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Dizziness in the Emergency Department: Insights and Epidemiological Data – a Population Based Study

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ABSTRACT

Background: *Dizziness is a commonly referred symptom in emergency departments (EDs). The aim of this study is to describe the epidemiology of dizziness included acute vestibular syndrome (AVS) in the ED of the University Hospital of Ioannina, Grecce, during a six-month period.*

Methods: *A total of 60 patients presenting with dizziness to the ED of our hospital during a short period of six months in 2021 were identified. Data were obtained through retrospective and prospective review of medical records. Statistical analysis was based on IBM-SPSS Statistics 26.0.*

Results: *Among the 60 patients, 16.67% received the diagnosis of cerebellar stroke, 3.33% Meniere disease, 16.67% vestibular neuritis, 20% benign paroxysmal positional vertigo, 3.33% cardiovascular disease, and 1.67% had a neurological disease. Finally, 35% of patients left the ED undiagnosed.*

Conclusions: *Benign paroxysmal positional vertigo was found to be the most common cause of dizziness in the ED, followed by cerebellar stroke and vestibular neuritis. A detailed neurological examination is recommended for the diagnosis of dizziness in the ED. Our data confirm the findings of previous studies in the GreeK population of patients presenting with dizziness to the ED of our hospital.*

Keywords: vertigo, dizziness, acute vestibular syndrome, emergency department, stroke.

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INTRODUCTION

Dizziness is a commonly reported symptom in Emergency Departments (EDs). There is a wide spectrum of causes in dizzy patients, including mainly benign diseases but also serious underlying conditions such as cerebrovascular diseases, associated with significant morbidity and mortality. Otovestibular, cardiovascular, neurological, metabolic, myoskeletal, psychiatric and infectious conditions are some of the most commonly encountered diseases in patients presenting with dizziness to the ED (1-4). The acute vestibular syndrome (AVS) is produced through an injury to either peripheral or central vestibular structures. The clinical presentation of a patient with AVS consists of vertigo, spontaneous nystagmus, nausea and vomiting, postural instability. As infraction and hemorrhage of the inferior cerebellum may simulate vestibular neuritis, it is important to recognize a stroke. The produced cerebellar swelling may lead to brain-stem compression even death if not treated immediately through neurosurgical intervention (5-8). Infarction of the inferior cerebellum may be caused by occlusion of the posterior or anterior inferior cerebellar artery due to embolism or atherosclerotic stenosis. The peripheral vestibular system includes the vestibular labyrinth that contains the sensory receptors for balance, and the vestibular nerve. A unilateral disorder that causes an imbalance between the right and left vestibular afferents leads to severe vertigo. The cerebellum receives projections from the vestibular labyrinth, vestibular nerve and brainstem vestibular nuclei, and it is involved in the visual suppression of vestibulo-ocular responses, including the nystagmus caused by acute, unilateral, peripheral vestibular dysfunction. The internal auditory artery, which is usually a branch of the anterior inferior cerebellar artery (AICA), supplies the vestibular and auditory labyrinth. The posterior and anterior cerebellar arteries provide the blood supply to the inferior cerebellum and the parts of the cerebellum most closely related to the vestibular system (8, 9).

