

Research Article

# Chronic Kidney Disease affecting the Characteristics of Blood Pressure: An Observational Study

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DOI: <https://doi.org/10.24321/2349.7181.202116>

## I N F O

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### How to cite this article:

Abhishek KB, Sumanth BV, Ramesh B. Chronic Kidney Disease affecting the Characteristics of Blood Pressure: An Observational Study. J Adv Res Med. 2021;8(3):22-26.

Date of Submission: 2021-12-09

Date of Acceptance: 2022-01-13

## A B S T R A C T

**Background:** Chronic kidney disease (CKD) is a global public-health problem that affects millions of individuals. Despite widespread use of medicines to slow the course of CKD, the burden of end-stage renal disease in many affluent nations remains high. Hypertension is far more frequent in persons with CKD than it is in the general population, and it becomes worse as renal function declines. Controlling blood pressure, which is a controllable risk factor for this complication, may reduce the risk of cardiovascular events and decrease the decline of renal function.

**Objective:** To assess the Characteristics of Blood Pressure in Chronic Kidney Disease.

**Materials and Methods:** A cross-sectional Study was conducted at MS Ramaiah Medical College, Bangalore from 1st of January 2018 to 31st of July 2019. A total of 100 Cases were included in the study.

**Results:** In our research, 10% of the participants were under the age of 30. In the research, 33% of the participants had Stage 3 CKD, 35% had Stage 4 CKD, and 32% had Stage 5 CKD. There was a significant difference in mean OSBP and mean ODBP with increasing CKD stage in the research. With rising CKD stage, mean OSBP and ODBP increased..

**Conclusion:** Ambulatory BP measurements revealed a significant degree of overestimation (white coat HTN) and underestimate (masked HTN) of BP among patients with CKD, indicating that adopting ABPM may assist avoid mistakes in BP measurement as well as correct treatment of HTN in CKD.

**Keywords:** Kidney Disease, Hypertension, Blood Pressure, Cardiovascular

## Introduction

Chronic kidney disease (CKD) is a worldwide public-health problem that affects millions of individuals. Though use of medicines has become common to diminish the rate of progression of CKD, the burden of end-stage renal disease remains high in several developed countries.<sup>1,2</sup> Hypertension is far more frequent in persons with CKD than it is in the general population, and it becomes worse as renal function declines. Excessive mechanical and oxidative stresses damage blood vessels in the kidney and other organs, potentially leading to renal failure and cardiovascular disease.<sup>3,4</sup>

Because hypertension is a preventable risk factor for this complication, lowering blood pressure may assist to reduce the risk of cardiovascular events and renal function loss.<sup>5,6</sup> Hypertension is a major risk factor for the development of chronic kidney disease (CKD). Despite the fact that hypertension affects 86 percent of CKD patients, the number of people who can manage their blood pressure (BP) under 130/80 mm Hg remains low.<sup>7</sup> As the estimated glomerular filtration rate (eGFR) falls, patient health deteriorates, and 86 percent of patients will ultimately develop end-stage renal disease (ESRD).<sup>8,9</sup> In CKD patients with and without proteinuria, rigorous control of blood pressure (BP) to 130/80 and 140/90 mmHg, respectively, is recommended to decrease risks.<sup>10</sup>

However, a considerable percentage of CKD patients have poor blood pressure management, and the numbers vary across studies.<sup>11</sup> Clinic blood pressure is judged insufficient to diagnose HTN and monitor overall BP management since it does not correlate well with ambulatory blood pressure monitoring (ABPM), which includes white-coat or masked Hypertension. Not only is CKD linked to an aberrant dipping pattern, but it's also linked to white-coat or disguised HTN.<sup>12</sup>

## Objectives

To assess the characteristics of blood pressure in chronic kidney disease.

## Materials and Methods

A cross-sectional study was conducted at MS Ramaiah Medical College, Bangalore, between 1st of January 2018 to 31st of July 2019.

Since it was a time bound study, a total of 100 patients with CKD included based on the inclusion and exclusion criteria.

The research covered all instances of chronic kidney disease identified in people over the age of 18 who were admitted to the hospital's Department of Medicine and Nephrology.

Patients with HIV, cirrhosis, transplant recipients, dialysis patients, and pregnant mothers were all excluded from the research.

