Original Article

The Comorbidity Profile among Chronic Kidney Disease Patients in Clinical Practice: A Prospective Study

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Abstract

Background: The comorbidity profile among chronic kidney disease (CKD) patients can influence and predispose them to increase mortality and health-care costs. In addition, there could also be a prolongation in the length of hospital stay and recurrent frequency of hospitalization. **Aim:** This study was predominantly designed to highlight and create awareness concerning the burden of comorbidity profile among CKD patients in renal practice. **Materials and Methods:** This was a descriptive prospective study of 18-month duration that was carried out to review the medical case records of consented adult CKD patients attending a Nigerian Tertiary Kidney Care Hospital from January 2015 to June 2016. **Results:** This study involved 123 consented adult CKD patients comprising 82 (66.67%) males and 41 (33.33%) females, with a mean age of 53.81 ± 16.03 years. A majority of the respondents 45 (36.59%) were having 2 comorbidities with hypertension in 103 (83.70%), diabetes mellitus in 39 (31.70%), obesity in 24 (19.51%), heart failure in 11 (8.90%), obstructive uropathy in 8 (6.50%), human immunodeficiency virus infection in 7 (5.70%), peptic ulcer disease/gastroesophageal reflux disease in 7 (5.70%), gastroenteritis/gastrointestinal tract sepsis in 6 (4.9%), stroke in 5 (4.10%), adult polycystic kidney disease in 5 (4.10%), and hepatitis B virus infection in 5 (4.10%), being the most frequent. Eighty-six (69.9%) patients were in CKD Stage 5, 15 (12.2%) were in CKD Stage 4, 19 (15.5%) were in CKD Stage 3, 2 (1.6%) in CKD Stage 2, and the remaining one (0.8%) in CKD Stage 1. Regarding the form of nephrological interventions offered, majority of the respondents 66 (53.66%) were on maintenance dialysis, followed by 53 (43.09%) on conservative care, while 4 (3.25%) were on renal graft transplant. **Conclusion:** The prevalence rates for comorbidities such as hypertension, diabetes mellitus, and obesity were significantly high among these CKD patients; this agreed with the previous studies conducted in other regions of the world. In this study, the comorbidity profile among CKD patients may significantly increase the risk of mortality, recurrent frequency of hospitalization, length of hospital admission, and health-care costs.

Keywords: Chronic kidney disease, comorbidity profile, diabetes mellitus, hypertension, obesity

Introduction

The most common diseases leading to end-stage renal disease (ESRD) globally include malignant/accelerated hypertension,[1] severe septicemia,[2] poorly controlled chronic diabetes mellitus,[3] human immunodeficiency virus (HIV)-associated nephropathy,[4] and focal segmental glomerulosclerosis.[5] Genetic causes of ESRD include polycystic kidney disease,[6] a number of inborn errors of metabolism,[7] and autoimmune conditions such as systemic lupus erythematosus.[8] Diabetes is the most common known cause of kidney transplantation, accounting for approximately 25% of those in the United States.[9]

Chronic kidney disease (CKD) is associated with increasing incidence[10] and prevalence,[11] high cost of treatment,[12] and poor outcomes.[13] There is evidence to suggest that, early in the course of CKD, appropriate interventions may slow down its progression or completely halt the progression of the disease.[14] Despite

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Access this article online

Quick Response Code:

Website: http://iahs.kaums.ac.ir

DOI: 10.4103/iahs.iahs_21_18

How to cite this article: Fasipe OJ, Akhideno PE, Owhin SO, Ilukho FA, Ibiyemi-Fasipe OB. The comorbidity profile among chronic kidney disease patients in clinical practice: A prospective study. Int Arch Health Sci 2019;6:46-51.

this, many patients with CKD present late to the nephrologists so that, at the time of initial patient assessment, all that can be offered is preparation for renal replacement therapy.[15] This is particularly so in resource-poor settings where among several other factors, the lack of awareness,[16] traditional beliefs about the cause and nature of the disease,[9,17] the need to pay out of pocket for health care,[18] and shortage of specialists[19] combine to promote inappropriate healthcare-seeking behavior[11,20] and late presentation to the nephrologist.[21] Several studies showed that hypertension[1] and diabetes mellitus[3] are the most common causes of ESRD worldwide; therefore, control of high blood pressure (BP)[22] and optimization of blood glucose level[23] are essential in delaying and retarding CKD progression.[24] These necessitate the use of several medications to improve the quality of life expectancy of these patients and slow down the progression of early CKD to full-blown ESRD.[25,26]

This study was designed to unravel the comorbidity profile among CKD patients attending the nephrology clinic of a Nigerian Tertiary Kidney Care Hospital. This will create awareness on the burden of comorbidity profile among CKD patients in renal practice. In addition, it will also highlight the need to appropriately manage these associated comorbid conditions and/or complications in order to retard the disease progression to full-blown ESRD.

