

# Vestibular Test in a Population with Dizziness Complain

## Abstract

**Purpose:** Describe the findings of the vestibular test in a population with dizziness complain, who underwent computerized vectoelectronystagmography (VENG).

**Methods:** A retrospective and descriptive study was made, through the analysis of the anamneses and vestibular tests in individuals of both sexes, treated in a private otoneurological diagnostic service in Rio de Janeiro. The sample was composed of individuals evaluated from January 2011 to February 2012. The variables considered in the analysis were: age, gender, type of dizziness, complaints and otoneurological symptoms, diseases and associated symptoms, vestibular test findings and syndromic diagnosis. To analyze data it was used the independence chi-square test.

**Results:** In the population studied, there was primacy female. The age of the sample was composed mostly of subjects over 40years old. Rotatory vertigo was the most frequent. Hearing disorders, tinnitus and neurovegetative symptoms were predominant factor in peripheral cases. The studied also showed the presence of diseases and symptoms correlated with impaired vestibular system.

**Conclusion:** the precise identification of the cause of dizziness should involve a clinical evaluation directed to the patient's complaint, associated diseases, as well as an integral evaluation of the systems involved in body balance and their possible limitations. The major finding was in relation to the age group where we have seen that there was no difference between the age groups of 40 to 59years and age equal or above 60years. This study reaffirms the importance of a detailed history to be applied in the process of diagnosis of dizziness.

**Keywords:** dizziness, vertigo, postural balance, otoneurology, vectoelectronystagmography, benign paroxysmal positional vertigo, syndromic, diagnosis, vestibular, population

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## Introduction

Body balance, considered as an extremely complex function, is fundamental in the spatial relationship of the organism to the environment.<sup>1</sup> According to the Hearing and Balance Committee of the American Academy of Otorhinolaryngology and Head and Neck Surgery, dizziness can be defined as any illusory sensation of movement without any real movement in relation to gravity.<sup>2</sup> This symptom may also be described as zonzera, stunning, hollow head sensation, dizziness (rotational dizziness), instability, fluctuation, oscillations, imbalance, motion sickness, lipothymia, falls and oscillopsia.<sup>3,4</sup> Vertigo is the most common type of dizziness. Generally, sudden onset may manifest itself accompanied by nausea, vomiting, cold sweating, visual dimming and feeling of fainting.<sup>3-5</sup>

Changes in balance may occur in people of any age group and regardless of gender, being more frequent in adults and the elderly.<sup>6,7</sup> One of the reasons that makes dizziness such a common symptom is its aetiological diversity that may be due to primary or secondary functional disorders of the vestibular system.<sup>3,8</sup> Dizziness is considered to be extremely debilitating, causing varying degrees of social and/or professional disability, impairing the quality of life and its epidemiology of fundamental interest in clinical practice.<sup>9,10</sup> The present research aims to determine the prevalence of dizziness and its clinical characteristics aiming to contribute to advances in dizziness therapy.

## Methods

This study was approved by the Research Ethics Committee

of Universidade Veiga de Almeida, Opinion no. 346.485. This is a retrospective and descriptive cross-sectional study carried out by analyzing the anamnesis and the vestibular test, from the charts of 685 subjects seen in a private otoneurological diagnostic service located in the city of Rio de Janeiro, stored in a database, Source of research. The sample consisted of individuals of both genders evaluated from January 2011 to December 2012, who presented an exclusive complaint of dizziness.

The classification by age group of the sample was performed as follows: from 2 full years to 9years and 11months of age (childhood), from 10 to 14years and 11months (pre-adolescence), from 15 to 19years And 11months (adolescence), from 20 to 39years and 11months (young adult), from 40 to 59years and 11months (adult) and equal to or above 60years (senility). The variables considered in the analysis were: age, gender, type of dizziness, complaints and otoneurological symptoms, associated diseases and symptoms, vestibular test findings and syndromic diagnosis. All subjects underwent the standardized anamnesis (Appendix 1), clinical otorhinolaryngological examination and vestibular test, performed by computerized vectoelectronystagmography (VENG).

Obtaining the vestibulo-ocular records with electrodes was done, in this research, using the Computerized System of Vectoelectronistagmografia SCE Nistagmus. The E96 water otocalimeter, both from Contronic, was also used.

