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**ARAŞTIRMA / RESEARCH**

# Analysis of the patients who applied to emergency medicine with dizziness

## Acil servise başvuran baş dönmesi olan hastaların değerlendirilmesi

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**Abstract**

**Purpose:** In this study, it was aimed to evaluate the demographic characteristics of the patients presenting to the emergency room with dizziness, the etiologic causes leading to the complaints and the laboratory findings as well as the prognosis.

**Material and Methods:** The file data of a total of 5,056 patients admitted to the Adana Numune Training and Research Hospital Emergency Medicine Clinic between January 2013 and January 2015 were reviewed retrospectively. Mean, standard deviation, median, lowest, highest, frequency and ratio values were used in the descriptive statistics of the data. SPSS 22.0 program was used in the analyses.

**Results:** Two thousand nine hundered four of the patients were female (57.4%), 2,152 were male (42.6%) and the average age was 53.6 (± 18.2) years. It was determined that the complaints were common in the population between the ages of 51-70, and peripheric peripheral vertigo (n: 4.130, 81.6%), systemic causes (n: 664, 13.1%), and central vertigo (n: 249, 4.9%) were the most prevalent etiologies, respectively. 83% of the patients were discharged following necessary procedures in the emergency room.

**Conclusion:** Dizziness is one of the most important symptoms that brings patients to the emergency services. While many etiologies play a part in it, it is determined that neurological and cardiological evaluations must be done, annd patients can mainly be managed in emergency services by simple maneuvering or medical treatment options.

**Keywords:** Emergency medicine, dizziness, vertigo

**Öz**

**Amaç:** Bu çalışmanın amacı, acil servise baş dönmesi olan hastaların demografik özelliklerini, şikayete neden olan etyolojik nedenleri, laboratuvar bulgularını ve prognozu değerlendirmektir.

**Gereç ve Yöntem:** Adana Numune Eğitim ve Araştırma Hastanesi Acil Tıp Kliniğine Ocak 2013-Ocak 2015 tarihleri arasında başvuran toplam 5.056 hastanın dosya verileri retrospektif olarak incelendi. Verilerin tanımlayıcı istatistiklerinde ortalama, standart sapma, ortanca, en düşük, en yüksek, frekans ve oran değerleri kullanılmıştır.

**Bulgular:** İki bin dokuz yüz dört hasta (% 57.4) kadın, 2.152'si erkek (% 42.6) ve yaş ortalaması 53.6 (± 18.2) idi. Şikâyetlerin 51-70 yaş arası periferik periferik vertigo (n: 4.130,% 81.6), sistemik nedenler (n: 664,% 13.1) ve santral vertigo (n: 249) arasında yaygın olduğu saptanmıştır. En sık görülen etiyolojiler ise% 4.9'du. Acil serviste gerekli prosedürleri takiben hastaların% 83'ünün taburcu olduğu tespit edildi.

**Sonuç:** Baş dönmesi, hastaları acil servise getiren en önemli belirtilerden biridir. Pek çok etiyolojinin bir parçası olmasına rağmen, nörolojik ve kardiyolojik değerlendirmelerin yapılması gerektiği belirlenir. Hastalar genellikle basit manevra veya tıbbi tedavi seçenekleri ile acil servislerde yönetilebilir.

**Anahtar kelimeler**: acil servis,vertigo,baş dönmesi

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## INTRODUCTION

Dizziness is a common term used to describe vertigo, presyncope and imbalance, each of which has a large number of etiologies. Approximately 20-30% of the general population has experienced this symptom during their lifetime and is one of the reasons for frequent referrals to emergency services, internal medical departments and otolaryngology polyclinics. As a matter of fact, it has been reported that it affects more than 90 million people in America, the most common complaint in people of 75 years of age or older1. It is often difficult for a physician to illuminate the etiologic factor that causes the symptom that the patient has expressed and to treat it in this direction. Because multifactorial causes such as vestibular system related peripheral reasons, central nervous system diseases, psychiatric disorders, cardiologic factors, hematologic disorders, endocrinologic reasons such as hypoglycaemia, medicines and substances play a role in the etiology.

