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Clinical and demographic profile of peripheral neuropathy in chronic kidney disease in Baghelkhand region (Central India)

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Abstract

Background and Objectives: This study aimed to examine clinical manifestations and determine the prevalence of peripheral neuropathy and peripheral nerve dysfunction in CKD patients attending our hospital, considering the severity and duration of their condition. CKD is a significant health issue, with rising prevalence, particularly among the elderly and those with diabetes and hypertension.

Methods: This cross-sectional study included 100 CKD patients from a tertiary care hospital in Baghelkhand region, central India, representing different age groups. Peripheral nerve dysfunction was assessed using clinical evaluation and electrophysiological nerve conduction studies.

Results: It was found that 66% of the study population exhibited both chronic kidney disease and peripheral nerve dysfunction. Notably, the prevalence of peripheral nerve dysfunction was more prominent among individuals aged 65 years and above in comparison to those under 65 years of age. Additionally, a higher prevalence of peripheral nerve dysfunction in individuals with longer durations of CKD was noted. In cases where creatinine clearance was below 15 ml/minute, the incidence of peripheral nerve dysfunction was higher in male subjects. However, for creatinine clearance between 30-59 ml/minute, both sexes were equally affected.

Conclusion: CKD can lead to various forms of peripheral neuropathy, including both overt and subclinical neuropathy. Among these, distal symmetrical sensory motor neuropathy was frequently observed in CKD patients. Moreover, the prevalence of peripheral neuropathy increases in correlation with the duration and severity of CKD.

Key words: Peripheral neuropathy**,** Chronic Kidney Disease, India.

Introduction

Chronic Kidney Disease (CKD) represents a significant global public health challenge and is characterized by long-term kidney damage. Irrespective of the underlying cause, CKD results in the progressive and irreversible loss of nephron mass. The consequences of a severe reduction in nephron mass extend to the dysfunction of nearly all organ systems within the body. Notably, CKD is an escalating health concern worldwide, with a prevalence of 15% in developed nations. Peripheral neuropathy emerges as a frequent complication associated with kidney disease [1, 2].

In the United States and Europe, the average prevalence of CKD, excluding individuals undergoing dialysis or with a functioning transplant, has been reported to be approximately 11%. CKD has the potential to impact the nervous system at various levels, encompassing

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both the Central Nervous System (CNS) and the Peripheral Nervous System (PNS). The definition of CKD involves the presence of kidney damage, which is indicated by abnormal albumin excretion or reduced kidney function as measured or estimated by the Glomerular Filtration Rate (GFR), persisting for a duration exceeding 3 months [3-6].

CKD encompasses various stages, forming the basis of an international classification system. Earlier clinical guidelines pertaining to renal conditions have primarily concentrated on patients with End-Stage Renal Disease (ESRD), which represents the most advanced stage of CKD (referred to as Stage 5). These guidelines have predominantly addressed the management and treatment of individuals in this particular stage of kidney disease [7-9]. The precise prevalence of CKD in India is currently unknown due to the absence of a renal registry. However, certain community-based studies have provided estimates of the prevalence of chronic kidney failure in the range of 0.16% to 0.79% [3,10].

The significance of peripheral nervous dysfunction in CKD is underscored by the substantial global mortality rate of up to 20% per year in patients with End Stage Renal Disease (ESRD). Notably, neuropathy is observed in at least 65% of patients prior to commencing dialysis for CKD and represents one of the most prevalent neurological complications associated with chronic uremia. From a neurological perspective, CKD manifests with clinical features such as weakness, length-dependent sensory impairment, leading to functional disability, and in cases of acute uremia, altered mental state due to encephalopathy. Neuropathy can manifest as encephalopathy, peripheral polyneuropathy, autonomic dysfunction, sleep disorders, and less commonly as peripheral mononeuropathy [11, 12 and 13].

