

## Original article

# To Evaluate Hearing Pattern In Cases Of Chronic Renal Failure

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### Abstract

The purpose of our study was to determine the incidence of hearing loss and to describe the hearing impairment and the possible contributing factors, responsible for sensorineural hearing loss in chronic renal failure (CRF) patients. This was a cross sectional study carried out on 104 known cases of CRF attending nephrology department of National institute of medical sciences and research, Jaipur. These patients gave their consent and attended the ENT OPD for hearing evaluation. In the present study of out of 104 patients of CRF 30 patients had hearing loss. All the patient had Sensory neural hearing loss of moderately severe to severe degree in the high frequency range, which was bilateral and symmetrical.

**Keywords:** Chronic renal failure (CRF), Sensory neural hearing loss (SNHL)

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### Introduction

Sensorineural hearing impairment has been reported in chronic renal failure (CRF) patients with a prevalence of 20–40%. 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>Quick CA, 1973[1]</sup>

There also are certain anatomic similarities at an ultra-structural level and evidence for similar antigenicity of the cochlea and kidney <sup>[Alpor 1927(1)]</sup>. Moreover, in patients with established CKD, multiple risk factors have been hypothesised to cause hearing loss, including the use of ototoxic medications, hypertension, and diabetes, particularly in association with electrolyte disturbances, and hemodialysis itself. <sup>[Arnold W. 1984 (2), [Davidson AM 1998 (15)]</sup>

Evidence of a possible link between kidney function and hearing loss, potentially could modify the usual care of people with CKD.

Hence, this study has been taken up to determine the magnitude of hearing loss in CRF patients.

### Materials and Methods

The present material consists of cross sectional study carried out on 104 cases of chronic renal failure attended the Department. of ENT and Department. Of Nephrology, NIMS. Medical college between period of January 2015 to July 2016, for the evaluation of hearing loss.

The present study was conducted in the patients having chronic renal failure having no history of noise exposure, diabetes and not undergone renal transplantation.

- **Inclusion criteria:**

(1) Proven cases of chronic renal failure between 15-55 yrs. age group who are willing to give their consent for the study

**Exclusion criteria**

- (1) Patient with conductive hearing loss.
- (2) Patients who don't give their consent.
- (3) Bedridden patient who can't attend ENT OPD for hearing evaluation.
- (4) Patients having documented history of hearing loss prior to developing renal failure.
- (5) Patients who had sudden hearing loss due to use of ototoxic drugs were not taken in this study.

After selecting appropriate patients who were fulfilling the criteria mentioned in the Performa and explaining the purpose of study to them a thorough

Clinical Examination and a complete ENT checkup were done. They were also subjected to appropriate Serological and Radiological investigations (mentioned in Performa).

Finally, Audiological examinations were done.

Audiological Examinations includes —

- 1. Tuning fork tests
- 2. Pure Tone Audiometry
- 3. Tone decay test
- 4. Short Increment Sensitivity Index (SISI Test)

. Other investigations like serum electrolytes (Na<sup>+</sup>, K<sup>+</sup>, Cl<sup>-</sup>) and urine for protein (albumin) were also carried out. USG abdomen (for kidney size) was advised for every patient

**Observations**

**Table 1**

**Comparison in between Patients of CRF without SNHL & With SNHL**

Age group	No. of patient	No. of patient having hearing loss	Percentage
15-25	10	4	40%
26-35	58	14	24.13%
36-45	20	6	30%
46-55	16	6	37.5%
<b>Total</b>	<b>104</b>	<b>30</b>	

Table showing comparison in between patients without SNHL & with SNHL

Maximum numbers of patients with SNHL i.e. 14(24.1%) are of 26-35 age group .

**Table 2**

**Degree of Hearing loss in patients suffering from CRF**

Degree	Cases	Percentage
25-40dB (mild)	-	-
41-55 dB (moderate)	4	13.33%
56-70 dB (moderately severe)	11	36.6%
71-91 dB (severe)	15	50%
>91 (profound)		

Table showing degree of hearing loss in patients suffering from CRF. This table shows that most patients are having moderately severe to severe degree hearing loss.

