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Original Article

Serum Creatinine Levels Across Different Stages of Chronic Kidney Disease and its Impact on Periodontal Health

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Abstract

Background: Chronic kidney disease (CKD) is a progressive condition characterized by a decline in renal function, which is often assessed through serum creatinine levels. Periodontal disease is a common comorbidity in CKD patients, potentially worsening systemic inflammation and further impairing kidney function.

Objective: To assess the varying levels of serum creatinine in CKD patients and their impact on periodontal health.

Methods: A descriptive comparative cross-sectional study was conducted at Sharif Medical and Dental College Lahore, including 50 CKD patients. Data on serum creatinine levels, CKD stage, and sociodemographic factors were collected using a structured proforma. Periodontal health was assessed using the Community Periodontal Index of Treatment Needs (CPITN). Ethical approval was obtained (No. SMDC/SMRC/100-19), and informed consent was secured from all participants. Patients aged 18 and above with CKD, irrespective of the stage, were included, while those with other systemic illnesses or on medications for conditions other than CKD were excluded. Statistical analysis was performed using the Kruskal-Wallis test in SPSS version 25, with a significance level set at $p \leq 0.05$.

Results: The study included 50 individuals with a mean age of 45.26±16.799 years (52% males, 48% females). Serum creatinine levels varied significantly across CKD stages ($p=0.001$), with mean ranks of 6.55 for stage 3, 19.32 for stage 4, and 34.38 for stage 5. Significant differences were also observed across periodontal health categories ($p=0.042$), with mean ranks of 5.75 for healthy periodontium, 18.00 for bleeding gums, 31.63 for calculus, and 25.50 for pocket depth of 4-5mm.

Conclusion: Serum creatinine levels were highest in stage 5 CKD patients and those with severe periodontal disease. These findings underscore the importance of integrating periodontal health management into the overall care of CKD patients to potentially reduce systemic inflammation and improve outcomes.

1 Introduction

Chronic kidney disease (CKD) is a progressive condition characterized by a gradual loss of kidney function over time. A crucial biomarker for assessing kidney function is serum creatinine, a waste product generated by

muscle metabolism (1). Creatinine is filtered from the blood by the kidneys and excreted in the urine, and elevated serum creatinine levels indicate impaired kidney function, reflecting the kidneys' reduced ability to filter blood and eliminate waste (2, 3). The normal range of serum creatinine is 0.6 to 1.2 mg/dL for males and 0.5 to 1.1 mg/dL for females, making it a vital parameter in monitoring kidney health and ensuring optimal kidney function (4, 5).

The assessment of serum creatinine levels aids in estimating the glomerular filtration rate (GFR), an essential measure in staging CKD patients (6). CKD stages range from mild damage with normal or slightly elevated GFR (stage 1) to severely diminished GFR in stage 5 (7-9). Several factors influence serum creatinine levels, including demographic factors, medications, age, and muscle mass (6). Patients with CKD are at an increased risk of developing periodontal disease due to a compromised immune system and widespread inflammation (10, 11). Moreover, CKD patients often suffer from systemic issues such as hypertension and diabetes, which further impact their periodontal health (12, 13). The inflammation in the periodontium caused by periodontitis can spread systemically, potentially exacerbating kidney damage (14).

Maintaining oral hygiene and health is challenging for CKD patients due to numerous dietary restrictions and deteriorating physical health (15). Dental treatments are often complicated by the compromised immunity of CKD patients, some of whom are on blood thinners or immunosuppressive drugs, making dental procedures challenging or even impossible (16). Additionally, CKD patients frequently experience dry mouth, leading to increased periodontal problems, caries prevalence, and infections like candida (17). Addressing periodontal issues in CKD patients can improve overall health by reducing systemic inflammation (18). Thus, dental healthcare workers must collaborate with nephrologists to enhance the overall health of these patients (19).

This study aims to assess the varying levels of serum creatinine in CKD patients and its impact on periodontal health, filling a gap in the existing literature that has not extensively explored this connection. Understanding this relationship is crucial as it may lead to new treatment modalities and improved oral health management for CKD patients. By analyzing serum creatinine levels and periodontal health, this research provides valuable insights for clinicians to better understand and manage the oral health of CKD patients, ultimately contributing to their overall well-being.

2 Material and Methods

A descriptive comparative cross-sectional study was conducted at Sharif Medical and Dental College Lahore to evaluate serum creatinine levels and their impact on periodontal health in CKD patients. The sample size was determined to be 50, calculated with a 5% precision, a 3% prevalence of periodontitis in CKD patients, and a 95% confidence level. Patients aged 18 and above with chronic kidney disease, regardless of the stage, were included. Patients with other systemic illnesses or on medication for conditions other than CKD were excluded.

