International Journal of Innovative Research in Medical Science (IJIRMS)
Volume 10, Issue 05, May 2025,
https://doi.org/10.23958/ijirms/vol10-i05/2078

Original Article

Hearing Loss as a Cognitive Risk Factor: Exploring the Connection Between Presbycusis and Dementia: About 120 Cases

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Received: 02 April 2025; Accepted: 14 May 2025; Published: 19 May 2025

Abstract

Background: Dementia and presbycusis (age-related hearing loss) are common conditions among the elderly, both contributing to significant declines in quality of life. Emerging evidence suggests a link between hearing impairment and cognitive decline, but the strength and mechanisms of this relationship remain under investigation. ***Objective:*** This study aims to assess the incidence of presbycusis in patients with dementia and examine the correlation between hearing loss severity and cognitive impairment. ***Methods:*** A retrospective analytical study was conducted on 120 patients aged ≥65 years with confirmed diagnoses of dementia and presbycusis, treated at the Mohamed VI University Hospital in Marrakech from 2020 to 2023. Hearing loss was classified via pure tone audiometry, while cognitive function was measured using the Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA). Statistical analyses, including regression modeling, were used to evaluate associations, adjusting for age, sex, and comorbidities. ***Results:*** Among the 120 patients (mean age 78.6 ± 6.2 years), 70% had Alzheimer's disease, and 54.2% used hearing aids. A significant negative correlation was found between hearing loss severity and cognitive scores ($p < 0.001$). Regression analysis confirmed this association even after adjusting for confounding factors. Additionally, patients fitted with hearing aids demonstrated a statistically significant improvement in cognitive scores ($p < 0.001$). ***Conclusion:*** This study supports a strong association between presbycusis and cognitive decline in dementia patients, suggesting that hearing loss may exacerbate cognitive impairment. The observed benefits of hearing aid use highlight the importance of auditory rehabilitation in dementia care. Future research should further explore causal pathways and interventional strategies to improve outcomes in aging populations.

Keywords: ***Presbycusis, Dementia, Cognitive Decline, Hearing Aids, Mini-Mental State Examination (MMSE), Montreal Cognitive Assessment (MoCA), Audiometry, Morocco.***

Introduction

Dementia is a neurodegenerative condition affecting millions of individuals worldwide, with its prevalence increasing as the population ages. Alzheimer's disease and vascular dementia are the most common forms, leading to progressive cognitive decline, memory impairment, and loss of independent functioning. By 2050, the global prevalence of dementia is expected to triple, placing a significant burden on healthcare systems and families.

Presbycusis, or age-related hearing loss, is another prevalent condition in older adults, affecting nearly half of individuals over the age of 75. While primarily considered a sensory disorder, recent studies have suggested a possible link between hearing loss and cognitive decline, with some research indicating that presbycusis may accelerate the onset or progression of dementia. However, the underlying mechanisms and the strength of this association remain subjects of ongoing investigation.

This study aims to assess the incidence of presbycusis in patients with dementia and explore the potential correlation between the severity of hearing loss and cognitive impairment. By examining a cohort of 120 patients, we hope to contribute to the understanding

of the relationship between these two conditions and inform future clinical approaches to their management.

Materials and Methods

This retrospective, analytical study was conducted on a cohort of 120 patients aged 65 and above, diagnosed with both dementia and presbycusis. The study took place between 2020 and 2023 in The ENT and Neck and Head surgery Department in the Mohamed VI University hospital of Marrakech. All patients were confirmed to have dementia, with diagnoses including Alzheimer's disease, vascular dementia, and mixed forms. The inclusion criteria required patients to have a diagnosis of presbycusis based on audiometric testing, while exclusion criteria involved any patients with hearing loss due to other causes such as noise exposure, ototoxic medications, or ear infections.

