

## Pattern of Hearing Loss among Chronic Kidney Disease Patients on Haemodialysis

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### ABSTRACT

**Background:** Association of the chronic renal disease and hearing loss has been proved in various researches quoted in the past literature. Irrespective of the cause, sensorineural hearing loss is increasingly reported in patients with chronic kidney disease (CKD). In many aspects regarding the correlation of hearing loss with CKD and the role of haemodialysis in it is controversial. Hence; we planned the present study to assess the correlation between hearing loss in CKD patients on haemodialysis.

**Materials & Methods:** The present study included assessment of 15 patients who underwent treatment of CKD from 2015 to 2016. 15 subjects of comparable age and gender were also included in the present study under the control group. Complete documentation regarding the duration of the CKD and the number of haemodialysis session was done. Blood parameters, including haemoglobin, blood urea, serum creatinine, sodium and potassium were also obtained. The hearing thresholds at low and high frequency ranges were compared between these groups to identify the pattern of hearing loss. All the results were analyzed by SPSS software.

**Results:** Out of 15 patients in the CKD group, noise exposure was present as a risk factor in 3 patients while in the control group, only one patient had noise exposure as a risk factor. While comparing the incidence of risk factors in the CKD group

and control group, significant results were obtained in relation to hypertension and diabetes mellitus. Hearing loss was present in 7 patients out of 15 in the CKD group while it was present only in 1 patient in the control group. Significant results were obtained while comparing the hearing loss in the control group and the CKD group.

**Conclusion:** In CKD patients, mild form of hearing loss is commonly encountered.

**Key words:** Chronic Kidney Disease, Dialysis, Hearing Loss.

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### INTRODUCTION

Collagen is the substance which holds and binds together renal tissue and the cochlea of the inner membrane which have similar membranes. Similar function is performed by these membranes as they share common structure. In both cases, these membranes help to maintain the chemical balance of the fluids of the kidney and inner ear. Because of similar molecular structure, they can be damaged by the same drugs, such as overdose of diuretics.<sup>1</sup> Association of the chronic renal diseases and hearing loss has been proved in various researches quoted in the past literature. Irrespective of the cause, sensorineural hearing loss is increasingly reported in patients with chronic kidney diseases (CKD). Hearing disorders usually begin in the high frequency portion of the sound spectrum. As suggested by different authors, the association between the hearing loss and CKD has been

explained on the basis of common physiologic mechanisms involving fluid and electrolyte shifts in stria vascularis of cochlea and glomerulus.<sup>2</sup> Most of the studies found no correlation between the hearing loss and CKD, a recent study demonstrated that more is the disease duration, higher is the hearing loss.<sup>3</sup> Therefore, in many aspects regarding the correlation of hearing loss with CKD and the role of haemodialysis in it is controversial.<sup>4, 5</sup> Hence; we planned the present study to assess the correlation between hearing loss in CKD patients on haemodialysis.

### MATERIALS & METHODS

The present study was conducted on patients presented to renal unit and included assessment of 15 patients who underwent treatment of CKD from 2015 to 2016.

**Inclusion Criteria**

- Patients diagnosed with CKD,
- CKD patients who have undergone minimum of one dialysis session,

**Exclusion Criteria**

- Patients with any known drug allergy,
- Patients with conductive hearing loss,
- Patients with any syndromic aetiology of CKD

15 subjects of comparable age and gender were also included in the present study under the control group. Complete documentation regarding the duration of the CKD and the number of haemodialysis session was done. Blood parameters, including haemoglobin, blood urea, serum creatinine, sodium and

