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Evaluation of the CCT and MRI results of patients hospitalized after applying to the emergency department with vertigo complaints.

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Abstract

Introduction: Vertigo is a common complaint which can lead to a broad spectrum of diagnoses from benign to mortal etiologies. The diagnosis of vertigo can be challenging for Emergency Department (ED) specialists. Aim of the study is to guide clinicians in regard to the most commonly used screening techniques for differential diagnoses.

Methods: The study was conducted by evaluating the Cranial Computerized Tomography (CCT) and Magnetic Resonance Imaging (MRI) results of patients who were referred and admitted to an Emergency Department (ED) with complaints of vertigo. In total, 63 patients matching these criteria were included in this study. The age, sex, chief complaint, accompanying disease, physical examination findings, cranial computerized tomography and magnetic resonance imaging results and admission diagnosis data were recorded for each patient. The correct diagnosis ratio of cranial computerized tomography and magnetic resonance imaging were compared.

Results: The mean age of the patients was 65.1 ± 13.4 years. Regarding the last diagnosis of the patients, the most common was noted as cerebrovascular disease with a rate of 61.9%. The correct diagnosis rates were 31.9% and 82.5% for cranial computerized tomography and magnetic resonance imaging respectively. When cranial computerized tomography and magnetic resonance imaging findings were evaluated together, the rate of correct diagnosis was not statistically different from magnetic resonance imaging results (82.5%). Thus, it was found that cranial computerized tomography didn't contribute to the results.

Conclusion: According to our findings, magnetic resonance imaging provided better results than cranial computerized tomography for evaluation of patients with vertigo. In addition, clinical detection of patients with the risk of central vertigo, following the planning of magnetic resonance imaging directly, would be useful for clinicians.

Keywords: Vertigo, Dizziness, Emergency department.

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Introduction

Vertigo is one of the most common complaints in referrals To Emergency Departments (EDs). Although it is usually a benign situation, it could be life threatening and lead to some diseases which are hard to detect. This has been confirmed with the usage of Emergency Departments (ED) sources (laboratory examinations, imaging examinations and long waiting times at the emergency department etc.) [1]. Of all dizziness referrals, 54% are due to vertigo [2]. Vertigo is classified as either peripheral (vestibular) or central vertigo etiologically. Peripheral vertigo is commonly benign, whereas central vertigo could be related to life-threatening situations such as posterior fossa bleeding and infarction. Infarctions which are undiagnosed or undetected in Emergency Departments (EDs) have a mortality rate of 40% [2]. Therefore, determining the correct differential diagnosis in Emergency Departments (EDs) is mandatory.

Although medical history and physical examination findings generally lead to correct results, clinical situations such as unclear complaints, uncooperative patients, overcrowded Emergency Departments (EDs) and the fear of misdiagnosing the patient encourage clinicians to utilize neurological screening techniques. Cranial Computerized Tomography (CCT) is widely used to determine posterior fossa bleeding and

the central causes of vertigo [3,4]. However, in such patients, the sensitivity of Cranial Computerized Tomography (CCT) is inferior to Magnetic Resonance Imaging (MRI) [5-8]. It is known that magnetic resonance imaging provides more valuable information in the evaluation of patients with vertigo compared with cranial computerized tomography. However, only a limited number of studies have been conducted on this subject. Regarding overcrowded Emergency Departments (EDs), to prevent misdiagnosis and to shorten the time which is needed, planning the correct analysis is of great importance. In addition, avoiding unnecessary examination procedures and high costs is essential.

Even though there are studies that examine the effectiveness of imaging methods on patients who applied to the emergency departments with vertigo complaints, few have examined the effective-ness of both cranial computerized tomography and magnetic resonance imaging on the same patients. Our objective was to evaluate the accordance of the neuro-imaging (Cranial computerized tomography and MMR) results carried out at the emergency department for patients who applied to the emergency department with vertigo diagnosis and their hospitalization diagnoses and to give an idea to clinicians regarding the imaging methods they will choose.

Materials and Methods

This study was carried out at the Izmir Katip Celebi University Ataturk Training and Research Hospital Emergency department that has a capacity of 1100 beds and receives about 600 emergency patient applications per day.

Patient selection

The study was carried out with the retrospective evaluation of 63 patients who applied with vertigo complaints during August 2012-August 2013 and who were hospitalized after both cranial computerized tomography and magnetic resonance imaging. Hospitalization decisions of the patients were given by the related consultant. Inclusion criteria for this study were; patients over the ages of 18 who applied with dizziness complaints and who were hospitalized following both cranial computerized tomography and magnetic resonance imaging after consultations. Exclusion criteria for this study were; (i) trauma history; (ii) known brain tumour, (iii) those hospitalized without cranial computerized tomography or magnetic resonance imaging (iv) patients who have been diagnosed with peripheral vertigo before; (v) patients who have been examined with vertigo pre-diagnosis; (vi) patients under the influence of alcohol or drugs (vii) pregnant patients (vii) patients with missing data (viii) patients under the age of 18.

