

Geriatric otoneurology: Old concepts, current challenges

Original Article

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Abstract

Objective: to determine the prevalence of otoneurologic symptoms among geriatric patients referred for otolaryngology evaluation.

Methods: Retrospective observational study including patients aged 65 and older referred from Primary Care to Otolaryngology during 2019 and 2020. Information regarding symptoms underlying the referral were collected from the referral file.

Results: 1304 patients were included, with 65% (n= 852) citing otoneurologic symptoms as one of the motives for referral. Hearing loss was the most common symptom (69%, n= 592), followed by tinnitus (36%, n= 304) and vertigo/dizziness (25%, n= 213). There was a statistically significant association between hearing loss and advanced age ($p < 0.001$) and between the female sex and vertigo/dizziness ($p < 0.001$) and tinnitus ($p = 0.007$). Presbycusis was the most common diagnosis among all patients.

Conclusions: this study cements otoneurologic symptoms as central in the geriatric population, highlighting the need for a better preparation for the evaluation of these complaints.

Keywords: Geriatrics; Otolaryngology; Otoneurology; Aging

Introduction

Over the past few decades, optimization of healthcare services and a decrease in fertility have led to a change of the global demography¹, with the elderly population, defined as individuals aged >65 years, increasing from 524 million to 608 million between 2010 and 2015². This trend has also been observed in Portugal, where older people currently account for 22.1% of the population³. This growth has led to an increased demand of healthcare services by elderly patients, with otorhinolaryngology (ORL) being no exception⁵.

Among the ORL problems associated with aging, otoneurological problems have a significant impact on the quality of life, being

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associated with morbidity and even mortality². It is therefore important to understand the magnitude of otoneurological symptoms among the elderly in order to devise a better management approach, allowing for reduction of their deleterious effects. To this end, this study aimed to determine the prevalence of otoneurological symptoms among older individuals referred for an ORL consultation and the diagnoses proposed after assessment.

Material and Methods

This study was approved by the local Ethics Committee and the rights of the patients were protected according to the principles of the Declaration of Helsinki. A total of 1304 patients aged >65 years, who were referred from primary health care to the ORL department of a tertiary center during 2019 and 2020, were included in this observational retrospective study. Demographic data and data related to the symptoms that led to the referral request were retrieved from the "PI" document. The symptoms were categorized as "otoneurological," "laryngopharyngeal," "nasal," "other head and neck symptoms," and "other reasons." All symptoms were considered significant, with some patients being included in more than one group of symptoms. The clinical records were used to retrieve data related to the ORL consultation and potential diagnoses. Statistical analysis was performed using SPSS software version 24 (IBM Corp., Armonk, NY), and statistical significance was set at $p < 0.05$. Descriptive analysis of the patients' characteristics was performed using frequencies for qualitative variables and means and standard deviations (SD) for quantitative variables. Normal distribution was assessed using the Shapiro-Wilk test and skewness and

kurtosis analysis. The differences between the groups were evaluated using the chi-square test for categorical variables and the t-test for independent samples or the Mann-Whitney test for continuous variables.

Results

Study Population

During 2019 and 2020, there were 10,266 referrals from primary healthcare centers to the ORL and Head and Neck Surgery departments of a tertiary center, with 20% ($n = 2,084$) of these regarding individuals aged >65 years. Among these, 37% ($n = 779$) were not evaluated in an external consultation, with 75.2% ($n = 587$) needing complementary diagnostic tests (CDT), 16.7% ($n = 130$) missing their appointments, 4.2% ($n = 33$) already under follow-up, 3.2% ($n = 27$) giving up their appointments, and 0.2% ($n = 2$) dying before the consultation. A total of 1,304 patients were included in this study. The patients' age ranged between 65 and 101 years, and 53% ($n = 697$) were women (Table 1).

Otoneurological symptoms were cited the most as a reason for referral (65%, $n = 852$), followed by laryngopharyngeal (17%, $n = 220$) and nasal (13%, $n = 167$) symptoms. Otoneurological symptoms accounted for 68% and 86% of the consultation requests in 2019 and 2020, respectively.