Vertigo refers to an illusion of movement and remains the characteristic symptom of vestibular dysfunction. It is typically rotational, that may indicate a disease of the semicircular canals or their central connections. Vertigo can also be an illusion of tilting to one side that may occur in disorders affecting the otolithic organs or their projections. The dizzy patient has a feeling of imbalance during standing or walking. Acute vertigo is usually accompanied by nausea and vomiting. The time course, duration, and recurrence of the illusion of movement are diagnostic clinical features that help doctors making the final diagnosis. The type of nystagmus, severity of postural instability, and presence or absence of additional neurologic signs are the main distinguishing factors. Acute unilateral disorders of the peripheral vestibular labyrinth or nerve cause spontaneous nystagmus that continues in the same direction when the direction of gaze changes. The direction of nystagmus is typically horizontal and follows the Alexander's law. The velocity of the slow phase of peripheral vestibular nystagmus is attenuated by visual fixation and increased by removing fixation. Acute central vestibular disorders may cause spontaneous nystagmus that changes its direction with a change in the direction of gaze (gaze-evoked nystagmus). Except the characteristics of nystagmus, the evaluation and management of acute vestibular syndrome and dizziness requires the question whether the patient's history includes risk factors for stroke and findings on examination are consistent with a central disorder. Brain imaging is recommended when the examination of a patient with AVS does not end up to the typical peripheral vestibular disorder and when symptom onset is sudden in a patient with prominent risk factors for stroke. Brain imaging is not necessary if there is substantial improvement in 48 hours and the syndrome is consistent with a vestibular neuritis. If suggested magnetic resonance imaging and angiography are not available, a computed tomography (CT) of the brain should be performed, with fine cuts through the cerebellum and clear visualization of fourth ventricle, to rule out a cerebellar hemorrhage. Head-Impulse, Nystagmus, Test-of-Skew (HINTS), which appears more sensitive for stroke than early MRI in AVS, is proposed as a diagnostic tool for patients presenting with AVS in the ED (5, 10-19).

The aim of this study is to analyze and explain epidemiological data about dizziness in the Emergency Department of a Western Greek hospital during a six-month period. ❑

MATERIAL AND METHODS

Participants and data collection

Sixty (60) patients aged between 14 and 90 years old were included in the present study. All pf them were patients who presented with reported dizziness to the ED of the University Hospital of Ioannina, Greece. Each subject was informed about the research purposes and provided a written consent to participate. Data were obtained through retrospective and prospective review of medical records during a six-month period between June 2021 and November 2021. For each participant, a medical history and a clinical examination was performed. If it was indicated, a brain CT was performed, as magnetic resonance imaging and angiography were not available in the ED. Collected data were recorded in GI-CLINIC, an electronic data logger used in our hospital.

Patients' medical history

Patient demographics and habits were included in the medical history. The next question when a patient presented with dizziness to the ED was whether he/she had a medical history included risk factors for stroke such as hypertension, diabetes, dyslipidemia, smoking, diet, physical inactivity, infection, pollution, cardiovascular disorders. Previous stroke history or previous peripheral vestibular system disease play important role for the evaluation of a dizzy patient. A significant value given through medical history is the characteristics of vertigo, as perceived by the patient. Duration of vertigo may vary from minutes to days. Vestibular neuritis typically begins over a period of a few hours and then improves within days. Patients with Meniere's syndrome usually present with an isolated episode of severe vertigo lasts for hours and is followed by a sensation of dizziness for days. Infarction causes a vestibular syndrome that typically has an abrupt onset in patients with risk factors for stroke. A vertigo caused after rapid change in head position and lasts less than one minute, occasionally refers to benign paroxysmal positional vertigo (BPPV). Multiple sclerosis may also produce a vestibular syndrome that lasts hours to days. Associated symptoms can help in differential diagnosis and give useful information through medical history. Acute vertigo from a brain-stem stroke is usually accompanied by additional evidence of vertebrobasilar ischemia such as diplopia, dysarthria, dysphagia, reduced vision, and focal sensory or motor deficits. A peripheral vestibular lesion may be accompanied by hearing loss if the cochlear labyrinth or the cochlear nerve is also involved.

Clinical and paraclinical examination

Every patient who presented to the ED with dizziness was examined by an ENT doctor, a neurologist and an internal medicine doctor. In case of associated reported hearing loss or tinnitus, every patient underwent a micro-otoscopy and a hearing evaluation using a 512-Hertz tuning folk as well as an audiogram if needed. HINTS was prepared for every dizzy patient. The direction of nystagmus was evaluated in all patients. A spontaneous nystagmus that continues in the same direction when the direction of gaze changes, with and without visual fixation, is indicative for a peripheral vestibular labyrinth or nerve disorder. Spontaneous nystagmus that changes its direction with a change in the direction of gaze (gaze-evoked nystagmus), purely vertical nystagmus and purely torsional nystagmus are indicative for acute central vestibular disorders. Head impulse test (HIT) and skew deviation test (SDT) were additionally used for the determination of nystagmus. Dix-Hallpike test was used, as the standard procedure for the diagnosis of BPPV. Romberg test and Unterberger stepping test were used for balance examination. Falling or tilting to the side opposite to the direction of the fast phase of nystagmus is a characteristic finding in a peripheral vestibular disorder, while in patients with acute cerebella stroke the direction of tilting or falling with the Romberg test may be variable and they are often unable to walk without falling. The presence of cranial nerve signs was evaluated. Sensory changes, motor weakness, prominent dysmetria or abnormal reflexes suggest a central process.