Materials and Methods

This was a descriptive prospective study carried out at the nephrology clinic of a Tertiary Kidney Care Hospital, University of Medical Sciences, Ondo City, Ondo State, Nigeria. It receives referral from within and outside the State. One hundred and twenty-three consented adult CKD patients who were being managed at the center over 18 months between January 2015 and June 2016 were recruited for the study. Patients below the age of 18 years, those being managed for acute kidney injury (AKI), and adult CKD patients who did not grant their informed consent were excluded from the study. The medical case records of all the adult CKD patients were retrieved after a verbal informed consent has been obtained from each of them, and the following information was extracted using a pro forma: sociodemographic data, BP, body weight, height, stage of CKD, and number and list of comorbidities including hypertension, diabetes mellitus, obesity, heart failure, HIV infection, and stroke. In this study, CKD was defined as a progressive and irreversible deterioration in the renal function of an individual over a period of at least 3 months regardless of the underlying etiology.[1,24] The serum creatinine level was used to calculate estimated glomerular filtration rate (eGFR) using the Chronic Kidney Disease Epidemiology Collaboration formula, and CKD staging was done using eGFR based on the National Kidney Foundation-Kidney Disease Outcome Quality Initiative guideline as follows: stage 1 (eGFR of ≥90 ml/min with evidence of kidney damage), Stage 2 (eGFR of 60–89 ml/min with or without evidence of kidney damage), Stage 3 (eGFR of 30–59 ml/min with or without evidence of kidney damage), Stage 4 (eGFR of 15–29 ml/min with or without evidence of kidney damage), and Stage 5 (eGFR <15 ml/min with or without evidence of kidney damage).[24] The British Hypertensive Society-World Health Organization (BHS-WHO) guideline criteria were used for the classification category and severity grading of BP in this study. Furthermore, the prevalence rate for individual specific comorbidity among these CKD patients was obtained by dividing the total number of patients having the particular specified comorbidity by the total number of patients that participated in the study (sample size). Data collected were encoded and analyzed using the Statistical Package for the Social Sciences (SPSS) version 17 (released 2008; SPSS Inc., Chicago, Illinois, USA). Results were expressed as mean ± standard deviation or using frequency and percentage values where necessary. The *t*-test and Chi-square test were used to compare means and proportions, respectively. The level of statistical significance was set at $P < 0.05$. Ethical clearance was obtained from the Health Research Ethical Committee of the Tertiary Kidney Care Hospital about the study. In addition, a verbal informed consent was obtained from each of the adult CKD patients whose medical case records were used, whereas the medical case records for those who did not grant their informed consent were excluded from the study. Consent was sought from patient's relative where patient had impaired level of consciousness. Participants' confidentiality was respected and maintained by ensuring that no unauthorized person have access to the information on the questionnaires so that no information can be traced to the respondents (as coding system was used for the questionnaires instead of writing the patients' names on them), and no unauthorized use of information was made.

Results

There were 123 consented adult CKD patients in this study, out of which 82 (66.67%) were male and 41 (33.33%) were female. The mean age of the study patients was 53.81 ± 16.03 years. Forty-eight patients (39.0%) were aged between 18 and 49 years, 52 (42.3%) were between 50 and 69 years, and the remaining 23 (18.7%) were 70 years and above [Table 1].

In this study, the range for the number of associated comorbidities was 0–6 diseases, with a mean of 2.33 ± 1.09 diseases per patient. A majority of the respondents 45 (36.59%) had 2 comorbidities, followed by 36 (29.27%) with 3 comorbidities, 23 (18.70%) had only one comorbidity, while 11 (8.94%) had 4 comorbidities [Table 1]. The most frequent specific comorbidities were hypertension in 103 (83.70%), diabetes mellitus in 39 (31.70%), obesity in 24 (19.51%), heart failure in 11 (8.90%), obstructive uropathy in 8 (6.50%), HIV infection in 7 (5.70%), peptic ulcer disease/gastroesophageal reflux disease (PUDx/GERD) in 7 (5.70%), gastroenteritis/gastrointestinal tract (GIT) sepsis in 6 (4.9%), stroke in 5 (4.10%), adult polycystic kidney disease in 5 (4.10%), and hepatitis B virus (HBV) infection in 5 (4.10%) [Table 1].