The "KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of CKD" was used to select patients with chronic kidney disease (CKD). The history was gathered with a focus on CKD symptoms, CHF, co-morbid conditions, and the length of time after CKD diagnosis and hemodialysis. Each participant had appropriate examinations performed on them, and the results were recorded. The Modification of Diet in Renal Disease (MDRD) approach was used to compute the eGFR, and CKD staging was conducted.

Each patient answered a short questionnaire at the time of the ABPM that captured information such as when they went to bed and when they woke up. Using the patient's diary, night-time was defined as actual sleep time.

As previously stated, ABPM was performed twice, first at the end of the drug-free baseline period and again at the end of the maintenance phase, using a Spacelabs model 90202 recorder. The monitor was configured to take data every 15 minutes during regular waking hours (6 a.m. to 10 p.m.), and every 30 minutes throughout the night (10 PM to 6 AM).

At least 6 readings were necessary for a suitable nighttime recording, whereas at least 30 readings were required for an acceptable daytime recording. The daytime parameters (BP and pulse rate) were calculated using the averages from 8 AM to 8 PM, while the nocturnal parameters (BP and pulse rate) were calculated using the averages from midnight to 6 AM. The night/ day ratios for each metric were calculated. The systolic blood pressure (SBP) night/ day ratio was calculated and expressed as a percentage.

Patients were categorised into four dipping groups based on their baseline nocturnal BP fall: severe dippers, with a nocturnal BP fall of 20% or more; dippers, with a nocturnal BP fall of 10% to 20%; non-dippers, with a nocturnal BP fall of 0% to 10%; and risers, with a nocturnal increase in SBP. To investigate the effect of regression to the mean on changes in dipping status, we defined dipping status as the average of baseline and doxazosin BP.

## Statistical Analysis

The data was imported into a Microsoft Excel spreadsheet and analysed using the SPSS 22 programme. Frequencies and percentages were used to represent categorical data. For qualitative data, the Chi-square test/ Pooled chi square was utilised as a test of significance. The mean and standard deviation were used to describe continuous data. When there are more than two groups in a variable, the ANOVA test is employed to determine its significance. The correlation test was used to see whether two continuous variables were related. Data visualisation: MS Excel and MS Word were used to create a variety of graphs, including bar diagrams, pie diagrams, and line diagrams. After applying all statistical

principles, a p value (probability that the result is true) of 0.05 was judged statistically significant.

**Results**

A total of 100 study subjects were included in the study and analyzed.

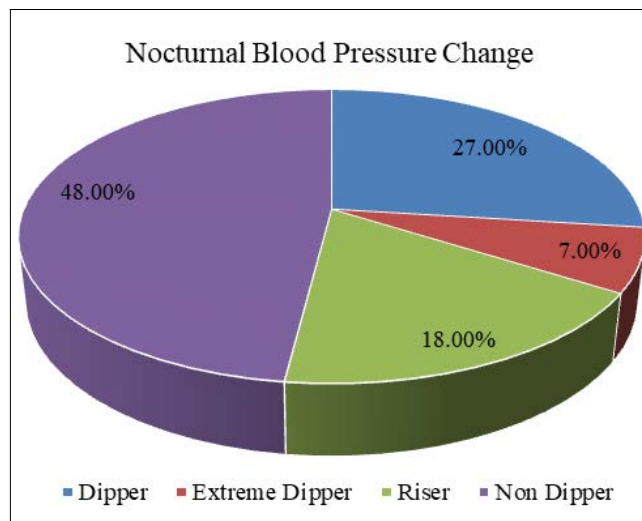
**Table 1. General Profile of CKD Subjects in the Study**

		Count	%
Age	<30 years	10	10%
	31 to 60 years	65	65%
	>60 years	25	25%
Gender	Female	29	29%
	Male	72	71%
Type 2 Diabetes Mellitus	No	54	54%
	Yes	46	46%
Number of Antihypertensive use	1	15	15%
	2	30	30%
	3	40	40%
	4	15	15%
Body Mass Index	Underweight (<18.5)	3	3%
	Normal (18.5 to 22.9)	27	27%
	Overweight (23 to 24.9)	16	16%
	Obese (>25)	54	54%
Stages of CKD	Stage 3	33	33%
	Stage 4	35	35%
	Stage 5	32	32%
Proteinuria	2+	21	21%
	3+	53	53%
	4+	26	26%

In our study, 10% were in the age group <30 years, 65% were in the age group 31 to 60 years and 25% were in the age group >60 years. Majority of them were males 71% and 29% were females. In the study 15% were on one anti hypertensive, 30% were on two anti-hypertensives, 40% were on three anti-hypertensive and 15% were on four anti hypertensives. In the study 33% had Stage 3 CKD, 35% had stage 4 CKD and 32% had Stage 5 CKD. In the study 46% had Diabetes Mellitus and 54% did not have Diabetes Mellitus. In the study 21% had Proteinuria of 2+,53% had Proteinuria of 3+,26% had Proteinuria of 4+.