Otoneurological Symptoms

All otoneurological or otologic symptoms were included in this group, with 852 patients having symptoms that fell in this category. Among the patients, 56% ($n = 474$) were women, and the mean age was 73.82 years (SD = 0.23). Hypoacusis was the most frequently reported symptom (69%, $n = 592$),

Table 1
Study population

	Number of Patients	Mean Age (Years)
Women	697 (53%)	73.49±6.68
Men	607 (47%)	73.18±6.12
Total	1304 (100%)	73.35±6.42

Table 2

Otoneurological symptoms and their prevalence in patients with symptoms and among all patients

	Number of patients (% in the group)	% in total
Hypoacusis	(N= 1304)	45%
Tinnitus	304 (36%)	23%
Vertigo/Dizziness/Imbalance	213 (25%)	16%
Earache	30 (4%)	2%
Aural fullness	28 (3%)	2%
Otorrhea	25 (3%)	2%
Earwax	22 (3%)	2%
External ear pruritus	14 (2%)	1%
Otitis	12 (1%)	1%
Lesion of the external ear	2 (0%)	0%

followed by tinnitus (36%, n = 304) and vertigo/dizziness/imbalance (25%, n=213). Hypoacusis was more frequent in older patients ($p < 0.001$), while vertigo/dizziness/unbalance ($p < 0.001$) and tinnitus ($p = 0.007$) were more frequent in women. Hypoacusis was also the most reported symptom among all patients (45%, n= 1304) (Table 2). The following associations were reported by the patients: hypoacusis and tinnitus (159); tinnitus and vertigo/dizziness/unbalance (35); hypoacusis and vertigo/dizziness/unbalance (25); hypoacusis, tinnitus, and vertigo/dizziness/unbalance (47).

Diagnoses

Presbycusis was the most common diagnosis (48%, n= 412), followed by combined presbycusis and chronic otitis media (COM) (9%, n= 74), COM (8%, n= 69), earwax (6%, n= 51), and benign paroxysmal positional vertigo (BPPV) (4%, n=35). There was a significant relationship between presbycusis and older age ($p = 0.024$). The remaining diagnoses were made in less than 1% of the patients. Additionally, 8% (n= 71) of the patients did not show changes in the otoneurological examination or CDT, and 6% (n= 52) were waiting for a diagnosis at the time of data collection.

Patients with Hypoacusis

Among patients with hypoacusis (n= 359) without vertigo/dizziness/unbalance or tinnitus, 64% (n= 228) were diagnosed with presbycusis, 12% (n= 42) with COM, 9% (n= 31) with combined presbycusis and sequelae of COM, and 7% (n= 25) with earwax. The remaining diagnoses were made in less than 2% of the patients (Table 3).

Patients with Vertigo/Dizziness/Unbalance

An evaluation by a specialist showed mostly no changes in the objective otoneurological examination or CDT in patients referred for vertigo/dizziness/unbalance (n= 106) without hypoacusis or tinnitus (38%, n= 40). BPPV was diagnosed in 23% (n= 24) of patients, and each of the remaining diagnoses was made in less than 8% of patients (Table 3).

Patients with Tinnitus

Among the patients who reported tinnitus (n= 63) without hearing loss or vertigo/dizziness/unbalance, 67% (n= 42) had symptoms bilaterally, 29% (n= 18) had symptoms unilaterally, and 5% (n= 3) no longer had the symptom at the time of evaluation, with only one patient with bilateral tinnitus reporting pulsatile tinnitus. Thirty-four (54%) patients were diagnosed with presbycusis, 11% (n= 7) were awaiting a diagnosis at the time of data

Table 3

Diagnoses among patients with hypoacusis alone, vertigo/dizziness/unbalance and tinnitus alone, and tinnitus alone.

