

# Sensorineural Hearing Loss as a Common Finding in Chronic Kidney Failure Patients Undergoing Hemodialysis

**Emirjona Vajushi**

MD, Department of Otorhinolaryngology,  
American Hospital, Tirana, Albania

**Zamira Shabani**

MD, Department of Nursing, Faculty of Natural Sciences,  
University of Shkodra, Shkodra, Albania

## Abstract

**Background:** Chronic renal failure affects all organ systems. Senses are not exception and hearing impairment in this group of patients is very common, particularly sensorineural hearing loss (SNHL). **The aim** of this study is to put in evidence the situation of sensorineural hearing in hemodialysis patients that are presented at our department. **Methodology:** This is a transversal study. In this study were included 65 patients. 21 (32.3%) female patients and 44 (67.7%) male patients Study was performed in the American Hospital 2 of Tirana during years 2015-2016. 27 (41.5%) patients during 2015 and 38 (58.5 %) patients during 2016. **Results:** 81.5 % of patients under hemodialysis had sensorineural hearing loss. 18.5 % of patients under hemodialysis had normal hearing. 15.4% of patients had mild sensorineural hearing loss, 50.8% of patients had moderate sensorineural hearing loss, 9.2 % had severe sensorineural hearing loss and 6.2% of patients had profound hearing loss. Hearing loss was mostly in high frequencies but without a specific pattern. All patients with sensorineural hearing loss (100%) had two sides damage of hearing. **Conclusions:** Sensorineural hearing loss is very common in hemodialysis patients. The hearing loss affects more the high frequencies. In the patient care of hemodialysis patients should be included the routine hearing monitoring test.

**Keywords:** sensorineural hearing loss, hemodialysis

## Introduction

Hearing impairment is very common in end stage renal disease patients. Sensorineural hearing loss is much more common in this group of patients than

conductive hearing loss.(1) Literature data report that 20–87% of these patients have sensorineural hearing loss.(2)

Possible mechanisms of sensorineural hearing loss (SNHL) associated with renal failure and hemodialysis are controversial. Possible mechanisms include a shared antigenicity between the kidney and the inner ear, osmotic alteration caused by hemodialysis, and the ototoxic effect of diuretics.(3)

Hearing loss is a common finding in patients with chronic renal failure and deafness may occur during the course of hemodialysis. Uremia, ototoxins, axonal uremic neuropathy, anemia, and toxic degradation products from cellulose acetate dialyzer membranes are all possible etiologic factors. Anemia seems to be an important factor responsible for hearing disorders in patients with end-stage renal failure. (5)

Diabetes Mellitus is a probable cause of hearing impairment and treatment of anemia with erythro-poetin administration seemed to be a possible preventing factor.(6)

Sensorineural hearing loss could occur in chronic kidney disease patients undergoing hemodialysis. In general, the frequency of hearing impairment in chronic kidney disease is connected with age and gender, and with associated disorders such as hypertension and diabetes mellitus. Hearing loss included hypertension and DM type-2, and hypercholesterolemia. Those factors affect the inner ear blood flow which directly causes impairment of oxygen and nutrient transport to the cochlear cells and indirectly on auditory nerve degeneration. Chronic hypertension causes nephrosclerosis and the longer the hypertension the more severe glomerular injury and tubular atrophy that eventually leads to renal failure. Diabetes mellitus is a common systemic metabolic disease, associated with multiple macro- and microvascular complications, including thickening of the basal membrane of the stria vascularis capillaries on the lateral wall of the cochlea and other microvascular and neuropathic changes that could induce hearing loss. DM usually is associated with the development of bilateral hearing loss. (7)

With progression in the stage of chronic kidney disease, the hearing loss also increased indicating a possible link between the two. We also noted that the hearing loss increased with the increasing age.(8)

## **Methodology**

The study included 65 patients in end stage renal disease treated with hemodialysis, three times a week, for 4–4.5 hours, using capillary dialyzers made of cellulose diacetate or polysulphone, of the surface area of 1.5–2.2 m<sup>2</sup>, of predominantly low permeability, sterilized by g-irradiation or ethylene oxide, with common blood (250–300 mL/min) and dialysate flow (500 mL/min). Water for dialysis was prepared by reverse osmosis, and conductivity of below 10 µS/cm<sup>3</sup> was ensured. Exclusion criteria were history of exposure to noise, Alport's syndrome and those with conductive and/or mixed hearing loss confirmed by pure tone audiometry. The patients underwent examination by the otorhinolaryngologist which was familiar

with the study. HT was measured for air and bone conductivity, for both ears, for frequencies of 125,250, 500, 1000, 2000,3000, 4000, 6000 and 8000 Hz.

We were based on World Health Organization Grades of Hearing impairment (WHO 2008) for the classification of hearing loss in hemodialysis patients.

Grade of impairment*	Corresponding audiometric ISO value**	Performance	Recommendations
0 - No impairment	25 dB or better (better ear)	No or very slight hearing problems. Able to hear whispers.	
1 - Slight impairment	26-40 dB (better ear)	Able to hear and repeat words spoken in normal voice at 1 metre.	Counselling. Hearing aids may be needed.
2 - Moderate impairment	41-60 dB (better ear)	Able to hear and repeat words spoken in raised voice at 1 metre.	Hearing aids usually recommended.
3 - Severe impairment	61-80 dB (better ear)	Able to hear some words when shouted into better ear.	Hearing aids needed. If no hearing aids available, lip-reading and signing should be taught.
4 - Profound impairment including deafness	81 dB or greater (better ear)	Unable to hear and understand even a shouted voice.	Hearing aids may help understanding words. Additional rehabilitation needed. Lip-reading and sometimes signing essential.

