Original Article

Factors Associated with Blood Pressure Control in Predialysis Chronic Kidney Disease Patients: Short-term Experience from a Single Center in Southern Nigeria

EI Okaka, OE Ojeh-Oziegbe, EI Unuigbe

Department of Medicine, Renal Unit, University of Benin, University of Benin Teaching Hospital, Benin City, Nigeria

Abstract

Background: Hypertension is a leading cause of kidney disease worldwide, and chronic kidney disease (CKD) is a known cause of secondary hypertension. Blood pressure (BP) control is a main-stay in the management of CKD because it retards the progression of established CKD. **Aim:** To determine BP control and its associated factors in predialysis CKD patients in a tertiary hospital setting. **Methodology:** CKD patients who attended the renal outpatient clinic during the period from December 2013 to June 2014 were recruited into the study. Demographic and clinical information were obtained from their case records. The average of the three most recent clinic BPs was calculated for each patient. Good BP control was taken as an average BP of <140/90 mmHg. **Results:** One hundred and three patients (53 males and 50 females) met inclusion criteria for the study. The mean age of the patients was 40.6 ± 17.4 years. Estimated glomerular filtration rate was <60 ml/min in 49.5% of patients. Good BP control was seen in 57 (55.3%) patients. Poor BP control was associated with middle age, proteinuric CKD, and prescription of 3 or more BP medication. **Conclusion:** BP control in predialysis CKD patients still needs to be optimized. Special attention should be given to middle-aged patients who have proteinuric CKD and those on multiple BP drugs without optimal BP control.

Keywords: *Blood pressure control, chronic kidney disease, predialysis*

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Introduction

Chronic kidney disease (CKD) is a significant noncommunicable disease with an estimated worldwide prevalence of 8–16%.[1] The prevalence of CKD and end-stage renal disease (ESRD) is on the increase, especially in developing and underdeveloped countries. CKD ranked 18th on the list of causes of death globally in 2010.[2]

Hypertension is a leading cause of kidney disease worldwide; in the United States, it is second to diabetes mellitus while in Nigeria, it ranks second to chronic glomerulonephritis as a cause of CKD. Kidney disease is also a known cause of secondary hypertension and should be suspected when a young adult presents with hypertension and anemia. Resistant hypertension is fairly common among CKD patients with its prevalence increasing as renal function worsen.[3] Resistant hypertension refers to persistent blood pressure (BP) above target in spite of the use of three antihypertensive drugs (at full dose) including a diuretic, or BP on target only using four, or more antihypertensive drugs. High pill burden with its associated poor adherence can be a problem for CKD patients with resistant hypertension.

A combination of factors including increased activity of the renin-angiotensin system, sodium, and water retention and increased activity of the sympathetic system contribute to the development of hypertension in

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Address for correspondence: Dr. EI Okaka, Department of Medicine, Renal Unit, University of Benin, University of Benin Teaching Hospital, Benin City, Nigeria.
E-mail: enajite.okaka@uniben.edu

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CKD patients.[4] BP control is a main-stay in retarding CKD progression. Some workers have reported that lowering BP is beneficial in retarding CKD progression in both diabetic and nondiabetic CKD. However, BP control targets of ≤130/80 mmHg are preferred for patients with proteinuric CKD as opposed to a target of ≤140/90 mmHg for those with nonproteinuric CKD.[5] However, the recent 2014 guidelines on the management of hypertension published by the 8th Joint National Committee (JNC 8) proposed a target BP of ≤140/90 mmHg for all CKD patients.[6] In persons with proteinuric CKD, renin-angiotensin system blocking agents are especially beneficial because they have been shown to reduce proteinuria by 40–45%.[7]

Uncontrolled hypertension apart from its effect on CKD progression also poses a risk of cardiovascular disease and attendant complications such as stroke and ischemic heart disease. Cardiovascular disease is currently the leading cause of death among patients with CKD. De Nicola *et al*. have reported that patients with "true resistant hypertension" (concordant elevated ambulatory and office BP measurements) have a high risk of cardio-renal events with a significant increase in morbidity and mortality.[3]

We sought to assess BP control in predialysis CKD patients in our center and to determine factors associated with BP control in them.

