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ORIGINAL ARTICLE

Prevalence of Vestibular Dysfunction with Presbycusis among Elderly in Malaysia

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ABSTRACT

Objectives: This study aims to determine the prevalence of vestibular dysfunction in the Malaysian elderly and its association with presbycusis, age and other associated risk factors.

Methods: A cross-sectional study was undertaken in a tertiary otorhinolaryngology department and the community. Adults aged 60 years and above who attended the ORL CLINIC with or without presbycusis were invited to participate. The main outcome measures, including the Malay Version Vertigo Symptoms Scale, pure tone audiometry and vestibular assessment, were obtained using a Video Head Impulse Test (VHIT).

Results: The prevalence of vestibular dysfunction with presbycusis in the study population of 135 participants was 46.7 per cent (95 per cent confidence interval, 24.0 to 36.2 per cent). The median age was 68 years (range, 60–86 years). The A chi-square test of independence showed that there was significant association between Presbycusis and Tinnitus, X^2 (1, N = 135) = 97.37, p < .001. A chi-square test of independence was performed to examine the relation between presbycusis and dizziness. The relation between these variables was significant, X^2 (2, N = 135) = 28.42, p < .001. A chi-square test of independence showed that there was no significant association between presbycusis and VHIT, X^2 (1, N = 135) = .01, p = .938.

Conclusion: Vestibular dysfunction is independently associated with ageing and presbycusis. More research investigating the advantages of additional screening for vestibular dysfunction in older presbycusis patients is needed.

Key words: Elderly; Presbycusis; Vestibular dysfunction; Video Head Impulse Test (VHIT)

INTRODUCTION

Many countries in the world including Malaysia have an ageing population. Currently, there are an estimated 3.5 million people or 7% of the population in Malaysia who are above the age of 65 (DOSM, 2020)[1]. The Department of Statistics Malaysia (DOSM) estimated that the number of older generation age 60 and above is expected to reach 5.8 million in 2030, making up about 15 per cent of the total population. This situation is associated with an epidemic of age-related diseases, including presbycusis and vestibular dysfunction.

Vestibular dysfunction can be defined as malfunction of the vestibular organs. Vestibular dysfunction is a cause of falls in the elderly, even if it is not symptomatic. According to studies conducted in the United States, vestibular dysfunction affects up to 35.4 percent of persons aged 40 and above.[2] Presbycusis is a complicated, underdiagnosed condition with a complex aetiology. It is the most common sensory impairment in the elderly, and it can have a negative impact on their quality of life and mental health.[3] Presbycusis is characterised by the progressive loss of hair cells in the cochlea, resulting in bilateral high frequency hearing loss. Hearing loss in ageing has been ranked as the third leading cause of years lived with disability in the Global Burden of Disease Study 2019[4] after low back pain and migraine, higher than many other chronic diseases such as diabetes, dementia, and chronic obstructive pulmonary disease. It was ranked first among sensory disorders. In 2019, one in every five persons experienced hearing loss, according to an estimate of 1.57 billion people worldwide.[5]

Presbycusis, also known as age-related sensorineural hearing loss, is a complex condition that causes a gradual loss of auditory ability.[6]A considerably high number of these patients with presbycusis or age-related sensorineural hearing loss also experience dizziness and related vestibular symptoms. Study has shown that many people with presbycusis also experience tinnitus, which is the perception of a sound in one or both ears or in the head in the absence of an external sound source.[7]Although auditory and vestibular systems are distinct, they work just alike. So, there is a great relation among their functions. Once one is stimulated, the other experiences changes as well.[8]

No convincing evidence has been published to support an association between vestibular and cochlear dysfunction in the elderly. In addition, very little is known about the medical risk factors for vestibular dysfunction.

The current study aimed to determine the prevalence of vestibular dysfunction with presbycusis in the Malaysian elderly. No previous studies have been reported on the prevalence of presbycusis in the elderly of the Malaysian population. Given that anatomically linked structures (e.g., the vestibulocochlear nerve) serve both vestibular and auditory functions, the association between vestibular dysfunction and presbycusis was also evaluated.