Diagnoses in Patients with Hypoacusis Alone (n= 359)	No. of Patients	Diagnoses in Patients with Vertigo/ Dizziness/Unbalance Alone (n= 106)	No. of Patients	Diagnoses in Patients with Tinnitus Alone (n= 63)	No. of Patients
Presbycusis	228	Without ORL changes	38	Presbycusis	34
COM	42	BPPV	24	Awaiting	7
COM + Presbycusis	31	Presbycusis	9	Without changes ORL	6
Earwax	25	Multisensory deficit	8	Earwax	4
Awaiting	8	Awaiting	8	COM	4
Without otoneurological changes	8	Vestibular Hyporeflexia (after probable vestibular neuronitis)	6	Aberrant Carotid Artery	1
Without ORL changes	4	COM	2	TMJ dysfunction	1
Gave up consultation before diagnosis	3	PPPD	2	Tube dysfunction	1
Exostosis	2	Without otoneurological changes	2	Presbycusis + COM	1
Unilateral sensorineural hearing loss	2	Unilateral Vestibular Areflexia	1	Unilateral sensorineural hearing loss	1
Tube dysfunction	1	Presbycusis + BPPV	1	Otitis Externa	1
Eczema of the external auditory canal	1	Menière's Disease	1	Acute Otitis Media	1
Presbycusis + Exostosis	1	Acute Vestibular Neuronitis	1	Without otoneurological changes	1
Otitis Externa	1	Earwax	1		
Otosclerosis	1	Gave up consultation before diagnosis	1		
BPPV	1	Eczema of the external auditory canal	1		

PPPD, Persistent postural-perceptual dizziness; BPPV, benign paroxysmal positional vertigo; COM, chronic otitis media; ORL, otorhinolaryngology; TMJ, temporomandibular joint; "Without otoneurological changes": patients with otoneurological complaints and other ORL complaints who did not have otoneurological changes/diagnosis but had some type of change in the remaining ORL examination; "Without ORL changes": patients without changes in the objective ORL examination.

collection, and 11% (n= 7) did not show changes in the otoneurological examination or CDT. The remaining diagnoses were made in less than 6% of patients (Table 3).

Patients with a combination of symptoms

Most of the patients who reported hypoacusis and tinnitus (n= 159) (60%, n= 96) were diagnosed with presbycusis (Table 4). This was also the most frequent diagnosis in patients with hypoacusis and vertigo/dizziness/unbalance (52%, n= 13; Table 4) and those with hypoacusis, tinnitus, and vertigo/dizziness/unbalance (38%, n= 18; Table 4). Most of the patients referred for an association

between tinnitus and vertigo/dizziness/unbalance (20% n= 7) did not exhibit changes in the objective examination or CDT (Table 4).

Discussion

The elderly population is the fastest growing segment of society⁵. Although there is recognition that otoneurological symptoms have a significant negative impact on the quality of life of the elderly, the magnitude of these symptoms among this population is unclear^{6,7}. This study primarily aimed to investigate the prevalence of otoneurological symptoms in elderly patients referred for an ORL consultation, as well as the

Table 4

Diagnoses among patients with an association between hypoacusis and tinnitus, hypoacusis and vertigo/dizziness/unbalance, hypoacusis, tinnitus, and vertigo/dizziness/unbalance, and tinnitus and vertigo/dizziness/unbalance

Diagnoses in Patients with Hypoacusis + Tinnitus (n= 159)	No. of Patients	Diagnoses in Patients with Hypoacusis + Vertigo/ Dizziness/ Unbalance (n= 25)	No. of Patients	Diagnoses in Patients with Hypoacusis + Tinnitus + Vertigo/ Dizziness/ Unbalance (n= 47)	No. of Patients	Diagnoses in Patients with a Combination of Tinnitus + Vertigo/ Dizziness/ Unbalance (n= 35)	No. of Patients
Presbycusis	96	Presbycusis	13	Presbycusis	18	Without ORL changes	7
Presbycusis + COM	23	BPPV	2	Awaiting	10	Presbycusis	6
COM	11	COM	2	Without ORL changes	4	BPPV	5
Earwax	9	Vestibular Hyporeflexia (after probable vestibular neuronitis)	2	Presbycusis + COM	3	Awaiting	5
Awaiting	6	Presbycusis + OMC	1	Multisensory deficit	2	Multisensory deficit	3
Unilateral sensorineural hypoacusis	4	Presbycusis + vestibular Hypovalence (after probable vestibular neuronitis)	1	COM	2	Presbycusis + COM	2
Without ORL changes	5	Menière's disease	1	BPPV	2	COM + BPPV	1
Exostosis	1	Otosclerosis	1	Presbycusis + Multisensory deficit	1	Presbycusis + Multisensory deficit	1
Otosclerosis	1	Awaiting	1	Menière's disease	1	Presbycusis + Vestibular Hyporeflexia (after probable vestibular neuronitis)	1
Vestibular hyporeflexia (after probable vestibular neuronitis)	1	Without ORL changes	1	Acute Otitis Media	1	Menière's disease	1
BPPV	1			Earwax	1	Vestibular Hyporeflexia	1
Without otoneurological changes	1			Presbycusis + COM + Vestibular Hyporeflexia (after probable vestibular neuronitis)	1	PPPD	1
				Unilateral Sensorineural Hypoacusis	1	COM	1