In the study 27% were dippers, 7% were extreme dippers, 18% were risers and 48% were non-dippers. In our study,

28% had controlled HTN, 29% had masked HTN, 35% had persistent HTN and 8% had white coat HTN.



**Figure 1. Pie diagram showing Nocturnal Blood Pressure Changes distribution among CKD subjects**

**Table 2. Comparison of Mean Office Blood Pressure with Respect to Stage of CKD**

Mean	OSBP		ODBP		
	SD	Mean	SD	Mean	
Stage of CKD	Stage 3	135.2	14.81	77.5	7.12
	Stage 4	138.7	12.83	77.5	7.24
	Stage 5	147.9	12.77	82.7	6.45
P value		0.001*		0.004*	

\*ANOVA test.

In the study there was significant difference in mean OSBP and mean ODBP with increase in Stage of CKD. Mean OSBP and ODBP was increasing with increase in stage of CKD.

In the study, significant positive correlation was observed between stage of CKD and OSBP, ODBP, that is, with increase in stage of CKD there was increase in OSBP, ODBP, respectively, and vice versa.

**Table 3. Spearman's Correlation between Stage of CKD and Blood Pressure**

Correlations					
		Stage of CKD	OSBP	ODBP	
Spearman's rho	Stage of CKD	Correlation Coefficient	1.000	0.346**	0.209*
		P value	.	<0.001*	0.02*
		N	100	100	100

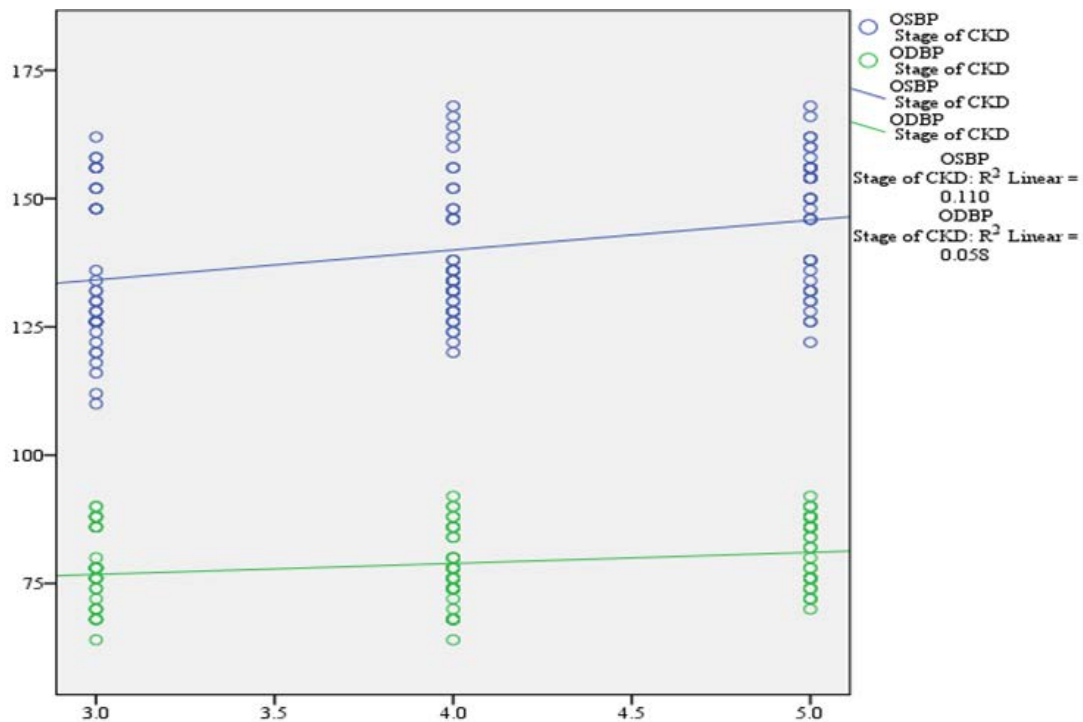


Figure 2. Scatter Plot Showing Correlation between Stage of CKD and Blood Pressure

