

Blood pressure control among patients with chronic kidney disease in Saudi Arabia: a single-center experience

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Abstract

Background: Chronic kidney disease (CKD) is a global health challenge that contribute to substantial patients' morbidity and mortality. Hypertension is highly prevalent among CKD patients, resulting in higher risks of cardiovascular events and CKD progression. We aim to explore the state of blood pressure (BP) control among pre-dialysis CKD patients, and to explore the factors contributing to its poor control in this group of patients.

Material and methods: This is an observational retrospective study examining the prevalence of hypertension and factors associated with BP control in patients with pre-dialysis CKD at a large tertiary hospital in Saudi Arabia. Data were analyzed using SAS Version 9.2 by SAS Institute Inc., Cary NC, United States.

Results: A total of 339 patients with pre-dialysis CKD were included in this study. The mean age of the study population was 53.5 ± 16.6 , and 55% were male. The prevalence of hypertension was as high as 89%, with 216 (64%) patients being identified as having uncontrolled BP. Age groups 18–39 years, or more than 60 years were significantly associated with poor BP control ($p < 0.001$). Additionally, diabetes ($p < 0.001$), obesity ($p < 0.003$), and advance CKD stage were significantly associated with poor BP control.

Conclusion: BP control is suboptimal among pre-dialysis CKD patients in Saudi Arabia, putting this population at higher risk of CKD progression and cardiovascular events. Large scale efforts and interventions in Saudi Arabia are needed to tackle this problem through multidisciplinary approaches in order to improve the outcomes of CKD patients with hypertension.

Key words: chronic kidney disease; hypertension; uncontrolled blood pressure; Saudi Arabia

Arterial Hypertens. 2023, vol. 27, no. 2, pages: 73–77
DOI: 10.5603/AH.a2023.0010

Introduction

Chronic kidney disease (CKD) has been increasingly recognized as a global health problem that pose huge challenges to patients, caregivers, and healthcare systems, given the highly associated mobility, mortality, treatment costs, and decreased quality of life [1–4]. Over the last couple

of decades, the prevalence of CKD has increased by 29.3%, affecting 10–15% of the population worldwide [5]. In Saudi Arabia, the prevalence of different risk factors for CKD such as diabetes mellitus (DM), hypertension (HTN), obesity, sedentary lifestyle, and smoking has substantially increased over the last years, resulting in higher risks of CKD in this part of the world [6–8].

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Hypertension and CKD are interrelated, as HTN can be a cause or a consequence of CKD. Previous studies have estimated that 60–92% of CKD patients have HTN, resulting in additional risks for cardiovascular disease, which is by the far the leading cause of mortality in this group of patients [9–11]. Blood pressure (BP) control is arguably the most effective intervention to slow the progression of CKD, as well as to lower the risk of cardiovascular disease [12]. However, previous studies have demonstrated that only small proportion of CKD patients achieve optimal BP control [11, 14].

Despite the importance of HTN management and its role in slowing the decline in glomerular filtration rate (GFR) in CKD patients, little is known about the state of blood pressure control among patients with CKD in Saudi Arabia. In the study, we aim to investigate the prevalence of hypertension and inadequate BP control among adult patients with pre-dialysis CKD and to evaluate the factors related to poor BP control in this group of patients.

Material and methods

This was a cross-sectional, retrospective study including 339 patients with pre-dialysis CKD who were following in the outpatient nephrology clinics at a large tertiary hospital in the eastern province of Saudi Arabia from the period of January 1 to November 30, 2022. Participants included patients who were 18 years or older, diagnosed with CKD for at least three months and who had not been undergoing dialysis. CKD patients with kidney transplant were excluded from the current analysis. Demographic and clinical information including age, gender, comorbidities, body mass index (BMI), number of prescribed BP medications, and serum creatinine were obtained from patients' records. CKD was defined as a GFR less than 60 mL/min/1.73 m². The estimated GFR was calculated from serum creatinine using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation. To determine BP control, an average of the three most recent clinic BP measurements was used. BP measurements in our nephrology clinics are usually taken in a sitting position after 5 minutes of rest using validated automated sphygmomanometers. Hypertension was defined as either BP values > 140/90 mm Hg, or current treatment with anti-hypertension medications. All the participants in this study had been provided an informed consent for being included in the study according to the declaration of Helsinki. Data were described using means ± standard deviation

(SD) for continuous variables and frequency distributions with percentages for categorical variables. A p-value < 0.05 was considered significant. Calculations were carried out using SAS Version 9.2 by SAS Institute Inc., Cary NC, United States.

