measured using acucheck glucometer.

Glomerular filtration rate calculation

The modification of diet in renal disease (MDRD) equation was used to calculate GFR:

$$GFR\ (ml/min/1.73\ m^2) = 175 \times (S_{cr})^{-1.154} \times (Age)^{-0.203} \times (0.742 \text{ if female}) \times (1.212 \text{ if African}).$$

Using National Kidney Foundation guideline (2012), CKD was taken to be present at eGFR < 60ml/min/1.73 m^2 and absent at eGFR ≥ 60ml/ml/1.73 m^2. Renal function was staged as follows: Stage 1

Table 1. Sociodemographic characteristics of the subjects.

Characteristic	Non-Hypertensive n=131 (%)	Hypertensive n=131 (%)
Sex		
Male	63 (48.1)	68 (51.9)
Female	68 (51.9)	63 (48.1)
Age (in years)		
≤30	4 (3.1)	21 (16.0)
31-40	12 (9.2)	33 (25.2)
41-50	20 (15.3)	23 (17.6)
51-60	34 (26.0)	16 (12.2)
61-70	30 (22.9)	20 (15.3)
>70	31 (23.7)	18 (13.7)
Mean ± SD	58.1± 19.4	59.0 ±14.6)
Educational status		
Nil	31 (23.7)	24 (18.3)
Primary	33 (25.2)	23 (17.6)
Secondary	34 (26.0)	39 (29.8)
Tertiary	33 (25.2)	45 (34.4)
Marital status		
Married	89 (67.9)	71 (54.2)
Others	42 (32.1)	60 (45.8)

(normal) = GFR>90; Stage 2 (mild to moderate renal impairment) = GFR 60-89 and Stage 3-5 (CKD) = GFR< 60ml/ml/1.73m^2.

Statistical analysis

Results were presented as mean ± SD. Data was analyzed using statistical package for social sciences (SPSS) version 21.0. Student's "*t*" test was used to assess the significance. One way analysis of variance (ANOVA) was used to compare the difference between groups. *P* value of <0.05 was considered statistically significant.

RESULTS

Socio-demographic characteristics of subjects

The mean age of non- hypertensive (control) and hypertensive (cases) was 58.1±19.4 years and 59.0±14.6 years respectively (Table 1). About half of the non-hypertensive (51.2%) had at least secondary education compared to 47.4% found in the hypertensive group. Majority of the subject were married (hypertensive: 67.9%, non-hypertensive: 54.2%) (Table 1). Among the hypertensive, males constituted 48.1% and females 51.9% while among the non-hypertensive males constituted 51.9% and females 48.1%. In the hypertensive group, 63.3% of the females had mild to moderate renal impairment compared to 55% found in the males (Table 5). In the non-hypertensive group, 63.5% of the females had mild to moderate renal impairment compared to 23.5% of their male counterpart (Table 5). Renal impairment in the male non-hypertensive group was significantly lower ($p<0.01$) compared to that in male hypertensive whereas there was no significant difference between the female values in both hypertensive and non-hypertensive. Both cases of severe renal impairment seen were females.

Mean blood pressure and BMI of the hypertensive and non-hypertensive

The mean SBP was 161.6±20 and 123.6±11.9 mmHg while DBP was 93.4±14.8 and 75.0±9.8 mmHg in hypertensive and non-hypertensive subjects respectively. Both BP values were significantly different ($p<0.001$) when compared to each other (Table 2). BMI values in both groups were not significant when compared to each other (Table 2).

GFR pattern among the hypertensive non-hypertensive subjects

The mean eGFR in hypertensive subjects was 87.4±40.2ml/min/1.73 m^2, this was significantly lower ($p<0.05$) than that of non-hypertensive (99.9±42.3) (Table 3). In the hypertensive group, 30.5, 29.0 and 0.8% had mild, moderate and severe renal impairment respectively whereas in the non-hypertensive group, the values were 28.2, 14.5 and 0.8% respectively (Table 4). In the

Table 2. Mean blood pressure (BP) and body mass index (BMI) in hypertensive and non-hypertensive groups

BP/BMI	Hypertensive Mean ± SD	Non-Hypertensive Mean ± SD	t-test	P-value
SBP (mmHg)	161.6±20.0	123.6±11.9	18.65	<0.001
DBP (mmHg)	93.4±14.8	75.0±9.8	11.86	<0.001
BMI (Kg/m^2)	26.7±5.3	25.5±4.8	1.86	0.06

Table 3. Mean eGFR in hypertensive and non-hypertensive subjects

Formula	Hypertensive Mean± SD	Non-hypertensive Mean±SD	t-test	P-value
MDRD ml/min/1.73 m^2	87.4±30.2	99.9±32.3	2.45	0.015

Table 4. Patterns of renal impairment among hypertensive and non-hypertensive subjects.