## Discussion

In our study, age of the patients varied from 18 to 80 years. The commonly affected age group in our study population was 31 to 60 years (65%). The mean age of patients was  $49.8 \pm 13.3$  years. In a study by Gorostidi et al.,<sup>13</sup> Cuncha C,<sup>14</sup> mean age was  $61 \pm 13.9$ ,  $59 \pm 15$  years, respectively. In Prakash et al.,<sup>15</sup> study mean age was  $47.5 \pm 14.9$  years and study by Singh et al.,<sup>16</sup> mean age was  $45.22 \pm 15.2$  years. In our study, the sex ratio was 2.4:1; in study by limuro et al.<sup>17</sup> (n=682 [63.4%]), Oh et al.<sup>18</sup> (n=226 [58.4%]), Pogue et al.<sup>19</sup> (n= 382 [62%]). Compared to other western studies, our study had little more prevalence of male patients.

In this study, 33% had Stage 3 CKD, 35% had Stage 4 CKD and 32% had Stage 5 CKD. In a study by Satoshi limuro al,<sup>17</sup> it was 471(43.8%), 459(41.7%), 155(14.4%) in CKD Stage 3, Stage 4 and Stage 5 respectively.

In our study, 46% had diabetes. In Satoshi limuro al<sup>17</sup> 381 (35.4%) had diabetes. In Singh et al.,<sup>16</sup> 5094 (31.6%) out of 16120 had diabetes compared to other studies our study had little more prevalence of diabetes. In our study Diabetes was the main cause for CKD. In our study, 21% had proteinuria of 2+, 53% had proteinuria of 3+, 26% had proteinuria of 4+. In limuro et al.<sup>17</sup> 926 (87%) had proteinuria.

In this study 27% were dippers, 7% were extreme dippers, 18% were risers and 48% were non-dippers. In limuro et al.<sup>17</sup> 105 ( 9.7%) were extreme dipper, 395(36.7%) were dipper, 408 (37.9%) were non-dipper, 167 (15.5%) were riser. In Otero et al.<sup>20</sup> 4.7%, 47.2%, 42.3%, 5.9%. In Pogue et

al.<sup>9</sup> dippers 19.7%, non-dippers 41%, reverse dippers 39.2%. In Cha et al. dippers 33.3%, non-dippers 34.5%, reverse dippers or risers 17.3%, extreme dippers 14.9%. Since the study was conducted in a tertiary care centre, prevalence of advanced stage of CKD was more when compared to other studies and hence prevalence of non-dippers and risers was relatively more when compared to other studies.

In our study, mean OSBP of stage 3,4,5 is  $135.2 \pm 14.81$ ,  $138.7 \pm 12.83$ ,  $147.9 \pm 12.77$  and mean ODBP  $77.5 \pm 7.12$ ,  $77.5 \pm 7.24$ ,  $82.7 \pm 6.45$ . In the study, significant positive correlation was observed between Stage of CKD and OSBP, ODBP; that is, with increase in stage of CKD, there was increase in OSBP, ODBP, respectively, and vice versa. In limuro et al.<sup>17</sup> OSBP of stage 3, 4, 5 was  $129.7 \pm 17.2$ ,  $132.7 \pm 17.8$ ,  $137.8 \pm 18.8$  and mean ODBP  $77.9 \pm 11.3$ ,  $77.3 \pm 11.5$ ,  $77.5 \pm 12.1$ . Same pattern was also found in limuro et al.<sup>17</sup>

## Conclusion

Our study showed that 24 hour ABPM provides a more reliable assessment of BP in patients with CKD. Evaluation of ambulatory BP also showed a remarkable amount of overestimation (white coat HTN) and underestimation (masked HTN) of BP among patients with CKD so by using ABPM we can circumvent errors in measurement of BP and also helpful in proper management of HTN in CKD. We found that prevalence of persistent HTN was high in CKD population and increased in association with progression of CKD. Prevalence of non-dipping and risers are more in advanced stages of CKD.

**Conflict of Interest:** None

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