Is there any difference in the elderly population followed in the balance department? Comparative study between elderly and non-elderly with vestibular pathology

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ABSTRACT

Objectives: To find out if the elderly population (≥65 years-old) with vestibular disorders is different from their younger peers and, secondarily, if Multitest Equilibre Posturography® is related to the occurrence of falls in the last year. Study design: Retrospective study. Material and Methods: We reviewed the clinical charts of 175 patients followed in the Balance Department, between January and December 2019. Patients were divided in two groups, according to the 65-year cut-off. Results: Patients aged 65 years and over had fewer complaints of vertigo and more postural and visual-vestibular complaints compared to younger patients (p=0,005). The postural instability test (PII) in condition 5 was higher in the elderly (p=0,01). The occurrence of falls in the last year was correlated with the vestibular component of the SOT (p=0,01). Conclusion: In the balance departement, the elderly population was distinct from the younger one.

Keywords: Elderly; Unsteadiness; Falls; Computerized Dynamic Posturography

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ORIGINAL ARTICLE

INTRODUCTION

The prevalence of vertigo, dizziness, and imbalance is 30% in populations aged > 60 years, and 50% among those aged > 85 years, and this is likely to increase as the global population ages[1,2] These disorders are predictors of falls, which have consequences and implications for public health; they reduce the quality of life among older adults and their relatives, limit independence, and can even be life threatening.[3]

Otorhinolaryngologists are often consulted in the context of these complaints and should therefore have a profound knowledge of these disorders to be able to identify them and provide the best guidance to patients. In this population, dizziness and imbalance are typically multifactorial. Elderly patients presenting with dizziness or imbalance often have baseline presbystasis associated with benign paroxysmal positional vertigo (BPPV),which can be worsened by orthostatic hypotension due to excessive antihypertensive medication.[3]

Presbyvestibulopathy is a recently defined condition among populations aged > 60 years that includes at least two of the following vestibular symptoms: imbalance, gait disorders, chronic dizziness, and/or recurrent falls, associated with documented mild bilateral vestibular hypofunction.[1]

Moreover, the fact that complaints among the elderly are not always typical should be considered. Reports of less rotational vertigo and more dizziness or instability are typical.[4] More than one condition may underlie such symptoms in elderly persons and this should be clarified by directly asking patients and their aides, given the usual memory difficulties in this age group.

This study aimed to determine differences between populations aged ≥ 65 years and younger patients who attended the balance disorder clinic at CHUC and whether the findings of the posturography platform Multitest Equilibre® are associated with the prevalence of falls during the preceding 12 months in the older population.

MATERIAL AND METHODS

The retrospective study of 175 patients with vestibular disease was conducted between January and December 2019, with at the Balance Study Clinic at the CHUC. The patients were allocated to Group 1 comprising 99 patients

aged ≥ 65 years or Group 2 comprising 76 patients aged < 65 years. Data were collected using the S-Clínico®, Alert®, and RSE® platforms. Sociodemographic and clinical data were analyzed, including the results of the Dizziness Handicap Inventory (DHI) and Hospital Anxiety and Depression Scale (HADS) questionnaires, and the results of diagnostic complementary tone audiometry, computerized dynamic posturography (CDP), and videonystagmography (VNG).

Vestibular disorder was diagnosed according to the classification of the Bárány Society and encompassed benign paroxysmal positional vertigo (BPPV), unilateral vestibulopathy, Meniere's disease (MD), vestibular migraine, and other diagnoses (bilateral vestibular deficit, persistent postural-perceptual dizziness, vestibular paroxysmia, labyrinthitis, late endolymphatic hydrops, and central vestibulopathy). The average hearing threshold, in decibels was expressed as the mean of hearing thresholds at frequencies of 0.5, 1, 2, and 4 kHz. Degrees of hearing loss were classified according to the International Bureau for Audiophonology.

