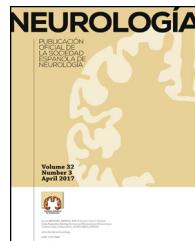


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ORIGINAL ARTICLE

Analysis of the relationship between cognitive skills and unilateral sensory hearing loss^{☆,☆☆}



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KEYWORDS

Central auditory processes;
Cognitive abilities;
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Monaural tests;
Language skills;
Compensation

Abstract

Objective: To analyse cognitive skills in patients with severe unilateral hearing loss versus those in subjects with normal hearing.

Methods: 40 adults participated: 20 patients (10 women and 10 men) with severe unilateral hearing loss and 20 healthy subjects matched to the study group. Cognitive abilities were measured with the Spanish version of the Woodcock Johnson Battery-Revised; central auditory processing was assessed with monaural psychoacoustic tests. Box plots were drawn and *t* tests were performed for samples with a significance of $P \leq .05$.

Results: A comparison of performances on the filtered word testing and time-compressed disyllabic word tests between patients and controls revealed a statistically significant difference ($P \leq .05$) with greater variability among responses by hearing impaired subjects. This same group also showed a better cognitive performance on the numbers reversed, visual auditory learning, analysis synthesis, concept formation, and incomplete words tests.

Conclusions: Patients with hearing loss performed more poorly than controls on the filtered word and time-compressed disyllabic word tests, but more competently on memory, reasoning, and auditory processing tasks. Complementary tests, such as those assessing central auditory processes and cognitive ability tests, are important and helpful for designing habilitation/rehabilitation and therapeutic strategies intended to optimise and stimulate cognitive skills in subjects with unilateral hearing impairment.

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PALABRAS CLAVE

Procesos centrales auditivos; Habilidades cognitivas; Hipoacusia unilateral sensorial; Pruebas psicoacústicas monoaurales; Habilidades lingüísticas; Compensación

Análisis de la relación entre habilidades cognitivas e hipoacusia sensorial severa unilateral

Resumen

Objetivo: Analizar la asociación de competencias cognitivas en sujetos con hipoacusia unilateral severa versus sujetos con audición normal.

Métodos: Participaron 40 adultos; 20 pacientes, 10 de cada género, con hipoacusia unilateral sensorial severa y 20 sujetos sanos pareados al grupo de estudio. Las habilidades cognitivas se midieron con la batería Woodcock Muñoz-revisada y los procesos centrales auditivos con pruebas psicoacústicas monoaurales. Se realizaron gráficas de caja y prueba t de Student para muestras relacionadas con significación $p \leq 0,05$.

Resultados: Al comparar el desempeño en las pruebas palabra filtrada y bisílabos comprimidos, se encontró diferencia estadísticamente significativa $p \leq 0,05$, con mayor variabilidad de respuesta en los hipoacúsicos, los cuales también tuvieron mejor desempeño cognitivo en las subpruebas inversión de números, aprendizaje visual auditivo, análisis y síntesis, formación de conceptos y palabras incompletas.

Conclusiones: Los hipoacúsicos presentaron bajo desempeño en palabra filtrada y bisílabos comprimidos, y mayor habilidad para memoria, razonamiento y procesamiento auditivo. Es importante realizar pruebas complementarias, tales como procesos centrales auditivos y habilidades cognitivas que permitan establecer estrategias de habilitación, rehabilitación y terapéuticas con la finalidad de optimizar y estimular las habilidades de los sujetos con hipoacusia unilateral.

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Introduction

According to World Health Organization data, 275 million people had moderate to profound hearing loss in 2012¹; this number rose to 360 million in 2013.²

In Mexico, the 2010 population census revealed that 12.1% of disabled Mexican patients had hearing problems.³ According to the Mexican National Household Income and Expenditures Survey, this number reached 16.5% in 2012.⁴

In the United States, unilateral hearing loss affects around 83 in every 100 000 live births; the National Health and Nutrition Examination Survey reports an incidence of 3% among school-age children.⁵

Hearing impairment is defined as a partial or complete inability to hear, and may affect one or both ears.⁶

Central auditory processes are the auditory mechanisms responsible for the behavioural phenomena of sound localisation and lateralisation, auditory discrimination, auditory pattern recognition, temporal processing, and auditory performance in the presence of degraded or competing acoustic signals.⁷

Central auditory processing disorders (CAPD) involve deficiencies in the neural pathways responsible for auditory information processing.⁶ Patients with CAPDs have difficulty focusing attention, recalling oral information, following complex instructions, perceiving language in noisy settings, and understanding fast or degraded acoustic signals (time-compressed, filtered, interrupted, or competing).⁸

Published evidence suggests that unilateral hearing loss results in poor academic performance, behavioural issues, and the need for educational assistance.⁹ Patients with

unilateral hearing loss have been found to have lower intelligence quotient scores than their normal-hearing peers, especially the areas of working and phonological memory, attention, and processing speed.¹⁰ They also present emotional, social, and language problems,⁹ particularly affecting comprehension.^{11,12} Several studies suggest that these patients develop certain compensatory mechanisms which enable them to achieve better comprehension, language, and verbal function scores, despite which their performance is worse than that of their normal-hearing peers.^{12–14}

We aimed to analyse cognitive and central auditory performance in a sample of adult patients with severe and profound unilateral hearing loss and a group of normal-hearing controls.

Material and methods

Forty adults participated in the study. The study group included 20 patients (10 men and 10 women) with a diagnosis of severe or profound acquired unilateral sensory hearing loss (10 with right-sided hearing loss, 10 with left-sided hearing loss) under follow-up at the audiology department of the National Institute of Rehabilitation Luis Guillermo Ibarra Ibarra. Progression time was below 10 years (range, 1-7) in 10 patients and over 10 years (range, 10-27) in the remaining 10. Mean age was 23.8 ± 3.8 years (range, 18-30). The control group included 20 sex-, age-, and education-matched normal-hearing individuals. Completed undergraduate study was the most frequent education level, and secondary school

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