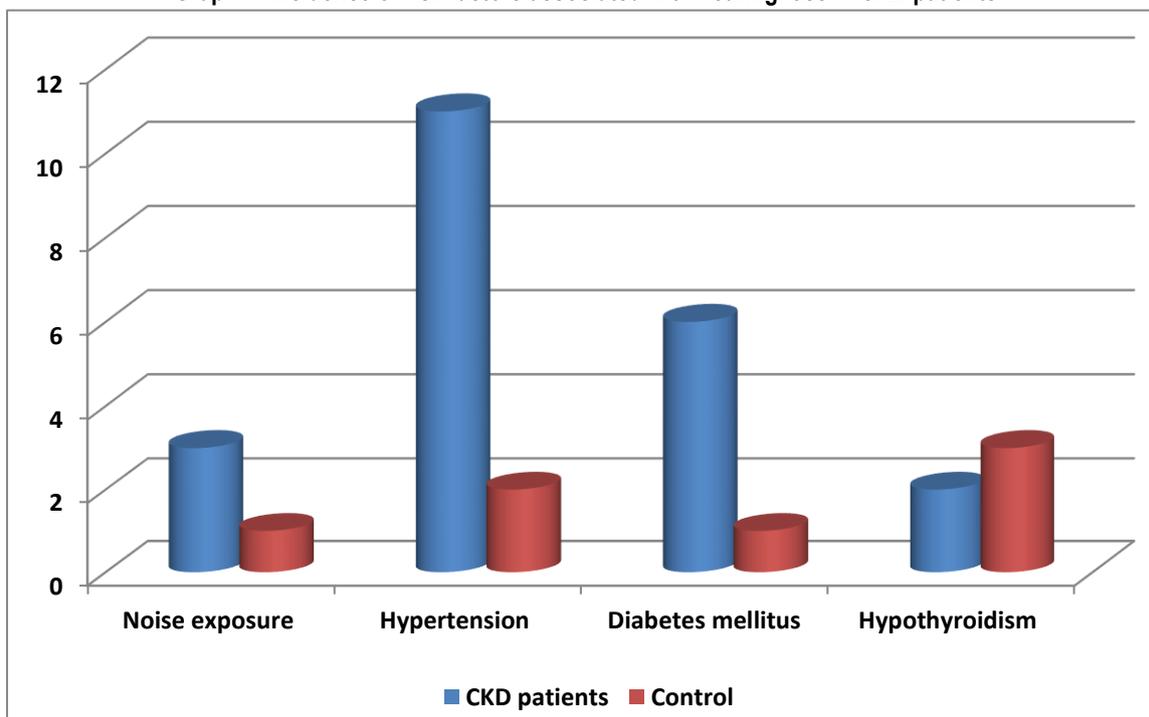
potassium were also obtained. All CKD patients and controls were subjected to hearing assessment using standard pure tone audiometry and impedance audiometry. Prevalence and degree of hearing loss was determined in CKD patients and controls. Based on the presence and absence of hearing loss, the CKD patients were further divided into two sub groups. These two groups were compared for any differences with regard to exposure to ototoxic drugs, duration of CKD, number of haemodialysis sessions, and blood parameters. The hearing thresholds at low and high frequency ranges were compared between these groups to identify the pattern of hearing loss. All the results were analyzed by SPSS software. Chi-square test and student t test were used for the assessment of level of significance.

**Table 1: Correlation of incidence of risk factors associated with hearing loss in CKD patients**

Variable	CKD patients (n= 15)	Control (n= 15)	p-value
Noise exposure	3	1	0.20
Hypertension	11	2	0.01*
Diabetes mellitus	6	1	0.02*
Hypothyroidism	2	3	0.25

