

## HEARING LOSS IN CHRONIC RENAL FAILURE AND CHANGES WITH KIDNEY TRANSPLANTATION

M. KAVIANI AND M. ALBORZI

*From the Department of Otolaryngology, Shiraz University of Medical Sciences, Shiraz, Islamic Republic of Iran.*

### ABSTRACT

Loss of hearing is a known problem in patients with chronic renal failure, occurring in 40-80% of cases and being most often of the high frequency sensorineural type. We performed a study on 50 patients with this disease, including 20 who had undergone a successful kidney transplantation. Our results show an 80% incidence of hearing loss in these patients and a chance of improvement in at least 60% of cases after transplantation.

**Key words:** chronic renal failure, kidney transplantation, sensorineural hearing loss.  
*MJIRI, Vol. 9, No. 3, 209-211, 1995.*

### INTRODUCTION

Chronic renal failure as an end-stage kidney disease may have a detrimental effect on hearing. Hearing loss is most often of the sensorineural type and especially involves high frequencies.

There are many explanations for all or part of the hearing loss seen in these patients, including the presence of anemia, infection, systemic diseases such as diabetes mellitus, hypertension or arteriosclerosis, use of ototoxic drugs and hemodynamic changes due to hemodialysis or transplantation, all of which cause damage to the cochlea or retrocochlea.<sup>1-5</sup> Kidney transplantation as a final therapeutic modality may have favorable or adverse effects on the level of hearing in these patients.<sup>6-8</sup>

In this research we studied the hearing of patients with chronic renal failure who were under follow-up of our nephrology ward and those who had a kidney transplantation at Nemazee Hospital, Shiraz University of Medical Sciences.

### MATERIAL AND METHODS

Fifty patients with chronic renal failure were studied. There were 34 males and 16 females, with ages ranging from 16 to 60 years. Audiological studies including pure-tone, speech reception and discrimination, tympanometry and acoustic reflex were performed with a Madsen OB-822 audiometer and Madsen ZO-174 tympanometer.

For twenty of these patients who had a successful kidney transplantation, the above-mentioned audiological studies were repeated with the same instruments and by the same audiologist 1-3 months after surgery.

### RESULTS

Of 50 patients, 9 patients (18%) had quite normal pure-tone audiometries (PTA). Hearing loss among the remaining 41 patients (82%) were divided into three groups: group I with mild hearing loss of 0-25 dB consisting of 14 cases (28%), group II with moderate hearing loss of 26-50 dB consisting of 13 cases (26%) and group III with more than 50 dB loss of hearing consisting of 14 patients (28%).

Speech reception in all patients correlated directly with the PTA results. Speech discrimination was above 90%. Acoustic reflexes relative to hearing were normal except for 12 cases who had elevated or absent reflexes despite normal or near-normal hearing (24%). Tympanometry showed no significant or remarkable findings.

Results of post-transplantation audiological studies in 20 patients which had been done 1-3 months after operation were as follows. There was improvement of hearing in 12 patients (60%) of at least 10 dB. In 5 patients, all of whom had quite normal hearing before operation, there was no change in hearing. Hearing impairment of at least 10 dB was observed in 3 subjects (15%). Seven patients had elevated or absent acoustic reflexes which became normal in five patients

and remained abnormal in the other two.

### DISCUSSION

There have been many explanations presented to answer why hearing is impaired in patients with chronic renal failure. Some of these explanations focus on similarities between the kidney and the inner ear so that any factor causing an abnormality in the former may cause a problem in the latter.

1. Marginal cells of the stria vascularis, like the tubular cells of the proximal loop of Henle, have very high numbers of mitochondria, reflecting the high state of metabolic activity. Also, both of these structures are endoplasmic folds invaginating into their capillary bed, and are very actively involved in ionic exchanges.<sup>6</sup>

2. There is an antigenic similarity between the inner ear and the kidney. Injecting serum containing antibodies against the cochlea may cause positive immunofluorescent staining of renal tubular cells.<sup>9</sup>

3. There are several drugs and chemicals which are toxic to both the ear and the kidney, such as aminoglycoside antibiotics.<sup>6</sup>

4. Several congenital disorders are present which have both renal and aural problems as their main manifestation, such as Alport's syndrome and Epstein's syndrome.<sup>6,10,11</sup> Other theories focus on increased levels of toxic materials in serum due to impaired kidney function or imbalance in serum electrolyte levels and fluid or endocrine abnormalities and therefore state that changes of hearing following hemodialysis or kidney transplantation may be secondary to changes in these factors.<sup>12,13</sup>

Finally, contributing factors such as systemic diseases, use of ototoxic drugs or infection must also be kept in mind.<sup>14-17</sup>

Hearing loss is reported to be found in 40-50% of patients with chronic renal failure, and involves mainly the high frequencies. Gatland and colleagues reported an incidence of 41% in low, 15% in middle and 53% in the high frequencies.<sup>5,18,19</sup> We found hearing loss in 82% of our patients; 15% in low, 10% in middle and 58% in high frequencies.