eGFR (MDRD)	Hypertensive N=131 (%)	Non-hypertensive N=131 (%)
Normal	52 (39.7)	74(56.5)
Mild	40 (30.5)	37 (28.2)
Moderate	38 (29.0)	19 (14.5)
Severe	1 (0.8)	1 (0.8)
Failure	0(0)	0(0)

Table 5. Classification of GFR by sex among hypertensive and non-hypertensive subjects.

eGFR	Hypertensive		Non-hypertensive	
	Male (n=63)	Female (n=68)	Male (n=68)	Female (n=63)
Normal (Stage 1)	28 (44.4%)	24 (35.3%)	52 (76.5%)	22 (34.9%)
Mild (Stage 2)	18 (28.6%)	22 (32.4%)	16 (23.5%)	21 (33.3%)
Moderate (Stage 3)	17 (27.0%)	21 (30.9%)	0 (0.0%)	19 (30.2)
Severe (Stage 4)	0 (0.0%)	1 (1.5%)	0 (0.0%)	1 (1.6%)

hypertensive subjects, 39.7% had normal eGFR compared to 56.5% found in non-hypertensive (Table 4). The prevalence of CKD was 29.8 and 15.3% among the hypertensive and non-hypertensive subjects respectively; there was a significant difference ($p<0.001$) in the pattern of renal impairment between cases and control. Among the hypertensive subjects, 27% of the males had CKD compared to 30.9% of the females; there was no significant gender difference (Table 5). Among the non-hypertensive subjects, none of the males had CKD compared to 30.2% of the females; there was a significant gender difference ($p<0.001$) in this group (Table 5).

DISCUSSION

Hypertension has been identified as one of the major risk factors that contribute to the global increase in prevalence of CKD (Tedla et al., 2011). Uncontrolled hypertension can accelerate the development of CKD and may lead to ESRD. In the present study, hypertension significantly reduced GFR and the prevalence of CKD differed significantly between hypertensive and non-hypertensive subjects. This may be due to two factors: Lack of awareness leading to poor uptake of health care services and poverty. Many of the hypertensive subjects were not even aware that they have the disease and most were not aware of effect of hypertension on the kidney. Some of the hypertensive who knew that they have the disease blamed their inability to obtain regular health care services on their inability to afford the drugs. The prevalence of CKD (29.8%) among the hypertensive group was higher than that (8-16%) obtained from a previous study (Vivekanand et al., 2013). This is a clear indication of lack of awareness on both hypertension and its effect on the kidney in our environment. This may also contribute to

the recent increase in mortality from ESRD in Nigeria since most of the patients cannot afford the huge cost of kidney transplant. However, the prevalence of CKD from the present study was similar to that (27.5%) obtained in USA among hypertensive individuals (Diedra et al., 2010). These workers also obtained a prevalence of 13.4 % among non-hypertensive subjects while 15.3% was obtained in the present study. The difference in prevalence values in the two studies suggests that apart from hypertension, other factors such as nutritional, environmental, etc may also contribute to the development of CKD. Our results confirmed earlier reports that CKD is found even among the non-hypertensive (Diedra et al., 2010), though its prevalence in the hypertensive was twice that of the non-hypertensive in both studies. The possible reasons for this similarity may be due to adoption of western lifestyle, urbanization, sedentary lifestyle and consumption of fast food in most Nigerian cities including the study area (Agaba et al., 2009) which have earlier been linked to CKD (Diedra et al., 2010). Most young Nigerians are moving out of their local communities to cities in search of jobs and 'better life'. In a previous study, Diedra et al. (2010) reported higher prevalence of CKD among female Americans; in the present study, we also observed a higher prevalence of CKD in females of both hypertensive and non-hypertensive groups.

Previous studies have reported different figures for the prevalence of CKD in different parts of Nigeria; in Osun State, South-West Nigeria, the overall prevalence of CKD in general population was 18.8% (Oluyombo et al., 2013). In Edo State, South-South, Nigeria, a prevalence of 24.3% was reported among adults (Okoye et al., 2011) while a prevalence of 23.7% was reported in Enugu, South-East, Nigeria (Ulasi et al., 2009). These values are lower than that obtained from the present study because they were conducted in general population whereas we conducted only among hypertensive subjects and the exclusion criteria in the earlier studies were not clearly defined. However, a higher prevalence of 45.5% was reported among hypertensive patients in another previous study in Borno State (Nwankwo et al., 2009); this study was carried out among rural dwellers whereas the present study was done in an urban area. Socio-economic factors such as limited education, poverty, use of herbal remedies (which is rampant in rural communities) and untreated diseases like urinary tract infection may be the possible reasons for the higher prevalence of CKD reported among the rural dwellers. A higher prevalence of CKD (46%) was also reported in a multi centre study carried out in Ghana (Osafor et al., 2011) compared to 30% obtained in the present study.