Paraclinical examination included an audiogram for the evaluation of hearing loss when there were indications for otovestibular disorder. A CT brain imaging was performed when there were cranial nerve signs and a suspicion of central vestibular injury.

Statistical analysis

For the statistical analysis we used IBM-SPSS Statistics 26.0.

We calculated the percentages of different gender in the total sample as well as the percentages of patients without medical history and of those with a medical history including hypertension, diabetes, dyslipidemia, stroke, and BPPV. The mean age of the total sample was counted. We also counted the percentages of patients with specific reported symptoms from their history. Specifically, we calculated the percentages of patients with and without rotational type dizziness, with and without frailness, with sudden inception of symptoms, gradual inception of symptoms, with and without tinnitus, with and without hearing loss, with duration of symptoms from both minutes to hours and hours to days. We counted the percentages of patients with specific clinical findings through clinical examination: with normal otoscopy, pathological otoscopy with vertical nystagmus, with spontaneous horizontal nystagmus and without nystagmus, with unidirectional and multidirectional nystagmus, first-degree, second-degree and with third-degree vestibular nystagmus, provoked nystagmus, spontaneous nystagmus. We also calculated the percentage of patients with positive and negative HIT, positive and negative SDT, positive and negative Romberg test, positive and negative Unterberger test, positive Dix-Halpike test and horizontal semicircular canal, positive Dix-Halpike test and posterior semicircular canal, positive Dix-Halpike test and anterior semicircular canal, hearing loss, normal audiogram, and CT positive and negative for stroke. Finally, we counted the percentages of patients with the following diagnosis: acute vestibular syndrome, stroke, Meniere disease, vestibular neuritis, BPPV, cardiovascular disease, neurological disease, vestibular migraine, undiagnosed. ❑

RESULTS

This study included 60 dizzy patients who were examined in the ED of our hospital during a six-month period. In the total sample, 22 (36.67%) patients were males and 38 (63.33%) females (Figure 1). Their mean age was 54.73 years (SD±18.81). Among the 60 patients, 24 (40%) had no medical history, 20 (33.33%) had hypertension, eight (13.33%) diabetes, 20 (33.33%) dyslipidemia, two (3.33%) had a stroke medical history and two (8.33%) BPPV (Table 1).

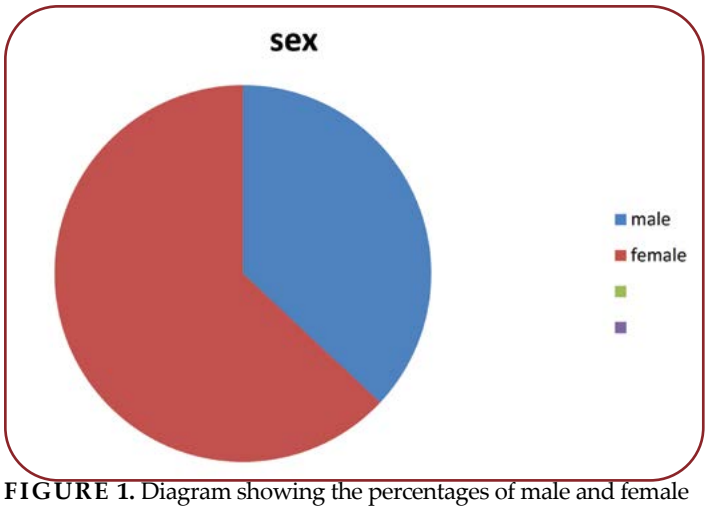

FIGURE 1. Diagram showing the percentages of male and female subjects in the total sample