Results

Demographic and clinical characteristics

A total of 339 patients met the inclusion criteria and were included in the present analysis. The patients' demographic and clinical characteristics are presented in Table 1. The mean age of the study population was 53.5 ± 16.6, and 55% were male. Out of the included patients, 69% had diabetes, and 22% were known to have ischemic heart disease. Obesity

Table 1. Patient characteristics

Characteristics	N (%) Total = 339
Age, years (53.5 ± 16.6)	
18–39	30 (9%)
40–60	86 (25.5%)
> 60	223 (65.5%)
Gender	
Male	187 (55%)
Female	152 (45%)
Comorbidities	
Diabetes mellitus	235 (69%)
Hypertension	301 (89%)
Ischemic heart disease	73 (22%)
CKD stage	
3A	49 (15%)
3B	85 (25%)
4	96 (28%)
5	109 (32%)
Body mass index (BMI)	
< 18.5	9 (2.5%)
18.5–24.9	64 (19%)
25–29.9	115 (34%)
30–39.9	128 (37.5%)
≥ 40	24 (7%)
Number of BP medications	
0	11 (3%)
1	38 (11%)
2	139 (41%)
3	120 (36%)
≥ 4	31 (9%)
Controlled BP (< 140/90 mm Hg)	
Yes	123 (36%)
No	216 (64%)

BP — blood pressure

was common with 44.5% of the patients having BMI above 30 kg/m². In terms of the stage of CKD, 15% had stage G3A, 25% stage G3B, 28% stage G4, and 32% stage G5.

Hypertension prevalence, treatment and control

From the total population studied, 301 individuals were identified as hypertensive, thus the prevalence of hypertension was as high as 89%, with 216 (64%) patients being identified as having uncontrolled BP (a mean of 3 BP readings \geq 140 mm Hg and/or diastolic blood pressure \geq 90 mm). In terms of hypertension management, 11% were on one BP medication, 41% on two medications, 36% on three medications, and 9% on four medications or more (Tab. 1).

Association between the study variables and blood pressure control

As presented in Table 2, there was a significant association between BP control and the age groups, such that patients aged 18–39 years, or more than 60 years tended to have poorer BP control ($p < 0.001$) compared to those aged 40–60 ($p = 0.351$). On other hand, no significant difference was noted in blood pressure control between males and females. Poor BP control was seen more among patients with diabetes ($p < 0.001$) and obesity ($p = 0.003$). In terms of CKD stages, the more advanced the stage, the stronger the association with poor BP control. While stage G3A CDK was not associated with poor BP control ($p = 0.327$), Stage G3B, G4, and G5 were significantly associated with poor BP control ($p = 0.023$, $p = 0.007$, $p = 0.0005$, respectively).

Table 2. Association between the study variables and blood pressure (BP) control

Study variables	Controlled BP (< 140/90 mm Hg)	Uncontrolled BP (> 140/90 mm Hg)	p-value
	N (%)	N (%)	
Age [years]			
18–39	7 (23.5%)	23 (76.5%)	0.005
40–60	36 (42%)	50 (58%)	0.351
> 60	80 (36%)	143 (64%)	0.0005
Gender			
Male	65 (35%)	122 (65%)	NS
Female	58 (38%)	94 (62%)	
Diabetes mellitus	84 (36%)	151 (64%)	0.0002
Ischemic heart disease	29 (40%)	44 (60%)	0.084
CKD stage			
3A	19 (39%)	30 (61%)	0.327
3B	32 (38%)	53 (62%)	0.023
4	35 (36%)	61 (64%)	0.007
5	37 (34%)	72 (66%)	0.0005
Body mass index (BMI)			
< 18.5	5 (56%)	4 (44%)	0.254
18.5–24.9	27 (42%)	37 (58%)	0.334
25–29.9	41 (36%)	74 (64%)	0.003
30–39.9	44 (34%)	84 (66%)	0.003
> 40	6 (25%)	18 (75%)	0.017
Number of BP medications			
0	8 (73%)	3 (27%)	0.247
1	13 (34%)	25 (66%)	0.057
2	52 (37%)	87 (63%)	0.009
3	40 (33%)	80 (67%)	0.0008
\geq 4	7 (23%)	24 (77%)	0.003

