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Original Research Article

Tinnitus and vertigo in chronic kidney disease patients: an observational study at tertiary care centre

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ABSTRACT

Background: Chronic kidney disease is characterized by the progressive and irreversible loss of kidney function over a period of months and years. Due to antigenic similarity, the cochlea and kidney have similar physiological mechanisms namely active transport of fluid and electrolytes achieved by stria vascularis in the cochlea and glomeruli in the kidney. Objective was to inspect the relation between hemodialysis and development of tinnitus and vertigo in CKD patients.
Methods: Prospective observational study conducted at Srinivas Institute of medical science, Mangalore, 88 patients were enrolled in this study.
Results: Out of 88 patients studied 09 patients (10.22%) complain of tinnitus, 12 patients (13.63%) complain of vertigo, 48 patients (54.54%) had both tinnitus and vertigo, and the remaining 19 patients (21.59%) didn't develop any tinnitus or vertigo symptoms. The pure tone audiometry results in these individuals were indicative of inner ear pathology. The statistical analysis was done using SPSS 22.
Conclusions: Vertigo and tinnitus are common with haemodialysis in patients with chronic kidney disease as 78.40% were affected with either tinnitus or vertigo or with both.

Keywords: CKD, Tinnitus, Vertigo

INTRODUCTION

Chronic kidney disease (CKD) is characterized by the progressive and irreversible loss of kidney function over a period of months and years. Diabetes and hypertension are the main causes in most countries and diabetes account for 30–50% of the patients with CKD.[1] In the course of chronic kidney disease, uremic toxins will accumulate and cause adverse biological effects. There is evidence that uremic toxins can contribute to inflammation, immune dysfunction, vascular disease, and platelet dysfunction.[2]

The patients with CKD whether they are on renal replacement therapy or not had led to the development of late manifestation hearing system impairment.[3]

Tinnitus is a perception of sound in the absence of external auditory stimulus and often has a negative effect on the quality of life.[4,5]

Vertigo is a delusional perception of movement either of one's own body, such as swaying or rotation, or of the environment, or both.[4,5]

The cochlea and kidney have similar physiological mechanisms of the active transport of fluid and electrolytes achieved by the stria vascularis in the cochlea and the glomeruli in the kidney.[6,7]

Strokes and renal function show a strong and inverse relationship, with stroke risk increasing by 7% every 10 ml/minute/1.73 m^2 decrease in estimated glomerular filtration rate (eGFR).[8]

The relationship between hearing impairment and CKD has been discussed; however, the relationship between CKD, hemodialysis, tinnitus, and vertigo in terms of their prevalence, incidence, and effects on disease severity remains unclear.

In patients with chronic kidney disease, metabolic, hydroelectric, and hormonal changes affect the cochlea.[9]

The aim of our study was to examine the relationship between tinnitus and vertigo in CKD patients submitted to hemodialysis treatment, and to check for any changes in symptoms (tinnitus and vertigo) with the duration of CKD and hemodialysis, medical treatment, and blood urea, creatinine, and other electrolytes.

METHODS

Study design

This prospective observational study was done at the Srinivas Institute of Medical science and research centre hospital which is a tertiary care centre in Mangalore, Karnataka.

The study duration was 20 months from January 2021 to September 2022. After a detailed explanation of the study, written consent was obtained from all participants.

This study was approved by the Ethics committee of the Srinivas Institute of Medical Sciences and Research centre.

Patients

All the patients with chronic kidney disease who are on hemodialysis for the different duration were interviewed in this study.

Inclusion criteria

CKD patients on hemodialysis regardless of the duration of the hemodialysis.

Exclusion criteria

The patients with chronic use of ototoxic drugs, CSOM, acoustic neuroma, conductive hearing loss, ontological trauma, surgery, renal transplantation, or conductive hearing loss before the onset of chronic kidney disease.

Among all indoor and outdoor patients, 100 were examined.

During the follow-up period, 10 patients died and 2 patients were excluded based on the exclusion criteria.

The remaining 88 patients (50 males and 38 females) representing the final sample size enrolled in the study.

Data collection

The patients were questioned regarding their sociodemographic traits and past medical history. To rule out conductive hearing loss and external and middle ear diseases, otological examination, pure tone audiometry, and tympanometry were performed. The pure-tone audiometric tests are done by an audiologist. Tinnitus and/or vertigo symptoms are assessed in terms of their duration, treatment and how they affect the patient's quality of life.

Statistical analysis

The data were analysed using the SPSS (SPSS Inc., Chicago, IL, USA) version 22. Chi-square test was used to find the significance of differences in categorical parameters.

RESULTS

This study involved 88 patients [50 (56.81%) men and 38 (43.18%) women]. Among the studied population, the mean age was 53.94±8.86 years.

Out of these 88 patients, nine (10.22%) complained of tinnitus, 12 (13.63%) complained of vertigo, 48 (54.54%) complained of both, and 19 (20.59%) did not develop any tinnitus or vertigo symptoms during the study period, as indicated in the respective figure.

Table 1: Basic variables.