MATERIALS AND METHODS

Study setting and study population: A cross-sectional study was performed in the Otorhinolaryngology (ENT) Department of a Malaysian tertiary teaching hospital at the Health Campus, Universiti Sains Malaysia. The study protocol was approved by the university ethics committee. Participants were elderly persons aged 60 years and above who could walk and had attended the Otorhinolaryngology (ORL) clinic between February and December 2020. Those who were unable to stand steadily on their own or had a history of neurological disorders or signs of neurological deficits, active uncontrolled cardiovascular and/or respiratory conditions, spinal or musculoskeletal disorders, uncorrected ocular disorders, mental disorders, acute illness, were under the influence of alcohol, taking medication with neuromuscular, ocular, vestibular or ontological suppressive or toxic effects were excluded.

Demographic data, general medical and ENT histories, and a fall history were obtained from all participants. The main outcomes were pure tone audiometry and vestibular function assessment using the Video Head Impulse Test (VHIT).[3]

A standardised questionnaire using the Malay Version Vertigo Symptoms Scale (MVSS) that fulfilled our objectives was available. This included both open-ended and standardised questions and was designed to distinguish between vestibular vertigo and non-vestibular dizziness. Descriptions of dizziness or vertigo were first recorded in the participant's own words to avoid suggestive questioning and then followed by a semi-structured interview. Participants were asked about the type of dizziness, its duration, provoking factors and previous diagnoses. Interviews were conducted by the researcher. Additional information was collected, including demographic data, a medical history, a fall history (i.e., falls resulting in a hospital stay or impaired mobility for at least three days), and an ENT history of vertigo or tinnitus symptoms.

Audiometry: Pure tone audiometry at 1, 2, 4 and 8 kHz was conducted by audiologists from the institution's audiology department using Amplivox 240 (Eynsham, UK) and Interacoustics AD226 (Assens, Denmark) diagnostic audiometers.

Vestibular assessment using the Video Head Impulse Test (VHIT) was undertaken in the following manner:

1 Fit and adjust the goggles on the patient's head. It must be tightly fixed (this is crucial).
2 Tighten the strap firmly to ensure that goggles will not shift during application of head impulses. Place the cable from the goggles at the midline of the neck and attach it to the cable strap holder.
3 Ensure that the eyes are wide open, with eyelids in a position where they do not interfere with pupil detection.
4 Align the camera to center the pupil in the image by rotating the camera in the yaw, pitch, or roll direction.
5 Check if the reflections from the LED (two white dots) appear to be close to the edge of the pupil.
6 Ask the participant to look straight ahead at the leveled fixation dot.

Statistical analysis: All data were entered into IBM SPSS Statistics software version 23.0 for statistical analysis. Continuous variables, such as age and with or without presbycusis, were regrouped into categorical variables. Furthermore, data were stratified to determine the effects of potential confounders or effect modifiers.

The prevalence of vestibular dysfunction was first estimated in the overall population and then stratified by sociodemographic, MVSS and otological characteristics. Cross-tabulation and chi-square F-testing were used to obtain odds ratios for binomial variables and vestibular dysfunction, and to test for overall differences in their respective proportions. Binary logistic regression was used to estimate interactions between different variables and vestibular dysfunction, and to account for confounding and independent risk factors. Statistical significance was set at a p value of 0.05.

RESULTS

Table 1. Sociodemographic Characteristics of Respondents

	n (%)	M (SD)
Sex of Respondents Male Female	 41 (30.4) 94 (69.6)	
Ethnicity of Respondents Malay Chinese	 124 (91.9) 11 (8.1)	
Age of Respondents		65.3 (4.2)

Notes: N = 135. n = frequency, % = per cent, M = mean, SD = standard deviation.