In this study, patients who presented to emergency services with a dizziness complaint were evaluated in terms of their demographic features, laboratory and radiological findings, and the etiologic features that caused the complaint.

## MATERIAL AND METHODS

Ethics committee approval was obtained from the Ethics Committee of Adana Numune Research and Training Hospital. The file data of a total of 5,056 patients admitted to the Adana Numune Training and Research Hospital Emergency Medicine Clinic between January 2013 and January 2015 have been examined retrospectively. Inclusion criteria of the study were; being 18 years of age or older, having a folder that includes demographic information, laboratory and radiological results in addition to having a determined disease etiology; the exclusion criteria was; being younger than 18 years old, not having access to the patient folder and the folder having missing information.

### Parameters

The patient's history, familial history, presence of drug and substance use, physical and neurological examination findings were reviewed. The diagnosis and etiological reason(s) discovered through examinations such as complete blood count and biochemical panel conducted for the etiologic diagnosis, electrocardiography (ECG), neuroimaging methods such as computerized brain tomography and cerebral magnetic resonance imaging in case of indication from the physician, other examination methods such as carotid / vertebral doppler examination and endoscopy, if present, were recorded. Patients were divided into four main groups; peripheral vertigo, vertigo due to central causes, and vertigo due to psychogenic and systemic causes.

### Statistical analysis

Mean, standard deviation, median, lowest, highest, frequency and ratio values were used in the descriptive statistics of the data. SPSS 22.0 program was used in the analyses.

## RESULTS

A total of 5,056 patients over 18 years of age were included in the study. 2,904 of the patients were female (57.4%), 2,152 were male (42.6%). The average age of the patients was 53.6 ± 18.2) years. Patients were divided into 9 subgroups according to age groups as indicated in Table 1.

**Table 1. Age and sex distribution of patients**

| | **Min-Max** | **Median** | **Mean±s.d. /n-%** | |
|---|---|---|---|---|
| Age | 18 -103 | 55 | 53.6 ± 18.26 | |
| Age Group | 18-30 | | 725 | 14.3% |
| | 31-40 | | 633 | 12.5% |
| | 41-50 | | 752 | 14.9% |
| | 51-60 | | 995 | 19.7% |
| | 61-70 | | 940 | 18.6% |
| | 71-80 | | 699 | 13.8% |
| | 81-90 | | 283 | 5.6% |
| | ≥ 91 | | 29 | 0.6% |
| Sex | Male | | 2.152 | 42.6% |
| | Female | | 2.904 | 57.4% |

When the histories of the patients were examined, it was determined that they had vascular risk factors such as hypertension (HT) (18.5%), diabetes mellitus (DM) (9.5%), coronary artery disease (9.4%) and stroke (3.2%) as well as asthma-chronic obstructive pulmonary disease (2.6%) in order of frequency. This was followed by other neuropsychiatric disorders and chronic kidney disorders with less frequency (Table 2).

**Table 2. Additional disease distribution (n, %)**

| | | | | |
|---|---|---|---|---|
| Additional Disease | | None | 3.635 | 71.9% |
| | | Present | 1.421 | 28.1% |
| | | | | |
| | | Hypertension | 936 | 18.5% |
| | | Coronary Artery Disease | 475 | 9.4% |
| | | Diabetes Mellitus | 482 | 9.5% |
| | | Asthma-COPD* | 133 | 2.6% |
| | | Malignancy | 42 | 0.8% |
| | | Cerebro-vascular Event | 164 | 3.2% |
| | | Chronic Kidney Disease/Failure | 53 | 1.0% |
| | Parkinson/Dementia/Alzheimer | | 28 | 0.6% |
| | Depression Anxiety Psichosis | | 93 | 1.8% |
| | | Other | 253 | 5.0% |

*Chronic Obstructive Pulmonary Dissease.

Only 1,329 of 1,432 patients use medications such as anti-ischemic, psychoanaleptic and vestibulosuppressants, antihypertensives, antidiabetics and antidepressant-antipsychotic-neuroleptics drugs in association with additional health problems (Table 3).

