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ORIGINAL ARTICLE

## Could the type of treatment for chronic kidney disease affect the auditory system?☆

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### KEYWORDS

Hypertension;  
Diabetes mellitus;  
Hearing loss;  
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### Abstract

**Introduction:** Chronic kidney disease (CKD) is defined as the presence of renal injury that leads to the slow and progressive loss of kidney function.

**Aim:** To compare audiological tests between patients with CKD receiving different types of treatment.

**Material and method:** This was a clinical and experimental study. Groups were divided according to treatment: hemodialysis (n = 35), peritoneal dialysis (n = 15), and conservative (n = 51), and were compared to 27 healthy controls. Patients older than 60 years; those with congenital hearing loss, genetic syndromes, and middle-ear infections; and those who had been submitted to a kidney transplant were excluded. Audiologic evaluation included pure-tone audiometry, transient evoked otoacoustic emissions, and auditory brainstem response (ABR). The variables considered were gender, age, diagnosis of arterial hypertension, time since the diagnosis of diabetes and hypertension, CKD stage, duration of CKD, and duration of treatment.

**Results:** The variables age, presence of arterial hypertension, and time of CKD were statistically significant and controlled. The auditory thresholds measured by pure-tone threshold audiometry were worse for the conservative treatment group, and the III-V interval of the ABR of the conservative treatment group was significantly greater than that of the hemodialysis groups.

**Conclusion:** The conservative treatment group presented worse audiological tests, regardless of hypertension and diabetes, reinforcing that patients need to undergo a complete hearing assessment for better understanding of the disease and its effects on the auditory system.

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**PALAVRAS-CHAVE**

Hipertensão;  
Diabetes *mellitus*;  
Perda auditiva;  
Insuficiência renal  
crônica;  
Eletrofisiologia

**O tratamento da doença renal crônica pode afetar a audição?****Resumo**

**Introdução:** Doença renal crônica (DRC) é definida pela presença de lesão renal levando à perda lenta e progressiva da função renal. A influência do tratamento da DRC sobre a audição ainda é inconclusiva.

**Objetivo:** Comparar testes auditivos entre pacientes com DRC submetidos a diferentes tipos de tratamento.

**Material e método:** Cohort transversal. Os grupos foram divididos de acordo com o tratamento: hemodiálise (n = 35), diálise peritoneal (n = 15), conservador (n = 51) e 27 pacientes saudáveis (controle). Pacientes com idade superior a 60 anos, perda auditiva congênita, síndromes genéticas, infecções de orelha média e transplante renal foram excluídos da pesquisa. A avaliação audiológica incluiu audiometria tonal, emissões otoacústicas evocadas transitientes e Potencial Evocado Auditivo de Tronco Encefálico (PEATE); e as variáveis avaliadas foram: sexo, idade, diagnóstico de hipertensão arterial e diabetes, estadiamento da DRC, tempo de diagnóstico do diabetes e da hipertensão arterial, duração da DRC e do tratamento.

**Resultados:** A idade, presença de hipertensão arterial e tempo de DRC foram estatisticamente significantes e controlados. O grupo conservador apresentou piores limiares auditivos na audiometria tonal e o intervalo III-V do PEATE significativamente maior que o da hemodiálise.

**Conclusão:** O tratamento conservador mostrou piores resultados na avaliação auditiva, independente de diabetes e de hipertensão, reforçando que os pacientes submetidos a tratamento para DRC merecem avaliação auditiva completa para melhor compreensão da doença e de seus efeitos sobre o sistema auditivo.

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**Introduction**

Chronic kidney disease (CKD) is defined as the presence of renal injury that leads to the slow and progressive loss of kidney function.<sup>1</sup>

An association between CKD and hearing loss was first described in patients with Alport syndrome.<sup>2</sup> However, anatomical, physiological, pathological, and pharmacological similarities between the nephron and stria vascularis of the cochlea may explain this association in cases that are not related to syndromes or genetic diseases.<sup>3,4</sup> Sensorineural hearing loss at high frequencies is the most common type in patients with CKD, and includes both cochlear impairment and lesions to particular portions of the auditory pathway.<sup>5-8</sup>

However, the influence of CKD treatment on auditory function is inconclusive,<sup>8</sup> and hypertension and diabetes mellitus are frequently associated with CKD and hearing loss; these variables were not considered when analyzing these findings.

In the present study, the audiological tests between patients with CKD receiving different types of treatment were compared and associated with hypertension and diabetes mellitus.

**Methods****Study population**

This was a cross-sectional study conducted in a tertiary referral center. The target population consisted of patients with CKD from the region around the hospital with a non-probabilistic intentional sample.

The exclusion criteria were: previous kidney transplant, congenital hearing loss or middle ear alterations, genetic syndromes, history of excessive exposure to noise, history of use of ototoxic medications, and age greater than 60 years. These data were confirmed by the patient's clinical history or medical information.

Patients were divided into groups according to treatment: hemodialysis (n = 35), peritoneal dialysis (n = 15), and conservative (n = 51), as well as 27 healthy subjects.

**Audiological assessment**

This audiologic evaluation consists of pure-tone audiometry (PTA), transient evoked otoacoustic emissions (TEOAEs) and auditory brainstem response (ABR).

The PTA was performed by an audiologist in a sound-treated room using standard TDH-39 earphones and an Interacoustics AD229b audiometer. Audiometric thresholds for air-conduction stimuli in both ears were established for frequencies at 250, 500, 1,000, 2,000, 3,000, 4,000, 6,000, and 8,000 Hz.

TEOAEs measurements were performed using Otodynamics ILO 288, USB II system with standard settings. The stimulus level was set to 84 dB SPL a number of 260 averages was used. Values < 3 dB amplitude were considered as negative.<sup>9</sup>

For the ABR analysis, the rarefaction click stimulus was presented by the 3 Ω insertion phone, with 90 dBnHL intensity and a presentation rate of 20.1 c/s with a band-pass filter of 100 and 3,000 Hz and average of 2,000 stimuli, using Interacoustics EP<sup>15</sup> Eclipse. The ABR were captured through ECG disposable electrodes (MEDITRACE™ 200), with EEG

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