Another remarkable finding in this study was an abnormal acoustic reflex which was either increased or absent in 24% of patients. It may be explained as a complication of uremic neuropathy.

Can kidney transplantation cause better hearing by improving renal function? McDonald et al. in a study on 6 patients with Alport's syndrome who underwent transplantation found that hearing was improved in one patient and stabilized in others, considering the fact that hearing loss is a progressive problem in these patients.<sup>8</sup> Mitschke et al. also had similar results in a study on 10

patients and stated that kidney transplantation may improve hearing.<sup>7</sup>

Our results confirm these studies because there has been at least a 60% improvement in the hearing threshold of these patients. We emphasize on the phrase "at least" because the 25% of patients with no difference in hearing all had completely normal hearing before transplantation.

Although it is noted in some references that the severity of hearing loss correlates directly to the number of dialyses,<sup>20</sup> our study did not confirm this.

### ACKNOWLEDGEMENT

The authors are grateful to Dr. A. Gaafari for his valuable assistance in audiological evaluation of the patients.

### REFERENCES

1. Nicolai P, Camerini C, Maiorca R: Audiological findings in elderly patients with chronic renal failure. *Acta Otolaryngologica (suppl)* 476: 54-68, 1990.
2. Quick CA: Hearing loss in patients with dialysis and renal transplants. *Ann Otol Rhinol Laryngol* 85: 776-790, 1976.
3. Oda M, Preciado MC, Quick CA, Paparella MM: Labyrinthine pathology of chronic renal failure patients treated with hemodialysis and kidney transplantation. *Laryngoscope* 84: 1489-1506, 1974.
4. Kusakari J, Kobayash T, Rokugo M, et al: The inner ear dysfunction in hemodialysis patients. *J Exp Med* 135: 359-369, 1981.
5. Gatland D, Tucker B, Chalstrey S, Keene M, Baker L: Hearing loss in chronic renal failure; hearing threshold changes following hemodialysis. *Journal of the Royal Society of Medicine* 84 (10): 587-9, 1991.
6. Arnold W: Inner ear and renal diseases. *Ann Otol Rhinol Laryngol (suppl)* 112: 119-124, 1984.
7. Mitschke H, Schmidt P, Kopsa H, Zazgornik J: Reversible uremic deafness after successful renal transplantation. *N Eng J Med* 292: 1062-1063, 1975.
8. McDonald TJ, Zincke H, Anderson CF, Ott NT: Reversal of deafness after renal transplantation in Alport's syndrome. *Laryngoscope* 88: 38-41, 1978.
9. Quick CA, Fish A, Brown C: The relationship between cochlea and kidney. *Laryngoscope* 83: 1469-1481, 1973.
10. Sahinoglu C, Kumi M, Kilin C, Meter R: Hereditary macrothrombocytopenia, deafness and nephritis (Epstein's triad). *International J Ped Otorhinolaryngol* 9(3): 257-61, 1985.
11. Gubler M, Levy M, Broyer M, Naizot C, Gonzales G, Perrin D, Habib R: Alport's syndrome; a report of 58 cases and a review of the literature. *Am J Med* 70: 493-503, 1981.
12. Mitschke H, Schmidt P, Zazgornik J, Kopsa H, Pils P: Effect of renal transplantation on uremic deafness, a long-term study. *Audiology* 16 (6): 530-534, 1977.
13. Ikeda K, Kusakari J, Arakawa E, Okyama K, Inamura N,

- Kawamoto K: Cochlear potentials of guinea pigs with experimentally-induced renal failure. *Acta Otolaryngologica* (suppl) 435: 40-45, 1987.
14. Fairbanks D: Antimicrobial therapy for chronic suppurative otitis media. *Ann ORL* 90 (suppl 84): 58-62, 1981.
  15. Brummett RE, Harris RF, Lindgren JA: Detection of ototoxicity from drugs applied topically to the middle ear space. *Laryngoscope* 86: 1177-87, 1976.
  16. Meyerhoff WL, Morizono T, Shaddock LC, et al. Tympanostomy tubes and otic drops. *Laryngoscope* 93: 1022-1027, 1983.
  17. Bergstorm LV, Thompson P, Sando I, et al: Renal disease: it's pathology, treatment and effects on the ear. *Arch Otolaryngol* 106: 567-572, 1980.
  18. Mitschke H: Otorhinolaryngological diseases in patients with advanced kidney failure after kidney transplantation. *Fortschr Med* 98 (12): 437-440, 1980.
  19. Kligerman A, Ventry IM, Goodman AI, Weseley S: Hearing impairment associated with chronic renal failure. *Laryngoscope* 91: 583-592, 1981.
  20. Myerhoff WL, Liston SL: Metabolic hearing loss. In: Paparella MM, Shumriek DA, Glickman JL, Myerhoff WL, (eds.). *Otolaryngology*. Philadelphia, W. B. Saunders Co, pp. 1671-72, 1991.