Screening for chronic kidney disease among health workers in a tertiary hospital in North Central Nigeria

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Abstract

Background: Screening adults for chronic kidney disease and managing those identified has been advocated as one of the means of limiting the burden of the disease. The renal study team of Federal Medical Centre, Bida decided to screen health workers in the hospital for chronic kidney disease as part of activities marking the world kidney day.
Methods: A purposive cross-sectional study involving 262 health workers; using self -administered questionnaire was carried out after adequate publicity. Chronic kidney disease was defined according to KDIGO. Data obtained were analyzed with SPSS version 21.
Results: Chronic kidney disease defined as eGFR <60mls/min/1.73m^2 was seen in 19 (7.25%) of the respondents. Also 79 (30.15%) had eGFR spanning within 60 – 89mls/min/1.73m^2. Marital status and recurrent body swelling were significantly associated with chronic kidney disease (p= 0.018 and 0.045 respectively). Marital status was the only predictor of chronic kidney disease in the population (p=0.047, Exp B= 0.166, CI= 0.028 – 0.976).
Conclusion: We advocate that comprehensive renal function test should be included in pre-employment medical screening test in the country.

Dépistage de l'insuffisance rénale chronique chez les agents de santé d'un hôpital tertiaire du centre-nord du Nigeria

Résumé
Contexte: Le dépistage des maladies rénales chroniques chez les adultes et la prise en charge des personnes identifiées ont été préconisés comme l'un des moyens de limiter le fardeau de la maladie. L'équipe d'étude rénale du Centre médical fédéral de Bida a décidé de dépister les agents de santé de l'hôpital pour les maladies rénales chroniques dans le cadre des activités marquant la Journée mondiale du rein.
Méthodes: Une étude transversale intentionnelle impliquant 262 agents de santé ; l'utilisation d'un questionnaire auto-administré a été réalisée après une publicité adéquate. La maladie rénale chronique a été définie selon KDIGO. Les données obtenues ont été analysées avec SPSS version 21.
Résultats: Une maladie rénale chronique définie comme un DFGe < 60 ml/min/1,73 m2 a été observée chez 19 (7,25 %) des répondants. De plus, 79 (30,15 %) avaient un DFGe compris entre 60 et 89 ml/min/1,73 m2. L'état civil et les gonflements corporels récurrents étaient associés de manière significative à l'insuffisance rénale chronique (p = 0,018 et 0,045 respectivement). L'état matrimonial était le seul prédicteur de maladie rénale chronique dans la population (p = 0,047, Exp B = 0,166, IC = 0,028 – 0,976).
Conclusion: Nous préconisons qu'un test complet de la fonction rénale soit inclus dans le test de dépistage médical préalable à l'emploi dans le pays.
Mots clés: Agents de santé, dépistage, maladie rénale chronique, etat civil

INTRODUCTION

Kidney diseases are on the rise globally, it is estimated that by 2040 chronic kidney disease (CKD) will account for the 5th most common non-communicable disease globally[1]. Chronic kidney disease is defined as reduction in glomerular filtration rate (<60mls/min/1.73m^2) or presence of kidney damage for at least 3 months with implications for health[2]. Chronic kidney disease usually complicates most renal disorders and may progress to end stage renal disease.

Managing chronic kidney disease especially when advanced is very expensive. In high income countries, expenditure on dialysis and transplant accounts for 2-3% of annual health care budget[1]. In low income countries (LICs) like Nigeria, health insurance schemes still do not fully cater for their care and a significant proportion of health care cost are incurred by the users. This has been responsible for a worsening fatality from kidney related ailments in LICs.

Kidney function is best assessed with glomerular filtration rates (GFR)[3]. One of the cost-effective ways of obtaining GFR is by analyzing serum creatinine levels and using standardized equations to obtain the estimated GFR for such subjects. Normal eGFR in adults ranges from 90 – 120ml/min/1.73m^2. This value normally declines by 0.4 – 1.2mls/min/1.73m^2 annually in healthy adults[4], however, in presence of chronic morbidities such as hypertension, diabetes mellitus and obesity the decline is more remarkable with 1 – 2mls/min/1.73m^2 yearly[4]. This decline is even more in those with ensuing CKD with an annual reduction of 2-5mls/min/1.73m^2/year[3]. The presence of chronic kidney disease stage III has also been reported to increase mortality 5 times more when compared with individuals of same age with normal eGFR[5, 6].