CKD — chronic kidney disease

Discussion

This study investigated the prevalence of uncontrolled BP pressure among patients with pre-dialysis CKD in Saudi Arabia, which has not been explored before. Such prevalence was found to be as high as 89%. We have also identified different factors associated with poor blood pressure control in this group of patients. These factors included age, diabetes, obesity, and advanced CKD stage. The high prevalence of uncontrolled BP among CKD patients in the present studies is consistent with previous reports, which has ranged between 60–90% [9–11]. Such high prevalence is very concerning given that uncontrolled hypertension is a leading cause of CKD progression. Large scale interventions at national level in Saudi Arabia are needed to tackle this problem through multidisciplinary approaches in order to improve the outcomes of CKD patients with hypertension and slow CKD progression to advance stages and dialysis requirements.

One of the underestimated factors that is highly prevalent among CKD patients, that could contribute largely to the suboptimal control of BP is non-adherence to medications. CKD patients are at higher risk of medications non-adherence given the large number of medications and comorbidities in these group of patients. Different studies have demonstrated that medications non-adherence is common among CKD patients, and that it associates with increased risk of hospitalization, morbidity, and mortality [15–17]. Nephrologists should be aware about the importance of counselling their patients about medications adherence during every visit to the clinic in order to improve BP control and outcomes. Additionally, lifestyle modifications, namely salt restriction, weight reduction, and exercise play major roles in the management of hypertension. This is even more important in CKD population as obesity can accelerate the progression of CKD. The high prevalence of obesity in this study (44.5%) is noteworthy and further highlights the need for different interventions aiming to promote weight reduction in this group of patients. Moreover, this study found that blood pressure control was significantly suboptimal in those with advanced stage G5 CKD. This in fact can be related to the hypervolemic status of these patients with reduced urine output, highlighting again the importance of salt and water restriction, in addition to the appropriate use of diuretics, which are a valuable option in blood pressure control in these patients in particular.

CKD patients are at risk of several complications, including cardiovascular disease, which has remained the leading cause of death among patient with CKD [18, 19]. Optimal BP control will not only reduce the risk of CKD progression but will also decrease the risk of cardiovascular events in these patients. In a previously published meta-analysis, the effect of lowering systolic blood pressure by 10 mm Hg was found to result in a proportional reduction in the risk of major cardiovascular events by 20% [12]. Of note, the target BP among CKD patients is variable by guidelines ranging between 120–140 mm Hg systolic. The target that was used in this study was in line with National Institute for Health and Care Excellence (NICE), which suggest a more conservative target of < 140/90 mm Hg as compared to < 120/80 [20]. Using such BP target in the current study might have actually underestimated the poor blood pressure control rate in this study population.

Although this study has provided an insight to the state BP control and its related factors among pre-dialysis CKD patients in Saudi Arabia, we do acknowledge several limitations in this study. The use of office blood pressure readings (as opposed 24-hour ambulatory blood pressure monitoring), the observational, retrospective nature of the data in this single-center study, and the exclusion of patients with stage G1 and G2 CKD are factors that may affect the generalizability of this study. Moreover, this study was confined to Saudi population, and the finding may not be generalizable to other countries with different populations and ethnicity backgrounds. Although this study has assessed the number of BP medications used by patients, data on the type of these medications were limited. The impact of each drug type on BP control could not be assessed, with largely the result of the frequent changes and modifications of BP therapy. Lastly, other factors that could affect BP control such as smoking, dietary habits and socioeconomic status were not assessed in present study. Further multi-center prospective studies with a larger sample size in this region of the world are therefore needed.

In conclusion, BP control is suboptimal among pre-dialysis CKD patients in Saudi Arabia, putting this population at higher risk of CKD progression and cardiovascular events. Large scale efforts and interventions in Saudi Arabia are needed to tackle this problem through multidisciplinary approaches in order to improve the outcomes of CKD patients with hypertension.

Competing interests

The author declare that he has no competing interests.

Funding

No funds were needed nor were received from any governmental or private Institutions.

Authors' contributions

The manuscript was prepared by a single author, who analyzed and interpreted the data, and wrote the manuscript.

Acknowledgements

I would like to thank the nurses in the nephrology clinics for facilitating the process of data collection.

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