The VENG comprised the stages of observation and recording of ocular movements through the following tests: nystagmus and positional or positional vertigo using the Dix-Hallpike maneuver,

spontaneous nystagmus with open and closed eyes, semi-spontaneous nystagmus, nystagmus (Calibration, fixed and randomized saccadic movements, pendular and optokinetic screening) and caloric tests. The closed-eyes tests were performed with constant conversation in order to maximize the vestibulo-ocular reflex responses. The caloric tests consisted of stimulation with water at 44°C and 30°C (for 40 seconds), respectively, in both ears, respecting a 3-minute interval between the stimulations. Responses were recorded with eyes closed and then with eyes open for observation of the inhibitory effect of ocular fixation. For the interpretation of the caloric test and analysis of labyrinth predominance (LP) and directional preponderance (DP), the Jongkess formula was used.<sup>11</sup>

In the analysis of this study, labyrinthian paresis was considered as a difference of nystagmographic response greater than 20% between the two sides, the worst labyrinth being the one that had the most deficient caloric response.<sup>12</sup> The Dix Hallpike maneuver was considered positive when there was presence of vertigo and / or nystagmus, and the test was initiated by the position opposite to the trigger, according to the information obtained from each subject, when reported.<sup>8</sup> For the statistical analysis of the data and all crosses performed in this study, we used the chi-square test to verify if the variables are independent of each other. The null hypothesis of this test is that the variables are independent. Thus, in all the results that will be presented, the test described above was applied at a significance level of 5%. The results of all subjects served in the service are described and stored in a database, the source of the research.

## Results

The total of 668 subjects, 181 were males and 487 were females, 28.6% of whom were between 40 and 59years old (Table 1). The vestibular exam was altered in 255 (61.8%) of the 668 subjects, of whom 249 (37.3%) had peripheral vestibular syndrome (PVS), 4 (0.6%) central vestibular syndrome (CVS) and 2 (0.3%) mixed vestibular syndrome (MVS). The distribution by age group and syndromic diagnosis of the study population is shown in Table 2. These variables are independent at the significance level of 5%. Regarding the distribution and frequency of the sample by type of dizziness 317 of the subjects presented dizziness of the rotatory type. The subjects that presented the most rotatory dizziness were those of the female gender who are aged between 40 and 59years. Analyzing the interdependence between the two variables, we observed that the type of dizziness and the age group were two independent variables ( $p$  value = 0.127). The distribution and frequency of otoneurological symptoms (neurovegetative signs, tinnitus and auditory alterations) of the study population are shown in Table 3. Applying the chi-square statistical test to test the independence of auditory alteration variables by gender and by age group, we found that the variables present significant dependence ( $p$  = 0.004). The result of the crossing of the tinnitus and gender variables showed that the two variables did not present significant dependence ( $p$  value = 0,348). The same occurred with the variable age group ( $p$  value = 0.106).

The data on the presence or absence of diseases and symptoms reported in the anamnesis of the subjects submitted to the vestibular examination are shown below: the most frequent disorder was cervicgia with 59.7%, followed by hypertension with 38, 3%, headache with 37.7%, dyslipidemia with 35.9%, thyroid dysfunction with 20.2%, diabetes with 12.0%, neurological disorder with 5.8% and finally psychological disorder with 4.5%. The data found regarding the cross-referencing of the variables syndromic diagnosis by gender ( $p$  value = 0.245), by age group ( $p$  = 0.138) and type of dizziness

( $p$  = 0.625) showed no present significant dependence between these variables. We have also seen that these variables are independent in the results of the syndromic diagnosis and frequency distribution due to neurovegetative symptoms, tinnitus and auditory alterations ( $p$  = 0.907).

The Dix-Hallpike maneuver had a positive result in 70 (10.5%) of the subjects submitted to the vestibular test, prevailing in the female gender and in the age group equal to or above 60 years. The result of the cross-over of the gender variables and Dix-Hallpike Maneuver showed that the two variables did not significant dependence ( $p$  value = 0.993). Regarding the age variable, the two presented significant dependence ( $p$  value = 0.019).