Methodology

This was a cross-sectional, retrospective survey over a six-month period (December 2013 to June 2014). We looked at predialysis CKD patients attending the renal outpatient clinic in our data base during the period of study and retrieved their clinical records. The renal outpatient clinic in our center has a high patient turnover rate because the patients tend to present late and with advanced CKD such that they require renal replacement therapy (RRT) at first contact or soon after the first presentation. The other reason is the high mortality rate among the patients because majority is unable to afford RRT.

Demographic and clinical information including age, sex, clinical diagnosis, number of prescribed BP medications, and estimated glomerular filtration rate (eGFR) were obtained from case records. Patients who were new to the renal clinic (<3 months) were excluded from the study. Patients who showed persistent dipstick proteinuria (one plus or more) during clinic visits as well as patients with confirmed diabetic nephropathy were considered to have proteinuric CKD while those with no proteinuria, trace, or infrequent one plus proteinuria were considered to have nonproteinuric CKD. The most recent serum creatinine value was used to estimate GFR using the modification of diet in renal disease (MDRD) (4 variable) formula which has been previously validated among Nigerians.[8] Patients were grouped according to eGFR into two groups: Those with eGFR ≥60 ml/min (mild CKD) and those with eGFR <60 ml/min (moderate to severe CKD).

To determine BP control, an average of the three most recent clinic BP readings was taken. BP readings in our outpatient clinic are usually taken in the left arm with the patient in the sitting position after 3–5 min of rest. Patients with average clinic BP readings ≤140/90 mmHg were considered to have good BP control.

Statistical analysis

Data analysis was carried out using IBM SPSS Statistics version 21 (IBM Corp. Armonk, New York). Categorical variables were presented as frequency and percentages while quantitative variables were presented as means and standard deviations. Tables and bar charts were used to present data. Chi-square test was used to compare parameters and $P < 0.05$ taken as statistically significant.

Results

One hundred and fifteen predialysis CKD patients were seen during the study period, but 12 were excluded because they were new to the renal clinic. One hundred and three patients (53 males and 50 females.) were thus

Table 1: Characteristics of study population

Parameters	Frequency (%)/mean±SD
Age (years)	
Mean age	49.6±17.4
<40	37 (35.9)
40-59	27 (26.6)
≥60	39 (37.9)
Gender	
Male	53 (51.5)
Female	50 (48.5)
Diagnosis	
Hypertensive nephropathy	37 (36)
Diabetic nephropathy	22 (21.4)
Chronic glomerulonephritis	14 (13.6)
Polycystic kidney disease	9 (8.7)
Others	21 (20.4)
eGFR (ml/min)	
≥60	52 (50.5)
59-30	25 (24.3)
<30	26 (25.2)
Good BP control	57 (55.3)
Poor BP control	46 (44.7)

eGFR=Estimated glomerular filtration rate; BP=Blood pressure; SD=Standard deviation

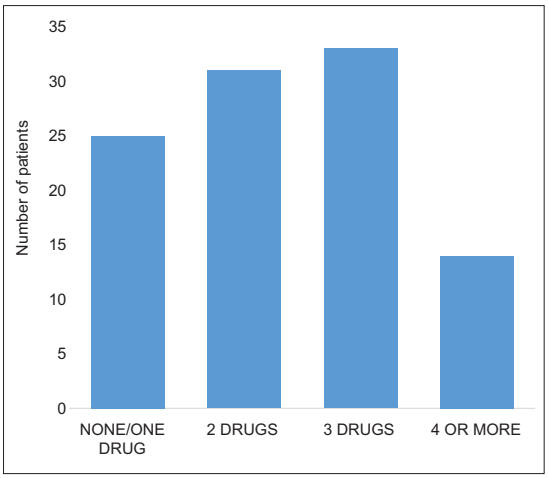

Figure 1: Number of blood pressure drugs consumed by patients ($n = 103$)