ST and T wave changes (6,5%), left bundle branch block (2,8%), sinus tachycardia (2,1%), supraventricular tachycardia (1,2%), tachyarrhythmia (1.2%) such as atrial fibrillation, right bundle branch block (0.8%) and sinus bradycardia (0.5%) were detected in the ECG of the patients when they were first admitted to emergency services (Table 4).

**Table 3. Distribution of the medication patients use (n, %)**

| | | | | |
|---|---|---|---|---|
| Medication used | | Yes | 1.329 | 26.3% |
| | | No | 3.727 | 73.7% |
| | | | | |
| Antiischemic -Psychanaleptic -Vestibulosupressant | | | 950 | 18.8% |
| | | ACE* Inhibitor/ARB** | 729 | 14.4% |
| | | Diuretic | 593 | 11.7% |
| | | Beta-Blocker | 481 | 9.5% |
| | | Oral Antidiabetic | 341 | 6.7% |
| | | Calsium Channel Blocker | 329 | 6.5% |
| | | Insulin | 210 | 4.2% |
| | Antidepressant-Antipsychotic-Neuroleptic | | 131 | 2.6% |
| | | Antibiotic | 112 | 2.2% |
| | | Nitrate | 88 | 1.7% |
| | | Digital | 21 | 0.4% |
| | | Anti-arythmic | 11 | 0.2% |

*****ACE: Angiotensin Converter Enzyme; **ARB: Angiotensin Receptor Blocker

**Table 4. Electrocardiography findings of patients presenting with dizziness complaint (n, %)**

| | | | |
|---|---|---|---|
| | Normal Sinus Rhytm | 4.361 | 86.3 |
| | ST and T Wave Changes | 330 | 6.5 |
| | Left Branch Block | 140 | 2.8 |
| | Sinus Tachycardia | 106 | 2.1 |
| ECG | Tachyarrythmia (SVT*-AF**) | 62 | 1.2 |
| | Right Branch Block | 42 | 0.8 |
| | Sinus Bradycardia | 26 | 0.5 |
| | Other | 12 | 0.2 |
| | A-V Complete Block | 6 | 0.1 |

*SVT: Supraventricular Tachycardia; **AF: Atrial Fibrillation

The mean hemoglobin values of the patients were 13.0 ± 2.9 g / dl (3.4-18.8 g / dl) and the mean hematocrit values were 37.9 ± 8.0 (11.5-60.3). Gastrointestinal bleeding was detected in 24 (0.5%) of the patients who had anemia and endoscopy was performed for 19. Gastrointestinal bleeding was detected in 7 patients (0.1%).

**Table 5. Distribution of consultation requested clinics (n,%)**

| | | | |
|---|---|---|---|
| Consultation asked for in the Emergency Room | Yes | 570 | 11.3 |
| | No | 4.500 | 89.0 |
| | Internal Medicine | 174 | 3.4 |
| | Neurology | 170 | 3.3 |
| Requested clinics | Cardiology | 127 | 2.5 |
| | Ear-Nose-Throat | 46 | 0.9 |
| | Brain Surgery | 35 | 0.7 |
| | Other | 18 | 0.4 |

Brain CT was performed in 2.922 patients (57.8%) and cerebral MRI was performed in 73 patients (1.4%) for dizziness due to central causes etiology, this ratio was found to be 59.2% of the patients. A consultant physician's opinion was not requested in a large percentage such as 89% of the patients, whereas 11,3% of the patients were consulted to the clinicians of Internal Medicine, Neurology, Cardiology, Otorhinolaryngology, Brain Surgery, respectively (Table 5). The patients were divided into 4 diagnosis groups of peripheral vertigo, vertigo due to central causes, and vertigo due to psychogenic and systemic causes, based on the data acquired through patient history, neurological examination findings, conducted laboratory tests and imaging studies. The most common cause for the complaint of dizziness was found to be peripheral causes at a rate of 81.7%. This was followed by vertigo due to systemic causes, vertigo due to central causes and with a very small ratio, psychogenic causes (Table 6).

When the patients were evaluated from a diagnostic perspective, they were found to have 81.7% vestibular, 4,8% endocrine-metabolic-nutrition and immunodeficiency, 4.5% neurological and 4,5% cardiovascular diseases as their etiology, and gastrointestinal (GIS) bleeding (0,5%), infectious causes (0.4%), head trauma (0.4%), psychiatric disorders (0.3%) and drug side effects were also present, albeit much less frequent (Table 7).