**Table 1** Distribution and frequency by age group and gender of the subjects submitted to the vestibular test

Age Group	Genre		Total (%)
	Female n(%)	Male n(%)	
02 A 09 Years	0	1(0,1)	1(0,1)
10 A 14 Years	0	2(0,3)	2(0,3)
15 A 19 Years	4(0,6)	4(0,6)	8(1,2)
20 A 39 Years	107(16,0)	40(6,0)	147(22,0)
40 A 59 Years	107(16,0)	40(6,0)	147(22,0)
> 60 Years	185(27,7)	64(9,6)	255(38,2)
TOTAL	487(72,9)	181(27,1)	668(100,0)

**Table 2** Distribution and frequency by age group and by syndromic diagnosis of the subjects submitted to the vestibular test

Age Group	Syndromic Diagnosis				Total (%)
	NOR n(%)	PVS n(%)	CVS n(%)	MVS n(%)	
02 A 09 Years	1(0,1)	0	0	0	1(0,1)
10 A 14 Years	1(0,1)	1(0,1)	0	0	2(0,3)
15 A 19 Years	4(0,6)	4(0,6)	0	0	8(1,2)
20 A 39 Years	88(13,2)	57(8,5)	1(0,1)	1(0,1)	147(22,0)
40 A 59 Years	169(25,3)	84(12,6)	2(0,3)	0	255(38,2)
> 60 Years	150(22,5)	103(15,4)	1(0,1)	1(0,1)	255(38,2)
TOTAL	413(29,0)	249(47,5)	4(0,4)	2(0,3)	668(100,0)

**Table 3** Distribution and frequency by Otoneurological symptoms of the subjects submitted to the vestibular test

Otoneurological Symptoms	Yes n(%)	No n(%)	Total (%)
Neurovegetative Signs	389(58,2)	279(41,8)	668(100,0)
Tinnitus	304(45,5)	364(54,5)	668(100,0)
Hearing Alterations	165(27,7)	503(75,3)	668(100,0)

## Discussion

Several signs of vestibular dysfunction can be detected by means of a detailed anamnesis associated with the clinical examination and the vestibular test with vectoelectronystagmography and in this, one or more tests may present alterations, making possible the formulation of the diagnostic hypothesis.<sup>13,14</sup> The normal examination obtained in this study, a relatively significant value, this finding is in agreement with an extensive study on vestibulocochlear diseases. The absence of alterations to the vestibular examination despite labyrinthine symptoms can be explained when there was little impairment of the vestibular apparatus or when it has already recovered.<sup>15</sup>

The diagnostic sensitivity of vectoelectronystagmography (VENG), which reveals normal results in 40% of the patients with a diagnostic hypothesis of labyrinthine alteration, should also be

considered.<sup>16</sup> In the evaluation of the syndromic distribution, among the altered results, we found in this study a higher prevalence of peripheral vestibular syndrome, followed by central and mixed. These data do not differ from those found in the literature, which point out that the main causes of otoneurological symptoms are those that affect the peripheral vestibular system.<sup>17</sup> However, attacks of central origin are generally more dangerous and deserve attention.<sup>18</sup>

In this study, it is easy to observe the large numerical difference between the female and the male gender in the studied population, in the proportion of 2.7: 1, confirming the reports of world literature.<sup>5,19,20</sup> Several studies have shown that women are more susceptible than men to otoneurological changes. This "sensitivity" could be attributed in part to the natural hormonal variations that the woman presents.<sup>18,21</sup> Studies suggest that female sex hormones would physically alter peripheral vestibular function because of changes in endolymphatic pressure and blood viscosity. However, the most significant changes would be those involving the effects of progesterone and estrogen on the central nervous system, and consequently on neurotransmitters and their interactions.<sup>22</sup>

As for the syndromic distribution by gender, there was again a significant difference between the two, and the peripheral vestibular syndrome in the female gender was the most frequent, given the concordance with those reported in several studies.<sup>5,18,23</sup> Age groups aged 40 to 59 years and equal to or above 60 years had similar results, although some studies indicate that the majority of individuals complaining of dizziness are the elderly.<sup>3,23,24</sup> It should therefore be taken into account that the mean and age of the female subjects (54.3 years) coincide with the menopause period.<sup>22</sup> In childhood, pre-adolescence and adolescence were few cases, perhaps because the psychoemotional problems of this population range are on the rise.<sup>5</sup> In the observation of syndromic distribution by age group, there was a greater prevalence of peripheral syndrome. Studies show that there is no significant relationship between age and diagnostic hypothesis.<sup>5,11,18</sup>