In the present study, GFR in males was higher than that in females which indicates better renal function among males. In the hypertensive group, 32.4% of the females had CKD while 27% of the males had it whereas in the non-hypertensive group, no male had CKD compared to 31.8% of females who had it. Age could be a contributory factor responsible for this disparity; 46.6% of the female hypertensive subjects were 60 years and above compared to 29% of the males since GFR reduces with age (National Kidney Foundation, 2012). Limited education and low income which were more predominant among the females might also have contributed to the higher prevalence among females. This finding supports previous studies in the United States which linked age, female sex, limited education and low income with greater prevalence of CKD (Diedra et al., 2010). The prevalence of CKD in both male and female hypertensive subjects agrees with that from a previous study by Osuji et al. (2012) who found no statistical significant difference between males and females GFR values in patients with congestive heart failure. This suggests that hypertension is also a risk factor the development of CKD.

CONCLUSION

Hypertension increased renal impairment and the prevalence of chronic kidney disease in Nigeria. Females were affected more than males. Socio-demographic factors such as sex, educational and income status may be contributory factors. The pattern of renal impairment observed underscores the need for screening for CKD among hypertensive and non-hypertensive individuals.

RECOMMENDATION

There is the need to create public awareness by appropriate government agencies and organizations about hypertension and CKD in our environment and develop strategies that will reduce their prevalence. More studies on CKD in different risk populations are recommended.

Conflict of interests

The authors hereby declare that no conflict of interest exists among them.

REFERENCES

Agaba EI, Chinyere MW, Agaba PA, Antonios H, Tzamaloukas (2009). Performance of the Cockcroft-Gault and MDRD equations in adult Nigerians with chronic kidney disease. Int. Urol. Nephrol. 41:635-642.

Akinkugbe OO (2003). Current epidemiology of hypertension in Nigeria. Arch Ib Med. 1:3-5.

Diedra CC, Laura CP, Edgar RM, Rajiv S, Elizabeth H (2010). Prevalence of chronic kidney disease in persons with undiagnosed or prehypertension in United States. Hypertens 55:1102-1109.

Laragh J (2001). Laragh's lessons in pathophysiology and clinical pearls for treating hypertension. Am. J. Hypertens 14:186-94.

Levey AS, Stevens LA, Schmid CH, Zhang YL, Castro AF, Feldman HI, Kusek JW, Eggers P, Van Lente F, Greene T, Coresh J (2009). A

new equation to estimate glomerular filtration rate. Ann. Intern. Med. 150(9):604-612.
National Kidney Foundation (2012). KDOQI Clinical Practice Guideline for Diabetes and CKD: Am. J. Kidney Dis. 60(5):850-886.
Nwachukwu DC, Nwagha UI, Obikili EN, Ejezie FE, Okwuosa CN, Nweke ML, Ezeh CO (2010). Assessment of Body mass index and Blood pressure among university students in Enugu, South East Nigeria. Nig. J. Med. 19(2):148-52.
Nwankwo EA, Nwankwo B, Mubi B (2006). Prevalence of impaired kidney function in hospitalized hypertensive patients in Maiduguri, Nigeria. Int. J. Intern. Med. 6(1).
Okoye CO, Oviasu E, Ojogwu LI (2011). Prevalence of chronic kidney disease and its risk factors among adults in a rural population in Edo state, Nigeria. J. US-China Med. Sci. 8:471-881.
Oluyombo R, Ayodedele OE, Akinwosi PO, Okunola AA, Arogundale FA, Sanusi AA, Onayade A (2013). Community study of the prevalence, risk factor and pattern of chronic kidney disease in Osun State, South West Nigeria. West Afr. J. Med. 32(2):85-92.
Osafo C, Mate-Kole M, Affram K, Adu D (2011). Prevalence of chronic kidney disease in hypertensive patients in Ghana. Ren Fail. 33(4):388-92.
Osuji CU, Nwaneli CU, Onwubere BJ, Onwubuya EI, Ahaneku GI (2012). Renal Function in Patients with Hypertension Associated Congestive Cardiac Failure Seen in a Tertiary Hospital. Int. J. Nephrol. 1-5
Pesce AJ, Kaplan LA (1987). Creatinine clearance. In Pesce AJ, Kaplan LA (eds) Methods in Clinical Chemistry.The CV Mosby Company, St. Louis. pp. 13-17.
Tedla FM, Brar A, Brown R, Brown C (2011). Hypertension in Chronic Kidney Disease: Navigating the Evidence. Int. J. Hypertens. 2011:132405.
The Seventh Report of the Joint National Committee on Prevention JNC-7 (2003). Detection, Evaluation and Treatment of High Blood Pressure: the JNC 7 report. JAMA. 289:2560-2572.
Ulasi II, Ijoma CE. Arodiwe O, Onodugo O, Okoye J (2009). Lifestyle risk factors and markers of chronic kidney disease: A community based study. A presentation at the AFRAN Congress, Abuja, Nigeria.
Vivekanand J, Guillermo G, Kunitoshi I, Zuo L, Saraladevi N, Brett P, Rajiv S, Angela YMW, Chih-Wei Y (2013). Chronic kidney disease: global dimension and perspectives. Lancet 382(9888):260-270.