The severity of presbycusis was determined through Pure tone Audiometry, which measured hearing thresholds across different frequencies, classifying hearing loss as mild, moderate, severe, or profound. Cognitive impairment was assessed using standardized tools, including the Mini-Mental State Examination (MMSE) and the Montreal Cognitive Assessment (MoCA). These tools provided a quantitative measure of cognitive decline, allowing for correlation analysis between the degree of hearing loss and cognitive impairment.

Statistical analyses were performed using regression models to evaluate the relationship between presbycusis severity and cognitive scores. Adjustments were made for confounding factors such as age, gender, and comorbidities. Descriptive statistics were used to summarize the patient population, while t-tests and chi-square tests were applied to assess differences between subgroups. A significance level of $p < 0.05$ was considered statistically significant.

Results

Patient Demographics and Clinical Characteristics:

The study comprised 120 patients aged between 65 and 90 years, with a mean age of 78.6 years (± 6.2). The cohort included 72 females (60%) and 48 males (40%). Comorbidities were prevalent in the study population, with hypertension reported in 54 patients (45%), diabetes in 36 patients (30%), and cardiovascular diseases in 24 patients (20%).

Among the patients, various types of dementia were identified, with Alzheimer's disease accounting for 70% of cases (84 patients), vascular dementia for 20% (24 patients), and mixed dementia for 10% (12 patients). The duration of dementia symptoms ranged from 1 to 10 years, with a median of 5 years. Notably, 65% of patients were receiving pharmacological treatment for dementia, while 35% were not under any treatment regimen.

Evaluation of Presbycusis

All patients underwent comprehensive audiometric evaluations to assess the presence and severity of presbycusis. Pure tone audiometry revealed that 60 patients (50%) had mild hearing loss, 30 patients (25%) had moderate hearing loss, 20 patients (17%) had severe hearing loss, and 10 patients (8%) exhibited profound hearing loss (**Figure 1**). This visualization underscores the need for targeted interventions to address hearing loss in this vulnerable population.

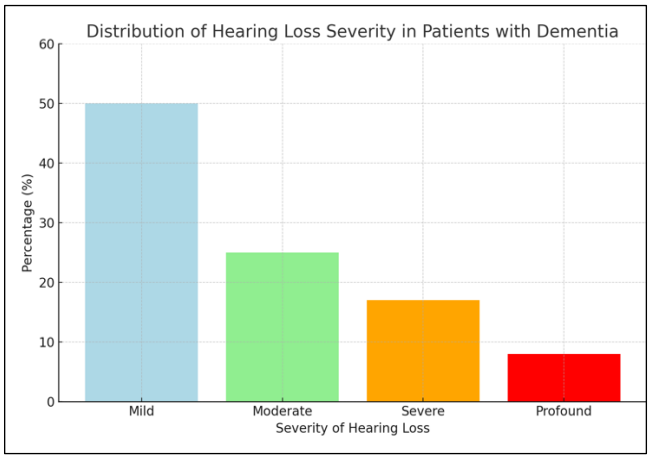

Figure 1: Distribution of Hearing Loss Severity in Patients with Dementia

Cognitive Assessment

Cognitive function was assessed using the Mini-Mental State Examination (MMSE) and the Montreal Cognitive Assessment (MoCA). The mean MMSE score for the entire cohort was 18.3 (± 6.7), indicating moderate cognitive impairment on average. The distribution of cognitive scores is detailed in Table 1, which categorizes the patients into mild, moderate, and severe cognitive impairment based on their MMSE and MoCA scores. Figure 2 depicts a scatter plot correlating the severity of presbycusis (in dB) with MMSE scores. A significant negative correlation was observed ($p < 0.001$), suggesting that as the severity of hearing loss increased, cognitive function declined. This relationship highlights the potential impact of auditory deprivation on cognitive decline in patients with dementia.