**Table 3**

**Comparison in between duration of CRF in patients with and without hearing loss**

Duration in years	Cases	Cases with hearing loss	Percentage
>5	6	6	100%
4 — 5	42	17	40.47%
3 — 4	22	5	22.72%
2 — 3	24	2	8.3%
1 — 2	8	-	-
<1	2	-	-
Total	104	30	

Table shows comparison in between duration of CRF in patients without SNHL & with SNHL. Maximum number of patients with hearing loss were seen in 4-5 year duration. so with increase in the duration of Chronic Renal Failure the hearing loss become more prominent.

Table 12 Comparison in between Serum urea levels in patients without SNHL & with SNHL

Urea levels in mg %	Cases	Cases with hearing loss	Percentage
> 500	-		-
400 — 500	4	2	50%
300 — 400	12	2	16.66%
200 — 300	48	15	31.25%
100 — 200	29	9	31.03%
50 — 100	11	2	18.18%
Total	<b>104</b>	<b>30</b>	

Table 15 Comparison in between Serum Creatinine levels in patients without SNHL & with SNHL

Serun Creatinine level in mg %	Cases	Cases with hearing loss	Percentage
20 — 25	-		-
15 — 20	6	2	33%
10 — 15	58	13	22.41%
5 — 10	27	7	25.92%
1.5 — 5	13	8	61.53%
Total	104	30	

Table-16 Comparison in between Urine albumin levels in patients without SNHL & with SNHL

Urine albumin	Cases	CASES WITH HL	Percentage
1+	19		
2+	41	15	36.58%
3 +	36	11	30.55%
4 + and above	8	4	50%
Total	104	30	

## DISCUSSION

The purpose of this study was to evaluate the patient suffering from chronic renal failure whether they were suffering from hearing loss or not and if yes which type of hearing loss and the probable causes of hearing loss, performed at NIMS Medical College Jaipur (Raj.)

### Factors pertaining to Chronic renal failure

Chronic renal failure is a disease affecting any age group. The incidence is slightly higher in males. Genetic causes of renal failure have definite incidence of hearing disorder like alport's syndrome. The presence of hearing loss in patients with renal failure were noted way back in the early part of 20th century with **Alport in 1927<sup>(1)</sup>** presenting the classic genetic syndrome "Hereditary Familial Congenital Hemorrhagic Nephritis " and linked auditory deficit with renal failure but whether the loss occurred as a result of direct hereditary defect or secondarily from renal failure was uncertain at that time. Whereas the presence of hearing loss in nongenetic renal failure cases are controversial.

Various factors have been implicated to the cause of decrease hearing in chronic renal failure patients. These factors include increased level of urea, Serum

Creatinine, electrolyte disturbance and duration of chronic renal failure which modify the cause of chronic renal failure progression. The onset of hearing loss in old age is said to accelerate the appearance of presbycusis in these patients.

### Hearing loss-

Keeping the above mentioned facts in mind, work up was done in 104 patients with CRF, of non-genetic cause. The risk factors which could induce hearing loss were excluded carefully as described in study design. Of the 104 patient examined 30 (28.84%) out of them were found to have hearing loss. All the 30 patients had SNHL which was bilateral. It shows hearing loss is more prevalent among CRF patient (20 % to 40 %). **Lasisi AO, Salko BL (2007)<sup>(3)</sup>**, reported that SNHL is more common in CRF patients.

**In** our study all the 30 patient who had SNHL have hearing loss. Hearing loss is found mainly of cochlear type i.e. 28(93.33%) patients out of 30 patients of hearing loss.

Degree of hearing loss is mainly moderately severe (i.e. 56-70db) to severe (i.e. 71-91db) in the patients of chronic renal failure suffering from hearing loss.

### Age and Sex —

Out of total 30 patients of hearing loss of total 104 patients of Chronic renal failure Number of patients were 4 in 15 — 25 age group, 14 in 26 — 35 age group, 6 in 36 — 45 age group, and 6 were in 46 — 55 age group. So no particular age group were affected specifically.

