Association between self-reporting of dizziness and tests of static and dynamic balance in the elderly

Associação entre a autorreferência de tontura e testes de equilíbrio estático e dinâmico em idosos

Asociación entre la autorreferencia de mareo y pruebas de equilibrio estático y dinámico en ancianos

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Abstract

Dizziness can reach about 20-40% of the population and among its losses, falls are considered one of the main complications in the health of the elderly. **Objective**: To verify the association between self-reporting of dizziness and the tests of static and dynamic balance in the elderly of a Hearing and Rehabilitation Center of São Paulo. **Methods:** 27 elderly subjects answered five self-reported questions of dizziness and were submitted to the following tests of static and dynamic balance: Fournier, Romberg, Romberg-Barré, Unterberger and Linear gait. The data were analyzed in a descriptive way and the associations through the Chi-square test. **Results**: The age range of the sample was 61 to 91 years, with a mean of 74 years. The majority of the elderly, 16 (59.25%) stated feeling the symptom of dizziness. Of the total, 13 individuals (48.14%) reported vertigo associated with imbalance, seven (25.92%) reported having suffered at least one fall in the last 12 months and 14 (51.85%) were afraid of falling. The Chi-square test showed an association between the outcome variable "Do you feel dizzy?" With the questions "Do you have imbalance or instability?" (P = 0.018) and "Are you limited to doing activities near your

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residence due to fear of falling or lose balance?" (p = 0.021). **Conclusion:** There was no association between the complaint of dizziness and the results of the balance tests. However, self-reported questions of dizziness and imbalance can be an important tool for the screening process, in the identification of the elderly with risk of falls.

Keywords: Aged; Dizziness; Vertigo; Postural Balance.

Resumo

A tontura pode atingir cerca de 20-40% da população e entre os seus prejuízos, as quedas são consideradas uma das principais complicações na saúde de idosos. **Objetivo:** Verificar a associação entre autorreferência de tontura e os testes de equilíbrio estático e dinâmico em idosos de um Centro Especializado em Reabiltação de São Paulo. **Método:** 27 idosos responderam a cinco perguntas de autorreferência de tontura e foram submetidos aos seguintes testes de equilíbrio estático e dinâmico: Fournier, Romberg, Romberg-Barré, Unterberger e de Marcha linear. Os dados foram analisados de forma descritiva e as associações por meio do teste qui-quadrado. **Resultados:** A faixa etária da amostra foi de 61 a 91 anos, com média de 74 anos. A maioria dos idosos, 16 (59,25%) afirmou sentir o sintoma de tontura. Do total, 13 indivíduos (48,14%) relataram vertigem associada ao desequilíbrio, sete (25,92%) afirmaram ter sofrido pelo menos uma queda nos últimos 12 meses e 14 (51,85%) tinham medo de sofrer quedas. O teste Qui-quadrado mostrou associação entre a variável desfecho *"Você sente Tontura?"* com as perguntas *"Você tem desequilíbrio ou instabilidade?"* (p=0,018) e *"Você se limita a fazer atividades próximo a sua residência devido ao medo cair ou perder o equilíbrio?"* (p= 0,021). **Conclusão:** Não houve associação entre a queixa de tontura e os resultados dos testes de equilíbrio. Entretanto, perguntas de autorreferrência de tontura e desequilíbrio podem ser uma importante ferramenta para o processo de triagem, na identificação de idosos com risco de quedas.

Palavras-chave: Idoso; Tontura; Vertigem; Equilíbrio Postural.

Resumen

La mareo puede alcanzar alrededor del 20-40% de la población y entre sus pérdidas, las caídas son consideradas una de las principales complicaciones en la salud de ancianos. **Objetivo:** Verificar la asociación entre autorreferencia de mareo y las pruebas de equilibrio estático y dinámico en ancianos de un Centro Especializado en Rehabilitación de São Paulo. **Método:** 27 ancianos respondieron a cinco preguntas de autorreferencia de mareo y se sometieron a las siguientes pruebas de equilibrio estático y dinámico: Fournier, Romberg, Romberg-Barré, Unterberger y de Marcha lineal. Los datos fueron analizados de forma descriptiva y las asociaciones por medio del test chi-cuadrado. **Resultados:** El grupo de edad de la muestra fue de 61 a 91 años, con un promedio de 74 años. La mayoría de los ancianos, 16 (59,25%) afirmó sentir el síntoma de mareo. En el total, 13 individuos (48,14%) reportaron vértigo asociado al desequilibrio, siete (25,92%) afirmaron haber sufrido al menos una caída en los últimos 12 meses y 14 (51,85%) tenían miedo de sufrir caídas. La prueba Qui-cuadrado mostró asociación entre la variable desenlace "¿Usted siente Tontura?" Con las preguntas "¿Usted tiene desequilibrio o inestabilidad?" (P = 0,018) y "Usted se limita a hacer actividades cerca de su residencia debido al miedo caer o (p = 0,021). Conclusión: No hubo asociación entre la queja de mareo y los resultados de las pruebas de equilibrio. Sin embargo, las preguntas de autorreferencia de mareo y desequilibrio pueden ser una importante herramienta para el proceso de clasificación, en la identificación de ancianos con riesgo de caídas

