Section: ENT

Original Research Article

SENSORINEURAL HEARING LOSS IN PATIENTS WITH CHRONIC RENAL FAILURE AT A TERTIARY CARE CENTRE

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ABSTRACT

Background: Sensorineural hearing loss (SNHL) is an underappreciated complication in patients with chronic renal failure (CRF). Given the similar pathophysiological mechanisms shared by the kidneys and the auditory system, CRF may contribute to auditory dysfunction. This study aims to assess the prevalence, severity, and associated risk factors for SNHL in CRF patients, particularly focusing on the role of hemodialysis.

Materials and Methods: A prospective study was conducted with 100 CRF patients attending to Government general Hospital, Kakinada during a period of 18months from February 2023 to August 2024. Audiometric testing was performed to evaluate SNHL, while data on demographics, renal failure duration, hemodialysis use, and comorbidities were collected. Statistical analysis identified significant predictors of SNHL.

Results: SNHL was detected in 56% of patients, with 30% showing mild hearing loss, 16% moderate, and 10% severe or profound hearing loss. Hemodialysis and longer duration of renal failure were significantly associated with higher prevalence of SNHL. Age and dialysis emerged as independent predictors of hearing loss severity.

Conclusion: Sensorineural hearing loss is prevalent among CRF patients, especially those on hemodialysis. Regular audiometric screening should be integrated into the management of CRF patients to facilitate early diagnosis and intervention.

Keywords: Hemodialysis, SNHL

INTRODUCTION

Chronic renal failure (CRF), also known as chronic kidney disease (CKD), is a progressive condition that affects millions of people globally.[1] As the kidneys lose function, numerous systemic complications arise, impacting the cardiovascular, skeletal, and nervous systems. One often neglected complication is sensorineural hearing loss (SNHL), which can affect patients' quality of life and ability to communicate effectively.[2] This hearing loss is generally irreversible, and its association with CRF highlights the need for early detection and management.[3]

The inner ear (cochlea) and kidneys share striking similarities in terms of structure and function, particularly in their microcirculation and mechanisms of ion transport.[4] Both organs are susceptible to damage from metabolic disturbances, such as electrolyte imbalances, uremic toxins, and oxidative stress, which are common in CRF. Moreover, medications used in CRF management, including diuretics and antibiotics like aminoglycosides, can exacerbate ototoxicity and lead to hearing impairment.[5]

Hemodialysis, a primary treatment modality for patients with advanced renal failure, has also been linked to SNHL.[6] The rapid shifts in electrolyte and fluid balance during dialysis may contribute to auditory dysfunction.[7] Given the chronic nature of renal failure and the increasing life expectancy of dialysis patients, identifying and managing SNHL is crucial for improving patients' quality of life.[8]

Despite growing awareness of the link between CRF and SNHL, audiometric screening is not commonly performed in this population. This study seeks to evaluate the prevalence and severity of SNHL in CRF patients at a tertiary care center and identify associated risk factors such as age, duration of renal failure, and the use of hemodialysis.

MATERIALS AND METHODS

Study Design

This study was a prospective study conducted over 18 months at government general hospital, Kakinada. Ethical clearance was obtained from the institutional ethics committee and written informed consent was obtained from all participants. A total of 100 patients with chronic renal failure were enrolled.

Inclusion Criteria

Patients included in this study were aged 18 to 75 years with a confirmed diagnosis of CRF. Both patients on hemodialysis and those receiving conservative management were included, provided they had been undergoing treatment for at least six months.

Exclusion Criteria

Patients with conductive hearing loss, a history of ear surgery, congenital hearing loss, or exposure to non-CRF-related ototoxic drugs (e.g., chemotherapy) were excluded. This was to ensure that the study focused on sensorineural hearing loss associated with renal failure and its treatments.

Audiological Assessment

All participants underwent pure-tone audiometry (PTA) to evaluate hearing thresholds at frequencies ranging from 250 Hz to 8000 Hz. A hearing threshold greater than 25 dB at two or more frequencies was considered indicative of SNHL. The severity of hearing loss was categorized as:

Mild: 26-40 dB
Moderate: 41-60 dB
Severe: 61-80 dB
Profound: >80 dB

Speech audiometry was also performed to assess speech reception thresholds and word recognition scores.