The symptoms of peripheral neuropathy typically do not manifest unless the Glomerular Filtration Rate (GFR) drops below 12 to 20 mL/min or until uremia has been present for a minimum of six months. Peripheral neuropathy, as assessed by Nerve Conduction Velocity (NCV) studies, is found in 15% to 85% of individuals with decreased GFR. Sensory NCV is reduced in more than 90% of patients, while motor NCV is decreased in only 40% of cases. Among patients undergoing dialysis, objective evidence of neuropathy is present in 50% to 100% of cases, and the prevalence appears to rise with longer durations of dialysis. The onset and severity of neuropathy are correlated with the GFR level, but there is insufficient evidence to establish a specific threshold GFR level that indicates an increased prevalence or severity of neuropathy [14].

Therefore, the primary objective of the current study was to assess the prevalence of peripheral nerve dysfunction in patients with CKD. Additionally, the study aimed to investigate the clinical presentation and severity of peripheral nerve dysfunction in this patient population from Baghelkhand region of central India.

Material & methods

This descriptive cross-sectional study involved the inclusion of 100 patients diagnosed with CKD from a tertiary care hospital in Baghelkhand region in central India, encompassing various age groups. All the patients included in the study exhibited clinical and biochemical indicators confirming the presence of CKD, with renal failure durations ranging from 4 months to 8 years. None of the participants were undergoing dialysis at the time of the study. The research adhered to the ethical principles stated in the Declaration of Helsinki [15].

This study included patients with CKD across various age groups who met the following criteria: creatinine clearance <40 ml/minute, serum creatinine >2 mg%, and ultrasound abdomen revealing kidney size <9 cm. Patients with co-existing conditions such as diabetes mellitus, alcoholism, drug-induced peripheral neuropathy, and Hansen's disease were excluded from the study.

In order to evaluate the presence of peripheral nerve dysfunction, two approaches were employed: clinical assessment of nerve dysfunction based on motor and sensory symptoms

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and signs, and electrophysiological studies utilizing nerve conduction studies. These methods were used to assess and measure any potential abnormalities or impairments in the peripheral nerves.

A comprehensive clinical examination was conducted on all patients, with particular emphasis on assessing anemia, skin changes, peripheral nerve thickening, and sensory and motor signs, including the evaluation of ankle reflexes. Additional supportive evidence was obtained through diagnostic ultrasound, which served as a diagnostic tool to assess the size of the kidneys. This is important because kidneys often undergo contraction in individuals with chronic kidney disease, and ultrasound helps in confirming this aspect of the disease.

Due to the limitations of directly measuring total glomerular filtration rate (GFR), the creatinine clearance test was employed as an alternative method to estimate approximate values of total GFR. The Cockcroft-Gault equation, a commonly used formula, was utilized in this study to calculate the creatinine clearance. This equation takes into account factors such as age, sex, weight, and serum creatinine levels to estimate the GFR, providing an approximation of renal function in patients with chronic kidney disease.

The values obtained in this study were expressed as mean values. The prevalence of peripheral neuropathy and its various types were analyzed by calculating the percentage difference. This approach allowed for a quantitative assessment of the occurrence and distribution of peripheral neuropathy within the studied population.

Results

A total 100 patients from diverse age groups, who exhibited clinical and biochemical parameters indicative of chronic kidney disease, were included in this study. It was observed that 66 of them, accounting for 66% of the study population, exhibited peripheral nerve dysfunction. The distribution of peripheral nerve dysfunction among the patients showed a male-to-female ratio of 2.70:1, as indicated in Table 1.The incidence of peripheral nerve dysfunction showed a greater impact in relation to different age groups.

Table 1: Age and gender wise distribution of peripheral neuropathy in CKD patients

Age group	Patients with CKD	Patients with Peripheral Neuropathy	Peripheral Neuropathy (%)
15-24	13	6	46.15
25-34	15	10	66.67
35-44	27	18	66.67
45-54	22	15	68.18
55-64	10	7	70.00
65-74	13	10	76.92
Gender			
Male	73	51	69.86
Female	27	15	55.56

The risk of peripheral nervous dysfunction was found to increase with the duration of the CKD, particularly when the duration exceeds 5 years (as indicated in Table 2). Among the various types of neuropathy, distal motor sensory neuropathy was found to be the most common type observed in patients with chronic kidney disease (as presented in Table 3).

