Case Report

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Sudden profound sensorineural hearing loss following initiation of haemodialysis in a patient with end-stage renal disease

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ABSTRACT

Background: The population of patients receiving haemodialysis is on the increase in Nigeria. Various complications are associated with this life-saving procedure. Reports of sudden profound sensorineural hearing loss, following initiation of haemodialysis, are rare in the literature. Aim: The aim of this report is to highlight the unusual occurrence of sudden hearing loss after a common life-saving procedure. Methods: This is a case report of a 31-year old military officer who had an end-stage renal disease due to a chronic glomerulonephritis and with a baseline good social hearing. He developed profound hearing loss immediately after the first session of haemodialysis. Clinical evaluation of the ear was done. Pure tone audiometry and full audiological evaluation was conducted. This was repeated nine months later. Findings: Ear examination revealed unremarkable outer ear/otoscopic findings. Tuning fork test showed no perception to both Rinne’s and Weber’s test. Pure tone audiometry (PTA) revealed profound bilateral sensorineural hearing loss (SNHL) with pure tone average (at 500, 1000, 2000, 4000Hz) of 93dBHL and 88dBHL in the right and left ear respectively. Repeat audiometry revealed no significant change. Conclusion: The patient developed irreversible bilateral profound sensorineural hearing loss following initiation of haemodialysis. We recommend pre-haemodialysis otologic and audiological evaluation for patients. This can be repeated at intervals to identify patients who may develop hearing impairment in the course of treatment of the disease. Also medical personnel offering dialytic therapies should be vigilant for this rare complication.

Key words: Sensorinueral hearing loss, end-stage renal disease, chronic glomerulonephritis, haemodialysis, dialysis disequilibrium, pure tone audiometry

INTRODUCTION

Haemodialysis (HD) is the commonest method of renal replacement therapy for Nigerian patients with end-stage renal disease (ESRD) and acute renal failure.[1] Despite some technological improvements and better understanding of physiology associated with haemodialysis, a number of complications are known to be associated with it. These include cardiovascular complications like hypotension, hypertension and arrhythmia; muscle cramps, chest...
pain, fever and chills, air embolism, and haemolysis.

A diminished hearing acuity has been reported to be one of the complications of chronic haemodialysis and has been recognized as a high frequency deficit from early times of haemodialysis.[6] Several aetiological factors have been linked to its occurrence.[3] These include the use of ototoxic medications, electrolyte disturbances, hypertension[4,5] and haemodialysis treatment itself.[6,7] The role of haemodialysis in the causation of sensorineural hearing loss (SHL) is controversial; some authors have reported a depression in hearing threshold after haemodialysis while others are of the opinion that there was no relation between the two. The fact that the cochlea is susceptible to a wide variety of metabolic, hydroelectrolytic and hormonal imbalances is already widely known and these imbalances are systemic alterations usually found in patients who have compromised renal function. The cochlear function in patients under the treatment with haemodialysis may further be impaired. Vitamin D deficiency has been implicated as a contributing factor to hearing loss in renal failure.[8] Adler et al reported a significant decline in Na$^+$- K$^+$-activated ATPase in the inner ear of uraemic guinea pigs.[9] It was also documented that an inverse correlation between serum creatinine level and Na$^+$-K$^+$-activated ATPase.[9] Since Na$^+$- K$^+$-activated ATPase in the cochlea is important for maintaining cationic gradients, it was suggested that inhibition of this enzyme system may be a factor in inner ear dysfunction among uraemic patients.[9]

Report of sensorineural hearing loss immediately following initiation of haemodialysis is rare in the literature. This is a report of a 31-year old military officer who had an end-stage renal disease due to a chronic glomerulonephritis. He developed profound sensorineural deafness immediately after the first session of haemodialysis.

**CASE PRESENTATION**

The index patient is a 31-year old military officer who presented to our facility through the accident and emergency unit with history of bilateral leg swelling and dyspnoea on moderate exertion of 2 weeks duration. He was not previously diagnosed with hypertension or diabetes and no family history of renal disease or deafness. There was an associated hiccup, vomiting and restlessness. There was no hearing impairment or other otologic symptoms. He was not on any medication prior to presentation.

Examination findings revealed an acutely ill-looking man with good social hearing, conjunctival pallor, bilateral pitting leg oedema. His pulse rate was 72 beats per minute, raised blood pressure at 170/100 mmHg while the apex beat was undisplaced with normal first and second heart sounds. He was conscious and had flapping tremors of the outstretched hands. No clinical hearing evaluation was carried out prior to the haemodialysis because the patient gave no complaint of hearing impairment or any ear symptom. Details of urinalysis and renal function tests are shown in table 1.