Table 1. World Health Organization Grades of Hearing impairment (WHO 2008)

## Results and Discussion

In this study were included 65 patients. 21 (32.3%) female patients and 44 (67.7%) male patients Study was realized in the American Hospital 2 of Tirana during years 2015-2016. 27 (41.5%) patients during 2015 and 38 (58.5 %) patients during 2016.

81.5 % of patients under hemodialysis had sensorineural hearing loss.

18.5 % of patients under hemodialysis had normal hearing.

15.4% of patients had mild sensorineural hearing loss, 50.8% of patients had moderate sensorineural hearing loss, 9.2 % has severe sensorineural hearing loss and 6.2% of patients had profound hearing loss.

Hearing loss was mostly in high frequencies but without a specific pattern.

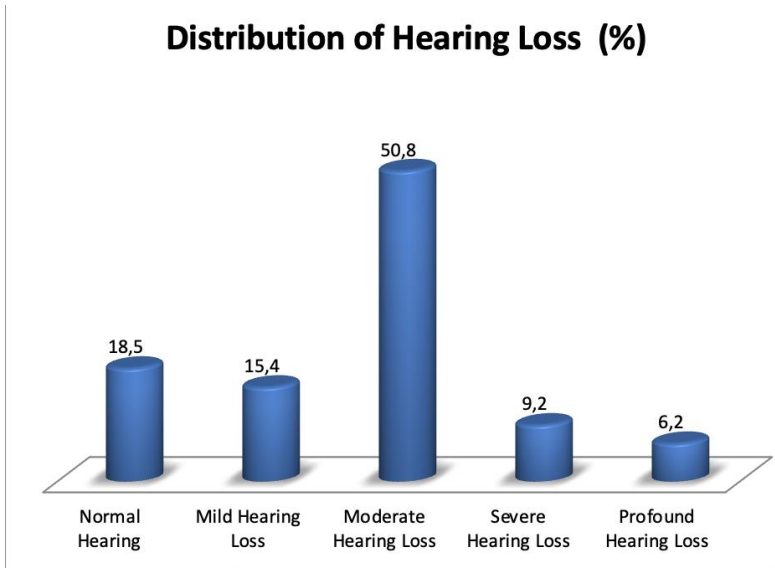
All patients with sensorineural hearing loss (100%) had two sides damage of hearing.

Minimal age was 32 years old, maximal 83 years old, medium age 62.69 years old, and standard deviation 62.69±11.32 years old.

	Frequence(N)	Percentage (%)
Normal Hearing	12	18.5
Mild hearing loss	10	15.4

Moderate hearing loss	33	50.8
Severe Hearing loss	6	9.2
Profound hearing loss	4	6.2
Total	65	100.0

Tab.2 Distribution of hearing loss



Graphic 1. Distribution of hearing loss

Based on the studies done before there is a higher presence of sensorineural hearing loss in our study (81.5 % of hemodialysis patients) than in the studies reported before. In our study hearing loss is mostly moderate sensorineural hearing loss. (50.8 % of hemodialysis patients had moderate sensorineural hearing loss). Hearing loss affected more the high frequencies.

On the study of Jamaldeen et al hearing loss as established by pure tone audiometry average was present in 50 out of 120 (41.7 per cent) chronic kidney disease patients and 18 out of 120 (15 per cent) controls ( $p=0.001$ ). Hearing thresholds were abnormal at low frequencies (250 Hz to 1 kHz) in 33 (27.5 per cent) patients and at high frequencies (2 kHz to 8 kHz) in 93 (77.5 per cent) chronic kidney disease patients. Hearing thresholds were abnormal across all frequency ranges in 52 (43 %) chronic kidney disease patients. Thus, high-frequency hearing loss was the most common hearing impairment among chronic kidney disease patients.(14)

Reddy et al reported from the study done in a group of 200 hemodialysis patients that sensorineural hearing loss was present at 4000 Hz in 53.5% individuals (48%

bilateral, 5.5% unilateral) and 8000 Hz in 63.5% individuals (61% bilateral, 2.5% unilateral).(9)

Charachon *et al.* reported that 75% of 54 patients with chronic kidney failure had hearing loss. (10) Kusakari *et al.* reported on inner ear function of 229 patients on chronic hemodialysis. They found that 60% had hearing loss.(11) Johnson and Mathog noted high frequency hearing loss in 61 adults early in the course of hemodialysis.(12) Bergstrom and Thompson reported that 47% of 151 pediatric end-stage renal patients had hearing loss.(13)

### **Conclusions**

Sensorineural hearing loss is very common in hemodialysis patients. The hearing loss affects more the high frequencies but without a specific pattern. In the patient care of hemodialysis patients should be included the routine hearing monitoring test.

### **Acknowledgments**

We would like to thank the patients for their collaboration.

### **Conflict of Interest**

The authors declare that they have no conflicts of interest.

### **Author Contributions**

Emirjona Vajushi followed these patients, drafted and revised this manuscript.

### **Ethics Approval**

An Ethics Approval Statement was not required for this report.

### **Animal Rights**

This article does not contain any studies with human or animal subjects performed by the any of the authors.

### **Data Availability Statement**

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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