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RESEARCH ARTICLE

Etiology of dizziness among patients referring to an Iranian ear, nose and throat clinic

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Abstract

Background and Aim: Dizziness is one the most common complaints of patients in the emergency rooms. It has various etiologies and can lead to falling and other life-threatening injuries, especially in the elderly. Dizziness affects the quality of life and results in negative emotional reactions. This research studied the etiology of dizziness in a three-year study.

Methods: This study was conducted on 650 patients with the complaint of dizziness, whose specialists suspected them of having possible vestibular involvement, referred to a tertiary audiology clinic from 2015 to 2018. Videonystagmography, electrocochleography and cervical vestibular evoked myogenic potentials were administered. Other medical tests including neurologic examinations, blood analysis, and brain imaging were performed based on patients' complaints.

Results: This was a descriptive study of dizziness prevalence with different etiologies. Patients' age range was 18-85 years with mean (SD) age: 42.34 (13.12), including 377 (58%) females and 273 (42%) males. Patients' chief complaints included vertigo in 64.8%, dizziness in 20.2% and imbalance in 15.1%. Vestibular disorders were identified in 49.2% of the referred patients. The patients' final diagnosis in order of prevalence were as follows: systemic involvement (292 cases), benign paroxysmal positional vertigo (187 cases), unilateral vestibular weakness (63 cases), endolymphatic hydrops (51 cases), bilateral vestibular weakness (37 cases), central involvement (20 cases), cervical (10 cases) and migraine-associated vertigo (8 cases).

Conclusion: About 49.2% of the patients referred to the ENT clinic had actual vestibular involvement. Careful history taking, teamwork, and comprehensive evaluations are necessary to differentiate underlying cause and selecting appropriate treatment.

Keywords: Dizziness; imbalance; vertigo; etiology; Iranian; prevalence

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Introduction

Dizziness is a common complaint among subjects visiting general practitioners [1] and it is also a general term for disequilibrium [2]. A proportion of those with dizziness suffer from true vertigo defined as an illusion of movement, usually spinning of either oneself or

the environment. There are different reports about the prevalence of dizziness in the literature. It seems that 10.7 per 1000 subjects in a year, experience vertigo [1], in other words, dizziness affects 20–30% of the general population [2]. Dizziness is the main complaint of 6.7% of patients entering emergency room [3].

In 1952, Dix and Hallpike based on clinical experience declared Meniere's disease, benign positional vertigo, and vestibular neuritis as the most common causes of vertigo [4]. Other studies show that vestibular neuritis is responsible for 10–44%, Meniere's disease for 17–43%, and benign positional vertigo for 10–27% of vertigo incidence [1]. Nearly 7% of patients aged 85 years and older complain about dizziness. Women, especially older ones, suffer from dizziness more frequently than men [5]. Dizziness was studied in 1622 adults aged 60 and older and its lifetime prevalence was found to be about 29.3% [6].

Dizziness can have different underlying causes including vestibular system abnormalities, central disorders and systemic diseases (including metabolic and vascular) [7,8]. Vertigo often has vestibular origin [9]. Vestibular system abnormalities can be divided into peripheral and central vestibular diseases. The peripheral vestibular system consists of the vestibular end organs, including the three semicircular canals, the two otolith organs in each ear, and the vestibular portion of the eighth cranial nerve. The central vestibular system consists of vestibular nuclei (four main nuclei) and all its central connections [10]. Prevalence of central dizziness is about one-fourth of patients with dizziness complaints [2]. Therefore, dizziness can result from various etiologies and leads to falling and other life-threatening injuries, especially in the elderly. Dizziness affects the quality of life and may also result in negative emotional reactions and misbehaviors [11,12]. This study reports the final diagnosis of patients referring with dizziness complaints in a three-year period to a tertiary audiology clinic and also the prevalence of vestibular-related dizziness among them.