Their mean body mass index (BMI) was 25.71 ± 5.09 kg/m^2; 55 (44.72%) had normal BMI (18.50–24.99 kg/m^2), followed by 39

Table 1: Characteristics of the study population

Characteristics	Frequency (%)/mean±SD
Gender	
Male	83 (66.67)
Female	41 (33.33)
Mean age (years)	53.81±16.03
Age group (years)	
20-49	48 (39.0)
50-69	52 (42.3)
≥70	23 (18.7)
Level of education	
No formal education	16 (13.0)
Primary	18 (14.6)
Secondary	36 (29.3)
Tertiary	53 (43.1)
CKD stage	
1	1 (0.8)
2	2 (1.6)
3	19 (15.5)
4	15 (12.2)
5	86 (69.9)
Mean comorbidities (diseases)	2.33±1.09
Number of comorbidities (diseases)	
0	4 (3.52)
1	23 (18.70)
2	45 (36.59)
3	36 (29.27)
4	11 (8.94)
5	3 (2.44)
6	1 (0.8)
Specific comorbidities	
Hypertension	103 (83.70)
Diabetes mellitus	39 (31.70)
Obesity	24 (19.51)
Heart failure	11 (8.90)
Obstructive uropathy	8 (6.50)
HIV infection	7 (5.70)
PUDx/GERD	7 (5.70)
Gastroenteritis/GIT sepsis	6 (4.9)
Stroke	5 (4.10)
Adult polycystic kidney disease	5 (4.10)
HBV infection	5 (4.10)
HCV infection	4 (3.52)
Cardiac arrhythmias	4 (3.52)
Ankylosing spondylitis	4 (3.52)
UTI/pyelonephritis	4 (3.52)
Dyslipidemia	3 (2.44)
SLE	2 (1.63)
NSAID nephropathy	2 (1.63)
Glaucoma	2 (1.63)
Osteoarthritis	2 (1.63)
Renal osteodystrophy/osteoporosis	2 (1.63)
Bilateral duplex ureter	1 (0.81)
Multiple myeloma	1 (0.81)
Dementia	1 (0.81)
Sickle-cell disease/sickle-cell nephropathy	1 (0.81)
Seizure disorders	1 (0.81)
Bronchial asthma	1 (0.81)
Rheumatoid arthritis	1 (0.81)
Breast cancer	1 (0.81)
Hydronephrosis	1 (0.81)
CMV infection	1 (0.81)
Acute renal graft rejection	1 (0.81)
Gouty arthritis	1 (0.81)
Inguinal hernia	1 (0.81)
Erectile dysfunction	1 (0.81)
Mastoiditis	1 (0.81)
Genu valgum	1 (0.81)
Form of nephrological interventions	
Maintenance dialysis	66 (53.66)
Conservative care	53 (43.09)
Renal graft transplant	4 (3.25)
Mean BMI (kg/m^2)	25.71±5.09
BMI (kg/m^2)	
Underweight	5 (4.1)
Normal	55 (44.72)
Overweight	39 (31.71)
Mild (Grade-1) obesity	18 (14.63)
Moderate (Grade-2) obesity	5 (4.1)
Morbid (Grade-3) obesity	1 (0.8)

CKD: Chronic kidney disease, SD: Standard deviation, BMI: Body mass index, HIV: Human immunodeficiency virus, HBV: Hepatitis B virus, HCV: Hepatitis c virus, PUDX: Peptic ulcer disease, GERD: Gastroesophageal reflux disease, UTI: Urinary tract infection, SLE: Systemic lupus erythematosus, CMV: Cytomegalovirus, NSAID: Nonsteroidal anti-inflammatory drug, GIT: Gastrointestinal tract

(31.71%) with overweight BMI (25.00–29.99 kg/m^2), 18 (14.63%) had mild/Grade-1 obesity (30.00–34.99 kg/m^2), 5 (4.1%) each were having moderate/Grade-2 obesity (35.00–39.99 kg/m^2), and underweight (≤18.49 kg/m^2), respectively, while only one (0.8%) had morbid/Grade-3 obesity (≥40.00 kg/m^2) [Table 1].

Fifty-three (43.09%) study participants had tertiary education, 36 (29.3%) had secondary education, 18 (14.6%) had primary education, while 16 (13.0%) had no formal education. Eighty-six (69.9%) study participants were in CKD Stage 5, 15 (12.2%) were in CKD Stage 4, 19 (15.5%) were in CKD Stage 3, 2 (1.6%) in CKD Stage 2, and the remaining one (0.8%) in CKD Stage 1 [Table 1].