Out of 30 patients 21 were males and 9 were female, the incidence of hearing loss, seems higher in males because the number of males patient were greater in study as incidence of CRF is higher in males.

#### **Duration of renal failure —**

Duration of renal failure ranges from 6 months to 6 years in the patients included in our study. The duration of CRF, in patients with SNHL in our study, were 3 — 6 years. Thus it could be established that patients with long standing CRF suffered with SNHL.

#### **Serum urea and creatinine level —**

Blood urea levels ranged from 50 mg% to 500 mg% in the patients included in our study. In the patients with SNHL, there were not very high urea levels as the maximum numbers of patients had their urea level in the range less than 300 mg%. But the percentage of hearing loss patients increases with increase in urea level of patients suffering from chronic renal failure

Serum creatinine level, maximum patient were having serum creatinine less than 14 mg%. so patient of CRF who had SNHL, did not had very high creatinine levels so no relationship between hearing loss and creatinine levels.

#### **Serum electrolytes —**

It has been commonly observed and said that electrolyte imbalance in CRF are the main cause of decreased hearing. This was due to the fact that the hair cells in the inner ear are bathed electrolyte sensitive endolymph and cortilymph. In the study

conducted there was a limited derangement in the serum electrolyte levels from normal. Weather this could form a cause for decrease hearing could not be ascertained because of lack of pathophysiological studies. And weather serum electrolyte disturbance causes decrease hearing is itself is a question as only 30 out of 104 patients had SNHL. **Kusakari ( 1981)** <sup>(4)</sup>, reported there were no correlation with SNHL in CRF and electrolyte disturbance.

#### **Urinary protein —**

Proteinuria was present in all the 104 patient, and also in all the 30 patient with CRF. Out of 28 patients only 4 patients had very heavy proteinuria and 14 patient had moderate amount of proteinuria. But as the Proteinuria increases the percentage of hearing loss increases among those patients of chronic renal failure.

There is resemblance between stria capillary basement membrane (of cochlea) and glomerular basement membrane (in kidney). Both stria capillary basement membrane and glomerular basement membrane have common antigenicity (evidence of shared antigenicity between kidney and cochlea has been recognized by a study by **Quick C.A., Filch & Brown in 1973** <sup>(5)</sup>, and **Arnold in 1980** <sup>(2)</sup>, and both have similar physiological mechanism, namely the active transport of fluid and electrolyte (Na<sup>+</sup>, K<sup>+</sup>, Cl<sup>-</sup> ). These may accounts for similar effect of medication (nephrotoxic and ototoxic effect of aminoglycosides), and there is increased prevalence of SNHL among patients of CRF. Finally, it can be said that Hearing loss (SNHL type) occur in patients with Chronic renal failure of non-genetic cause. This happened even after exclusion of known risk factors, like noise exposure, ototoxic drugs, head injuries etc. The presence of additional factors accelerates the cause of Hearing loss. The presence of high serum

urea level, high serum creatinine level, electrolyte imbalance, hypertension, proteinuria are some of the factors which seems to have cumulative effect on deterioration of hearing in patients who were suffering from CRF. Yassin A, Badry A(1970)<sup>(8)</sup>, Wigand ME<sup>(17)</sup>, Meents O(1972)<sup>(17)</sup>, Quick C.A.(1973)<sup>(5)</sup>, Kusakari(1981)<sup>(4)</sup>, Urquiza R, Morell M(1986)<sup>(16)</sup> are some of who had studied on SNHL in CRF. Hence our study result resembles with many studies done previously on SNHL, in CRF.

### Conclusion

Evidence of a possible link between kidney function and hearing loss, as suggested by our study, potentially could modify the usual care of people with CKD.

It should encourage clinical nephrologists to include questions about hearing function in their preventive care protocols, to refer all patients reporting the hearing loss to a hearing health professional for evaluation and/or rehabilitation (e.g., hearing aids), and recommend that patients avoid further treatment with ototoxic medications to preserve their hearing ability.

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