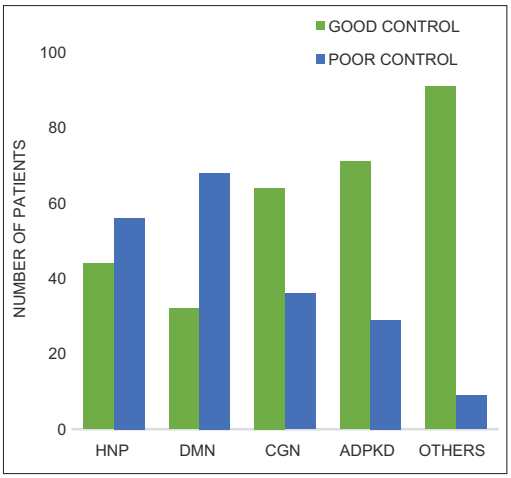

Figure 2: Blood pressure control of patients according to the etiology of chronic kidney disease legend. HNP = Hypertensive nephropathy; DMN = Diabetic nephropathy; CGN = Chronic glomerulonephritis; ADPKD = Autosomal dominant polycystic kidney disease

Table 2: Comparison of parameters between patients according to blood pressure control

Parameter	Poor BP control	Good BP control	*P*
Age (years)			
<40	10 (28.6)	25 (71.4)	0.011
40-59	19 (66.7)	9 (33.3)	
≥60	17 (43.6)	22 (56.4)	
Gender			
Male	27 (50.9)	26 (49.1)	0.175
Female	18 (37.5)	30 (62.5)	
Number of BP drugs			
≤2	11 (20.4)	43 (79.6)	<0.001
≥3	34 (72.3)	13 (27.7)	
Kidney disease			
Proteinuric	34 (54.0)	29 (46.0)	0.014
Nonproteinuric	11 (28.9)	27 (71.1)	
eGFR (ml/min)			
<60	18 (36.7)	31 (63.3)	0.104
≥60	26 (53.1)	23 (46.9)	

eGFR=Estimated glomerular filtration rate; BP=Blood pressure

Table 3: Comparison of patient parameters and number of blood pressure drugs prescribed

Parameter	≤2 drugs (%)	≥3 drugs (%)	*P*
Age (years)			
<40	25 (67.6)	12 (32.4)	0.024
40-59	9 (33.3)	18 (66.7))	
≥60	22 (56.4)	17 (43.6)	
Gender			
Male	23 (43.4)	30 (56.6)	0.021
Female	33 (66.0)	17 (34.0)	
Kidney disease			
Proteinuric	30 (47.6)	33 (52.4)	0.129
Nonproteinuric	24 (63.2)	14 (36.8)	
eGFR (ml/min)			
<60	34 (66.7)	17 (33.3)	0.010
≥60	20 (40.8)	29 (59.2)	

eGFR=Estimated glomerular filtration rate

included in the study. Mean age was 40.6 ± 17.4 years with 39 (37.9%) being aged above 60 years. Hypertension was the most common cause of CKD among participants followed by diabetes mellitus. eGFR was <60 ml/min in 51 (49.5%) of patients. Good BP control was seen in 57 (55.3%) of patients [Table 1]. The bulk of patients were on 2 or 3 BP medications while those on four or more BP medication recorded the least frequency [Figure 1].

There was a significant association between BP control and the age groups ($P = 0.011$) such that patients aged 40–59 years, tended to have poorer BP control compared to patients aged <40 years, and those aged 60 years and above [Table 2].

Being on 3 or more BP medications and having proteinuric CKD, was also associated with poor BP control. Gender and eGFR did not significantly affect BP control [Table 2]. Poor BP control was seen more among patients with diabetic nephropathy followed by those with hypertensive nephropathy [Figure 2].

Considering pill burden, male patients, patients aged 40–59 years and those with eGFR above 60 ml/min were more likely to be on three or more BP medications [Table 3].

Discussion

Good BP control using a cutoff of <140 mmHg systolic and 90 mmHg diastolic, was encountered in 53.3% of patients studied. This is higher than 18% reported by Makusidi *et al*.[9] in a similar study in Ilorin, Nigeria. This marked difference may be explained by the fact that Makusidi *et al*. used a lower BP target of <130/90 mmHg as a measure of good BP control.