After analyzing the prevalence of reported symptoms, we found an average number of 44 (75%) patients with reported rotational type dizziness, 13 (21.67%) without rotational type of dizziness, 21 (35%) with frailness, 23 (38.33%) without frailness, 35 (58.33%) with sudden in-

Comorbidities	Patients (n=60)	Percentages (%)
No medical history	24	40
BPPV	5	8.33
Stroke	2	3.33
Hypertension	20	33.33
Diabetes	8	13.33
Dyslipidemia	20	33.33

TABLE 1. Number of patients with comorbidities through the medical history

TABLE 2. Number of patients with reported symptoms

Reported symptoms	Patients (n=60)	Percentages (%)
Rotational type dizziness	44	75
No rotational type dizziness	13	21.67
Frailness	21	35
No frailness	23	38.33
Sudden inception of symptoms	35	58.33
Gradual inception of symptoms	25	41.67
Tinnitus	7	11.67
No tinnitus	53	88.33
Hearing loss	3	5
No hearing loss	54	90
Duration of symptoms: minutes to hours	34	56.67
Duration of symptoms: hours to days	26	34.33

TABLE 3. Number of patients with clinical findings through clinical and paraclinical examination

Clinical and paraclinical findings	Patients (=60)	Percentages (%)
Otoscopy normal	59	98.33
Otoscopy abnormal	1	1.67
Vertical nystagmus	3	5
Horizontal spontaneous nystagmus	32	53.33
Absence of spontaneous nystagmus	27	45
Unidirectional nystagmus	27	45
Multidirectional nystagmus	5	8.33
First-degree nystagmus	8	13.33
Second-degree nystagmus	5	8.33
Third-degree nystagmus	1	1.67
Provoked nystagmus	10	16.67
Spontaneous nystagmus	18	30
Positive HIT	7	11.67
Negative HIT	43	71.67
Positive SDT	4	6.67
Negative SDT	43	76.67
Positive Romberg test	13	21.67
Negative Romberg test	39	65
Positive Unterberger test	18	30
Negative Unterberger test	39	65
Dix-Halpike test-horizontal semicircular canal	3	5
Dix-Halpike test-posterior semicircular canal	9	15
Dix-Halpike test-anterior semicircular canal	0	0
Normal audiogram	19	31.67
Abnormal audiogram	2	3.33
No audiogram	36	60
CT positive for stroke	9	15
CT negative for stroke	22	36.67
No CT	17	28.33

TABLE 4. Epidemiology of dizziness in the ED through specific differential diagnosis

Diagnosis	Patients (n=60)	Percentages (%)
Stroke	10	16.67
BPPV	12	20
Meniere disease	2	3.33
Vestibular neuritis	10	16.67
Neurological disease	1	1,67
Cardiovascular disease	2	3.33
Undiagnosed	21	35

ception of symptoms, 25 (41.67%) with gradual inception of symptoms, seven (11.67%) with tinnitus, 53 (88.33%) without tinnitus, three (5%) with reported hearing loss, and 54 (90%) without reported hearing loss (Table 2).

After analyzing the prevalence of reported symptoms, we found an average number of 59 (98.33%) patients with normal otoscopy, one (1.67%) patient with pathological otoscopy, three (5%) patients with vertical nystagmus, 32 (53.33%) with horizontal spontaneous nystagmus, 27 (45%) without spontaneous nystagmus, 27 (45%) with unidirectional nystagmus, five (8.33%) with multidirectional nystagmus, eight (13.33%) with first-degree vestibular nystagmus, five (8.33%) with second- degree vestibular nystagmus, one (1.67%) patient with third-degree vestibular nystagmus, 10 (16.67%) patients with provoked nystagmus, and 18 (30%) with spontaneous nystagmus (Table 3).