Variables	Total
Mean age in years	53.94±8.86
Male/female ratio	1.3:1
Percentage of patients with DM	60 (68.18%)
Percentage of patients with HTN	80 (90.90%)
Serum blood urea (mg/dl)	160.48±42.97
Serum creatinine (mg/dl)	7.54±2.41
Serum sodium (mmol/l)	138.47±9.70
Serum potassium (mmol/l)	5.06±0.85

The onset of tinnitus and/or vertigo symptoms related to the initiation of hemodialysis was analysed, as stated in Table 3.

A significant correlation was observed between the duration of hemodialysis and the onset of symptoms in the patients involved (p value =0.001).

Additionally, a strong significant correlation was seen between the duration of hemodialysis and the levels of blood urea, serum creatinine, sodium, and hypoacusis severity.

There were no other significant correlations between the presence of tinnitus and/or vertigo and age, gender, comorbidity such as HTN, DM.

Table 2: Symptoms wise distribution.

Symptoms	Male n (%)	Female n (%)	Total
Tinnitus	2 (4)	7 (18.42)	9 (10.22)
Vertigo	8 (16)	4 (10.53)	12 (13.63)
Tinnitus + vertigo	27 (54)	21 (55.26)	48 (54.54)
None	13 (26)	6 (15.79)	19 (21.59)
P value*	Chi-square value- 5.914, df=3, p=0.116		

*Chi-Square t

The above Table 2 show symptom-wise distribution with 78.40% of the enrolled patients who developed tinnitus, vertigo, or both.

Table 3: Time onset of development of tinnitus and\or vertigo symptoms in relation to hemodialysis duration.

Onset of tinnitus/vertigo	Frequency	%	Cumulative percentage
At the start of hemodialysis	25	28.41	28.41
At 5 months of hemodialysis	21	23.86	52.27
At 10 months of hemodialysis	18	20.45	72.73
At 15 months of hemodialysis	13	14.77	87.50
At 20 months of hemodialysis	11	12.50	100.00
P value	(Chi square value 12.805) 0.001		

Table 4: Time onset of development of hypoacusis in relation to hemodialysis duration.

Duration of dialysis	Hypoacusis		Total
	Absent	Present	
<5 months	17	0	17
5-10 months	13	2	15
11-15 months	3	18	21
>15 months	0	35	35
Total	33	55	88
P value	<0.001		

Table 5: The significance of different parameters evaluated in the study.

Parameters	P value
Age	0.912
Gender	0.789
Serum blood urea (mg/dl)	0.048
Serum creatinine (mg/dl)	0.021
Serum sodium (mmol/l)	0.001
Serum potassium (mmol/l)	0.039
Serum calcium (mg/dl)	0.134
Comorbidity HTN and DM	0.734 and 0.966

DISCUSSION

CKD is one of the major global health burdens because of its prevalence, economic, and deleterious effects on vital organs.

The impact of CKD and hemodialysis on the auditory system is well documented. Alport's syndrome describes the presence of hereditary nephritis associated with sensorineural hearing loss and ocular abnormalities.[10]

Since then, numerous research has been done on this to demonstrate the connection between CKD, hemodialysis, and auditory functions. However, only a few of these studies have addressed the connection between these factors and the onset of tinnitus and/or vertigo.

Regardless of the stage of the disease, Johnson et al discovered that auditory pathways are impacted in different stages of chronic renal disease.[11] Therefore, in this study, all of the CKD patients are closely observed.

As a result of auditory vestibular dysfunction, this study has demonstrated that patients with CKD are more prone to experience otologic symptoms. The patient's quality of life is frequently negatively impacted by these symptoms because they are frequently permanent, challenging to manage, and fatalistic.

In this study, we investigated the relationship between CKD and inner ear pathology (tinnitus and vertigo) in 88 patients receiving hemodialysis for the treatment of CKD.

In this study, it was discovered that 78.40% of the enrolled patients experience tinnitus, vertigo, or both while receiving hemodialysis for their CKD. Only 21.59% of the participants experienced no tinnitus or vertigo during the study period. This finding was similar to the finding of Kang et al and Gabr et al, who found that 68.2% and 60% respectively had either tinnitus or vertigo.[12,13] Neslihan et al found that 15.95% had developed tinnitus alone.[14]

We observed that patients of the age group 40 to 60 years (mean age 53.94±8.86) with CKD had a significantly increased risk of tinnitus and/or vertigo in our study. This finding was similar to the finding of Saeed et al who found the mean age in years was 41.8±9.2.[15]

This study found that compared to male patients with CKD, female patients had a greater probability of getting vertigo and/or tinnitus. A similar result was seen in the study of Kim et al which found that female patients with CKD had a higher risk of developing SSNHL.[16]

Our study found a 62.05% incidence of hypoacusis in dialysis patients, which is similar to Altavilla's study, which found a range of 20 to 75%.[17]

In this study, we didn't find any significant correlations between the presence of tinnitus and/or vertigo with comorbidity like HTN, DM. This was similar to the finding of Agarwal et al, Yassin et al and Reddy et al.[18-20]

In this study we found that significant correlation between the presence of tinnitus and/or vertigo with blood urea, serum creatinine, serum sodium and serum potassium. Similar to Bazzi and Gatland report that high blood urea and electrolyte disturbances, particularly sodium, have been suggested as possible factors that contribute to hearing system deterioration in CKD.[21,22]

CONCLUSION

Vertigo and tinnitus are common with hemodialysis in patients with chronic kidney disease as 78.40% were affected with either tinnitus or vertigo or with both.

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