Taslim and Oluwafemi[10] in Lagos, Nigeria, recently reported good BP control in 25.3% using a BP target of 130/80 mmHg. Apart from the difference in BP targets used, this study used BP on an index day as a measure of BP control while we used the average of the three most recent clinic BP readings.

Considering studies done outside of Africa, Fraser *et al*.,[11] in a multicenter study, done in the United Kingdom involving 1741 stage 3 CKD patients, reported BP control to target of 58.1%, 35.9%, and 60.2%, respectively using the National Institute for Health and Clinical Excellence (NICE) guidelines,[12] the National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI) guidelines[13] and the Kidney Disease: Improving Global Outcomes (KDIGO) guidelines,[14] respectively. The NICE guidelines recommend a BP target of <140/90 mmHg (or <130/80 mmHg for patients with proteinuria) while the NKF KDOQI and KDIGO guidelines recommend ≤130/80 mmHg for all patients and ≤140/90 mmHg (or <130/80 mmHg for proteinuric patients), respectively. The 2014 evidence-based guidelines for the management of hypertension in adults as recommended by the JNC 8,[6] state that for CKD patients ≥18 years of age, BP goal should be <140/90 mmHg. This recommendation was given because results from the MDRD,[15] the African American Study of Kidney Disease and Hypertension[16] and Ramipril Efficacy in Nephropathy-2[17] trials showed no benefit of strict BP control on the progression of CKD. However, recently, Ku *et al*.[18] looked at MDRD trial enrollees and did an extended follow-up for 19.3 years comparing outcomes in participants randomized to have usual BP control target of 107 mmHg mean arterial pressure with those randomized to have strict BP control target of 92 mmHg mean arterial pressure. They found a lower risk of death after the onset of ESRD among participants randomized to have strict BP control.

In Nigeria, CKD patients tend to present late to the nephrologists and due to poor funding of renal care services, most ESRD patients die within 3–6 months. Therefore, the long-term benefits of strict BP control cannot be assessed in Nigerian patients in the current status quo.

Patients on three or more BP pills tended to have poorer BP control compared to those on fewer BP pills. It is possible that the patients were not adherent to therapy. Resistant hypertension is a common finding in patients with CKD and could be contributory to poor BP control in the patients.

Gender did not have a significant effect on BP control among the CKD patients studied. Previous studies on BP control and gender have shown varying results with some, reporting better BP control in females[19] and others suggesting better BP control in males.[20] It is possible that the presence of CKD in our patients may have modified the effects of gender coupled with the small sample size of our study. We however found a significant interaction between gender and number of BP pills such that males were on more BP pills compared to females. Although this study did not assess drug adherence, it is possible that males had their BP medication increased following lack of BP control on several pills.

Poor BP control was more among CKD patients with diabetes followed by those whose nephropathy was due to hypertension. Hypertension is quite common among diabetic patients and more so in diabetics with overt proteinuria. Saydah *et al*.[21] in their study, in the United States, reported only 35.8% of diabetic patients at BP target of <130/80 mmHg. In addition, in diabetic patients with established diabetic nephropathy, BP goal, especially systolic BP is difficult to achieve.[22] Mechanisms implicated in the development and worsening of hypertension in diabetic patients with nephropathy include the activation of the renin-angiotensin -aldosterone system, increased or abnormal sympathetic nervous system activity, oxidative stress, abnormal nitric oxide metabolism, and endothelial cell function.[23] All these play a role in the difficulty in achieving BP targets in diabetics and are probably at play in patients studied.

This study was limited by the following: Proteinuria was not quantified in the patients with persistent dipstick proteinuria, adherence to therapy was not assessed in the patients.

Conclusion

Poor BP control was associated with middle age, higher number of BP pills, and proteinuric CKD. Uncontrolled hypertension was most common among patients with diabetic nephropathy. Since BP control is a key factor in delaying CKD progression, repeated counseling of patients to encourage adherence to therapy, use of fixed dose combination BP medication where possible, is recommended.

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Conflicts of interest

There are no conflicts of interest.

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