Among the types of dizziness, the rotatory was the most frequent and the subjects who presented the most type of disorder were those of the female gender between the ages of 40 and 59 years, according to the literature.<sup>3,5</sup> The presence of neurovegetative symptoms occurred mostly in patients with peripheral alterations, a finding consistent with the literature, which also reports the low incidence of these symptoms in central vestibular syndromes.<sup>5,18</sup> In peripheral syndromes, dizziness and other types of dizziness may occur in combination with tinnitus, auditory changes, feeling of pressure or discomfort in the ear.<sup>3,25</sup> The prevalence of hearing loss and tinnitus increase with age, regardless of the presence of occupational history of exposure to noise. Regarding the variables of age and gender, we know that the prevalence of hearing loss and tinnitus increase over time.<sup>26-28</sup>

The occurrence of dizziness or dizziness associated with tinnitus in the peripheral findings, predominantly in females, make these data consistent with that reported in the literature,<sup>18,26,29</sup> confirming the importance of indicating otoneurological evaluation in the occurrence of this symptom. The presence of auditory alterations, mostly in the female gender, in the age group equal to or above 60 years old and in the patients with peripheral findings, is in agreement with the literature, which states that the peripheral syndromes usually present hearing loss and to these cases can be added many others of mixed syndromes, that is, without a fully defined topodiagnosis.<sup>18,26,29</sup>

The etiological factor causing vertigo can be suspected during the anamnesis between 75% and 80% of the cases; Eventually, through

complementary examinations, the vast majority of cases can be effectively diagnosed.<sup>14</sup>

When the vestibular symptom comes from alterations in other organs dizziness may occur without the functional impairment of this system.<sup>28</sup> Due to this fact, investigating the evaluation of vestibular functions, the relation of other diseases becomes relevant for the syndromic diagnosis.<sup>3,5,14</sup> The significant occurrence of cervical disorders in the population studied is in agreement with findings that refer to the most frequently encountered otoneurological clinical pictures in their studies, with vertebrobasilar insufficiency and cervical syndrome having a considerable prevalence.<sup>30</sup>

In the sample, the incidence of cardiovascular disorders is in agreement with the literature that refers to this etiology as one of the main causes of vertigo or dizziness. The presence of headache in the subjects of the sample agrees with the findings of authors, who reinforce that migraine is one of the common diseases that cause vertigo or dizziness. Transient vasoconstriction in the vertebrobasilar territory would promote ischemia of the vestibular nuclei, triggering the vestibular symptoms. The metabolic problems related to diabetes, thyroid dysfunction and dyslipidemia presented by the study population are currently accepted as responsible for changes in the balance of the vestibular system.<sup>18</sup>

The presence of psychological or neurological disorders confirms the literature that reports that psychic disorders, tumors and degenerative processes are common causes of vertigo and other types of dizziness. However, it is important to emphasize that psychosomatic symptoms may be secondary to labyrinth disorders and not necessarily the cause.<sup>3,9</sup> Vertigo with a frequent incidence in the Dix-Hallpike maneuver presented statistically compatible data with those reported in several studies on Benign Paroxysmal Positional Vertigo (BPPV), where this symptom is characteristic in the elderly and especially in the female gender.<sup>30</sup>

## Conclusion

The analysis of the 668 tests made it possible to conclude that about 68% of the subjects did not show changes in the vestibular tests, therefore, the precise identification of the cause of dizziness should involve a clinical evaluation directed to the patient's complaint, associated diseases, as well as an integral evaluation of the systems involved in body balance and their possible limitations, which may influence the onset of cochlear-vestibular symptoms.

It was demonstrated the prevalence of female gender in the population complaining of dizziness. However, the preponderant finding was in relation to the age group where we could observe that there was no difference between the age groups from 40 to 59 years and age equal to or above 60 years, since many studies indicate that the majority of individuals complaining of Dizziness is the elderly. In view of the above, this study reaffirms the importance of a detailed anamnesis in which the etiological factor associated with dizziness can be suspected in 80% of the cases, considering that no isolated clinical signs have a definite value in the location of the lesion and that few otoneurological findings, isolated, make the topographical diagnosis.

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## Conflicts of interest

Author declares there are no conflicts of interest.

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