Palabras claves: Anciano; Mareo; Vértigo; Balance Postural.

Introduction

The population aging is regarded as a demographic phenomenon all over the world. The highest growth rates in Brazil are among elderly individuals[1]. By 2025, Brazil will become the 6th country in the world with most elderly people, according to the WHO (2002)[1,2].

Numerous physiological changes occur in the body during the aging process and changes related to the auditory system can be highlighted among them. These changes occur not only in the peripheral structures of the auditory system, but also in structures of the central nervous system (CNS), such as the brain stem, cerebellum, cortex and the vestibular system. The symptoms related to disorders involving inner ear and the vestibular nerve (eighth cranial nerve) include dizziness, vertigo, tinnitus and hearing loss in different combinations[3].

Decreased vestibular function may lead to falls and, therefore, physical impairment (gait changes), psychological disorders (fear of falling, depression), isolation, dependency and even economic issues; such as the cost of medicines and rehabilitation[3].

The estimated prevalence of hearing complaints in São Paulo state, e.g., is approximately 22% for tinnitus[2], 9% for hearing loss[3], and 42% for dizziness[4]; and these rates increase with advancing age. Although several diseases are associated with otologic symptoms, the cause is not always identified[4].

'Dizziness' is a term that is used to describe many different sensations and it can be classified into four groups: vertigo, which is an illusion of rotational motion, imbalance, fainting and psychopathological dizziness, which is often associated with anxiety and panic[5,6].

The postural orientation involves the active alignment of the trunk and head in relation to gravity, support surfaces, visual receptors, information on the environment, location, direction and speed of movement of the individual; in addition to the somatosensory system (which is responsible for integrating information related to body position and informing the positioning of the limbs and of the body)[6].

Anticipatory postural adjustments, which are prior to the voluntary movement of the limb, and are responsible to maintain the postural balance and compensate for the destabilizing forces associated with the movement of a limb. Posture control involves many different underlying physiological systems, which can be affected by subclinical pathologies or restrictions[6-7].

In general, dizziness can affect about 20-40% of the population[8], and an incidence rate of 47.1 per 1,000 person-years is estimated at all ages[9]. Falls are considered one of the main complications and problems in the elderly[10], and it must be highlighted, since reports show that 30% of people aged over 65 falls at least once a year[11]. Among elderly people living in long-stay institutions, which are considered to be more debilitated, this prevalence increases to about 60-75%, with up to 3.6 falls/bed/year[12]. Potential consequences of falls are worrying, such as fractures may occur and, consequently, elderly people may become bedridden due to mobility problems for days or months or even lead to death[13].

In addition, the reduction of daily life activities is one of the consequences of the lack of body balance, which is especially reported in the group of people aged 60 or more, as they are more prone to fractures and falls. In addition, the suffering, the fear of falling again and the high treatment costs impair the quality of life[9,10,14].

Given the significant increase in the number of elderly people all over the world and also the high prevalence of dizziness in this population, more attention is required from health care professionals, family members and caregivers with respect to the issues associated with the aging process and the possible repercussions of this dizziness in people's health. The close relationship between the presence of dizziness, instability and imbalance with falls, shows the importance of using simple, fast and effective assessment methods; in order to identify the elderly at risk for falls. Implementation of preventive measures will certainly contribute to a better quality of life. Therefore, since dizziness is a complaint with a high incidence and prevalence in the population, further research is still required in order to allow the early identification of the symptom for the adoption of health protection measures for the elderly.

Thus, the objective of the present study was to verify the association between self-reported dizziness complaint and the performance in the static and dynamic balance tests in the elderly.

Methods

This is an observational and cross-sectional survey study, which is part of a broader project approved by CNPq in November 2014, and approved by the Ethics Committee under the no. CAEE-43831015.1.0000.5482.