Methods

In the present study, 720 patients were recruited who referred with the chief complaint of vertigo/dizziness/imbalance. In all cases, specialists suspected the patients of having vestibular involvement in their first visit in the emergency room or neurologic department. Videonystagmography (VNG) testing was performed by using Interacoustics VNG test system (Interacoustics; Assens; Denmark). Patients with distorted VNG results were removed from the statistical analysis (e.g. ocular problem, blindness, caloric stimulation intolerance, uncooperativeness). Patients without a complete history, under medications with dizziness as side effects, and patients who were missed in the follow up were excluded from the study. VNG test battery included oculomotor (gaze, saccade, smooth pursuit), positional tests (supine, head right/left), positioning test (Dix-Hallpike, roll test), and caloric test (bithermal).

Finally, 650 patients admitted from December 2015 to October 2018 were remained for further analysis. All study procedures were in accordance with the Institutional Research Committee guidelines and the 1964 Helsinki Declaration and its later amendments. Informed consent was obtained from all study participants.

Unilateral vestibular weakness was defined as the asymmetry between two ears in bithermal caloric response (24°C and 50°C) more than 25% and bilateral vestibular weakness was defined as total caloric response lower than 12°/s in both ears [13]. Regarding the oculomotor test, consistent saccade overshoot and undershoot (precision less than 80%), saccade velocity less than 400°/s, saccade latency more than 300 ms, consistent saccadic pursuit tracing, and pursuit gain lower than 80% were considered abnormal [11]. Optokinetic test due to low sensitivity and specificity was not interpreted in this study. Finally, the central involvement was confirmed by a neurologist.

Benign paroxysmal positional vertigo (BPPV) was diagnosed by the Dix-Hallpike and roll test. If the patient had torsional and up beating or down beating nystagmus, he/she was diagnosed as having posterior canal (PC) or anterior canal (AC) BPPV, respectively. If the patient had

horizontal nystagmus (geotropic or ageotropic) in the roll test, he/she was diagnosed as having horizontal canal (HC) BPPV. Cupulolithiasis and canalithiasis were differentiated based on nystagmus characteristics. In cupulolithiasis, nystagmus starts immediately after patients' head reaches provoking position and nystagmus lasts as long as the head remains in that position. In canalithiasis, nystagmus starts with a few seconds delay and nystagmus is transient (less than one minute). Epley maneuver was used for the treatment of PC and AC canalithiasis and liberatory (Semont) maneuver was used for the treatment of PC and AC cupulolithiasis. The barbecue maneuver (BBQ) was the chosen treatment for HC canalithiasis and cupulolithiasis if there was any [12].

For diagnosis of endolymphatic hydrops (ELH), case history, audiometry, electrocochleography (EcochG), and cervical vestibular evoked myogenic potentials (cVEMP) test results were used in addition to VNG testing. Patients with high summating potential to action potential (SP/AP) ratio (above 50%), abnormal VEMP asymmetry ratio (AR) above 45%, low tone loss in audiometry and history of two or more Meniere-like attacks (true vertigo lasting at least 20 minutes), positive response to diet and ELH medical treatment were considered as having ELH [12].

VEMP recordings were performed using ICS Chartr EP 200 (Natus; GN Otometrics; Denmark) by 90 dB nHL, 500 Hz tone burst with alternating polarity and 5.1/s rate. Stimuli were delivered through headphone TDH39. Electrode array consisted of a reference electrode on a middle part of the sternocleidomastoid (SCM), an active electrode on the upper part of the sternum, and a ground electrode on the forehead. Subjects sat in a comfortable chair and turned their heads to the contralateral side in order to tense the ipsilateral SCM muscle. The responses evoked in the neck electromyography (EMG) were averaged and presented as a VEMP response. The p13 latency was defined by a positive polarity of a biphasic waveform that appears approximately at 13 ms, and n23 latency was defined by a negative polarity of the biphasic waveform that appears at approximately 23 ms [14]. The amplitude of p13-n23 was measured from the most positive peak of the wave to the most negative trough of the wave in microvolts. AR was calculated automatically by the device based on the following formula [12]:

AR= [(cVEMP amplitude in left ear – cVEMP amplitude in right ear)/(cVEMP amplitude in left ear + cVEMP amplitude in right ear)]*100