Progression of CKD is mainly dependent on the primary cause of CKD and the presence of risk factors of CKD. However, it is known that some of the risk factors for CKD are modifiable such as hypertension, diabetes mellitus and obesity[7]. Though CKD stages 1-3 are mostly asymptomatic, early management of risk factors and detection of CKDs are important for preventing onset of disease and delaying the progression[8]. Population screening for CKD and its risk factors are important to avert this disease and its untoward complications. Interventions such as low dietary salt, regular exercise, smoking cessation and administration of angiotensin converting enzyme inhibitors are known to slow progression of CKDs[9, 10].

The World Kidney Day marked every second Thursday of March annually is a day set aside to raise awareness of the importance of our kidneys. To commemorate the 2020 edition, the renal study team of Federal Medical Centre (FMC), Bida opted to enlighten staff of the hospital on importance of caring for the kidneys and also carried out basic screening test among consenting staff of the hospital. This study therefore is aimed at examining the burden and risk factors for chronic kidney disease among staff of FMC, Bida.

MATERIALS AND METHODS

The study is the outcome of screening done to commemorate 2020 World Kidney day. The study was carried out by the renal study team of Federal Medical Centre, Bida. It was a cross-sectional screening study carried out at the Federal Medical Centre, Bida, Niger state, North central Nigeria.

The Federal Medical Centre (FMC) Bida, is one of the two tertiary health facilities in Niger state, it was established on the 3rd of April, 1997. The centre is located in Efu-Etsu Yisa area of Bida town[11]. The hospital is a 200 bed-capacity facility with availability of most specialist care including both an adult and paediatric nephrologist. It receives referrals from surrounding towns and also adjoining states including Kwara, Kogi, Kaduna as well as the Federal Capital Territory (FCT). The renal study team of Federal Medical Centre, Bida consist of Adult and Paediatric Nephrologist, Urologist, Chemical pathologist, Physicians and Resident doctors with interest in Nephrology, Nephrology Nurses, Medical Laboratory Scientist and Technicians as well as Technicians in the dialysis unit.

Prior sensitization and notification of the proposed screening exercise was carried out in all departments of the centre two weeks prior to the date. The study location was the hospital's main conference hall. The study population were healthy staff members of the hospital and the participants were willing members of staff who gathered in the hall at the appointed day and time. Prior to the screening exercise ethical approval has been obtained from the hospital research and ethics committee with approval reference no HREC/APPR/Vol 2/5/2020. The exercise commenced with a health talk and a detailed explanation of the study information sheet following which verbal consent was sought from each participant. Only those who consented were

recruited for the study. We excluded menstruating and pregnant staff members due to possibility of producing false positive proteinuria and haematuria.

A structured questionnaire which was adapted from the Nephrology association of Nigeria questionnaire for world kidney day. It contained questions on socio-demography, assessing for risk factors of CKD, knowledge of CKD, anthropometry measurements for participants, urine analysis and serum creatinine. It was distributed among participants to be self-administered. Members of the renal team were on ground to clarify any aspect not explicit to the respondents. Weight was measured using a standardized bathroom scale in kilogram placed on a hard surface (a known weight material was used for standardization prior to commencement and after recording weight of 10 respondents). Patients were weighed with light clothing and empty pockets. Height was measured with a wall-mounted stadiometer with participants head in the Frankfurt plane and they were asked to stand without their foot wear. We calculated body mass index (BMI) by weight (kg) / height^2 (m^2). Participants were classified as Normal BMI: 19 – 24.9kg/m^2, Overweight: 25 – 29.9kg/m^2, Obese: $\geq$30kg/m^{2}in line with WHO classification[12].

Blood pressure was measured using mercury sphygmomanometer with standard cuff. We ensured the inflatable cuff encircled at least 80% of the circumference of the arm of each participant and the cuff width covers at least 60% of the distance from the acromion to the olecranon process in each participant. Measurement was on the right arm with participants in sitting position after 5 minutes of rest, the reading was taken twice and the average recorded to ensure reliability. Hypertension was defined as blood pressure $\geq$140/90mmhg or respondents volunteering been known hypertensives and on medications.