The study was conducted in a Hearing and Rehabilitation Center - CER II of São Paulo. The sample consisted of 27 subjects of both sexes, aged over 60 years; all patients referred to the CER for audiological evaluation. The subjects were informed on the research objectives and possible risks and agreed to participate in the study.

The participants were submitted to an audiological evaluation and screening on dizziness, the latter being the focus of this study.

Inclusion criteria were: ≥60 years of age, verbal comprehension of the questions included in the questionnaires, and having a notorious mobility problem. Participants were evaluated by speech-language pathologists and responded to an interview with questions on general health and auditory aspects. Five questions were used to investigate dizziness, two of which were self-reported questions and three were suggested by Criter and Honaker (2016)[15] for the investigation of dizziness, namely:

Self-reported questions
1 - Do you feel dizzy?
2 - Do you have imbalance or instability?

Questions suggested by Criter and Honaker (2016)
3 - How many falls have you had in the last 12 months?
4 - Are you afraid of falling?
5 - Are you limited to doing activities near your residence due to fear of falling or lose balance?

Possible answers were 'yes' and 'no', and 'yes' was scored when any respondent answered 'sometimes'. Then, all patients underwent the static and dynamic balance tests, as described by Mangabeira and Ganança (1976)[16], which were first performed with their eyes opened and then with eyes closed for 20 seconds each. The tests were performed in the following sequence: Fournier, Romberg, Romberg-Barré, Unterberger Linear Gait tests.

All responses were recorded in a database. The chi-square test of independence was used In addition to the descriptive analysis of all results. The response to the question '*Do you feel dizzy?*' was used as the primary outcome in association tests with the following variables: balance test results, '*Do you have imbalance or instability?*', '*Are you afraid of falling?*' and '*Are you limited to doing activities near your residence due to fear of falling or lose balance?*'. On the other hand, the question '*How many falls have you had in the last 12 months?*' could not be assessed, since not all elderly people provided an appropriate response.

A 95% significance level (p<0.05) was adopted for statistical analysis.

Results

27 individuals were evaluated, of which nine (33.33%) were male and 18 (66.66%) were female. As shown in Figure 1, the age range was 61-91 years, with a mean of 74 and a standard deviation of 0.5 years. Most elderly (13-48.14%) reported a dizziness complaint associated with imbalance, while four (11.11%) only reported vertigo, four (14.8%) only reported imbalance and seven (25.9%) reported no symptom.

Table 1 shows the distribution of the answers of the five self-reported questions. A greater occurrence was recorded in: imbalance (17-62.96), dizziness (16- 59.25%) and fear of falling (14-51.85%).

Of the 16 elderly who reported dizziness, nine (33.33%) classified it as mild, while five (18.51%) classified it as intense, and two (7.4%) classified it as disabling.
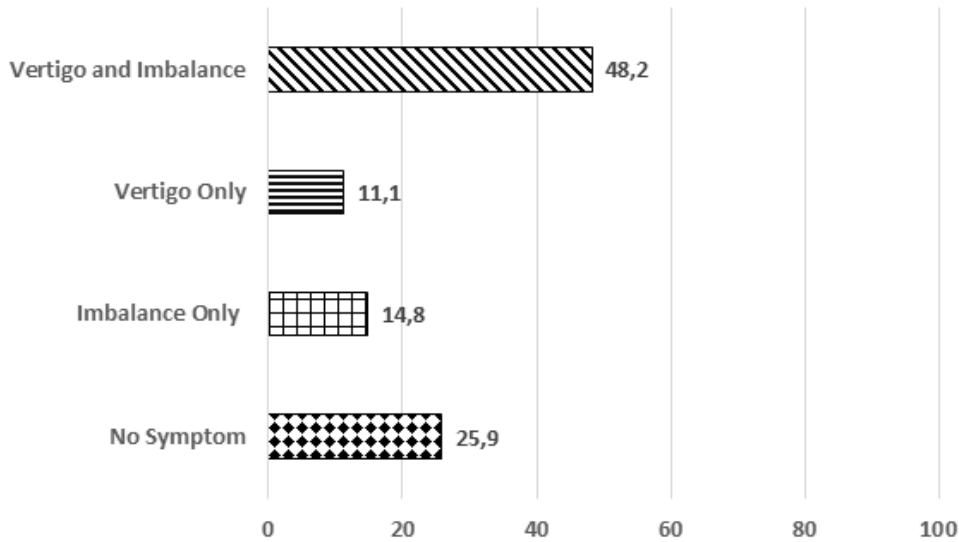
Figure 1. Distribution of dizziness symptoms (%) in elderly people (n=27).