EcochG recordings were performed using ICS Chartr EP200 (Natus; GN Otometrics; Denmark) by 90 dB nHL clicks with 7.1/s rate and alternating polarity. Electrode array comprised a reference electrode inside the test ear canal (gold electrode), an active electrode inside the non-test ear canal (gold electrode), and a ground electrode on the forehead. Subjects lay down on a comfortable bed. AP was the highest peak before 2 ms and SP was a hunch on the first slope of the AP. Baseline (BL) was marked as the lowest part of the response before SP. SP/AP amplitude ratio was calculated automatically by the device. This helps in diagnosing ELH. Patients with ELH usually have three symptoms or triad symptoms (hearing loss, tinnitus, and earfulness) as well [12].

Migraine vertigo (MV) or migraine-associated vertigo (MAV) was diagnosed in the cases with similar symptoms as ELH but without VEMP and EcochG abnormalities, with a headache related to vertigo and a positive response to migraine medications [12]. The diagnosis was confirmed by a neurologist.

For determining patients with pathologic anxiety, they were referred to the psychiatrists and evaluated by Beck anxiety inventory (BAI). BAI contains 21 questions; each answer is scored on a scale from 0 (not at all) to 3 (severely). Higher total scores indicate more severe anxiety symptoms. The standardized cutoffs are as follows: 0–9; normal to minimal anxiety, 10–18; mild to moderate anxiety, 19–29; moderate to severe anxiety, and 30–63; severe anxiety [12].

Cervical vertigo was diagnosed when patients had positional nystagmus in the head right/left position but there was not any significant nystagmus in the body right/left position (more than 50% reduction in the nystagmus). If there was

Table 1. Chief complaint of the patients (number/percent of cases) in both sexes

	Female	Male	Total
Vertigo	261 (40.15%)	160 (24.61%)	421 (64.76%)
Dizziness	67 (10.30%)	64 (9.84%)	131 (20.15%)
Imbalance	49 (7.53%)	49 (7.53%)	98 (15.07%)

pure geotropic or ageotropic nystagmus, at first the patient was treated as having lateral canal BPPV. If there was only dizziness without nystagmus or patient did not respond to BPPV treatments and/or the patient had neck problems, cervical vertigo would be suspected [12]. The definite diagnosis was confirmed by a neurologist.

Systemic causes of dizziness and vertigo comprised high/low blood pressure (90–129 mm Hg systolic and 60–84 mm Hg diastolic was considered normal), cardiovascular disease (including heart arrhythmia, coronary heart disease, stroke), hypercholesterolemia (LDL: 100–129 and HDL >41 mg/dL was considered normal), metabolic problems including hyperthyroidism or hypothyroidism (TSH: 0.4–4 mL/L), hyperglycemia, and high/low blood sugar. The diagnosis was confirmed by an internist via blood test and cardiovascular examination.

Descriptive information (mean values and standard deviations) of patients' chief complaints, accompanying symptoms and the final diagnosis were analyzed for both sexes by using SPSS 22 (IBM Corp, Released 2013, Armonk, New York, USA).

Results

Patients' age range was 18–85 years with mean (SD) age of 42.34 (13.12) years old. The study included 377 (58%) females with mean (SD) age of 40.33 (12.15) years and 273 (42%) males with mean (SD) age of 45.12 (13.09) years old.

In general, 421 subjects (64.8%) had vertigo, 131 (20.2%) dizziness and 98 (15.1%) imbalance complaint. Table 1 shows chief complaint of patients of both sexes (number/percentage of cases).