The Multitest Equilibre® CDP test included a postural instability index under condition 5 (PII5) and the Sensory Organization Test (SOT). The latter test evaluates anterior-posterior postural control under the following independent sensory conditions: 1) eyes open on a stable platform; 2) eyes closed on a stable platform; 3) eyes open on a stable platform, with a moving visual field; 4) eyes open on an unstable platform; 5) eyes closed on an unstable platform, and 6) eyes open on an unstable platform, with a moving visual field. The SOT results were calculated based on ratios of instability under each condition and allows assessment of the visual components (conditions 1 to 4), the proprioceptive component (conditions 1 to 2), and the vestibular component (conditions 1 to 5). To statistically analyze the SOT results, we allocated the patients to groups with SOT > 90%, considered normal by the CDP software, and those with SOT< 90%, which was considered low. Regarding caloric stimulation using VNG, we analyzed the global reflex and relative deficit.

Data were statistically analyzed using the SPSS v. 24 (IBM Corp., Armonk, NY, USA). The frequency of the categorical variables, means and standard deviations (SD) of the quantitative variables with normal distribution, and the medians of the remaining variables were calculated. Categorical variables were analyzed using Pearson chi-squared tests and continuous variables were analyzed using Student t-tests and Mann-Whitney tests. The level of significance was set at 0.05.

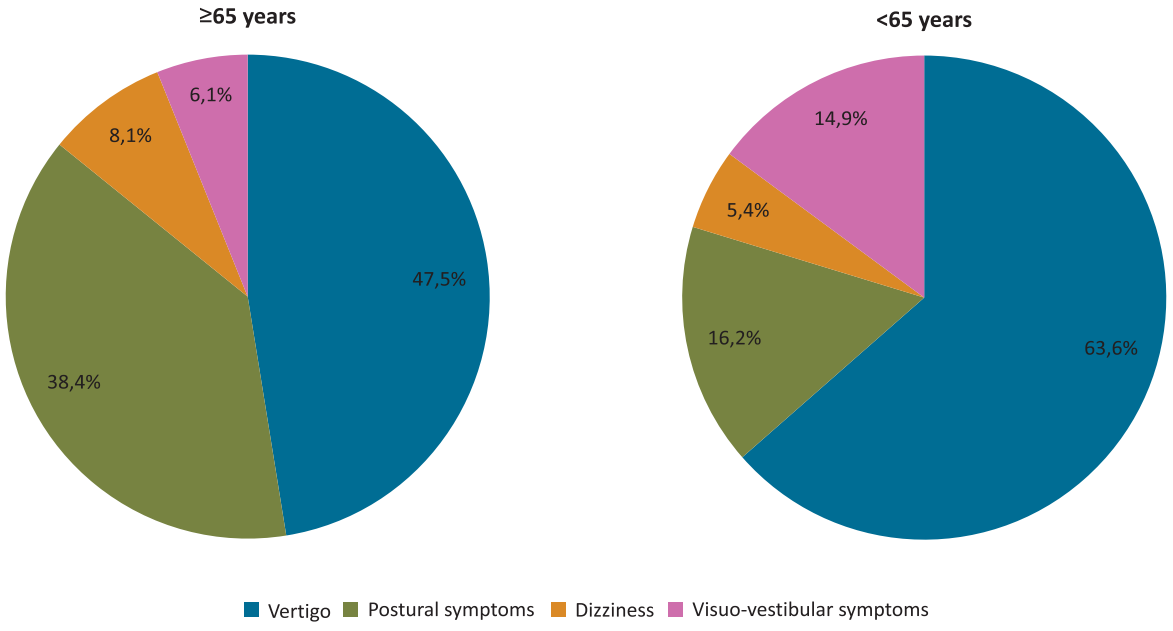
RESULTS

The sociodemographic findings showed that the mean ages of Groups 1 ($\bar{X}1 \pm SD$) and 2 ($\bar{X}2 \pm SD$) were 75 (74.52 ± 6.1) and 51 (50.81 ± 9.8) years, respectively, with women predominating in both groups (Groups 1 vs. 2 : 63.6% vs. 62.7%).