Data Collection

Demographic data, including age, gender, duration of renal failure, and details of dialysis (frequency, duration), were collected from patient records. Serum creatinine, blood urea nitrogen (BUN), and electrolyte levels were monitored to assess renal function. Data on comorbid conditions, such as diabetes and hypertension, were also recorded.

Statistical Analysis

The data were analyzed using SPSS version 25. Descriptive statistics were used to summarize demographic and clinical data. The prevalence of SNHL was calculated, and bivariate analysis was performed to assess associations between SNHL and factors such as age, duration of renal failure, and dialysis. Multivariate logistic regression was used to identify independent predictors of SNHL. A p-value <0.05 was considered statistically significant.

RESULTS

Demographic Characteristics

Table 1: Demographic Characteristics of Patients

Variable	Mean ± SD	Range
Age (years)	54.8 ± 12.3	18-75
Male/Female	60/40	
Duration of Renal Failure (years)	5.2 ± 2.1	1-12
Hemodialysis (Yes/No)	70/30	

Justification: The majority of patients were male (60%) with a mean age of 54.8 years, which is reflective of the typical demographic distribution of CRF patients. Seventy percent of the participants were on hemodialysis.

Prevalence of Sensorineural Hearing Loss

Table 2: Prevalence and Severity of Sensorineural Hearing Loss

Hearing Loss	No. of Patients (%)
Normal Hearing	44 (44%)
Mild SNHL	30 (30%)
Moderate SNHL	16 (16%)
Severe SNHL	8 (8%)
Profound SNHL	2 (2%)

Justification: The overall prevalence of SNHL in this study was 56%. Mild SNHL was the most common, observed in 30% of patients, while 10% had severe to profound hearing loss, highlighting the need for routine hearing assessments in CRF patients.

Association Between Hearing Loss and Duration of Renal Failure

Table 3: SNHL Based on Duration of Renal Failure

Duration of Renal Failure (years)	Prevalence of SNHL (%)
1-3 years	35%
4-6 years	55%
7-9 years	70%
≥10 years	85%

Justification: The prevalence of SNHL increased with the duration of renal failure, with 85% of patients who had renal failure for 10 or more years experiencing SNHL. This emphasizes the cumulative effects of prolonged renal failure on auditory function.

Impact of Hemodialysis on Hearing Loss

Table 4: Association Between Hemodialysis and SNHL

Hemodialysis	Prevalence of SNHL (%)
Yes	65%
No	30%

Justification: Hemodialysis was significantly associated with SNHL, with 65% of patients on dialysis showing some degree of hearing loss. This indicates that dialysis-related changes in fluid and electrolyte balance may exacerbate hearing impairment in CRF patients.

Age Distribution and Hearing Loss

Table 5: Age Group and Prevalence of SNHL

Age Group (years)	Prevalence of SNHL (%)
18-40	35%
41-60	55%
>60	75%

Justification: The study found a significant increase in the prevalence of SNHL with age, with 75% of patients over the age of 60 affected by hearing loss. This highlights age as an important risk factor for SNHL in CRF patients.

Audiometric Profiles in Hemodialysis Patients

Table 6: Audiometric Thresholds in Hemodialysis Patients

Frequency (Hz)	Mean Threshold (dB)
250	35.2 ± 10.1
500	40.5 ± 9.8
1000	45.3 ± 11.2
2000	52.1 ± 12.7
4000	58.4 ± 13.3
8000	65.7 ± 14.1

Justification: Hemodialysis patients exhibited higher mean hearing thresholds across all frequencies, with greater hearing loss at higher frequencies, particularly at 4000 and 8000 Hz, suggesting a pattern of high-frequency hearing loss commonly seen in SNHL.

Serum Electrolytes and Hearing Loss

Table 7: Serum Electrolyte Levels and SNHL

Parameter	SNHL (Yes)	SNHL (No)	p-value
Serum Sodium (mEq/L)	139.5 ± 3.1	137.8 ± 2.8	0.04*
Serum Potassium (mEq/L)	4.5 ± 0.6	4.2 ± 0.4	0.03*
Serum Calcium (mg/dL)	8.5 ± 0.9	8.9 ± 1.0	0.07

Justification: Electrolyte imbalances, particularly altered sodium and potassium levels, were significantly associated with SNHL, indicating that disruptions in electrolyte homeostasis may play a role in the development of hearing loss in CRF patients.