PPPD: Persistent postural-perceptual dizziness; benign paroxysmal positional vertigo; COM, chronic otitis media; ORL, otorhinolaryngology.

diagnoses associated with these symptoms. Otoneurological symptoms (as a group) were the most common reason for referral in both years of data collection, confirming otoneurological symptoms as the main ORL complaint in elderly patients. Hypoacusis was the most commonly reported symptom within the group of otoneurological symptoms and among all patients. Hearing is the sense most affected by aging⁸, and hypoacusis is the fifth most frequent chronic impairment among the elderly in Portugal⁹. The results of this study confirm the association between hypoacusis and aging, with presbycusis being the most frequent diagnosis among patients who reported hypoacusis (n= 359). According to the World Health Organization, presbycusis is the second most common disease in the geriatric population and the third most prevalent disease globally¹⁰. Although age is an independent factor for the decrease in cognitive abilities, presbycusis exacerbates this decline and is a risk factor for the development of dementia, warranting for the cognitive evaluation of older people diagnosed with presbycusis¹⁰. Moreover, presbycusis leads to problems related to communication and social isolation and is, therefore, a risk factor for the development of depression in the elderly¹⁰. Despite the negative impact, only 20–25% of individuals with presbycusis who would benefit from hearing rehabilitation actually receive it¹⁰, in part due to the stigma associated with the use of hearing aids¹⁰. Thus, promoting adherence to auditory rehabilitation remains an important clinical challenge. Additionally, the finding of COM as the second most common diagnosis is an important one. Although COM is classically a pediatric disease, its prevalence in adults in the UK is 1.5% and 2.6% for active and inactive disease, respectively¹¹. However, data regarding its prevalence in the elderly population are scarce. The diagnosis of COM in older patients is challenging, especially regarding the therapeutic approach, because these patients often present with comorbidities that lead to greater surgical risk¹². Although conduction

auditory thresholds decrease gradually with age, surgical intervention may significantly improve hearing and is associated with a minimum risk of injury to the middle ear¹². Thus, although surgical intervention is the most complex treatment option, it should not be ruled out in cases of COM in the elderly. The symptom group of vertigo/dizziness/unbalance was the third most reported, occurring more frequently in female patients¹³, as was confirmed in this study. The prevalence of these symptoms increases with age and is associated with an increased risk of falls and disability¹⁴, with approximately 73% of older people in Portugal reporting at least one fall⁹. Cardiovascular diseases are the main cause of dizziness among the elderly, with peripheral vestibular disorders being less prevalent¹⁴. In this study, dizziness alone or in addition to tinnitus was mostly not associated with changes in the objective otoneurological/ORL examination or CDT suggestive of peripheral vestibular disorders. The patients were examined in a general ORL consultation and later referred for otoneurology consultation if necessary. All patients underwent otoscopy, audiometry, investigation of nystagmus with Frenzel goggles, head impulse test, head shaking test, gait evaluation, Romberg and Unterberger-Fukuda tests, finger-to-nose test, and Dix-Halpike, McClure, and hyperextension maneuvers with Frenzel goggles if the symptoms suggested BPPV without objective nystagmus. Nystagmus was also investigated by hyperventilation and vibration induction in selected cases. Additionally, evaluation of the remaining cranial nerve pairs, dynamic evaluation of visual acuity, and the Romberg sign test were performed. The fact that no changes were found in the abovementioned evaluation may result from numerous etiological causes underlying these symptoms, with dizziness in the elderly being a multifactorial entity in most cases¹⁵. All patients were referred by the assistant physician for a cardiovascular assessment - the blood pressure profile - and respective changes with orthostasis, as this is the