Regarding the form of nephrological interventions offered, majority of the respondents 66 (53.66%) were on maintenance dialysis, followed by 53 (43.09%) on conservative care, while 4 (3.25%) were on renal graft transplant [Table 1].

Among these CKD patients, the prevalence rates for the most frequent specific comorbidities such as hypertension, diabetes mellitus, obesity, heart failure, obstructive uropathy, HIV infection, PUDx/GERD, gastroenteritis/GIT sepsis, stroke, adult polycystic kidney disease, and HBV infection were

Table 2: Prevalence rates for specific comorbidities among chronic kidney disease patients

Parameters	Prevalence (%)
Hypertension	83.70
Diabetes mellitus	31.70
Obesity	19.51
Heart failure	8.90
Obstructive uropathy	6.50
HIV infection	5.70
PUDx/GERD	5.70
Gastroenteritis/GIT sepsis	4.9
Stroke	4.10
Adult polycystic kidney disease	4.10
HBV infection	4.10
HCV infection	3.52
Cardiac arrhythmias	3.52
Ankylosing spondylitis	3.52
UTI/pyelonephritis	3.52
Dyslipidemia	2.44
SLE	1.63
NSAID nephropathy	1.63
Glaucoma	1.63
Osteoarthritis	1.63
Renal osteodystrophy/osteoporosis	1.63
Bilateral duplex ureter	0.81
Multiple myeloma	0.81
Dementia	0.81
Sickle cell disease/sickle cell nephropathy	0.81
Seizure disorders	0.81
Bronchial asthma	0.81
Rheumatoid arthritis	0.81
Breast cancer	0.81
Hydronephrosis	0.81
CMV infection	0.81
Acute renal graft rejection	0.81
Gouty arthritis	0.81
Inguinal hernia	0.81
Erectile dysfunction	0.81
Mastoiditis	0.81
Genu valgum	0.81

HIV: Human immunodeficiency virus, PUDX: Peptic ulcer disease, GERD: Gastroesophageal reflux disease, HBV: Hepatitis B virus, HCV: Hepatitis c virus, UTI: Urinary tract infection, SLE: Systemic lupus erythematosus, NSAID: Nonsteroidal anti-inflammatory drug, CVM: Cytomegalovirus, GIT: Gastrointestinal tract

83.70%, 31.70%, 19.51%, 8.90%, 6.50%, 5.70%, 5.70%, 4.9%, 4.10%, 4.10%, and 4.10%, respectively [Table 2].

The mean systolic BP of the respondents was 164.19 ± 35.12 mmHg, whereas their mean diastolic BP was 95.73 ± 19.08 mmHg. According to the BHS/WHO classification of BP, a majority of the respondents 47 (38.21%) had severe (Grade-3) hypertension, followed by 30 (24.39%) with moderate (Grade-2) hypertension, 26 (21.14%) had mild (Grade-1) hypertension, 8 (6.50%) had normal BP, while 6 (4.88%) each had optimal BP and high normal BP, respectively [Table 3]. Furthermore, 83 (67.48%) had combined systolic–diastolic hypertension, followed by 18 (14.63%) with isolated systolic hypertension, while 2 (1.6%) had isolated diastolic hypertension [Table 4].

In addition, among these CKD patients recruited for this study, there was also a statistically significant association between those with diabetes mellitus and obesity with $P < 0{\cdot}0001$ [Table 5].

Discussion

This study unravels the comorbidity profile among CKD patients attending the nephrology clinic of a Nigerian Tertiary Kidney Care Hospital. It also highlights the need to appropriately manage these associated comorbid conditions and/or complications in order to retard the disease progression to full-blown ESRD. The most common comorbidities in this study were hypertension and diabetes, which agreed with the previous studies conducted by Sgnaolin *et al*.[16] and Marquito *et al*.[20] This can be attributed to the fact that both conditions are the leading etiologies of CKD in Nigeria, sub-Saharan West African region, and worldwide. Therefore, adequate control of high BP with antihypertensives and regular optimization of blood glucose level with antidiabetics are essential in delaying and retarding CKD progression to full-blown ESRD and to reduce associated complications,[26,27] mortality,[17,28] health-care costs,[24,29] duration of hospital admission,[25,30] and recurrent frequency of hospitalizations.[31,32]

Concerning BMI status, the study conducted by Marquito *et al*.,[20] in which majority of the respondents 372 (66.7%) were either overweight or obese, also agreed with our study in which 68 (55.28%) were either overweight or obese. This increased BMI (overweight or obesity) had a positive correlation with the increasing prevalence of acquired CKD in this study as a risk factor.