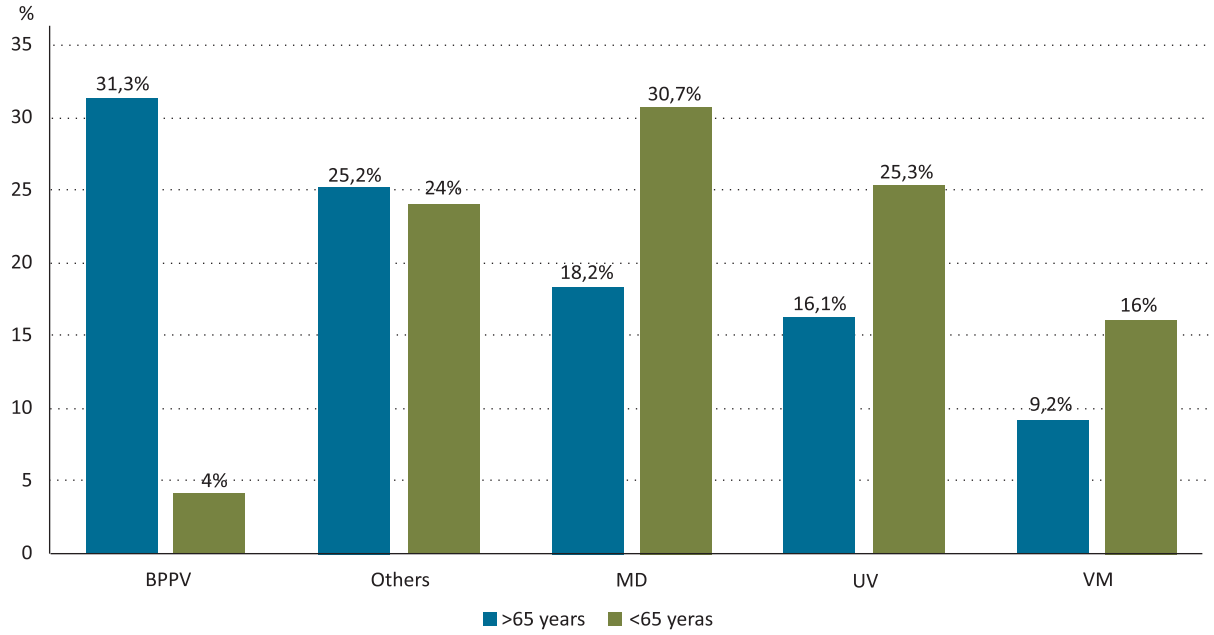
Graph 1 shows that patients in Group 1 had less vertigo and more postural and visuo-vestibular disorders than did those in Group 2, and this difference was statistically significant (p = 0.005; chi-squared tests). The distribution of vestibular disorders also significantly differed between the groups (p = 0.00; chi-squared tests), with BPPV being the most frequent diagnosis among the elderly

GRAPH 1

Distribution of vestibular symptoms in Groups 1 (age ≥ 65 years) and 2 (aged < 65 years) according to the Consensus document of the Committee for the Classification of Vestibular Disorders of the Bárány Society



GRAPH 2
Distribution of vestibular diagnoses in Groups 1 (aged ≥ 65 years) and 2 (aged < 65 years) according to the Consensus document of the Committee for the Classification of Vestibular Disorders of the Bárány Society



population (31.3%), followed by other diagnoses (25.2%), and MD (18.2%) (Graph 2).

Cardiovascular risk factors (CVRF) significantly differed between the groups, being more prevalent in Group 1, than 2 (93.9% vs. 62.2%, p = 0.0; Table 1).

The incidence of falls during the preceding 12 months was higher in Group 1 than group 2, and the difference almost reached statistical significance (29.3% vs. 17.8%, p = 0.08). The mean DHI score was similar between the groups ($\bar{x}1$ = 51.9% vs. $\bar{x}2$ = 49%, p=0.45). In Group 1, the presence of CVRFs correlated with higher DHI scores (p = 0.026, Student t tests). The HADS component was significantly higher in Group 1 (Md1= 9 ± 4.5 vs. Md2 = 6±4.8, p = 0.027; Table 1).

The degree of hearing loss significantly differed between the groups, with more patients in Group 2 having a hearing threshold within the normal range (Table 2).

The degree of hearing loss significantly correlated with PII5 in Group 1. Greater hearing loss was associated with a higher mean PII5 (p = 0.046; analysis of variance).