Fig. 1 shows other accompanying symptoms that the patients reported besides vertigo/dizziness/imbalance. Most subjects had no

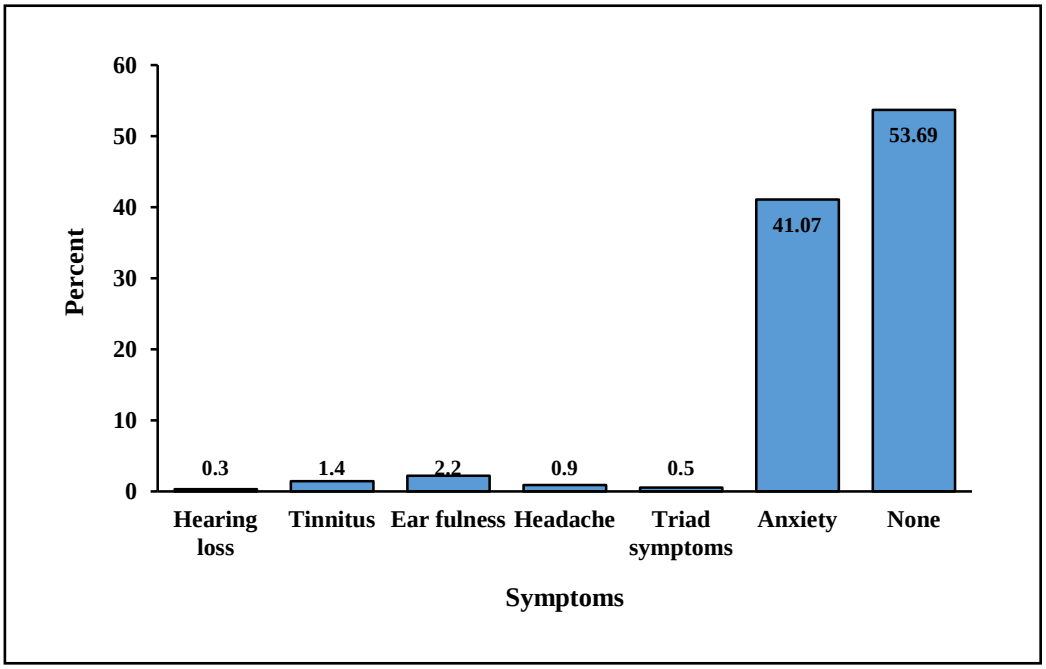

Fig. 1. Symptoms associated with vertigo in patients.