Table 1: Results of renal function tests, urinalysis and packed cell volume before and after first session of haemodialysis

<table>
<thead>
<tr>
<th></th>
<th>Renal function tests</th>
<th>Urinalysis</th>
<th>PCV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Urea (mg/dl)</td>
<td>Creatinine (mg/dl)</td>
<td>Bicarbonate (mmol/l)</td>
</tr>
<tr>
<td>Pre-dialysis</td>
<td>256</td>
<td>12.3</td>
<td>12</td>
</tr>
<tr>
<td>Immediate post- dialysis</td>
<td>151</td>
<td>4.2</td>
<td>21</td>
</tr>
<tr>
<td>Two days post-dialysis</td>
<td>209</td>
<td>5.5</td>
<td>19</td>
</tr>
</tbody>
</table>

SG- Specific gravity, ND- Not done
Figure 1: The pure tone audiometry of the patient after occurrence of hearing loss
Figure 2: A repeat pure tone audiometry done 9 months after the initial one
Figure 3: Transient evoked response emission
Figure 4: Auditory brainstem response audiometry
Figure 5: Auditory brainstem response audiometry
The estimated glomerular filtration rate (eGFR) based on the Modification of Diet in Renal Disease (MDRD) formula\(^\text{[10,11]}\) was 6mls/min/1.73m\(^2\). The renal ultrasound scan showed that both kidneys were reduced in sizes, measuring 8.5 x 3.5cm and 8.0 x 3.4cm for the left and right side respectively. They had raised parenchymal echogenicity with complete loss of cortico-medullary distinction. Complete blood count analysis showed evidence of normocytic normochromic anaemia. He had normal white blood cells and platelets count.

All these were in keeping with a diagnosis of end-stage renal disease with uraemia, possibly secondary to chronic glomerulonephritis. He had a session of haemodialysation at blood flow of 200mls/min, using the Fresenius F7HPS polysulfone dialyser over 2 hours with ultrafiltration volume of 1500mls. At the end of the session, patient discovered that he was unable to hear spoken words or any other forms of sound. The otorhinolaryngology unit was invited to review the patient. Ear examination revealed unremarkable outer ear/otoscopic findings. Tuning fork test showed no perception to both Rinne’s and Weber’s test. Pure tone audiometry (PTA) revealed profound bilateral sensorineural hearing loss (SNHL) with pure tone average (at 500, 1000, 2000, 4000Hz) of 93dBHL and 88dBHL in the right and left ear respectively (figure 1).

Patient’s hearing did not improve after subsequent sessions of haemodialysis. Hence, a full audiological evaluation was conducted 9 months later. The repeat audiometry showed a PTA with pure tone average of 92dBHL and 82dBHL in the right and left ears respectively (figure 2). Speech recognition score were measured at 65dBHL (figure 2). Speech recognition scores for monosyllabic phonetically balanced words were measured CNE due to the severity of hearing loss. Tympanometry was normal. Ipsilateral acoustic stapedial reflexes were absent from 500Hz to 4000Hz . Transient evoked response emission revealed poor emission from 1500Hz to 4000Hz (figure 3). There was observable repeatable wave I, III, V at100dBHL and wave V identified down to 60dBH in the case of auditory brainstem response (ABR) audiometry (Figure 4 and 5. Hearing aids were prescribed for the patient and he benefitted from its use.

**DISCUSSION**

This case was reported in order to highlight an uncommon complication associated with initiation of haemodialysis therapy. Most cases reported in the literature involved patients who had progressive hearing deficit during the course of haemodialysis. Our index patient had a sudden profound hearing loss at initiation of haemodialysis. It is our impression that the hearing loss might have been attributable to osmotic disequilibrium in the labyrinth similar to the well known dialysis disequilibrium that may occur at initiation of haemodialysis. However, we do not know why the hearing loss persisted till the moment of this report. In end-stage renal disease haemodialysis is a life-saving procedure and could not be withheld from this patient as there were no immediately available alternative.

Rizzvi and Holmes had earlier reported a 47-year-old man with normal hearing who had chronic progressive renal failure\(^\text{[12]}\). He experienced hearing loss in additive increments with peritoneal dialysis and haemodialysis\(^\text{[13]}\). This persisted until he had profound deafness bilaterally. “Postmortem studies showed collapse of the endolymphatic system and oedema and atrophy of most of the specialized cell types of the auditory and vestibular sense organs”\(^\text{[12]}\). It was concluded that osmotic disequilibrium in association with haemodialysis accounted for the alterations observed.

Olatoke reported two patients who developed sensorineural deafness after multiple sessions of haemodialysis\(^\text{[13]}\). One of the patients was a 35-year-old man who developed profound SNHL after 5 sessions of haemodialysis, and the other was a 36-year-old woman who developed severe to profound SNHL after 7 sessions\(^\text{[13]}\). Both hearing losses were attributed to possible osmotic disequilibrium in the labyrinth or an acute injury to the labyrinth caused by contamination of the blood by the degraded product of the old cellulose acetate haemodialyzer membrane used (the haemodialyzer had been in use for 15 years). Examination findings in both patients showed that the external anatomy of the ear, nose, and throat were normal. Both patients showed no response to tuning-fork test or to distraction test with a bell rung at ear level. Pure-tone audiometry in both patients showed a profound bilateral bone-conduction hearing loss (<100 dB at all frequencies).\(^\text{[13]}\) Repeat PTA at 3rd and 6th month were essentially unchanged. Both patients were advised to procure a set of hearing aids.

Our patient had profound sensorineural hearing loss immediately after the first session of haemodialysis. Repeat PTA done after three months did not show any improvement. As
spontaneous recovery was not feasible, he had trial of hearing aid which he benefitted from. Hence he was advised to procure hearing aids and for occupational rehabilitation.

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The findings of the study have been presented as abstract at the conference of the National Association of Nephrology in Sokoto, Nigeria in February, 2016.

REFERENCES


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Conflict of Interest: None declared

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