Sample collection:

Urinalysis:

A universal sterile bottle was provided for each participant to collect 5ml of mid-stream urine for urine analysis. Test was performed on each urine sample using Combi 9 SG Bayer reagent strip. All urine strip reagent area was immersed in urine sample provided by each respondent. The strips are then placed horizontally and compared with standardized colour chart. Changes were read at the time specified by the manufacturers. The following findings were considered significant proteinuria >1+, Haematuria: >1+.

Blood sugar and Serum Creatinine

Five mls of blood sample was collected from each participant in a sterile procedure. Two mls was put in a fluoride oxalate bottle for blood sugar analysis. The samples were then analyzed by glucose oxidase method at the chemical pathology laboratory of the hospital. Participants had been instructed to fast on the day of screening. Diabetes was defined as fasting plasma glucose $\geq$7.0mmol/l.

Three mls of the blood sample (3millilitres) drawn was put into lithium heparin bottle for serum creatinine. Samples were transferred to the Chemical Pathology at intervals of 1- 2hours for storage at 2-8^{o}C during the screening. A team consisting of Chemical Pathologist and Scientist analyzed the sample for serum creatinine within 48hours. The samples were analyzed by the modified Jaffe's method using RA-50 spectrophotometer (Bayer, Germany) at the hospital's chemical pathology laboratory. Estimated glomerular filtration rate (eGFR) was calculated from the serum creatinine using CKD-EPI equation for each participant[13].Chronic kidney disease was consequently classified using the kidney disease improving global outcome definition and classification method[3,14].

All obtained data were entered into a spread sheet and analysis was done using statistical package for social sciences version 21. Prevalences were expressed in proportion and percentage. Mean ±SD was calculated for normal variables. Cross-tabulation was used to calculate significance in relation to risk variables. Logistic regression model was used to predict significance of risk factors for CKD in the population. Results were reported as odd ratio (OR) and 95% confidence interval (CI). Significance was set at <0.05.

Participants with abnormal results were counselled as appropriate for enrollment at a clinic for follow up.

RESULTS

Of the 288 willing participants 262 completed the questionnaire and had all laboratory investigations done and results analyzed. The mean age of the population was 40.6±8.4years. The population had 126 males and 136 females accounting for a male: female ratio of 1:1.08. Majority of the population were married (83.2%) and Nupe tribe (55.3%) constituted the most common ethnic group.

Nurses (92; 35.1%) constituted majority of the participants followed by staff in the administrative section (86; 32.8%) and doctors (70; 26.7%) (Table I). The mean weight of the population was 74.6±14.2kg while the mean height was 1.6±0.1m. The mean BMI was 27.3±5.8kg/m^2 (Table II).

Mean systolic and diastolic blood pressures were 119±14.5 and 77.9±7.9 respectively (Table II). Thirty-eight (14.5%) of the respondents had elevated blood pressure with values ≥ 140/90mmgh or were known hypertensives on treatment. Twelve (4.6%) of the subjects were known diabetic patients or had fasting blood sugar ≥ 7mmol/l. Cigarette smoking (9 ; 3.4%), regular alcohol consumption (8 ; 3.1%), regular consumption of local concoction (7 ; 2.7%) and use of bleaching creams (2 ; 0.8%) were volunteered by some respondents (Table III) Recurrent body swelling and decreased urine volume was volunteered by 2 (0.8%) and 3 (1.1%) of the participant's respectively (Table III).

Twenty-four (9.1%) of the participants had significant proteinuria (2+ or more/ 500-1500mg/24hrs). Chronic kidney disease defined as estimated GFR of < 60mls/min/1.73m^2 was seen in 19 (7.25%) of the respondents, in addition 79 of respondents (30.15%) had high risk of progressing to CKD with eGFR ranging from 60 - 89mls/min/1.73m^2 (Table IV).

