# *Sensorineural Deafness Among Patients with Chronic Renal Failure in Al-kindi Teaching Hospital*

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## *Abstract.*

**Background:** Patients with chronic kidney disease have different grades of sensorineural deafness .

**Objective:** To study the incidence of sensorineural hearing loss and possible contributing factors in patients with chronic kidney disease.

**Methods:** A total of 100 patients with chronic kidney disease were studied. All of them were males. 92 of them were on regular haemodialysis programme. Only 8 patients were on conservative management the age range of the study patients was 18-40 year patients were divided into three groups according to age. All patients were assessed clinically and were evaluated by audiometry , and analysis was made on bone conduction threshold .The mean follow up period was 28 weeks .

**Results:** 36 patients (36 %) showed sensorineural hearing loss .The incidence of sensorineural deafness was found to increase with the advancing age and duration of chronic kidney disease but not directly proportional to the number of haemodialysis sessions .The number of haemodialysis sessions did not show increase in the degree of sensorineural deafness .

**Conclusion:** Patients with chronic kidney disease have **sensorineural** deafness of some degree which should be assessed and evaluated to halt its progression.

**Keywords:** Sensorineural deafness, chronic kidney disease. Conduction threshold.

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## *Introduction*

The Cochlea and the kidney have similar physiological mechanisms, namely the active transport of fluid and electrolytes accomplished by striae vascularis and the glomerulus respectively [1,2] .

They may also have common antigenicity [3,4]. These may account for similar effects of medications i.e. nephrotoxic and ototoxic effects of aminoglycosides and immunological factors on the two organs. Inner ear and kidney development are both influenced by similar genetic factors in hereditary conditions such as Alport's syndrome and branchio-oto-renal syndrome [5].

## *Methods*

From January to 31 st of December 2010, a prospective study was performed on 100 patients attending Al-Kindy Teaching Hospital, all of them were males and they were diagnosed as having acquired Chronic Kidney Disease (CKD).

92 Patients were kept on regular haemodialysis programs, while 8 patients were managed only by conservative measures: - dietary restriction , phosphate binder, cholecalciferol orally, folic acid supplement along with B12 injection once weekly .

The age of patients ranged from 18 to 40 years. Thus, almost practically, excluding presbyacusis (degenerative changes of old age) as a cause of sensor neural deafness (SND).

Patients who had one or more of the following criteria were excluded from the study because these may cause SND:

1. Local otological disease.
2. Previous otological trauma or surgery.
3. Family history of hearing loss.
4. Definite exposure to ototoxic drugs by careful drug history.
5. Habitual exposure to hazardous noise such as exposure to explosions, those who work in electric generation machines.

After being examined clinically, they were evaluated by audiometry, and the analysis was made of the bone conduction thresholds.

Patients were divided into three age groups in order to make a precise comparison between their bone conduction thresholds and the corresponding normal audiograms.

Thus, the age groups were as follows:

Group A: 18-20 years.

Group B: 21-30 years.

Group C: 31-40 years.

The duration of CKDs was also taken into consideration and the relation between the

duration of the disease and the degree of hearing loss was detected.

The average bone conduction thresholds were, on the other hand, measured immediately before and after haemodialysis.

The two audiometric tests occurred within 8 hours of each other.

Furthermore, subsequent audiograms were performed daily in the next week and at weekly intervals later on to identify the long term audiometric changes.

Blood was analyzed for creatinine, urea, glucose, sodium, potassium, calcium and cholesterol.

All patients on maintenance hemodialysis twice weekly for 4-6 hours duration.

## Results

All hundred patients had CKD of different aetiologies table 1.

36 Patients (36%) showed some degree of sensorineural hearing loss, while 64 patients (64 %) escaped the phenomenon.

The incidence of SND was found to increase with age group of 40 years table 2.

The 92 patients who were kept on regular hemodialysis program twice weekly were categorized according to the number of dialyses they had received table 3 .

The average bone conduction loss was estimated for each age group table 4.

The incidence of sensorineural hearing loss was found to increase with increasing duration of the disease table 5.

The average bone conduction thresholds were estimated according to the duration of renal failure table 6.

The incidence of SND was not directly proportional to the number of heamodialyses the patient had received Table 7.

## Discussion

Sensorineural hearing loss among patients with CKD has been a common finding in studies investigating the effects of renal failure on auditory function. Despite differences in methodologies and indices of auditory function, existence of hearing loss has been a common threat. The higher incidence of hearing loss among patient with CKD has long been established and is constantly being verified by new studies .

Bergstrom *et al*. [6] reported hearing loss in 40% of the CKD patients on haemodialysis.

Bergstrom Land Thompson [7] reported that 47% of 151 pediatric end stage renal patients had hearing loss. Hearing loss is a more commonly reported finding than vestibular dysfunction.

Kusakari *et al*. [8] studied inner ear function of 229 patients with chronic haemodialysis. They found that 60% had hearing loss, 36% had vestibular dysfunction and 26% had a combination of both. Johnson and Mathog [9] noted high frequency hearing loss in 61 adults early in the course of haemodialysis.