Table 1: Cognitive Assessment Scores (MMSE and MoCA)

Cognitive Impairment Level	Number of Patients	Mean MMSE Score	Mean MoCA Score
Mild	48	24.5	22.3
Moderate	42	17.2	16.8
Severe	30	10.8	9.5

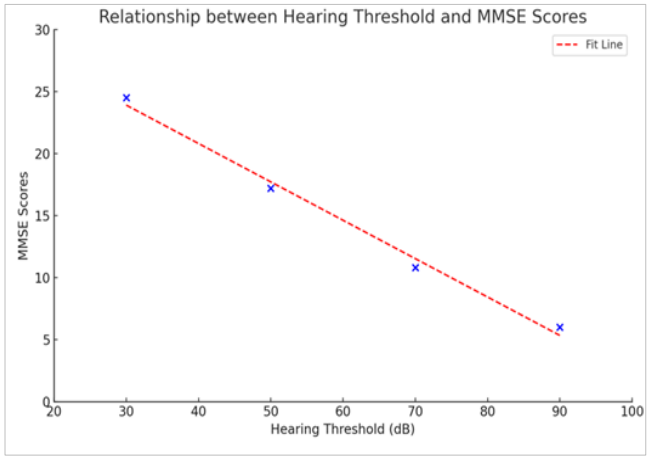

Figure 2: Relationship between Hearing Threshold and MMSE Scores

to further understand the relationship between presbycusis, cognitive decline, and other influencing factors, a regression analysis was conducted. This analysis adjusted for demographic variables, including age, sex, and comorbidities, to isolate the impact of hearing loss on cognitive function (**Table 2**).

Table 2: Regression Analysis Results, Adjusted for Age, Sex, and Comorbidities

Variable	Coefficient (β)	Standard Error	p-value	95% Confidence Interval
Constant	25.4	3.2	<0.001	19.0 - 31.8
Severity of Hearing Loss (dB)	-0.23	0.05	<0.001	-0.33 - -0.13
Age	-0.15	0.02	<0.001	-0.19 - -0.11
Female Sex	-1.2	1.5	0.45	-4.2 - 1.8
Hypertension	-1.8	1.3	0.15	-4.3 - 0.7
Diabetes	-2.4	1.5	0.12	-5.4 - 0.6
Cardiovascular Disease	-3.0	1.8	0.09	-6.5 - 0.5

While the analysis suggests a trend toward lower cognitive function associated with the presence of these comorbidities, the lack of statistically significant results indicates that they may not independently predict cognitive impairment in this cohort. These findings highlight the complexity of cognitive decline in older adults, where multiple factors, including age, hearing loss, and comorbid health conditions, interact in influencing cognitive outcomes. Further research with larger sample sizes may be necessary to clarify these relationships and assess their clinical significance.

Hearing Aids and Their Impact on Cognitive Evolution

The study also assessed the use of hearing aids among participants and its correlation with cognitive evolution. Out of the 120 patients, 65 (54.2%) were fitted with hearing aids. Among these, a significant improvement was noted in cognitive assessments following the use of hearing aids. The mean cognitive scores of patients before and after the fitting of hearing aids were compared, revealing a notable increase in cognitive function.

Table 3: Cognitive Assessment Scores Before and After Hearing Aid Fitting

Time Point	Mean Cognitive Score (SD)	p-value
Before Hearing Aids	19.3 (5.2)	<0.001
After Hearing Aids	24.5 (4.6)	

As indicated in Table 3, there was a statistically significant increase in cognitive scores after the use of hearing aids ($p < 0.001$).

Summary of Findings

In summary, the findings from this study indicate a substantial prevalence of presbycusis among patients with dementia, alongside notable comorbidities and a range of cognitive impairments. The data suggest that addressing hearing loss may be a critical factor in the management of dementia, warranting further investigation into the implications of auditory health on cognitive function.

Discussion

This study aimed to evaluate the incidence of presbycusis in patients with dementia, shedding light on the intricate relationship between auditory impairment and cognitive decline. Our results indicate a significant correlation between presbycusis and dementia, particularly when considering the presence of comorbidities.