**Table 6. Patient distribution based on diagnosis groups**

| | n | % |
|---|---|---|
| Peripheral Vertigo | 4130 | 81.7 |
| CentralVertigo | 249 | 4.9 |
| Systemic Causes | 664 | 13.1 |
| Psychiatric Disorder | 13 | 0.3 |

When outcome of the patients from the hospital ward or intensive care unit they were admitted to is examined, 340 (85.6%) patients were discharged, 27 (6.8%) patients left the hospital voluntarily, 22 (5.5%) patients were exitus, 7(%1.8) patients were referred to another health institution because of a lack of space, and 1 (0.3%) patient left the hospital without permission. Four of the exitus patients were found to have died due to cardiovascular disease, 8 due to endocrine, metabolic and immunodeficiency, 7 due to stroke and 3 due to malignancy.

**Table 7. Etiological distribution of factors causing dizziness**

| | n | % |
|---|---|---|
| Diagnosis | | |
| Vestibular Disease | 4.130 | 81.7 |
| Endocrine, Metabolic, Nutrition ve Immune Disorders | 244 | 4.8 |
| Neurological Diseases | 23 | 4.5 |
| Migraneous Vertigo | 83 | 36.0 |
| Stroke<br>Ischemic Stroke | 68 | 29.5 |
| Transient Ischemic Attach | 23 | 10.0 |
| Hemoraggic Stroke | 14 | 6.0 |
| Subarachnoid bleeding | 9 | 3.9 |
| Intraserebral Mass | 20 | 8.6 |
| Subdural bleeding | 6 | 2.6 |
| Sinus vein thrombosis | 2 | 0.8 |
| Epilepsy | 2 | 0.8 |
| Hypertensive encephalopathy | 1 | 0.4 |
| Cardiovascular Diseases | 225 | 4.5 |
| Cardiac Syncope | 54 | 1.1 |
| Hypertension | 52 | 1.0 |
| Disrythmia | 38 | 0.8 |
| Gastrointestinal Bleeding | 24 | 0.5 |
| Infectious Diseases | 19 | 0.4 |
| Head Trauma | 19 | 0.4 |
| Psychiatric Diseases | 13 | 0.3 |
| Medicine side effects | 8 | 0.2 |

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**Table 8. Distribution to wards and durations of stay of hospitalised patients**

| | | | n | % |
|---|---|---|---|---|
| | No | | 4896 | 96.8 |
| | Yes | | 160 | 3.2 |
| | Coronary Intensive Care | | 58 | 1.1 |
| Admitted Intensive Care | Internal Medicine Intensive Care | | 38 | 0.8 |
| | Neurology Intensive Care | | 35 | 0.7 |
| | | | | |
| | Brain Surgery Intensive Care | | 23 | 0.5 |
| | General Surgery Intensive Care | | 4 | 0.1 |
| | Critical Intensive Care | | 2 | 0.0 |
| | No | | 4817 | 95.3 |
| | Yes | | 239 | 4.7 |
| | Neurology | | 75 | 1.5 |
| | Internal Medicine | | 61 | 1.2 |
| | Ear-Nose-Throat | | 31 | 0.6 |
| | Cardiology | | 17 | 0.3 |
| Admitted Ward | Nephrology | | 14 | 0.3 |
| | Brain and Nerve Surgery | | 12 | 0.2 |
| | Gastroenterology | | 10 | 0.2 |
| | Other | | 19 | 0.4 |
| | Min-Max | Median | Mean±s.d. | |
| Duration of stay (day) | 1.0-30.0 | 4.0 | 5.0± 4.5 | |

## DISCUSSION

Complaints of dizziness are one of the most common complaints affecting approximately 20-30% of the population and are known to account for 3.6% of the annual rate of admission to emergency services[2,3]. It has been suggested that dizziness constitutes 3% of all primary care and emergency service admissions of patients 25-years-old or older[4,5].