Marital status (p= 0.018) and recurrent body swelling (p= 0.045) were significantly associated with CKD, while there was no association with other socio-demographic, clinical or laboratory features (Table V)

On binary logistic regression for predictors of CKD in the population only marital status (p= 0.047) was a significant predictor, with widows/widowers having 16 times more risk when compared to married and single participants (Table VI)

DISCUSSION

The prevalence of chronic kidney disease among health workers in Federal Medical Centre, Bida was 7.25%. Though we could not lay our hands on a similar study, a study in Jos[15], north-central Nigeria combining both health workers in Jos University Teaching Hospital and the general populace reported a prevalence of 10.5%. A study in South-South Nigeria reported a prevalence of 7.8% among civil servants[16]. Hospital based prevalence from South-western Nigeria reported 8-10%[17, 18]. All these values are comparatively close giving the impression of similarity in community and hospital based prevalences. Globally, prevalence range differs but are close to the finding in our population. A prevalence of 7.0 -8.6% were reported in the Americas[19 -21], European prevalence ranges from 6.4 – 8.1%[22-24], in Africa prevalence range of 6.4 - 13.9%[25 , 26] has been reported and prevalence from Asia range from 6.6 – 6.8%[27, 28]. Most of these studies were community based like ours and the index study prevalence compares well with reports across continents except for some reports from Africa that reported double digits' prevalence[29]. Among the African studies, Sumaili et al in Kinshasa[29], Democratic Republic of Congo reported a prevalence range of 12.4%. This prevalence however, was among all the 5 stages of CKD contrary to our study that used the KDIGO definition (<60ml/min/1.73m^2) for CKD. The prevalence using the KDIGO definition for the Sumaili et al study was 8.0%. Though it is well documented that black Africans may have a higher risk of CKD due to increased APOL-1 gene variants in the population[30].

About a third of the respondents (78; 30.15%) in our study had eGFR that classifies them as CKD stage II based on the KDIGO classification. Thirty-nine (50%) of this population are < 40years. These individuals may not manifest symptoms but may have structural kidney damage and proteinuria. They are at risk of progression which can be mitigated by proper treatment and lifestyle changes. Prior to this study they were not aware and therefore with no intervention may contribute to the 10million cases of CKD reported for the country in 2017 which is the highest in Africa[16]. Poor awareness, inability to afford screening and treatment of comorbid conditions are reported to be responsible for increasing number of CKDs in low- and middle-income countries like Nigeria[31].

Our proteinuria rate of 9.16% in the population is low compared to report from Kano[32], Lagos[33] or Enugu[34]. Though all 3 reports emanated from Nigeria, the marked difference may be due to the definition for proteinuria. Our study adopted urine dipstick value of ≥ 2+ (100mg/dl).

Hypertension and diabetes mellitus are the most common cause of CKD in Africa, other causes are chronic glomerulonephritis and tubule-interstitial disorders[35]. Our study revealed 14.5% and 4.6% of the respondents were hypertensive and diabetic respectively. Similar studies within Nigeria[15, 32, 36, 37] and other developing countries[38] reported a similar range for diabetes mellitus in their respondents (2.6 –

5.29%). However, same studies reported higher number of hypertensives among their subject's contrary to our finding (24 – 50.2%). This implies fewer hypertensives in our population.

Identified risk factors for CKD in our studied population asides hypertension and diabetics mellitus were alcohol intake, cigarette smoking, use of bleaching creams and regular consumption of local concoction. All these risk factors were not associated with CKD in our analysis ($p > 0.05$; Table V).

Recurrent body swelling and marital status were significantly associated with CKD in our study. However, when subjected to a prediction test only marital status remained significant with widows/widowers being a significant predictor of CKD compared to their married and single respondents. Widowhood is associated with elevated urinary catecholamines and hypertension[39]. Hypertension meanwhile, is a known risk factor for CKD. other risk factors predicting CKD has been documented in some reports. Abebe et al[15] and Egbi et al[16] both reported advancing age as a risk factor for CKD. Report from China[40] and South East[34] Nigeria identified regular use of nephrotoxic medications and herbal medicines respectively as predictors of CKD. Olarewaju et al[37] from same geo-political zone as our study reported advancing age, female gender, abdominal obesity and diabetes mellitus as predictors of CKD. Okwonu et al[41] also from South-East Nigeria reported hypertension as a predictor of CKD.