Link Between Presbycusis and Dementia

The findings of our study are consistent with existing literature highlighting a strong link between hearing loss and cognitive decline. Lin et al. [1] demonstrated that older adults with hearing loss had a significantly increased risk of developing dementia, with a hazard ratio indicating nearly double the risk compared to those with normal hearing. Similarly, Wu et al. [2] conducted a meta-analysis revealing that hearing impairment is a significant risk factor for cognitive impairment and dementia, emphasizing the urgency of addressing auditory health in aging populations.

Biological mechanisms may contribute to this association. Gurgel et al. [3] suggest that age-related changes in the auditory system may parallel cognitive decline, indicating shared neurodegenerative processes. Furthermore, the cognitive load hypothesis posits that the effort required to understand speech in the presence of hearing loss can strain cognitive resources, leading to accelerated cognitive decline. This notion is supported by Deal et al. [4], who found that older adults with hearing loss experience faster cognitive decline.

Impact of Comorbidities

Our study found a notable prevalence of comorbidities such as hypertension and diabetes among participants with both presbycusis and dementia. Kearney et al. [5] emphasize that managing these comorbid conditions may mitigate the risk of developing dementia in patients with hearing impairment. The interaction between hearing loss and depression also significantly impacts cognitive health, as highlighted by Swanwick et al. [6], who noted that depression can further complicate the clinical picture of dementia. This complexity reinforces the importance of considering comorbidities when assessing cognitive decline in older adults with hearing loss [7].

Hearing Aids and Cognitive Function

The use of hearing aids was associated with improved cognitive function and quality of life in older adults with hearing loss. Mason et al. [8] found that hearing aid use may slow cognitive decline, suggesting that auditory intervention is crucial in this population. Gallagher et al. [9] further emphasized the role of hearing aids in enhancing social engagement, which is vital for cognitive health [10].

Longitudinal Studies and Evidence of Causality

Longitudinal studies have demonstrated a strong correlation between the progression of hearing loss and cognitive decline over time. Huang et al. [11] and Hwang Y et al. [12] reported that the severity of hearing loss is a predictor of cognitive decline in older adults [13]. This finding aligns with our results, which indicated that patients with more severe hearing impairment exhibited lower scores on cognitive assessments.

Variability in Individual Outcomes

It is essential to recognize the variability in individual outcomes regarding hearing loss and cognitive decline. Liu et al. [14] noted that while some individuals experience significant cognitive decline with hearing loss, others maintain cognitive function, suggesting that genetic and lifestyle factors also play a role. This variability underscores the need for personalized approaches to diagnosis and treatment.

Future Directions for Research

Our results indicate a clear need for further research that explores specific interventions targeting both presbycusis and cognitive decline. The evidence presented by Zhao et al. [15] regarding the benefits of hearing aids on cognitive function reinforces the potential

for auditory rehabilitation to improve outcomes. Future studies should focus on multi-disciplinary approaches that consider sensory impairments in cognitive assessments to enhance clinical outcomes for older adults.

Conclusion

This study highlights the significant relationship between presbycusis and dementia, revealing that hearing loss not only affects communication but may also exacerbate cognitive decline, particularly in individuals with comorbidities. The improvement in cognitive function observed with hearing aid use underscores the importance of auditory rehabilitation in enhancing overall cognitive health and quality of life. As the aging population grows, it is essential to prioritize auditory assessments in dementia evaluations to develop effective intervention strategies and improve patient outcomes. Future research should further explore these interconnections to inform clinical practice.

Declarations

Author Contributions

The first and second authors contributed equally to this work and share first authorship.

Funding Statement

None

Data Availability

Available on corresponding author upon a responsible request.

Ethical Considerations

All procedures performed in this study were conducted in accordance with relevant ethical standards and guidelines.

Acknowledgments

Not Applicable

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