It could be hard to determine the reason that is causing dizziness because the symptoms are usually non-specific. This situation causes the differential diagnosis list to expand. However, a few simple questions and physical examination tests along with a detailed history can help narrow down potential diagnoses[6]. Thus, prevention of unnecessary examinations, increase of quality of life with correct diagnosis and treatment, prevention of loss of work power and avoiding wasting time in the diagnosis of underlying cardiovascular or neurological diseases are ensured[7,8].

Dizziness complaint increases with age. The reason is that vascular risk factors that may play a role in etiology and the incidence of systemic diseases increases with age. Narita and colleagues reported that 47.3% of patients were 65 years of age or older in their series of 242 cases[9]. Kroenke and colleagues reported that the average age of 185 cases was 62 years, while Arya and colleagues reported as 52.6 years[7,10]. In our study, the mean age of the patients was 53.6 ± 18.26 years and it was determined that 51-70 age group was the most frequent group to approach emergency services with complaints of dizziness. Dizziness is more common in women than in men and this rate increases with age. As a matter of fact, studies have suggested that 58-66% of the patients are women[10-12,15]. Katsarkas et al. found the ratio of female patients as 62.8% in their study of 1194 cases with patients over 70 years of age, and Maarsingh et al. found the ratio of female patients as 74% in 417 cases of patients 65 years and older[13,14]. The rate of female patients in our series was determined as 57.4% and was found to be in accordance with the literature data.

As mentioned above, dizziness complaint is a symptom that increases with age and in the research conducted on this issue it is seen that the most common diseases accompanying it are hypertension, coronary artery disease, hyperlipidemia and diabetes mellitus[11,15-17]. In our study, we most frequently found the presence of hypertension, diabetes and

coronary artery disease, respectively, 1421 patients (28.1%).

Medicine used by the patient for various reasons should also be closely monitored and the side effects and interactions of the drug should be known. The feeling of vertigo/dizziness, which is seen as a side effect of some medicines, accounts for 5% of all reports coming in 2012 to the Pharmacovigilance Center in Italy[20]. These drugs include aminoglycoside and macrolide group antibiotics, antimalarial drugs, loop diuretics, plastic based chemotherapeutic agents, some nonsteroidal antiinflammatory drugs, antiepileptics such as carbamazepine and lamotrigine, anesthetics, antidepressants (seratonin reuptake inhibitors - paroxetine and sertraline) and antipsychotics, antidiabetics, proton pump inhibitors like pantoprazole, oral contraceptives,cardiovascular medications especially antihypertensive drugs including combinations of ARB + CCB and ARB + diuretics[18-25]. It was determined that 26.3% of the patients who were included in the study were using drugs for different reasons, but it was determined that 8 had a feeling of vertigo/dizziness due to them.

Cardiac causes are one of the etiologic agents that should be considered in patients with dizziness or risk factors for dizziness. It was determined that 2.6% of the cases admitted to the ER and evaluated as type 1 myocardial infarction approached emergency services with dizziness complaints[26]. Navi and colleagues found that in 16.4% of patients who approach emergency services with a dizziness complaint, ECG changes such as ST and T wave changes, atrial fibrillation / flatter and 2nd-3rd degree block was observed[11]. Dizziness can be a finding of myocardial infarction and/or arrythmia due to coronary artery disease. ECG, troponin and CK MB values may be indicative of this.

Another important etiological factor leading to dizziness is neurological diseases. A detailed neurological examination should be performed for each patient presenting with this symptom, and the patient should be evaluated by the neurologist when there is suspicion. Because many diseases affecting the central or peripheral nervous system may cause an individual to approach emergency services with a dizziness complaint. In our study, when we looked at which neurological disorders were causing this complaint, it was determined that migrainous vertigo was in the first place with a ratio of 1.6%. The prevalence of migrainous vertigo is 7% in dizziness clinics and 9% in migraine clinics[27,28]. In a meta-analysis study covering 1966-1996, cerebrovascular diseases were reported as an etiologic cause in 6% of dizziness patients [29]. This rate was found to be 4.9% in our study.