This is a reflection of the various risk factors that have been implicated in aetiology of CKD. It is apparent that most of these factors are modifiable and a robust public health approach to limit them will go a long way to prevent CKD in our environment considering the enormous cost incurred in caring for CKD.

Drawbacks to our study include that it is a one-off testing which is not in keeping with the guideline which require a second reading for serum creatinine at an interval of at least 3 months following the initial reading. Our study is strengthened by being one of the few from our search restricted to health workers but the risk of selection bias is possible considering it is a screening exercise and randomization was not done.

Our study adds to the body of data on CKD prevalence and its risk factors in our society. To ensure efficient execution of intervention towards mitigating CKD, we recommend increased awareness on CKDs for health workers. Also, government should institute policies to promote more screening research in the country to enhance early detection of CKDs. This is anchored on recent studies in the United States of America which as shown that screening for CKD and administering medications such as the sodium glucose co-transporter 2 inhibitors in addition to angiotensin receptor blockers to confirmed cases of asymptomatic CKD, will reduce those requiring renal replacement therapy in their country by more than 500,000 adults[42].

Conflicts of interest: The authors declare that they have no competing interest

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Table I: Demographic description of the population

Gender	Number (n)	Percentage (%)
Male	126	48.1
Female	136	51.9
Total	262	100
Marital status		
Single	38	14.5
Married	218	83.2
Widow	6	2.3
Total	262	100.0
Ethnic group		
Nupe	145	55.3
Hausa	7	2.7
Yoruba	68	26.0
Igbo	12	4.6
Others	30	11.4
Total	262	100.0
Profession		
Nurses	92	35.1
Doctor	70	26.7
Administrative staff	86	32.8
Laboratory scientist	6	2.3
Pharmacist	6	2.3
Others	2	0.8
Total	262	100.0

Table II: Anthropometric measurement and blood pressure of the population

Variable	Mean
Weight (kg)	74.6± 14.2
Height (m)	1.6 ± 0.1
BMI (kg/m2)	27.3 ± 5.8
Systolic BP (mmHg)	119.7± 14.5
Diastolic BP (mmHg)	77.9 ± 7.9

Table III: Risk factors and symptoms of CKD in the population

Variable	Number (n)	Percentage (%)
Detected hypertension/known hypertensives	38	14.5
Detected diabetics/ known diabetics	12	4.6
Regular alcohol consumption	8	3.1
Cigarette smoking	9	3.4
Use bleaching cream	2	0.8
Regular consumption of local concoction	7	2.7
Recurrent body swelling	2	0.8
Decreased urine volume	3	1.1

Table IV: Estimated glomerular filtration rate classification of participants in accordance with kdigo classification

Stage of CKD	Estimated eGFR (mls/min/1.73m^2)	Number (n)	Percentage (%)
Stage 1	=90	164	62.60
Stage 2	60 – 89	79	30.15
Stage 3a	45 – 59	13	4.96
Stage 3b	30 – 44		
Stage 4	15 – 29	4	1.53
Stage 5	< 15	2	0.76

Table V: Cross tabulation of chronic kidney disease and variables

Variable	Df	*P*
Gender	1.813	0.404
Marital status	10.128	0.018*
Religion	0.743	0.690
Ethnic group	2.456	0.780
Occupation	4.986	0.546
Recurrent body swelling	6.210	0.045*
Dysuria	1.228	0.693
Haematuria	0.720	0.396
Smoking > 5years	0.803	0.669
Alcohol > 5years	1.040	0.595
Haemoglobinuria (>1+)	1.706	0.636
Proteinuria (>1+)	3.699	0.296

Table VI: Binary logistic regression for predictors of ckd

Variables	B	S. E	Wald	Sig	Exp (B)	95% C.I for EXP (B)	
						Lower	Upper
Marital status							
Single	-20.510	40192.970	0.000	1.000	0.000	0.000	
Married	-20.510	6520.161	0.000	0.997	0.000	0.000	
Widow	-1.797	0.904	3.949	0.047*	0.166	0.028	0.976
Recurrent body swelling	2.490	1.438	2.999	0.083	12.062	0.720	202.031
Constant	-0.693	0.866	0.641	0.423	0.500		