After analyzing the prevalence of reported symptoms, we found an average number of seven (11.67%) patients with positive HIT, 43 (71.67%) with negative HIT, four (6.67%) with positive SDT, 43 (76.67%) with negative SDT, 13 (21.67%) with positive Romberg test, 39 (65%) with negative Romberg test, 18 (30%) with positive Unterberger test, 39 (65%) with negative Unterberger test, three (5%) with positive Dix-Halpike test and horizontal semicircular canal, nine (15%) with positive Dix-Halpike test and posterior semicircular canal, 0 (0%) with positive Dix-Halpike test and anterior semicircular canal, two (3.33%) with hearing loss in audiogram, 19 (31.67%) with normal audiogram, while 36 (60%) did not need to undergo an audiogram. There was an average number of nine (15%) patients with CT positive for stroke and 22 (36.67%) with CT negative for stroke, while 17 (28.33%) patients did not need to undergo a CT scanning (Table 3).

Finally, we calculated the following percentages of patients with specific diagnosis: 10 (16.67%) patients were diagnosed with a cerebellar stroke, two (3.33%) had Meniere disease, 10 (16.67%) vestibular neuritis, 12 (20%) BPPV, two (3.33%) cardiovascular disease, and one (1.67%) patient had neurological disease. Finally, 20 (35%) patients left the ED undiagnosed (Table 4). ❑

DISCUSSION

Dizziness ranks among the most commonly encountered complaints in medicine, affec-

ting 15–35% of the general population at some point in their lives. According to Dieterich and Brandt (1999) and Neuhauser *et al* (2001), BPPV is the most common cause of vertigo and vertigo migraine (VM) the second most common cause of recurrent vertigo after BPPV. In a British general practice study, vestibular neuritis was reported to be the second most common dizziness diagnosis after BPPV. Our outcomes provide support to these previous researches, as the most common cause of dizziness in the ED in our sample was BPPV, followed by vestibular neuritis and stroke. Meniere disease (MD) accounts for 3–11% of diagnoses in dizziness clinics but it is only rarely encountered in the general population. An estimated annual incidence rate of 15/100 000 and a point prevalence of 218/100 000 population describe the epidemiology of MD (20-25). We came to similar conclusions, as the percentage of patients with MD was small relatively to the total sample.

In several large-scale studies on dizziness patients from EDs (22, 26) who did not require a neurological examination in the ED, 50–75% of patients were discharged from the ED without a definite diagnosis. In contrast, Royl et al investigated neurological consultations in the ED (2). Another study found that the risk of being discharged from the ED despite the presence of an acute stroke (diagnosed on a second ED visit) was increased in patients who were not evaluated by a neurologist on their first presentation to an ED. So, the neurological evaluation of a dizzy patient in the ED has a primary role and is followed as a treatment protocol in our hospital. We observed that, despite the fact that only one patient was diagnosed with neurological disease, specifically with multiple sclerosis, neurologists in the ED isolated cerebellar stroke in 10 patients who had presented with clinical features suggesting vestibular vertigo. Furthermore, a study on 240 consecutive cases of isolated cerebellar infarction showed that 10.4% of those patients presented with clinical features suggesting vestibular neuronitis. So, an early recognition of cases of so called pseudovestibular neuronitis by detailed neurological examination and MRI is recommended (27).

Sample size may have been a limitation in the present study. It was not feasible to recruit more participants due to COVID-19 restriction laws. Taking into account these effect size limitations, the results of this study are good but a bigger number of participants would increase their validity. ❑

CONCLUSIONS

Through data collection in the present population based study we aimed to estimate the epidemiology of dizziness in the ED of our hospital. We noticed that, despite the fact that a dizzy patient is always examined by an otorhinolaryngologist, a neurologist and an internal medicine doctor in our emergency room, the percentage of patients diagnosed with a cerebellar stroke was high in relation to the total sample. We have also noticed that the majority of patients were discharged from the ED without a definite diagnosis. A detailed neurological examination and brain imaging is highly recommended if there is no substantial improvement of symptoms in 48 hours, in order to prevent a central vestibular injury, even if the clinical examination in the ED raises no suspicion of it. ❑

Conflicts of interests: none declared.
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