Non-indicated neuroimaging is unavoidable when the patient is not well evaluated. Kerber suggested an increase of 168% in 2004 compared with 1995 for CT / MRI methods used for the feeling of vertigo/dizziness[5]. Diffusion-weighted MRI has advantages in assessing acute stroke, even for less experienced physicians[30-31]. However, in the first few hours of ischemic stroke, the false negative rate of diffusion-weighted MRI may increase in patients with lesions of small size, especially those with brain stem or cerebellar lesions[32,33]. For this reason, if the physician is not vigilant about this possibility, the patients may receive a false diagnosis like peripheral vestibular disorder. In our study, 62.2% of the patients were diagnosed with neuroimaging. In our country, imaging methods such as CT and MRI are preferred because they are easily and quickly accessible in emergency services. In addition, it may lead to physicians preferrring these methods more often in order not to be a victim of malpractice.

Dizziness is a symptom that contains many etiologies within itself. Especially the emergency physician should not complicate this complaint that they can easily treat while quickly reviewing the causes that cause mortality and morbidity when encountering this group of patients.

**Yazar Katkıları:** Çalışma konsepti/Tasarımı: AA,SS; Veri toplama: MK; Veri analizi ve yorumlama: AA, MG; Yazı taslağı: AA; İçeriğin eleştirel incelenmesi: FK, SS; Son onay ve sorumluluk: MK, AA, MG, BŞA, SS, FK; Teknik ve malzeme desteği: -; Süpervizyon: AA; Fon sağlama (mevcut ise): yok.
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## REFERENCES


