Section: ENT

Original Research Article

HEARING LOSS IN CHRONIC KIDNEY DISEASE PATIENTS ON DIALYSIS: A CROSS-SECTIONAL STUDY

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Received *: 10/02/2026*
Received in revised form *: 01/04/2026*
Accepted *: 16/04/2026*

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DOI: 10.70034/ijmedph.2026.2.78

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (2); 463-466

ABSTRACT

Background: Chronic kidney disease (CKD) is a progressive systemic disorder that affects multiple organs, including the auditory system. Structural and physiological similarities between the cochlea and the kidney may predispose patients with renal dysfunction to hearing impairment. **Objectives:** The present study aimed to determine the prevalence and severity of hearing loss among CKD patients undergoing dialysis and to evaluate its association with serum creatinine levels and duration of dialysis.

Materials and Methods: A cross-sectional observational study was conducted among 50 patients diagnosed with CKD and receiving maintenance dialysis. Audiological assessment was performed and hearing loss was categorized as none, mild, moderate, or severe. Serum creatinine levels and duration of dialysis were recorded for each patient. Statistical analysis included descriptive statistics, Chi-square test for association, and Pearson correlation to determine the relationship between creatinine levels and severity of hearing loss. A p-value of <0.05 was considered statistically significant.

Results: Out of 50 patients, 29 (58%) demonstrated hearing loss. Moderate to severe hearing impairment was observed in 21 patients (42%). A statistically significant association was identified between duration of dialysis and severity of hearing loss ($p = 0.03$). Serum creatinine levels showed a moderate positive correlation with hearing loss severity ($r = 0.62$), indicating that higher creatinine levels were associated with greater auditory impairment.

Conclusion: Hearing loss is a common complication among CKD patients undergoing dialysis. Both elevated serum creatinine levels and longer duration of dialysis are associated with increased severity of hearing impairment. Incorporating routine audiological screening into CKD management may facilitate early detection and timely intervention.

Keywords: Chronic kidney disease, Sensorineural hearing loss, Dialysis, Creatinine, Audiometry.

INTRODUCTION

Chronic kidney disease (CKD) represents a major global health burden and is characterized by progressive loss of renal function over time. In addition to its well-recognized metabolic and cardiovascular complications, CKD has also been associated with abnormalities affecting the auditory system.

The inner ear and the kidney share several structural and physiological characteristics. Both organs possess specialized epithelial tissues responsible for electrolyte transport and fluid regulation. In particular, similarities in basement membrane composition, ion transport mechanisms, and microvascular supply suggest that pathological processes affecting the kidney may also influence cochlear function.[1]

Several mechanisms have been proposed to explain hearing impairment in CKD patients. These include the accumulation of uremic toxins, disturbances in electrolyte balance, microvascular changes, and potential ototoxic effects of medications commonly used in renal disease. Furthermore, dialysis itself may

contribute to auditory dysfunction through rapid osmotic and biochemical shifts that affect the inner ear.[2]

Previous studies have reported a higher prevalence of sensorineural hearing loss among patients with chronic renal failure.[3,4] However, routine auditory screening is not commonly included in the clinical management of CKD patients. Early identification of hearing impairment is important as it may significantly affect communication, treatment adherence, and overall quality of life.

Recent population-based studies have further confirmed the association between CKD and auditory dysfunction. Large epidemiological analyses have demonstrated increased prevalence of hearing loss and tinnitus among individuals with chronic kidney disease.[5] Additionally, longitudinal studies suggest that CKD may increase the risk of sudden sensorineural hearing loss.[6]

The present study was therefore conducted to assess the prevalence and severity of hearing loss in CKD patients undergoing dialysis and to evaluate its association with serum creatinine levels and duration of dialysis.

MATERIALS AND METHODS

This study was designed as a cross-sectional observational study conducted at MGM Medical college, Kamothe. A total of 50 patients diagnosed with chronic kidney disease (CKD) who were receiving maintenance dialysis were included in the study.