Table 1. Distribution of responses to the five self-reported questions related to dizziness and imbalance (n=27)

Variables	Category	n	%
Do you feel dizzy?	No	11	40.74
	Yes	16	59.25
Do you have imbalance or instability?	No	10	37.03
	Yes	17	62.96
How many falls have you had in the last 12 months?	None	20	74.07
	At least one fall	7	25.92
Are you afraid of falling?	No	13	48.15
	Yes	14	51.85
Are you limited to doing activities near your residence due to fear of falling or lose balance?	No	21	77.78
	Yes	6	22.22

Table 2 shows the distribution of the performance of elderly subjects in the static and dynamic balance tests, performed with opened and closed eyes. Results show that elderly people presented more failures in the Fournier and Romberg-Barré tests, and worse performances with their eyes closed.

Table 2. Performance in static and dynamic balance tests

Test	Change Reported With Eyes Opened		No Change Reported With Eyes Opened		Change Reported With Eyes Closed		No Change Reported With Eyes Closed	
	n	%	n	%	n	%	n	%
Fournier	10	37.03	17	62.96	18	66.66	9	33.33
Romberg	1	3.70	26	96.29	2	7.40	25	92.59
Romberg-Barré	14	51.85	13	48.14	16	59.25	11	40.74
Untenberg	3	11.11	24	88.88	7	25.92	20	74.07
Linear Gait	3	11.11	24	88.88	7	25.92	20	74.07

As shown in Table 3, the Chi-square test analysis found a statistically significant association of the primary outcome ('*Do you feel dizzy?*') only with the variables '*Do you have imbalance or instability?*' (p=0.018) and '*Are you limited to doing activities near your residence due to fear of falling or lose balance?*'(p=0.021). There were no associations of the primary outcome with the results of the balance tests.

Table 3. Distribution of joint frequencies and p-value in the Chi-square test of independence between the outcome variable '*Do you feel dizzy*?' and the variables of interest

Do you feel dizzy?	Yes		No		Total		p-value
	n	%	n	%	n	%	(x^2)
Change in the Fournier test with eyes opened							
Yes	7	70	3	30	10	100.0	**0.384**
No	9	52.9	8	47.05	17	100.0	
Change in the Fournier test with eyes closed							
Yes	12	66.67	6	33.33	18	100.0	0.268
No	4	44	5	56.56	9	100.0	
Change in the Romberg test with eyes opened							
Yes	1	100	-	-	1	100.0	**0.398**
No	15	57.7	11	42.3	26	100.0	
Change in the Romberg test with eyes closed							
Yes	2	100	-	-	2	100.0	**0.223**
No	14	56	11	44	25	100.0	
Change in the Romberg-Barre test with eyes opened							
Yes	9	64.3	5	35.7	14	100.0	**0.581**
No	7	54.9	6	46.1	13	100.0	
Change in the Romberg-Barre test with eyes closed							
Yes	10	62.5	6	37.5	16	100.0	0.679
No	6	54.6	5	45.4	11	100.0	
Change in the Unterberger test with eyes opened							
Yes	3	100	-	-	3	100.0	**0.128**
No	13	54.2	11	45.8	24	100.0	
Change in the Unterberger test with eyes closed							
Yes	4	57.1	3	42.9	7	100.0	**0.895**
No	12	60	8	40	20	100.0	
Do you have imbalance or instability?							
Yes	13	76.5	4	23.5	17	100.0	**0.018***
No	3	30	7	70	10	100.0	
Are you afraid of falling?							
Yes	10	71.4	4	28.6	14	100.0	**0.182**
No	6	46.1	7	53.9	13	100.0	
Are you limited to doing activities near your residence due to fear of falling or lose balance?							
Yes	6	100	-	-	6	100.0	**0.021***
No	10	47.6	11	52.4	21	100.0	

* = p < 0.05

Discussion

Approximately one in five elderly people have at least one complaint of dizziness or imbalance per year. Given the significant prevalence and the negative effect of balance problems in the elderly and in daily activities, such a complaint deserves special attention, particularly in the face of an aging population[17,18].