\*Significant

**Graph 1: Incidence of risk factors associated with hearing loss in CKD patients**



**RESULTS**

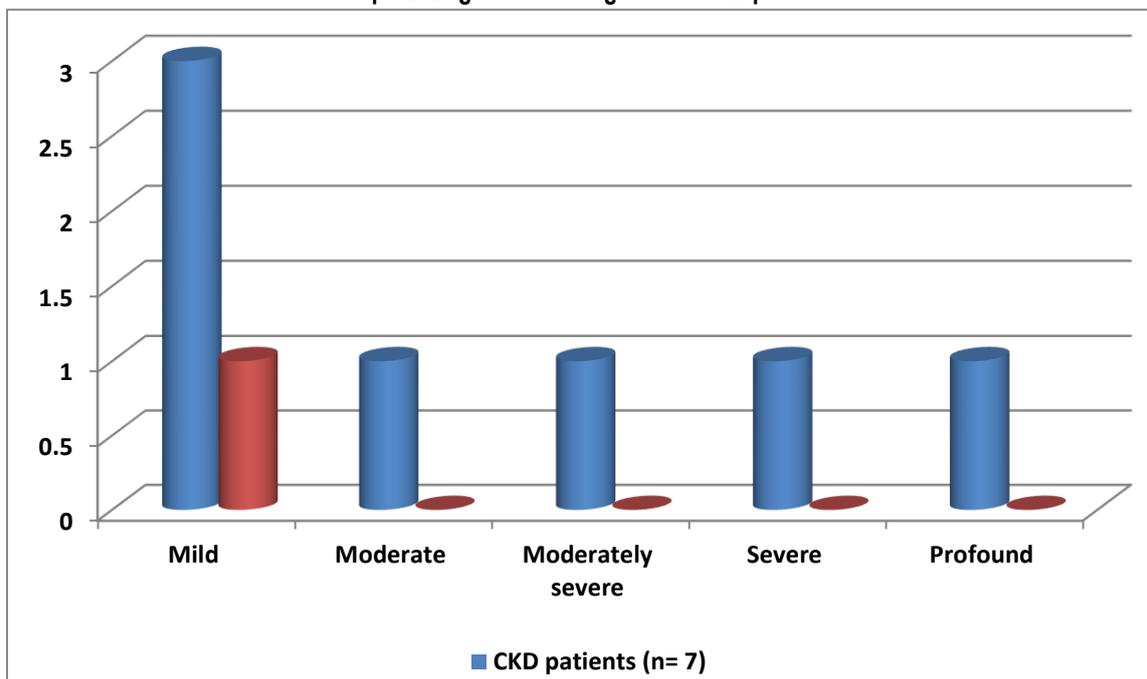
Out of 15 patients in the CKD group, noise exposure was present as a risk factor in 3 patients while in the control group, only one patient had noise exposure as a risk factor (Table 1, Graph 1). Hypertension was present as a risk factor in 11 and 2 patients of CKD group and control group respectively. Diabetes mellitus was present as a risk factor in 6 and 1 patient of the CKD group and control group respectively. While comparing the incidence of risk factors in the CKD group and control group, significant results were obtained in relation to hypertension and diabetes mellitus.

Hearing loss was present in 7 patients out of 15 in the CKD group while it was present only in 1 patient in the control group respectively. Significant results were obtained while comparing the hearing loss in the control group and the CKD group (p-value <0.05) (Table 2, Graph 2). Mild form of hearing loss was present in 3 patients in the CKD group while it was present in 1 patient in the control group. Moderate and moderately severe form of hearing loss was present in one patient in the CKD group and was not present in any of the patients in the control group respectively.

**Table 2: Correlation of degree of hearing loss in CKD patients**

Degree of hearing loss	CKD patients (n= 7)	Controls (n= 1)	p-value
Mild	3	1	0.01*
Moderate	1	0	
Moderately severe	1	0	
Severe	1	0	
Profound	1	0	

\*Significant

**Graph 2: Degree of hearing loss in CKD patients**

## DISCUSSION

Among the CKD patients, incidence of hearing loss has been proposed to be varying between twenty to forty percent. The etiopathogenetic mechanisms reported included osmotic alteration resulting in loss of hair cells, collapse of the endolymphatic space, edema and atrophy of specialized auditory cells and in some, complications of hemodialysis.<sup>6</sup> One of the most common methods of investigating the impact of renal pathologies on the auditory system is the assessment of presence or absence of hearing loss and estimation of type and degree of hearing loss. Degree of hearing loss may give an indication of the extent of damage to auditory function, whereas the type of hearing loss may distinguish between lesions in the outer and middle ear or the cochlea and the neural pathways.<sup>7</sup>