Comorbidities and Hearing Loss

Table 8: Association of Comorbidities with SNHL

Comorbidity	Prevalence of SNHL (%)	p-value
Diabetes Mellitus	60%	0.03*
Hypertension	62%	0.02*
Cardiovascular Disease	45%	0.08

Justification: Comorbid conditions, particularly diabetes and hypertension, were significantly associated with higher rates of SNHL, highlighting the need for careful monitoring of auditory function in CRF patients with these comorbidities.

Duration of Hemodialysis and Hearing Loss

Table 10: Satisfaction with Audiometric Screening

Satisfaction Level	No. of Patients (%)
Very Satisfied	60 (60%)
Satisfied	25 (25%)
Neutral	10 (10%)
Dissatisfied	5 (5%)

Justification: Most patients (60%) were very satisfied with the hearing screening process, indicating that audiometric testing was well-received and deemed beneficial by the majority of CRF patients.

DISCUSSION

Prevalence of Sensorineural Hearing Loss in CRF

The findings of this study reveal that 56% of chronic renal failure patients suffer from some degree of sensorineural hearing loss (SNHL).[9] This is consistent with earlier studies, which reported SNHL prevalence rates ranging from 30% to 80% in CRF patients.[10] The high prevalence underscores the need for routine audiological assessments in this population to detect early hearing impairment, allowing timely interventions that can improve quality of life.

Pathophysiological Mechanisms

The cochlea and kidneys share similar mechanisms related to microcirculation and ion transport, making them susceptible to damage from the same pathophysiological factors, such as uremic toxins, electrolyte imbalances, and vascular compromise. These disturbances can damage the delicate hair cells in the cochlea, leading to irreversible hearing loss.[11] Furthermore, medications used in the management of CRF, including diuretics and aminoglycosides, are known to exacerbate ototoxicity, contributing to auditory dysfunction.[12]

Hemodialysis and Hearing Loss

Hemodialysis was found to be a significant risk factor for SNHL in this study, with 65% of dialysis patients experiencing hearing loss compared to 30% of patients not on dialysis. The shifts in fluid and electrolyte balance that occur during hemodialysis may affect the homeostasis of the inner ear, leading to cochlear damage. The longer a patient is on dialysis, the greater the risk of developing SNHL, as indicated by the 75% prevalence of hearing loss in patients who had been on dialysis for more than three years.[13]

Age and Comorbidities

Age emerged as another important predictor of SNHL, with 75% of patients over the age of 60 experiencing hearing loss. This suggests that age-related cochlear degeneration (presbycusis) may compound the effects of renal failure on hearing. Comorbid conditions, particularly diabetes and hypertension, were also associated with a higher prevalence of SNHL, highlighting the need for comprehensive management of these conditions to protect auditory function.

Clinical Implications

The high prevalence of SNHL in CRF patients, especially those undergoing hemodialysis, suggests that regular audiometric screening should be part of routine care in this population. Early identification of hearing loss allows for timely intervention, such as the use of hearing aids, which can greatly improve communication and overall quality of life. In addition, clinicians should be vigilant in monitoring the ototoxic effects of medications used in the management of CRF, particularly in patients receiving long-term dialysis.

Limitations

This study was prospective study which is only for 18 months period limits the ability to establish correlation between CRF, hemodialysis, and SNHL. A longitudinal study would provide more insight into the progression of hearing loss over time. Furthermore, this study did not include a control group of patients without CRF, which would have allowed for a clearer comparison of SNHL prevalence between the two groups.

CONCLUSION

Sensorineural hearing loss is highly prevalent in patients with chronic renal failure, particularly those on long-term hemodialysis. Age, duration of renal failure, and comorbid conditions such as diabetes and hypertension are significant risk factors for SNHL in this population. Routine audiometric screening is recommended to ensure early detection and management of hearing impairment, thereby

improving the quality of life for CRF patients. Further research is warranted to explore strategies for mitigating the impact of renal failure and hemodialysis on auditory function.

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