Concerning the CKD staging and eGFR, this study in which majority of the participants 86 (69.92%) belonged to CKD Stage 5 agreed with the finding of Rama *et al*.'s study[17] where 113 (68.48%) belonged to CKD Stage 5, but disagreed with the finding of Marquito *et al*.'s study[20] in which most respondents 265 (47.5%) belonged to CKD Stage 3. This disparity can be attributed to the different variations in the serum creatinine levels of the respondents which were used to calculate their eGFRs.

Furthermore, on the form of nephrological interventions offered in this study, majority of the respondents were on maintenance dialysis 66 (53.66%) in contrast to the finding of Marquito *et al*.'s[20] study where most of the respondents 521 (93.37%) were on conservative care. Once again, this disparity can be attributed to the fact that most respondents in this study were of ESRD/CKD Stage 5 as opposed to pre-ESRD CKD stages 1, 2, 3, and 4 in the Marquito *et al*.'s[20] study.

Regarding sex distribution, our study was similar to the study conducted by that of Marquito *et al*., 2014,[20] on CKD patients at the NIEPEN Federal University of Juiz de Fora,

Table 3: Blood pressure grading (British Hypertensive Society-World Health Organization classification) for the respondents

BP category	Frequency (%)
Optimal	6 (4.88)
Normal	8 (6.50)
High normal	6 (4.88)
Mild HTN (Grade-1)	26 (21.14)
Moderate HTN (Grade-2)	30 (24.39)
Severe HTN (Grade-3)	47 (38.21)

Mean systolic BP=164.19±35.12 mmHg; Mean diastolic BP=95.73±19.08 mmHg. BP: Blood Pressure, HTN: Hypertension

Table 4: Blood pressure severity category for the respondents

BP category	Severity	Frequency (%)
Combined systolic-diastolic HTN	Mild	15 (12.19)
	Moderate	23 (18.70)
	Severe	45 (36.59)
Isolated systolic HTN	Mild	9 (7.32)
	Moderate	7 (5.69)
	Severe	2 (1.6)
Isolated diastolic HTN	Mild	2 (1.6)
	Moderate	0 (0.00)
	Severe	0 (0.00)

BP: Blood pressure, HTN: Hypertension

Table 5: Test for association between diabetes mellitus status and obesity status for the study population

	Obesity present	Obesity absent
Diabetes mellitus present	16	23
Diabetes mellitus absent	8	76

χ^2=16.83, *df*=1, *P*<0·0001 (significant), Critical value=3.841, α=0.05

Brazil, where majority of the respondents 305 (54.7%) were males. This showed that CKD was more predominant among males which can be attributed to their rugged lifestyles such as indulgence in chronic smoking, chronic alcohol consumption, poor nutritional feeding habit, inadequate exercise, multiple sexual partners, and poor healthcare-seeking behavior. On the other hand, our study disagreed with the one conducted by Sgnaolin *et al*., 2014,[16] in a hospital's hemodialysis unit in Brazil where 65 patients were included in the study, with a mean age of 59.1 ± 14.7 years and 33 (50.8%) were women.

Furthermore, among these CKD patients recruited for this study, there was also a statistically significant association between those with diabetes mellitus and obesity, as this implies that those patients with obesity are highly predisposed and at risk of developing diabetes mellitus.

This study has revealed the comorbidity profile among CKD patients in clinical practice. The strength and limitation of this study was that it considered only consented adult medical patients with CKD who were above the age of 17 years. There was exclusion of pediatric renal diseases' patients, adult CKD patients who did not grant their informed consent, and those patients with AKI from the study. The number of adult CKD patients who did not grant their informed consent and therefore declined from participating in the study was very small and statistically insignificant (about three patients).

Conclusion

The prevalence rates for hypertension, diabetes mellitus, and obesity were significantly high among these CKD patients. In this study, the comorbidity profile among these CKD patients may significantly increase the risk of mortality, health-care costs, length of hospital admission, and recurrent frequency of hospitalization. Regular organization of health education awareness programs on the prevention of CKD and its associated comorbidities or complications among the general public should be done by health-care professionals coupled with adequate support from both governmental agencies and nongovernmental organizations.

Acknowledgments

The authors of this article wish to specially acknowledge and thank the Almighty God for granting them wisdom and understanding to prepare this research work for publication.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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