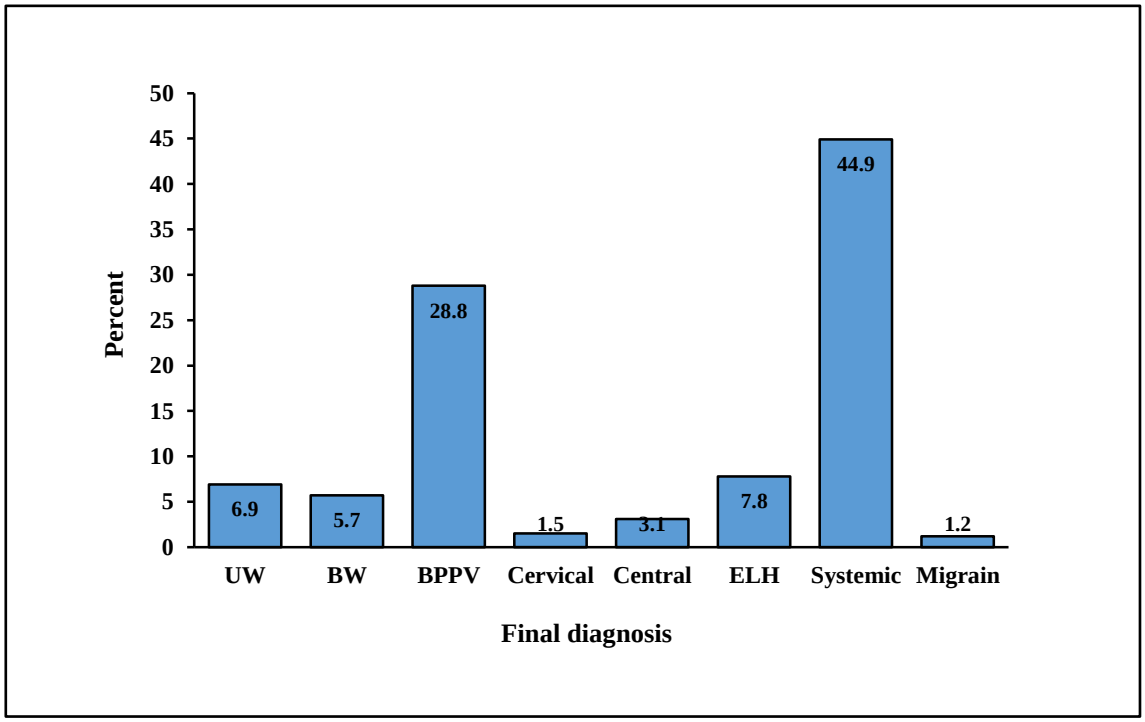

Fig. 2. Percent of final diagnosis among patients. UW; unilateral weakness, BW; bilateral weakness, BPPV; benign paroxysmal positional vertigo, ELH; endolymphatic hydrops.

accompanying symptoms or psychological symptoms. Fig. 2 shows final diagnosis made for the patients. Based on the results, vestibular disorders were identified in 49.2% of the patients. Final diagnosis in the order of the prevalence was as follows: systemic involvement (292 cases), BPPV (187 cases), unilateral vestibular weakness (63 cases), endolymphatic hydrops (51 cases), bilateral vestibular weakness (37 cases), central involvement (20 cases), cervical (10 cases) and migraine-associated vertigo (8 cases).

A total of 179 (95.72%) had canalithiasis BPPV and 8 (4.27%) subjects cupulolithiasis. Two patients (1.06% of BPPV) had recurrent BPPV. One patient had recurrent BPPV four and ten months after the first treatment (case 316) and the other had recurrent BPPV eight months after the first treatment (case 509). Six cases (3.20%) had the AC-BPPV and 181 cases (96.79%) had the PC-BPPV. In general, 49.2% of the patients referred to ENT clinic had actual vestibular involvement so specialists' first referral was valid in 49.2% of cases.

Discussion

This study reports the final diagnosis of patients referring with dizziness complaints in a three-year period to a tertiary audiology clinic and the prevalence of vestibular-related dizziness among them. The present study shows that the prevalence of dizziness (10.30% female and 9.84% male) and vertigo (40.15% female and 24.61% male) were higher in the women than men. However, the prevalence of imbalance was equal in the men and women (7.53%). Bisdorff et al. showed that the prevalence of vertigo was 48.3%, unsteadiness 39.1%, and dizziness 35.6% per year. In their study, the prevalence of all three symptoms were higher in the females than males [13]. Based on German National Telephone Health Interview Survey (GNT-HIS) report, there is a higher lifetime prevalence of moderate or severe dizziness or vertigo in females (36%) than males (22%) [15]. Koo et al. collected the relevant data from 2009 to 2010 via Korea National Health and Nutrition Examination Surveys, which were cross-sectional surveys of the South Korean civilians, non-

institutionalized population aged 40 years or older (n=3267). Failure on the modified Romberg test was assumed as an indicator of vestibular dysfunction. The prevalence of dizziness was 16.70% and the presence of vestibular dysfunction was noted in 1.84% [15]. In the present study, 49.2% of the patients with dizziness/imbalance/vertigo had actual vestibular abnormalities. Lifetime prevalence of dizziness or vertigo was reported 29.5% in German adults in 2003. The etiology of dizziness was vestibular involvement in 25% of the patients [14].

In the United Kingdom, the prevalence of dizziness was estimated to be 23%. About 46% of the patients with dizziness showed anxiety and/or avoidance of the movements and situations provoking dizziness and anxiety. In general the prevalence of anxiety presenting with vertigo, dizziness, and unsteadiness ranges from 11% to 40% [14]. Vertigo, dizziness, tinnitus, and hearing loss are mostly accompanying symptoms of the inner-ear diseases. In the present study, 0.3% of patients had hearing loss, 1.4% tinnitus, 2.2% earfulness, 0.9% headache, and 0.5% three symptoms or triad symptoms (hearing loss, tinnitus, and earfulness) accompanying with dizziness/imbalance/vertigo. In the present study, 7.8% of cases had ELH based on case history, audiometry, VEMP, EcochG and positive response for ELH treatment and diet. All cases had two or more Meniere-like attacks. Prevalence of ELH was higher in women than men (5.38% women and 2.46% men). In one study, 232 patients diagnosed with Meniere's disease (n=186) or cochlear hydrops (n=46) between 1959 and 2001 [16]. The prevalence of Meniere's disease obtained in that investigation was 43.2 per 100000 (95 % with the confidence interval (CI) of 37.6–49.6) at the end of 1996 [17].