Analysis of the posturography parameters showed:

- A significant difference in mean PII under condition 5 between the two groups, with PII being higher in Group 1 ($\bar{x}1$ vs. $\bar{x}2$: 4.2 vs. 3.6, p = 0.01);
- A significant difference in the visual and vestibular components of SOT between the two groups, with Group 1 having more patients with SOT< 90%;
- No statistically significant difference in visual dependence between the groups ($\bar{x}1$ vs. $\bar{x}2$: 33% vs. 20.5%, p = 0.85; Table 2).

In terms of caloric stimulation, we found no differences in global reflex ($\bar{x}1$ vs. $\bar{x}2$: 49.6 vs. 49.0, p = 0.9) or relative deficit ($\bar{x}1$ vs. $\bar{x}2$: 38.5% vs. 29%, p =) between the two groups.

TABLE 1
Comparison of clinical data between Groups 1 and 2 (age ≥ 65 and < 65 years, respectively)

	Group 1	Group 2	p
CV Risk Factors	93,9%	62,2%	**p=0,00**
High blood pressure	75,8%	36,5%	**p=0,00**
Diabetes mellitus	28,3%	6,8%	**p=0,00**
Dyslipidemia	62,6%	33,8%	**p=0,00**
BMI ≥25	48,5%	32,4%	**p=0,03**
Falls/12 months	29,3%	17,3%	p=0,08
Dizziness Handicap Inventory ($\bar{x}$ ± SD)	51,9±24,5	49,0±24,1	p=0,45
HADS -Anxiety ($\bar{x}$ ± SD)	9,8±4,4	9,0±4,2	p=0,96
HADS- Depression (Md ± SD)	9,0±4,5	6,0±4,8	**p=0,027**

TABLE 2
Comparison of complementary diagnostic test results between (age ≥ 65 and < 65 years, respectively)

	Group 1	Group 2	p
Tone Audiometry			
Normal (0–20 dB) Mild (21–40 dB) Moderate I/II (41–70 dB) Severe-Profound (≥ 71 dB)	11,1% 43,2% 30,9% 14,8%	40,6% 25% 17,2% 17,2%	**p=0,00**
Computerized Dynamic Posturography			
PII in condition 5 (Md ± SD)	4,1±1,2	3,7±1,2	**p=0,01**
SOT < 90% SOT_vestibular SOT_visual SOT_proprioceptive Visual dependence ($\bar{x}$ ± SD)	 36% 18,7% 24% 33±41,1	 17,8% 6,8% 21,9% 20,5±31	 **p=0,01** **p=0,03** p=0,71 p=0,85
Caloric Stimulation - VNG			
Global Reflex (Md ± SD)	49,6±43,6	49,1±37,7	p=0,9
Relative Deficit (Md ± SD)	38,5±72,5	29±36,8	p=0,6

TABLE 3
Correlation between falls within preceding year and dynamic posturography findings in Group 1

CDP \ Falls	None	≥ 1	p
PII under condition 5 ($\bar{x}$)	4,1±1,2	3,7±1,2	p=0,10
SOT-vestibular < 90%	17,3%	18,7%	p=0,01
SOT-visual < q90%	9,3%	9,3%	p=0,14
SOT-proprioceptive	16%	8%	p=1,0
Visual dependence ($\bar{x}$)	42	30	**p=0,02**

The relationship between the occurrence of falls during the preceding 12 months and CDP in the elderly population (Group 1):

- The relationship between PII5 and the occurrence of falls was not significant, although the PII5 was higher among those who fell (p = 0.01; Student t-tests);
- The occurrence of falls significantly correlated with the vestibular component of the grouped SOT (p = 0.01; chi-squared tests);
- An inverse correlation was found between visual dependence and the occurrence of falls (p = 0.02; Mann-Whitney tests; Table 3).