1. Thompson TL, Amedee R. Vertigo: a review of common peripheral and central vestibular disorders. Ochsner J. 2009;9:20-6.
2. Cappello M, di Blasi U, di Piazza L, Ducato G, Ferrara A, Franco S, et al. Dizziness and vertigo in a department of emergency medicine. Eur J Emerg Med. 1995;2:201-11.
3. Yardley L, Linda L. Treating dizziness with vestibular rehabilitation. British Medical Journal. 1994;308.6939:1252.
4. Sloane PD. Dizziness in primary care. J Fam Pract. 1989;29:33–8.
5. Kerber KA, Meurer WJ, West BT, Fendrick AM. Dizziness presentations in U.S. emergency departments, 1995–2004. Acad Emerg Med. 2008;15:744–50.
6. Post RE, Dickerson LM. Dizziness: A diagnostic approach. Am Fam Physician. 2010;82:361-8.
7. Kroenke K, Lucas CA, Rosenberg ML, Scherokman B, Herbers JE Jr, Wehrle PA, et al. Causes of persistent dizziness: a prospective study of 100 patients in ambulatory care. Ann Intern Med. 1992;117.11: 898-904.
8. Herr RD, Leslie Z, James JM. A directed approach to the dizzy patient. Ann Emerg Med. 1989;18.6:664-72.
9. Narita S, Kurose M, Kobayashi K Himi T. Study on 242 inpatients reporting vertigo and dizziness. Nippon Jibiinkoka Gakkai Kaiho. 2003;106:21-7.
10. Arya AK, Nunez DA. What proportion of patients referred to an otolaryngology vertigo clinic have an otological cause for their symptoms? J Laryngol Otol. 2008;122:145-9.
11. Navi BB, Kamel H, Shah MP, Grossman AW, Wong C, Poisson SN et al. Rate and predictors of serious neurologic causes of dizziness in the emergency department. Mayo Clin Proc. 2012;87:1080-8.
12. Uno A, Nagai M, Sakata Y, Moriwaki K, Kato T. Statistical observation of vertigo and dizziness patients. Nippon Jibiinkoka Gakkai Kaiho. 2001;104:1119–25.
13. Katsarkas A. Dizziness in aging: a retrospective study of 1194 cases. Otolaryngol Head Neck Surg. 1994;110:296-301.
14. Maarsingh OR, Stam H, van de Ven PM, van Schoor NM, Ridd MJ, van der Wouden JC. Predictors of dizziness in older persons: a 10-year prospective cohort study in the community. BMC geriatr. 2014;14.1:1.
15. Shahrami A, Norouzi M, Kariman H, Hatamabadi HR, Arhami Dolatabadi A. True vertigo patients in emergency department; an epidemiologic study. Emergency. 2016;4:25-8.
16. Warninghoff JC, Bayer O, Ferrari U, Straube A. Co-morbidities of vertiginous diseases. BMC Neurol. 2009;9:29.
17. Agrawal, Yuri, Carey JP, Della Santina CC, Schubert MC, Minor LB. Diabetes, vestibular dysfunction, and falls: analyses from the National Health and Nutrition Examination Survey. Otol Neurotol. 2010;31:1445-50.
18. Cianfrone, G, Pentangelo D, Cianfrone F, Mazzei F, Turchetta R, Orlando MP et al. Pharmacological drugs inducing ototoxicity, vestibular symptoms and tinnitus: a reasoned and updated guide. Eur Rev Med Pharmacol Sci. 2011;15.6:601-36.
19. Cianfrone G, Pace M, Turchetta R, Cianfrone F, Altissimi G. An updated guide on drugs inducing ototoxicity, tinnitus and vertigo. Acta Otorhinolaryngol Ital. 2005;25:3-31.
20. Chimirri S, Aiello R, Mazzitello C, Mumoli L, Palleria C, Altomonte M, et al. Vertigo/dizziness as a Drugs' adverse reaction. J Pharmacol Pharmacother. 2013;4:104-9.
21. Zhou Y, Sun PH, Liu YW, Zhao X, Meng L, Cui YM. Safety and Pharmacokinetic Studies of Silodosin, a New. ALPHA. 1A-Adrenoceptor Selective Antagonist, in Healthy Chinese Male Subjects. Biol Pharm Bull. 2011;34:1240-5.
22. Horn J. The proton-pump inhibitors: similarities and differences. Clin Ther. 2000;22:266-80
23. Fitzgerald KT, Bronstein AC. Selective serotonin reuptake inhibitor exposure. Top Companion Anim Med. 2013;28:13-7.
24. Lode H. Borner K, Koeppe P. Pharmacodynamics of fluoroquinolones. Clin Infect Dis. 1998;27.1:33-9.
25. Hirose T, Uwahodo Y, Yamada S, Miwa T, Kikuchi T, Kitagawa H et al. Mechanism of action of aripiprazole predicts clinical efficacy and a favourable side-effect profile. J Psychopharmacol. 2004;18:375-83.
26. Maag R, Sun S, Hannon M, Davies R, Alagona P, Foy A. Positive predictive value of an elevated cardiac troponin for type I myocardial infarction in ED patients based on the chief complaint. Am J Emerg Med. 2015;33:516-20.
27. Alvord LS, Herr RD. ENG in the emergency room: subtest results in acutely dizzy patients. J Am Acad Audiol. 1994;5:384-9.
28. Newman-Toker DE, Hsieh YH, Camargo CA Jr, Pelletier AJ, Butchy GT, Edlow JA. Spectrum of dizziness visits to US emergency departments: cross-sectional analysis from a nationally representative sample. Mayo Clin Proc. 2008;83:765-75.
29. Kroenke K, Richard MH, Douglas E. How common are various causes of dizziness? A critical review. South Med J. 2000;93:160-7.
30. Warach S, Gaa J, Siewert B, Wielopolski P, Edelman RR. Acute human stroke studied by whole brain echo planar diffusion-weighted magnetic resonance imaging. Ann Neurol. 1995;37:231-41.
31. Fiebach JB, Schellinger PD, Jansen O, Meyer M, Wilde P, Bender J et al. CT and diffusion-weighted MR imaging in randomized order Diffusion-weighted

imaging results in higher accuracy and lower interrater variability in the diagnosis of hyperacute ischemic stroke. Stroke. 2002;33:2206-10.
32. Chalela JA, Kidwell CS, Nentwich LM, Luby M, Butman JA, Demchuk AM et al. Magnetic resonance imaging and computed tomography in emergency assessment of patients with suspected acute stroke: a prospective comparison. Lancet. 2007;369:293-8.
33. Oppenheim C, Stanescu R, Dormont D, Crozier S, Marro B, Samson Y et al. False-negative diffusion-weighted MR findings in acute ischemic stroke. AJNR Am J Neuroradiol. 2000;21:1434-40.