In the present study, 1.5% of the patients had cervical vertigo. Vertigo triggering by neck movements could be secondary to a disorder in vestibular, visual, vascular, neurovascular, or cervico-proprioceptive mechanisms [18]. Vertigo (false sensation of movement) can happen due to degenerative or traumatic changes in the spine [19]. When vestibular and cervical stimuli are combined through head rotation relative to the trunk, the perception of both trunk and head rotation in space reflects the true position. There are two reflexes mediated by neck proprioceptors including the postural neck reflexes and the cervico-ocular reflex [18]. In one study, it was shown that 65% of dizziness in the elderly was secondary to spondylosis. However, whether cervical vertigo is an independent disorder is not clear. Anesthetic injections to the upper cervical dorsal nerve roots can make a sense of dizziness and nystagmus. Electrical stimulation to cervical muscles can make a sensation of tilting or falling. Proprioceptive input from the neck helps in the coordination of the eye, head, and body posture and spatial orientation [20].

In this study, 1.2% of dizzy patients had a migraine-associated vertigo (MAV). It affects 24–36% of patients with a migraine and up to 38% of dizzy patients have a migraine. MAV is a common cause of vertigo [21]. Other studies show that the prevalence of a migraine in general population is 16% and prevalence of vertigo is 7%. Therefore, concurrence of two conditions is about 1.1% by chance alone but epidemiological studies have shown that the actual comorbidity is higher (about 3.2%). Epidemiological evidence suggest that MAV affects more than 1% of the general population, about 10% of patients suffering from dizziness and at least 9% of patients in migraine clinics [22]. Possible pathogenic links have not been established yet [23].

In our study, 28.8% of patients had BPPV that is the most common cause of true vertigo with vestibular origin. Other studies show that BPPV is the most common cause for recurrent vertigo and is caused by movement of free-floating otoliths in the semicircular canals (canalithiasis) or otoliths that have adhered to the cupula (cupulolithiasis) [24]. Six (3.20%) cases had the AC-BPPV and 181 (96.79%) cases had the PC-BPPV. In general, PC-BPPV can be seen in 80–90% of the cases, while HC-BPPV, including both canalolithiasis and cupulolithiasis, happens in 10–20% of the patients. AC-BPPV is the rarest form with an estimated frequency of 1–2% [25]. In this study, there was not any HC-BPPV among referred subjects.

In the present study, 179 (95.72%) subjects had canalithiasis BPPV and 8 (4.27%) had cupulolithiasis and 92% of the patients were treated only with one maneuver and 8% were treated with two maneuvers. In the present study, there were two cases of recurrent BPPV in a one-year period. The reason for recurrence in both cases was probably related to heavy gym exercises especially weightlifting. They are symptom-free after the third treatment and changing the gym training plan. Studies show that Epley maneuver usually provides an immediate treatment of BPPV symptoms by removing the otoliths from the semicircular canal into the vestibule [24]. Successful treatment rate for Epley maneuver is about 75.9–95% [26].

Conclusion

In conclusion, there is a high prevalence of vertigo, imbalance, and dizziness among patients referring to ENT department. Vestibular abnormalities are the relatively common causes of the symptoms and need special attention. Various problems can lead to vertigo, dizziness, and imbalance. Therefore, careful history taking, teamwork, and full physiologic evaluations are necessary to differentiate underlying cause and execute appropriate treatment.

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Conflict of interest

The authors declare that they have no conflict of interest.

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