DISCUSSION

The present results conform with the published findings indicating that elderly individuals have less rotational vertigo than the remainder of the population. Older adults have more instability, intolerance to movement, and gait instability than younger patients with the same vestibular disorder.[1,4] This may be explained by a greater difficulty in expressing vestibular complaints among this population.[1] However, more accentuated senescence of the semicircular canals relative to other vestibular structures leads to a gradual reduction in the ability to feel angular acceleration, which leads to a loss of dynamic visual acuity with consequent inability to compensate for rapid head movements using corrective saccades.[4] Moreover, the simultaneous degeneration of central structures such as the medial vestibular nucleus, which is important for compensation through commissural fibers leads to deficient compensation phenomena after vestibular loss in the elderly.[4,5]

The present findings also reinforce BPPV as the most frequent peripheral vestibular disorder in older adults.[2,6] Its increased incidence with age is likely due to the higher probability of degradation and release of otoliths but also to a higher incidence of head trauma and other peripheral vestibular disorders that accumulate with aging.[2] The high incidence and the atypical presentation of this disorder in elderly persons reinforces the importance of diagnostic maneuvers in this population.[2]

Group 1 experienced more falls during the preceding 12 months than did Group 2, and the difference approached statistical significance (p = 0.08). The disparity between the groups might have been undervalued due to the sample size. Conversely, older individuals have a greater

perception of the consequences of a fall, which makes them more careful.[7]

The perception of incapacity measured by the DHI did not differ between elderly and younger patients. Similar prior conclusions have indicated that activities of daily life and physical activity are usually more limited in older persons; therefore, the perception of limitations resulting from balance deterioration does not increase.[7]

The presence of CVRFs correlated with the worst DHI scores, suggesting that the perception of incapacity is not only affected by end-organ disease but also by changes in the central pathways and in other systems, caused by cardiovascular disease.

The correlation between the degree of hearing loss and PII5 in the elderly population might be explained by simultaneous senescence of the hearing and balance organs, which are anatomically and physiologically interconnected.[8,9] Moreover, deafness entails a greater communication effort, thereby reducing the cognitive and attentional resources required for postural control in a population that is already cognitively vulnerable. Further, the auditory inputs provide information to the cerebral cortex, which plays an important role in spatial orientation.[10]

Proprioceptive information decreases less with age.5 Accordingly, the older adults in the present study used visual and vestibular information less than proprioceptive information.

Caloric stimulation varies little with age.[4,11,12] In fact, we did not find differences between the two groups regarding the global reflex or a relative deficit. According to the criteria of the Bárány Society, the diagnosis of presbyvestibulopathy encompasses bilateral mild vestibular hypofunction documented by video head impulse tests (vHIT), rotational chair tests, and/or caloric stimulation. Presbycusis initially disturbs high frequencies and, analogously, high-frequency responsive type I hair cells in the vestibular system are the most susceptible to senescence.[1] This explains why caloric stimulation, which evaluates the response of the vestibulo-ocular reflex to low-frequency stimuli, is less affected, at least at the initial stage.

The incidence of falls during the preceding 12 months correlated and with a low vestibular SOT in Group 1. This confirmed that vestibular information is one of several components that are most affected by age. The findings of a study on factors that predict falls among older adults indicated that overall SOT scores and the limit of stability were the CDP variables with the highest predictive value for multiple falls among elderly persons.[13]

The main limitation of the present study was its retrospective nature because some data were unavailable or incomplete, and their interpretation depended on the investigator. Moreover, the mean age of both groups was similar despite the cut-off of 65 years. This might have affected some results because histological analyses revealed a sharper decline in vestibular hair cells from the age of 50 years.[1] This study compared two groups of patients with baseline vestibular disorders, which did not allow the extrapolation of our results to elderly populations without vestibular disease. The absence of vHIT data may be an additional limitation because it is a complementary tool for a diagnosis of presbyvestibulopathy.

CONCLUSION

An elderly population with vestibular disorders exhibited differences in the chief complaint, vestibular diagnosis, and imbalance determined as PII5 in the posturography Multitest® compared with those observed in a younger population. The SOT values indicated that the elderly group used less visual and vestibular information, thus confirming that proprioception was less affected by age than by other components. Finally, a low vestibular component of the SOT correlated with the incidence of falls in the elderly population during the preceding 12 months.

Conflict of Interest

The authors declare no conflict of interest regarding this article.

Data confidentiality

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

Human and animal protection

The authors declare that the followed procedures complied with regulations established by the Ethics and Clinical Research Committee and according to the Helsinki declaration of the World Medical Association.

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Availability of scientific data

There are no publicly available datasets related to this study.

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