Table 2. Crosstabulation of Respondents' Experience of Presbycusis, Tinnitus, Dizziness and Video Head Impulse Test

Variable	Presbycusis n (%)		X^2	φ	V	p
	Yes	No				
Tinnitus Yes No	 63 (100.0) 0 (0.0)	 11 (15.3) 61 (84.7)	97.37	.85		<.001
Dizziness Never Few Times(1-3 times per year) Several Times (4-12 times per year)	 42 (66.7) 10 (15.9) 11 (17.5)	 72 (100.0) 0 (0.0) 0 (0.0)	28.42		.46	<.001
Video Head Impulse Test (VHIT) Normal Abnormal	 46 (73.0) 17 (27.0)	 53 (73.6) 19 (26.4)	.01	-.01		.938

Notes: N = 135. n = frequency, % = per cent, X^2 = Pearson Chi-square, φ = effect size Phi, V = effect size Cramer's V, p = p-value for Pearson Chi-square test.

The initial target for the sample population was 135, which provided a 95 per cent confidence interval (CI) with a 5 per cent margin of error (Table 1). None of the participants were excluded; data collection was complete for all participants. Slightly more women (52.3 per cent) than men were included. Most participants were Malay (92.1 per cent). The age range of participants was 60–86 years, with a median age of 65 years. The largest group was the 60–64 year age group (38.9 per cent), Participants aged above 75 were in the minority (12.5 per cent).

A chi-square test of independence showed that there was significant association between presbycusis and tinnitus, X^2 (1, N = 135) = 97.37, p < .001.

A chi-square test of independence was performed to examine the relation between presbycusis and dizziness. The relation between these variables was significant, X^2 (2, N = 135) = 28.42, p < .001.

A chi-square test of independence showed that there was no significant association between presbycusis and VHIT, X^2 (1, N = 135) = .01, p = .938.

DISCUSSION

The prevalence of vestibular impairment in Malaysians was investigated for the first time in this study. It provides objective evidence for older Malaysians suffering from vestibular impairment. According to the modified Clinical Test for Sensory Interaction on Balance, this finding is comparable to the 35% recorded for a US population of people aged 60 and above.[2] Interestingly, it is only slightly higher than the 21–29 per cent prevalence rates of self-reported vertigo reported for community-based cohorts from the UK (aged 18–64 years) and Finland (aged 12 years and above).[9,10] However, the average percentage of people affected was bigger than expected for people aged over 60 which had a prevalence of 46.7% in this study, compared with 28% reported in other studies.[11] Differences may be expected given the cultural variations, disparities in reporting accuracy, and efficiency of the procedures used by other research to document hearing loss. A major source of variability in estimates of the prevalence of vestibular dysfunction is the definition of a case. Most previous studies primarily used questionnaires to define cases of vertigo. A US study of data from the National Health and Nutrition Examination Survey was unique in its use of the modified Clinical Test of Sensory Interaction on Balance.[2] This test was first described by Shumway-Cook and Horak as a bedside alternative to computerised posturography.[3]

Many studies have been reported that men were more likely to be affected than women.[12,13] However this is contradict with the findings of this study which women are slightly higher than men due to the recruitment number of participants at the initial stage but consistent with a previous reports where women were found to experience more presbycusis.[14]

In terms of presbycusis and tinnitus, the findings is similar to many studies conducted suggest that presbycusis contributes to the higher prevalence of tinnitus.[15] This is due to the reduces the activity of cochlear and downregulates inhibitory neurons processes, thereby activating the central auditory structures, increasing the spontaneous firing rate of neurons, resulting in the awareness of tinnitus. Sound stimulation at different frequencies can inhibit the formation of tinnitus.[16]

CONCLUSION

These data provide estimates of the prevalence in Malaysian elderly and vestibular dysfunction is independently associated with ageing and presbycusis. With the increasing aging population, the number of people suffering from presbycusis will also increase. This study suggests that more interventions can be done to help the elderly recognize, acknowledge and address hearing loss in the country. Accurate estimates of hearing loss prevalence for the elder population are needed to identify the scope, magnitude, and impact of presbycusis on these populations. Further research into the benefits of additional screening for vestibular dysfunction in

elderly presbycusis patients is warranted.

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