Charachon*et al*. [10] reported that 75% of 54 patients with CKD had hearing loss.

Zeigelboim *et al*. [11] measured thresholds between 9 and 18 kHz in 37 patients with CKD undergoing conservative treatment and a control group with normal hearing function. Age ranges in both groups were 30–59 years. They found a more severe high-frequency hearing loss in the group with CKD. Hearing loss among patients with CKD seemed to deteriorate further a year after the first evaluation.

Kochhar *et al*. [12] reported an association between hearing loss and CKD in 27.5% of patients.

Henrich*et al*. [13] found that 75% of the patients showed no deterioration of hearing during the 4-year time of follow-up. They concluded that hearing loss is common in renal failure, but it does not worsen with duration of treatment.

Samir *et al*. [14] found no correlation between pure tone audiometry findings with serum electrolyte levels.

Kusakari*et al*. [15] reported that inner ear dysfunction (including hearing loss and vestibular dysfunction or a combination) was not correlated with urea and serum creatinine levels or with duration of haemodialysis treatment.

Johnson *et al*. [16] found no relationship between fluctuations of hearing and serum urea nitrogen, creatinine ,$K^+$, $Na^+$, $Ca^{++}$ and glucose.

In a similar report, Jorgenson [17], found that hearing loss was not related to changes in creatinine, $K^+$, $Na^+$, $Ca^{++}$, glucose, urea , blood pressure, weight or hyperlipidaemia which is similar to the results in our study.

## *Conclusion*

Duration on haemodialysis treatment does not seem to have a significant impact, although the method of treatment may influence the impact of the disease on hearing. However, lack of correlation between hearing function and a blood measure precludes a detailed description of the mechanisms causing hearing loss in CKD. Changes in the dialysis treatment have eliminated the temporary effects of single session of dialysis on hearing function. Therefore it is evident that there is no correlation between a single session or short-term treatment and changes in the patients' hearing sensitivity or auditory function.

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***Table 1. Aetiological factors of CKD in the studied group.***

| Diagnosis | % |
|---|---|
| Glomerulonephritis | 24 |
| Glomreulosclerosis | 2 |
| Diabetes mellitus | 15 |
| Polycystic kidney disease | 9 |
| Nephrosclerosis | 8 |
| Hypertension | 9 |
| Pyelonephritis | 3 |
| Other interstitial nephritis | 5 |
| Unknown aetiology | 6 |
| Other | 19 |

***Table 2. The incidence of sensorineural deafness was found to increase with advancing age in patients with CKD***

| Age group | Age in year | Number of patients | Patients with hearing loss | % |
|---|---|---|---|---|
| Group A | 18-20 | 26 | 7 | 26.9 |
| Group B | 21-30 | 51 | 18 | 35.2 |
| Group C | 31-40 | 23 | 11 | 47.8 |

***Table 3.Paitents categorized according to the number of dialyses they had received***

| Number of dialyses | Number of patients |
|---|---|
| 1st group (1-80) dialyses | 66 |
| 2nd group (81-160) dialyses | 19 |
| 3rd group (161-250) | 7 |

***Table 4. The average bone conduction loss was estimated for each age group***

| | Frequency in HZ | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **250** | **500** | **1000** | **2000** | **4000** | **8000** |
| **Threshold dB In** | **Group A (18-20)** | 11 | 12 | 14 | 20 | 24 | 30 |
| | **Group B (21-30)** | 13 | 15 | 26 | 26 | 33 | 40 |
| | **Group C (31-40)** | 21 | 21 | 28 | 35 | 40 | 55 |

***Table 5. The incidence of sensorineural hearing loss was found to increase with increasing duration of the disease***

| Duration in months | Number of patients | Patients with hearing loss | % |
|---|---|---|---|
| I. (0-6) | 59 | 15 | 25.4 |
| II. (6-12) | 30 | 13 | 43.3 |
| III. (12-18) | 7 | 5 | 71.4 |
| IV. (18-24) | 4 | 3 | 75 |

***Table 6. The average bone conduction thresholds were estimated according to the duration of renal failure***

| Frequency in HZ | | | | | | | |
|---|---|---|---|---|---|---|---|
| Threshold in dB | | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
| | Group I (0-6) | 12 | 17 | 22 | 28 | 28 | 32 |
| | Group II (6-12) | 22 | 22 | 28 | 31 | 34 | 39 |
| | Group III (12-18) | 25 | 29 | 29 | 34 | 38 | 45 |
| | Group IV (18-24) | 26 | 30 | 32 | 41 | 47 | 58 |

***Table 7. The incidence of sensorinerural deafness was not directly proportional to the number of heamodialyses patients had received RaadAboudAloubaide***

| Number of dialyses | Number of patients | Patients with hearing loss | % |
|---|---|---|---|
| 1st group (1-80) | 66 | 18 | 27.2 |
| 2nd group (81-160) | 19 | 13 | 68.4 |
| 3rd group (161-250) | 7 | 3 | 42.8 |



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