Patients were included if they had a confirmed diagnosis of chronic kidney disease, were undergoing regular maintenance dialysis, and provided informed consent for participation in the study. Patients with a history of chronic middle ear disease, noise-induced hearing loss, previous exposure to known ototoxic medications, or congenital hearing impairment were excluded from the study.

For each participant, relevant clinical and laboratory parameters were recorded, including serum creatinine levels, duration of dialysis therapy, and audiological status. Hearing evaluation was performed using standard pure tone audiometry. Based on the audiometric findings, hearing status was categorized into four groups: no hearing loss, mild hearing loss, moderate hearing loss, and severe hearing loss. Data were analysed using descriptive and inferential statistical methods.

Continuous variables were expressed as mean and range. The Chi-square test was used to study the association between duration of dialysis and severity of hearing loss. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Among the 50 CKD patients included in the study, 29 individuals (58%) demonstrated varying degrees of hearing loss.

Table 1: Distribution of hearing loss

Hearing Status	Number of Patients	Percentage
No hearing loss	21	42%
Mild hearing loss	8	16%
Moderate hearing loss	11	22%
Severe hearing loss	10	20%

The overall prevalence of hearing impairment in the study population was 58%.

The mean serum creatinine level among the study participants was 8.64 mg/dL, with values ranging from 1.5 mg/dL to 13.3 mg/dL. Pearson correlation analysis revealed a moderate positive correlation between serum creatinine levels and severity of hearing loss. Correlation coefficient (r) = 0.62. This finding indicates that higher creatinine levels were associated with more severe degrees of hearing impairment.

The relationship between duration of dialysis and presence of hearing loss was also examined.

Table 2: Dialysis duration and hearing loss

Duration of Dialysis	Hearing Loss Prevalence
1 year	~30%
2 years	~60%
3 years	~80%

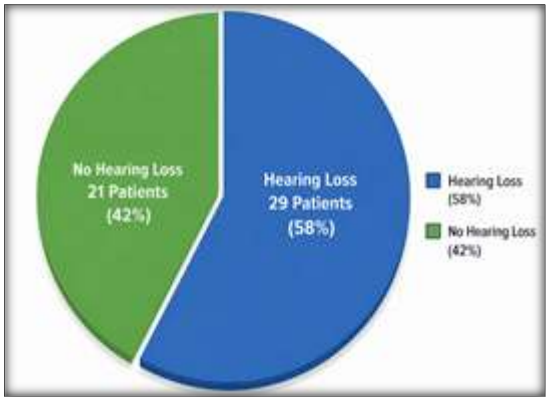

Figure 1: Prevalance of hearing loss

Statistical analysis using the Chi-square test showed a significant association between longer duration of dialysis and increased severity of hearing loss (p = 0.03).

DISCUSSION

The present study evaluated the prevalence and severity of hearing loss among patients with chronic kidney disease undergoing dialysis and examined its association with serum creatinine levels and duration of dialysis. The findings demonstrate that auditory impairment is a common complication in patients with chronic kidney disease.

In the present study, 58% of patients exhibited some degree of hearing loss. This finding is consistent with previously published literature reporting a higher prevalence of hearing impairment among individuals with chronic renal disease.[4] The cochlea and kidney share similar physiological mechanisms, particularly with regard to electrolyte transport and microvascular regulation, which may explain the susceptibility of the auditory system to renal pathology.

The prevalence observed in this study is comparable to that reported by Vilayur E and colleagues, who demonstrated that patients with chronic kidney disease had a significantly higher prevalence of hearing loss compared with the general population. 4 Their study reported an overall prevalence of approximately 63%, which closely aligns with the findings of the present investigation.