In the present study, we observed that hypertension and diabetes were the commonly associated risk factors observed in CKD patients with hearing loss (Table 1). We also observed that approximately 7 of the CKD patients had some form of hearing loss which in comparison with the control groups was considerably higher (p-value <0.05). (Table 2) Jamaldeen et al determined the prevalence and degree of hearing loss in CKD patients on haemodialysis. They assessed 120 CKD patients on haemodialysis. Information regarding age, gender, duration of disease, subjective hearing loss, exposure to ototoxic drugs, comorbidities like diabetes, hypertension, and hypothyroidism, renal functions, electrolytes and number of haemodialysis

sessions received were obtained. They compared CKD patients with and without hearing loss for association of hearing loss with disease duration, number of haemodialysis, and blood parameters. Hearing loss was present in 41.7 per cent of CKD patients, significantly higher than controls, and was mild in the majority of patients. Impairment was noted across high and low frequencies of audiometric testing. Median duration of disease was the same among CKD patients with and without hearing loss. CKD patients with hearing loss received 72 haemodialysis compared to 122 sessions by those without hearing loss. Mild sensorineural hearing loss was common in CKD. Hearing loss had no specific pattern as it prevails at high and low frequencies. Hearing loss may be inversely associated with the number of haemodialysis sessions but not with duration of disease.<sup>8</sup>

Rahman et al evaluated the association between chronic kidney disease and sensorineural hearing impairment. Early detection of sensorineural hearing impairment in CKD patient will allow appropriate treatment which will improve quality of hearing. Sensorineural hearing impairment was more prevalent in chronic kidney disease patients than control group. Subjects were divided into a case group consisting of 55 CKD patients and a control group of 50 people. Subjects with age below 18 years and above 60 years, audiometric evidence of conductive hearing loss & past medical or surgical treatment of otologic conditions were excluded from the study. Prevalence of sensorineural hearing loss in CKD patients was found to be 54% and the prevalence of hearing loss

in control subjects was found to be 16%. Comparison of hearing loss between CKD and the control groups was found to be statistically strongly significant. The study showed the relationship between chronic kidney disease and sensorineural hearing impairment to be statistically significant which signifies that that hearing loss is relatively prevalent in patients with CKD.<sup>9</sup> Reddy et al studied the magnitude of sensorineural hearing loss (SNHL) in CKD patients. Two hundred patients (400 ears) who had CKD 5 and all patients underwent hemodialysis were taken into study. In summary, high frequencies are affected in 52%, middle frequencies in 9%, and low frequencies in 2.5% of individuals. About 2.5% of patients had hearing loss in all frequencies. Hearing loss was observed only at 8000 Hz in 10% of individuals. Among all patients, 21 patients (42 ears) underwent a renal transplant, and post-transplant duration was about 1 year, 11 patients (57%) were having hearing loss. Thus, hearing loss was found in 122 (61%) members bilaterally. Unilateral hearing loss was present in 5 (2.5%) patients. Hearing loss was present in 63.5% individuals (249 out of 400 ears). Thus, SNHL was present in 63.5% in patients with chronic renal failure and severity correlated with duration of disease. No correlation between other covariables.<sup>10</sup> Renda et al determined the relationship between cochlear sensitivity and hemodialysis in dialytic and non-dialytic chronic kidney disease patients. The study included children aged 6-18 years that were divided into 3 groups: 36 non-dialytic patients with chronic kidney disease, 16 end-stage renal disease patients undergoing hemodialysis, and 30 healthy controls. Blood urea nitrogen, serum cystatin C levels, duration of chronic kidney disease, and the duration of hemodialysis were compared between the chronic kidney disease patients and end-stage renal disease patients undergoing hemodialysis. Hearing health was measured via tympanometry, pure-tone audiometry and distortion product otoacoustic emissions testing. The duration of CKD, the cystatin C level, and the blood urea level were not associated with hearing loss. They showed that there was impaired cochlear function in the dialytic and non-dialytic patient groups, regardless of hearing loss, as compared to the control group. Patients with chronic renal disease-both dialytic and non-dialytic-should be monitored to prevent any further deterioration by avoiding potential ototoxic agents, even if their hearing thresholds are within normal limits.<sup>11</sup>

## CONCLUSION

From the above results, our study concluded that in CKD patients, mild form of hearing loss is commonly encountered. However, future studies are recommended.

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