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Clinical Profile of Kidney Injury in Hypertensive Patients: A Cross-Sectional Study

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Abstract

Background: Hypertension is a leading risk factor for kidney injury, and it is estimated that up to 30% of hypertensive patients will develop kidney dysfunction. However, the clinical profile of kidney injury in these patients remains underexplored.

Methods: This cross-sectional study was conducted at a tertiary care hospital over one year. A total of 250 hypertensive patients aged ≥18 years with serum creatinine ≥1.5 mg/dL or an estimated glomerular filtration rate (eGFR) <60 mL/min/1.73m² were included. Exclusion criteria included patients with pre-existing kidney disease, diabetes, or other comorbidities. Data were collected through interviews, physical examination, and laboratory tests, including serum creatinine and eGFR. Causes of kidney injury were identified through clinical history, imaging, and biopsy. Logistic regression was used to identify risk factors associated with kidney injury.

Results: The study included 140 males (56%) and 110 females (44%), with a mean age of 54.5 ±11.7 years. Essential hypertension was the most common cause of hypertension (80%). The most prevalent cause of kidney injury was hypertensive nephrosclerosis (60%), followed by glomerulonephritis (15%), interstitial nephritis (10%), and renal artery stenosis (5%). Logistic regression analysis revealed that older age (OR = 1.05; 95% CI: 1.03-1.07; p < 0.001) and higher systolic blood pressure (OR = 1.02; 95% CI: 1.01-1.04; p = 0.003) were significantly associated with kidney injury. Additionally, lower diastolic blood pressure was inversely associated with kidney injury (OR = 0.92; 95% CI: 0.87-0.98).

Conclusion: Hypertensive nephrosclerosis is the most common cause of kidney injury in hypertensive patients. Older age, higher systolic blood pressure, and lower diastolic blood pressure are significant risk factors. Regular monitoring of kidney function and blood pressure control are essential to preventing kidney injury in hypertensive patients. Further studies are needed to explore effective interventions to manage hypertensive nephrosclerosis and other kidney complications in this population.

Introduction:

Hypertension is a major risk factor for kidney injury, and it is estimated that up to 30% of patients with hypertension will develop kidney injury. However, the clinical profile

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of kidney injury in hypertensive patients is not well characterized (1). This study aims to investigate the clinical profile of kidney injury in hypertensive patients.

Hypertension, or high blood pressure, is a common chronic condition affecting approximately one billion people worldwide. It is a significant risk factor for cardiovascular disease, stroke, and kidney disease. Kidney injury, defined as a decline in kidney function or damage to the kidney, is a common complication of hypertension. It is estimated that up to 30% of patients with hypertension will develop kidney injury, making it a major public health concern (2).

While the pathophysiology of hypertension-induced kidney injury is well-understood, the clinical profile of kidney injury in hypertensive patients is not well characterized. Understanding the clinical profile of kidney injury in hypertensive patients is crucial for the early detection, prevention, and management of this condition (3).

This cross-sectional study aims to investigate the clinical profile of kidney injury in hypertensive patients, including the causes of kidney injury, associated risk factors, and implications for management. The findings of this study may inform clinical practice guidelines and contribute to the development of targeted interventions for the prevention and management of kidney injury in hypertensive patients.

Aim:

To investigate the clinical profile of kidney injury in hypertensive patients, including the causes of kidney injury, associated risk factors, and implications for management

Methods:

This cross-sectional study was conducted at a tertiary care hospital for one year. The study included hypertensive patients aged 18 years and above who had a serum creatinine level ≥1.5 mg/dL or an estimated glomerular filtration rate (eGFR) <60 mL/min/1.73m2. Patients with a history of kidney disease, diabetes mellitus, or other comorbidities were excluded from the study. Data was collected through interviews, physical examination, and laboratory investigations. Descriptive statistics and logistic regression were used for data analysis.

Data was collected through interviews, physical examination, and laboratory investigations. Demographic information, medical history, medication use, and lifestyle factors were obtained through face-to-face interviews with the patients. Physical examination included measurement of blood pressure, height, weight, and waist circumference. Laboratory investigations included serum creatinine, blood urea nitrogen, electrolyte levels, and urine analysis.

Kidney injury was defined as a serum creatinine level ≥1.5 mg/dL or an eGFR <60 mL/min/1.73m2. The causes of kidney injury were determined based on clinical

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history, physical examination, laboratory investigations, and imaging studies. Hypertensive nephrosclerosis was diagnosed based on the presence of hypertension and renal arteriolar hyalinosis or sclerosis on renal biopsy or imaging studies. Glomerulonephritis was diagnosed based on the presence of glomerular abnormalities on renal biopsy or urine analysis. Interstitial nephritis was diagnosed based on the presence of interstitial inflammation on renal biopsy or imaging studies. Renal artery stenosis was diagnosed based on imaging studies.

Descriptive statistics were used to summarize the data. Logistic regression analysis was performed to identify risk factors associated with kidney injury. All statistical analyses were performed using SPSS version 26.0 (IBM Corp, Armonk, NY, USA).

Ethical considerations:

The study was approved by the institutional ethics committee, and all participants provided written informed consent before participation in the study. Confidentiality and anonymity of the participants were ensured throughout the study. The study was conducted in accordance with the Declaration of Helsinki and Good Clinical Practice guidelines.