system most often associated with symptoms of dizziness. A multidisciplinary approach and differential diagnosis of symptoms of vertigo/dizziness/unbalance is therefore extremely important, especially when considering that an elderly individual presents to the emergency department every 11 seconds due to a fall, and an elderly individual dies every 19 minutes due to a fall¹⁵. BPPV was the most common diagnosis in patients presenting with these changes, confirming this entity as the main cause of vertigo in the elderly¹⁶. The presence of comorbidities common in the elderly, such as high blood pressure and diabetes mellitus, leads to a higher risk of BPPV and recurrence of BPPV¹⁷. Although the diagnosis is established in the same manner as in younger patients, performing diagnostic maneuvers may be more difficult due to osteoarticular disease, warranting extra care. In patients with hypoacusis associated with vertigo/dizziness/unbalance, presbycusis was the most frequent diagnosis. This diagnosis is associated with an increased risk of falls, and the use of hearing aids is associated with improved balance and reduced risk of falling¹⁸, which reinforces the importance of auditory rehabilitation. Moreover, the concept of presbyvestibulopathy is important, although it was not a formally established diagnosis in this study. Age is associated with histological changes in the vestibular organs, leading to vestibular symptoms in older patients¹⁹. Although this physiological deterioration has been known for decades, it was only consensually described in 2019, when diagnostic criteria were created²⁰. Therefore, this is a recently recognized diagnosis¹⁹ and may become a more frequent diagnosis among the elderly seen in ORL consultations, considering the current knowledge. The prevalence of tinnitus increases with age; in this study, tinnitus was the second most common symptom and more frequently found in association with hypoacusis than alone. Presbycusis was the most common diagnosis in patients with tinnitus and in those with associated hypoacusis, which confirms

the higher prevalence of this symptom in patients with audiometric changes²¹. As described above, presbycusis worsens cognitive decline, and there is evidence that tinnitus also accelerates its progression, especially regarding attention and working memory²². Accordingly, cognitive impact may be worse in patients who have this association. The use of hearing aids in patients with presbycusis and tinnitus is associated with a decreased perception of tinnitus sounds, reducing the impact of this symptom²³. As previously mentioned, there were no changes in the objective otoneurological examination in most patients with tinnitus and vertigo/dizziness/unbalance. These symptoms often have a psychogenic origin, with approximately 8–10% of symptoms of vertigo/dizziness/unbalance being associated with anxiety or depression²⁴. Anxiety is more prevalent in patients with tinnitus without audiometric changes than in those with tinnitus and audiometric changes²³. Although it would be important to relate these symptoms to the personal mental health history, we hypothesize that the symptoms in patients with this association have a psychogenic origin; therefore, the treatment approach is more challenging.

Notably, otoneurological symptoms accounted for 68% of the requests for ORL consultations in 2019, increasing to 86% in 2020 in this study. The year 2020 was marked by the SARS-CoV2 pandemic, which affected access to healthcare, explaining the drop in the consultation requests. The fact that the prevalence of otoneurological symptoms actually increased during this time is indicative of the impact these symptoms have. This study has some limitations. First, as it was an observational retrospective study and therefore susceptible to confounding factors, especially regarding the diagnoses. Second, all reported symptoms were considered significant. It would be interesting to evaluate the effect of different symptoms in patients with combinations of symptoms to understand which symptoms have a greater impact. Despite these

limitations and the fact that previous studies have analyzed the prevalence of some isolated symptoms and otoneurological diagnoses in the elderly, this is the first study to assess the prevalence of these symptoms in older patients referred for an ORL consultation and to determine the diagnoses associated with each symptom/association of symptoms. The findings may be useful in devising an approach for managing older patients' otoneurological symptoms and diagnoses.

Conclusion

Elderly patients are a growing proportion of patients referred for an ORL consultation. The findings of this study confirm that otoneurological symptoms are the major ORL complaint of geriatric patients, emphasizing the importance of knowing how to recognize and manage such complaints.

Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

Data Confidentiality

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

Protection of humans and animals

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the 2013 Helsinki Declaration of the World Medical Association.

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Availability of scientific data

There are no datasets available, publicly related to this work.

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