The dizziness complaint was reported by most elderly subjects (58.25%) enrolled in this study. In addition, 13 subjects (48.14%) of the total sample reported dizziness (rotational or non-rotational) associated with imbalance. Dizziness complaint had a higher occurrence (74%) in the study with 50 elderly individuals aged 60-88 years conducted by Ferreira et al. (2014)[19]. However, the authors also found that the most common type of dizziness was vertigo alone or associated with imbalance problems.

A study on the impact of balance problems on daily activities of the elderly presented the following problems: lack of confidence (68.0%), walking on uneven surfaces (54,8%), vertigo (30,1%) and weakness (29,6%)[20]. In this research, the lack of confidence was assessed through the questions '*Are you afraid of falling?*' and '*Are you limited to doing activities near your residence due to fear of falling or lose balance?*'. The results found that more than half of these elderly people (51.85%) reported to be afraid of falls. Only six of them (22,22%) reported that they conduct activities near their homes; however, they are included in the group of elderly people with dizziness complaint (n=16). Thus, when considering only the elderly people complaining of dizziness, 37.5% of the subjects limit their activities nearby their residences.

The association of the dizziness complaint only with questions that investigate if there is fear of falling and the limitation of activities close to the residence may be related to both the size of the sample and the low sensitivity of the tests applied. However, the self-reported dizziness complaint should be valued from a clinical and epidemiological point of view; mainly due to the impact it may cause on daily activities. Some authors focused on the consequences caused by dizziness, noting the impairment of quality of life, emotional stress and psychosocial consequences. Given these consequences, it is possible to estimate that elderly people with dizziness tend to have psychological

and emotional problems, in addition to a dependence to perform their activities[20,21,22].

Although there was no statistically significant association noticed between the complaint of dizziness and the balance tests, it was possible to observe that subjects with vertigo associated with imbalance failed more in static and dynamic balance tests when compared to the elderly who only had dizziness complaint. When compared to the general sample, the analysis of the results suggests that the self-reported questions for the dizziness complaint seem to better reflect the reality in this group.

The discrepancy of the results in the balance tests was another issue found, since the subjects assessed obtained a number of errors in the Fournier and Romberg-Barré tests , but, on the other hand, they did not had significant flaws in the other tests. These results may be justified by the greater complexity of these two tests. Another reason would be the characteristic of the test, since the literature recommends the modified Romberg test as a balance screening, that is, it should be performed on fixed and unstable surfaces[22,23].

In order to determine whether some common screening tests can estimate changes in the vestibular system when compared to objective diagnostic tests, Cohen et al.[24] assessed two groups of elderly patients (60 patients with vestibular symptoms and 60 as control group). All the participants performed a complete vestibular diagnostic evaluation that included: Fukuda Stepping Test, Tandem Walking test with eyes open and closed, Head Impulse Test (HIT), caloric tests, Dix-Hallpike maneuver test; analysis of ocular reflex in the dark and vestibular evoked myogenic potentials. The authors were able to assume that the Fukuda Stepping Test is a poor screening test, since it does not correlate well with the objective findings of other tests. The Tandem Walking test was indicated as the best test to screen older patients with vestibular disorders. A positive HIT is probably consistent with severe peripheral vestibular impairment and may also be more useful in older patients. In younger patients with vertigo, the study has shown that a negative HIT may not be informative. The authors concluded that screening tests for vestibular system disorders are impacted by much interference that need to be better investigated.

In order to investigate the effect of anxiety on postural stability in patients with dizziness when standing, Goto et al.[25] suggested that anxiety

impacts with postural disturbance in the antero-posterior axis; anxiety possibly affects visual and vestibular interactions in maintaining postural balance in patients complaining of dizziness.

Among the issues raised in the literature on the subject and that can be regarded as limitation of the study, the following aspects must be highlighted: the subjectivity of the performance analysis of each individual; the issues of discrete neurological changes that the elderly may have and that are often not perceived by the researchers; the emotional condition of the elderly when performing the tests, among other factors. Therefore, it is essential to value the dizziness complaint brought by the patient, as well as to investigate the impact it causes in their daily life. Assessments that can identify the risks of falls are important tools in prevention strategies and should be part of the evaluations of health professionals. It is believed that studies with an epidemiological profile can greatly contribute to the findings of this study.

Conclusion

Dizziness complaint was not associated to the results of the balance tests, but to the report of fear of falls and limitations in daily activities.

It is believed that the self-report is an important tool for the screening process of dizziness, since it may enable the identification of elderly people at risk of falls and, consequently, to determine a referral for diagnostic evaluation and treatment.

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