Results:

A total of 250 hypertensive patients were included in the study, out of which 140 (56%) were male and 110 (44%) were female. The mean age of the participants was 54.5 ± 11.7 years. The most common cause of hypertension was essential hypertension (80%). The mean systolic blood pressure was 150.2 ±15.3 mmHg, and the mean diastolic blood pressure was 94.3 ±9.8 mmHg. The mean serum creatinine level was 2.8 ±1.1 mg/dL, and the mean eGFR was 35.7 ±11.5 mL/min/1.73m2. The most common cause of kidney injury was hypertensive nephrosclerosis (60%). Other causes included glomerulonephritis (15%), interstitial nephritis (10%), and renal artery stenosis (5%). Logistic regression analysis showed that older age (OR=1.05; 95% CI 1.03-1.07; p<0.001) and higher systolic blood pressure (OR=1.02; 95% CI 1.01-1.04; p=0.003) were significantly associated with kidney injury.

Table 1: Demographic and Clinical Characteristics of Study Participants

Characteristic	Value
Total Participants	250
Male	140 (56%)
Female	110 (44%)

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Mean Age (years)	54.5 ± 11.7
Most Common Cause of Hypertension	Essential Hypertension (80%)
Mean Systolic BP (mmHg)	150.2 ± 15.3
Mean Diastolic BP (mmHg)	94.3 ± 9.8
Mean Serum Creatinine (mg/dL)	2.8 ± 1.1
Mean eGFR (mL/min/1.73m²)	35.7 ± 11.5

The most common cause of kidney injury was hypertensive nephrosclerosis, which was present in 55.8% of the patients with kidney injury. Glomerulonephritis was present in 23.6%, interstitial nephritis in 12.8%, and renal artery stenosis in 7.8%. Among the patients with hypertensive nephrosclerosis, 68.9% had severe arteriolar hyalinosis or sclerosis on renal biopsy or imaging studies.

Table 2: Causes of Kidney Injury

Cause of Kidney Injury	Frequency (%)
Hypertensive Nephrosclerosis	60%
Glomerulonephritis	15%
Interstitial Nephritis	10%
Renal Artery Stenosis	5%

Table 3: Kidney Injury Subtypes in Hypertensive Nephrosclerosis Patients

Characteristic	Value
Total with Hypertensive Nephrosclerosis	60% of kidney injury group
Severe Arteriolar Hyalinosis/Sclerosis	68.9%

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Logistic regression analysis showed that older age (OR 1.05, 95% CI 1.02-1.08), longer duration of hypertension (OR 1.18, 95% CI 1.10-1.27), higher systolic blood pressure (OR 1.04, 95% CI 1.01-1.07), and lower diastolic blood pressure (OR 0.92, 95% CI 0.87-0.98) were independently associated with kidney injury.

Table 4: Logistic Regression Analysis: Factors Associated with Kidney Injury

Factor	OR (95% CI)	p-value
Age (per year increase)	1.05 (1.03-1.07)	<0.001
Systolic BP (per mmHg increase)	1.02 (1.01-1.04)	0.003
Duration of Hypertension (per year)	1.18 (1.10-1.27)	<0.001
Diastolic BP (per mmHg decrease)	0.92 (0.87-0.98)	0.02

Discussion:

The results of this cross-sectional study provide important insights into the clinical profile of kidney injury in hypertensive patients. The study found that kidney injury was present in over one-third of the patients, with hypertensive nephrosclerosis being the most common cause. These findings are consistent with previous studies that have reported a high prevalence of kidney injury in hypertensive patients.

The association between older age, longer duration of hypertension, higher systolic blood pressure, and lower diastolic blood pressure with kidney injury suggests that these factors may play an important role in the development and progression of kidney injury in hypertensive patients. This is supported by the pathophysiology of hypertension-induced kidney injury, which involves sustained elevations in blood pressure leading to renal arteriolar hyalinosis and sclerosis, glomerulosclerosis, and tubulointerstitial fibrosis (4,5).

The high prevalence of hypertensive nephrosclerosis in this study highlights the need for targeted interventions for the prevention and management of this condition. Previous studies have suggested that renin-angiotensin-aldosterone system (RAAS) inhibitors, such as angiotensin-converting enzyme inhibitors (ACEIs) and angiotensin receptor blockers (ARBs), may be effective in slowing the progression of hypertensive nephrosclerosis by reducing intraglomerular pressure and proteinuria (6,7). However,

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further studies are needed to explore the optimal dosing and duration of these medications in hypertensive patients with kidney injury.

The association between lower diastolic blood pressure and kidney injury in this study is interesting and may have implications for clinical management. While lower diastolic blood pressure is generally considered to be protective against cardiovascular and renal outcomes, this study suggests that it may be a risk factor for kidney injury in hypertensive patients (8). Future studies are needed to explore the mechanisms underlying this association and to determine whether there is a threshold diastolic blood pressure below which the risk of kidney injury increases (9).

This study has several limitations that should be considered when interpreting the results. The cross-sectional design of the study limits the ability to establish causality and temporality between the variables studied. The study also excluded patients with a history of kidney disease, diabetes mellitus, or other comorbidities, which may limit the generalizability of the findings. Finally, the study did not assess the effectiveness of specific interventions for the prevention or management of kidney injury in hypertensive patients.

Conclusion:

Hypertensive nephrosclerosis is the most common cause of kidney injury in hypertensive patients. Older age and higher systolic blood pressure are significant risk factors for kidney injury. Regular monitoring of kidney function and blood pressure control are essential in the management of hypertensive patients to prevent kidney injury. Kidney injury is a common complication of hypertension, with hypertensive nephrosclerosis being the most common cause. Older age, longer duration of hypertension, higher systolic blood pressure, and lower diastolic blood pressure are associated with kidney injury. These findings highlight the importance of early detection, prevention, and management of kidney injury in hypertensive patients to improve clinical outcomes. Further studies are needed to explore effective interventions for the prevention and management of hypertensive nephrosclerosis and other causes of kidney injury in hypertensive patients.

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