Data collection began after obtaining ethical approval from the Institutional Review Board (No. SMDC/SMRC/100-19) and ensuring adherence to the principles outlined in the Declaration of Helsinki. Informed consent was obtained from all participants before inclusion in the study. A structured proforma was used to document serum creatinine levels, stages of CKD, and sociodemographic factors. Periodontal health was assessed using the Community Periodontal Index of Treatment Needs (CPITN).

The Kruskal-Wallis test was utilized to analyze the differences in serum creatinine levels across CKD stages and periodontal health categories. Statistical significance was set at a p-value of ≤0.05. All statistical analyses

were performed using SPSS version 25. The data collection process involved recording serum creatinine levels through laboratory tests and assessing periodontal health through clinical examination by trained dental professionals. The results were then categorized based on CKD stages and periodontal health status, including healthy periodontium, bleeding gums, calculus, and pocket depth of 4-5mm.

Throughout the study, confidentiality and the privacy of participants were maintained. Data were anonymized to ensure the protection of personal information. The study aimed to provide comprehensive insights into the relationship between serum creatinine levels and periodontal health, offering a foundation for future research and potential improvements in clinical practices for managing CKD patients' oral health.

3 Results

The study included 50 individuals with a mean age of 45.26±16.799 years, consisting of 52% males and 48% females. The serum creatinine levels were found to be significantly different across the various stages of CKD (p=0.001).

Table 1: Serum Creatinine Levels Across Different Stages of Chronic Kidney Disease

Stage	N	Mean Rank	P value
Stage 3	10	6.55	0.001*
Stage 4	11	19.32	
Stage 5	29	34.38	

The results indicated that serum creatinine levels were highest in stage 5 patients, followed by those in stage 4 and then stage 3. A statistically significant difference was also observed in serum creatinine levels across different categories of periodontal health in CKD patients (p=0.042).

Table 2: Serum Creatinine Levels and Periodontal Health of Chronic Kidney Disease Patients

Periodontal Health of CKD Patients	N	Mean Rank	P value
Healthy	2	5.75	0.042*
Bleeding	7	18.00	
Calculus	15	31.63	
Pocket Depth 4-5mm	26	25.50	

Serum creatinine levels were highest in patients with a pocket depth of 4-5mm, followed by those with calculus, bleeding gums, and the least in individuals with a healthy periodontium.

These findings highlight the progressive nature of CKD, where serum creatinine levels rise with the severity of kidney damage and show a clear correlation with deteriorating periodontal health. The study's results underscore the importance of monitoring serum creatinine levels and managing periodontal health to potentially mitigate the overall health impacts on CKD patients.

4 Discussion

The findings of this study demonstrated a significant relationship between serum creatinine levels and periodontal health in patients with chronic kidney disease (CKD). Elevated serum creatinine levels, indicative of deteriorating kidney function, were associated with worsening periodontal health. This aligns with previous research indicating that CKD patients are more susceptible to periodontal disease due to compromised immunity and systemic inflammation (10, 11).

The highest serum creatinine levels were observed in stage 5 CKD patients, reflecting severe kidney dysfunction. This observation was consistent with established literature, which suggests that serum creatinine is a reliable marker for assessing kidney function and progression of CKD (3, 6). Furthermore, the study found that patients with greater periodontal pocket depths exhibited higher serum creatinine levels, suggesting that severe periodontal disease correlates with advanced CKD stages. Previous studies have also noted a similar association, highlighting that periodontal inflammation can exacerbate systemic conditions, including kidney disease (15, 27).

One strength of this study was its focus on a specific and relatively underexplored aspect of CKD management—the impact of serum creatinine levels on periodontal health. This provided a clearer understanding of how systemic conditions like CKD can influence oral health, reinforcing the need for integrated care approaches involving both nephrologists and dental health professionals. However, the study had several limitations. The sample size was relatively small, which may limit the generalizability of the findings. Future research with larger cohorts would provide more robust data and potentially reveal more nuanced relationships between CKD stages and periodontal health (23-28).

Additionally, the cross-sectional design of the study only allowed for observation at a single point in time, preventing any assessment of causality or longitudinal changes. Longitudinal studies could better elucidate the progression of periodontal disease in relation to CKD and serum creatinine levels. Another limitation was the exclusion of patients with other systemic illnesses or those on medications for conditions other than CKD, which might have provided a more comprehensive understanding of the interplay between multiple health factors and periodontal disease (11, 19).

5 Conclusion

The study concluded that elevated serum creatinine levels, indicative of advanced stages of chronic kidney disease, were significantly associated with worsening periodontal health. These findings highlight the crucial need for integrated healthcare approaches that include regular periodontal assessments and proactive dental care for CKD patients. By addressing oral health alongside kidney function, healthcare providers can potentially reduce systemic inflammation and improve overall patient outcomes, emphasizing the importance of interdisciplinary collaboration in managing complex chronic conditions.

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Disclaimers

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