Table 2: Duration of CKD and prevalence of peripheral neuropathy

Duration of Chronic Kidney Disease	Patients with CKD	Patients with Peripheral Neuropathy	Peripheral Neuropathy (%)
<1 year	15	6	40.00
1-3 years	28	15	53.57

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3-5 years	30	22	73.33
> 5 years	27	23	85.19

Table 3: Type of peripheral neuropathy in CKD patients

Type of Peripheral Neuropathy	Number of patients	Percentage (%)
Sensory	34	51.52
Motor	17	25.76
Sensory-Motor	15	22.73
Total	66	100.00

Table 4 presents the distribution of creatinine clearance based on gender among the CKD patients under study. On the other hand, Table 5 provides information on the manifestation of neuropathy, both overt and subclinical, in the same group of CKD patients.

Table 4: Gender wise creatinine clearance and peripheral neuropathy

Creatinine Clearance (ml/min)	Number of Patients with CKD		Number of Patients with Peripheral Neuropathy	
	Male	Female	Male (%)	Female (%)
<15	43	19	34 (79.07)	13 (68.42)
15-29	23	3	12 (52.17)	1 (33.33)
30-59	7	5	5 (71.43)	1 (20.00)

Table 5: Clinical manifestation of peripheral neuropathy in CKD patients

Overt Neuropathy n (%)	Subclinical Neuropathy n (%)	Total n (%)
21 (31.82)	45 (68.18)	66 (100)

Discussion

CKD is a chronic condition characterized by kidney damage, which can result in long-term health complications. The causes of kidney damage are varied, and the condition is typically irreversible, leading to adverse health outcomes. In certain cases, dialysis or kidney transplantation may be required to sustain the life of affected individuals. Recent studies have focused on the epidemiology of CKD, revealing that its prevalence is higher than previously estimated [16-18].

Peripheral neuropathy is a well-recognized complication of renal failure. Among patients with chronic kidney disease (CKD), the most common type of peripheral neuropathy is distal symmetrical sensory motor neuropathy. Interestingly, there is a higher prevalence of peripheral neuropathy in males compared to females, particularly when the creatinine clearance is below 15 ml/minute. This suggests a potential gender predilection for the development of peripheral neuropathy in CKD patients.

When the duration of chronic kidney disease (CKD) exceeds five years, a significant proportion of patients exhibit features of peripheral nerve dysfunction, either clinically or through electrophysiological assessments. This indicates that as the duration of CKD progresses, the likelihood of developing peripheral nerve dysfunction increases substantially.

In the present study, it was observed that polyneuropathy was most commonly observed in patients with higher levels of blood urea and creatinine, as well as lower creatinine clearances. These factors, indicative of severe renal insufficiency, were found to be associated with a higher likelihood of developing polyneuropathy. Additionally, the duration of severe renal insufficiency was also identified as a contributing factor to the

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onset of polyneuropathy. Thus, both the severity and duration of renal impairment played a role in influencing the occurrence of polyneuropathy in the studied population.

The findings of this study indicate that reduced motor nerve conduction velocity and sensory nerve conduction velocity are indicative of peripheral neuropathy. It is important to note that this study did not include F-waves and H-reflex as diagnostic measures, which are essential for identifying root lesions. The prevalence of overt neuropathy in the studied population was determined to be 31.82%, while subclinical neuropathy was observed in 68.18% of the patients. These results highlight the significant burden of peripheral neuropathy in individuals with chronic kidney disease.

The results demonstrated that CKD is associated with the development of peripheral neuropathy, including both overt and subclinical forms. Among the various types of peripheral neuropathy observed, distal symmetrical sensory motor neuropathy was found to be the most common. Importantly, the prevalence of peripheral neuropathy was found to increase with the duration and severity of CKD, suggesting a direct relationship between these factors. These findings emphasize the impact of CKD on peripheral nerve function and highlight the need for comprehensive assessment and management of neuropathic complications in patients with CKD. These findings are in line with previous studies [19, 20]

Conclusion

CKD is widely acknowledged as a significant health issue. With the growing population of CKD patients, primary care providers will face the challenge of managing the intricate medical issues specific to individuals with chronic renal impairment. The purpose of this study is to shed light on the prevalence and clinical manifestation of peripheral nerve dysfunction among patients diagnosed with CKD.

Conflicts of interest

None

Source of funding

None

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