Similarly, earlier work by Kusakari J reported significant sensorineural hearing loss among patients with chronic renal failure. The authors suggested that metabolic disturbances and electrolyte imbalance may affect cochlear hair cell function, resulting in progressive auditory dysfunction.[2]

In our study, moderate to severe hearing loss was observed in 42% of patients, indicating that a considerable proportion of CKD patients develop clinically significant hearing impairment. These findings are in agreement with the observations of Gatland D, who demonstrated that patients with long-standing renal failure frequently develop cochlear damage leading to sensorineural hearing loss.

More recent investigations continue to support this association. A study published in 2025 evaluating patients on haemodialysis reported a substantial prevalence of hearing impairment among CKD patients, further emphasizing the need for routine audiological assessment in this population.[8]

Another important observation in the present study was the moderate positive correlation between serum creatinine levels and hearing loss severity (r = 0.62). Elevated creatinine levels reflect worsening renal function, which may be associated with accumulation of uremic toxins and metabolic disturbances. These biochemical alterations may adversely affect the stria vascularis and cochlear hair cells, leading to progressive hearing impairment.

The relationship between renal dysfunction and auditory impairment has also been discussed by Nikolopoulos TP, who reported altered cochlear function in patients with chronic kidney disease. Their findings suggested that microvascular changes and metabolic disturbances associated with renal disease may contribute to cochlear dysfunction.[4]

Another key finding of the present study was the significant association between duration of dialysis and severity of hearing loss (p = 0.03). Patients undergoing dialysis for longer durations demonstrated a higher prevalence of hearing impairment. Dialysis may influence cochlear physiology through rapid osmotic changes, electrolyte fluctuations, and alterations in fluid balance. These factors may affect endolymph composition and potentially damage cochlear structures over time.

The pathophysiological mechanisms linking CKD and hearing loss are likely multifactorial. Several mechanisms have been proposed, including:

- Accumulation of uremic toxins
- Electrolyte imbalance affecting endolymph homeostasis
- Microangiopathy involving the cochlear vasculature
- Neuropathy affecting auditory nerve pathways
- Dialysis-related osmotic and metabolic shifts

Because the kidney and cochlea share similar antigenic and structural characteristics, pathological processes affecting the kidney may simultaneously affect the inner ear.

The findings of this study highlight the clinical importance of early detection of hearing impairment in CKD patients. Hearing loss can significantly impair communication, reduce treatment adherence, and negatively affect quality of life. Despite this, routine audiological screening is rarely incorporated into the standard management of CKD patients.

Therefore, baseline audiological assessment at the time of CKD diagnosis and periodic hearing evaluation during dialysis treatment may help identify auditory dysfunction at an early stage. Early identification would allow timely rehabilitation measures such as hearing aids and counselling, ultimately improving patient outcomes.

Clinical Implications

Hearing impairment in CKD patients can have significant clinical consequences. Communication difficulties may interfere with patient-doctor interaction, reduce treatment compliance, and negatively impact quality of life.

Routine auditory screening may therefore be beneficial in this population. Baseline audiometric evaluation at the time of CKD diagnosis followed by periodic monitoring could facilitate early identification and management of hearing impairment.

Limitations

The study had certain limitations

- The sample size was relatively small.
- A control group was not included for comparison.
- Frequency-specific pure tone audiometry data were not analysed.
- The cross-sectional design limits the ability to establish causal relationships.

Future studies with larger sample sizes and longitudinal follow-up may provide further insights into the progression of hearing impairment in CKD patients.

CONCLUSION

Hearing loss represents a significant but often underrecognized complication in patients with chronic kidney disease undergoing dialysis. In this study, more than half of the participants demonstrated varying degrees of hearing impairment. A significant association was observed between longer duration of dialysis and increased severity of hearing loss. Additionally, higher serum creatinine levels showed a moderate positive correlation with auditory impairment.

These findings highlight the importance of incorporating routine audiological assessment into the standard care of CKD patients, which may enable early detection and timely intervention to improve patient outcomes.

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