Data collection

ICD-10 (International Classification of Diseases, 10th Revision codes) r42, h81.1, h81.3, h81.4 codes were used by a person not related with the study in order to access the patient records. Age, gender, application complaints, accompanying diseases, physical examination findings, cranial computerized tomography results, magnetic resonance imaging results and the hospitalization diagnosis confirmed by the specialist doctors of the clinic they are hospitalized in were recorded for every patient. It was noted down whether the clinical and imaging findings of the patients were related with their hospitalization diagnoses. Application complaints and examination findings were evaluated with neuro-imaging results. Toshiba Aquillion 64 device was used for cranial computerized tomography with 5 mm cross-sections, General Elektrik SIGNA HTC 1, 5 tesla device was used for magnetic resonance imaging with 5.5 mm cross-sections. Imaging results were reported by radiology specialists.

Statistical analysis

Data were entered into SPSS software 15 statistics software. Physical diagnosis, accompanying diseases, cranial computerized tomography and magnetic resonance imaging results that helped the final diagnosis were evaluated and their percentiles were calculated. Successes of cranial computerized tomography and magnetic resonance imaging methods in evaluating the diagnosis were compared with Fisher's exact test.

Results

Of the 63 patients, 45 were female and 18 of them were male. The mean age was 65.1 ± 13.4 years. Twenty (31.7%) of the patients had diabetes mellitus, 21 (33.3%) had hypertension, 9 (14.3%) had coronary artery disease, 9 (14.3%) had a cerebrovascular accident, 2 (3.2%) had chronic obstructive pulmonary disease and 1 (1.6%) had chronic renal disease as accompanying comorbidities. Physical examination findings revealed that 5 (7.9%) had nystagmus, 14 (22.2%) had ataxia, 3 (4.8%) had disorders of consciousness, 10 (15.9%) had sensory disorders, 8 (12.7%) had dysmetria or dysdiadochokinesia, 10 (15.9%) had motor disorders, 4 (6.3%) had a pathological reflex, 5 (7.9%) had facial paralysis and 7 (11.1%) had former sequelae findings. The most common terminal diagnosis for the patients was cerebrovascular disease (n=39, 61.9%) (Including cerebral and cerebellar infarctions). Additionally, 4.8% of the patients had cerebral bleeding and 4.8% had brain tumour diagnoses. A total of 9.6% of the patients received a metabolic diagnosis (gastrointestinal system haemorrhage, electrolyte imbalance, renal dysfunction) as the reason of vertigo. In total, 4.8% of the patients were admitted with a peripheral vertigo diagnosis.

When the final diagnosis, accompanying diseases and physical examination findings were evaluated, it was observed that the patients with cerebral and/or cerebellar infarctions comprise the group with the most comorbid diseases and the most typical neurological examination findings. While the vertigo complaint is related to metabolic causes, according to neurological screening results, it was also detected that the vertigo complaint is related with former sequelae and systemic diseases as shown in Table 1. When the screening techniques which are used in Emergency Departments (EDs) to aid the diagnosis procedure were com-pared, the success rate of

cranial computerized tomography was found to be 41.3%, it was 82.5% for magnetic resonance imaging (p=0.006). When these two screening techniques were used together, it was seen that the success rate was equal to the result of magnetic resonance imaging (82.5%); cranial computerized tomography did not contribute. Likewise, it was observed that as a patient with cerebral bleeding couldn't be diagnosed with cranial computerized tomography, the correct diagnosis was made with magnetic resonance imaging as shown in Table 2.

Table 1. *Evaluation of initial physical examination findings, to the hospitalized diagnosis.*

	n	Initial complaint
Infarct	47	Sensory and motor disorders, ataxia
Haemorrhagic	3	Normal, ataxia
Tumour	3	Motor disorders
Metabolic	6	Former sequelae findings
peripheral	4	Nystagmus
The data on the incidence of 10% has been taken.		

Table 2. *Comparison of compatibility with the MRI and CCT findings of patients diagnosis.*

		CCT findings		MRI findings	
	n	Frequent finding	n (%)	Frequent finding	n (%)
Infarct	47	Normal	18 (38.3)	Normal	10 (21.3)
		Infarct	14 (29.8)	Infarct	36 (76.6)
		Chronic	12 (25.5)	Chronic	2 (4.2)
		Hydrocephalus	2 (4.2)	Hydrocephalus	1 (2.1)
		Haemorrhagic	1 (2.1)		
Haemorrhagic	3	Haemorrhagic	2 (66.7)	Haemorrhagic	3 (100.0)
		Mass	1 (33.3)		
Tumour	3	Tumour	3 (100.0)	Tumour	3 (100.0)
Metabolic	6	Normal	4 (66.7)	Normal	6 (100.0)
		Infarct	1 (16.7)		
		Chronic	1 (16.7)		
Peripheric	4	Normal	3 (75.0)	Normal	2 (50.0)
		Chronic	1 (25.0)	Chronic	1 (25.0)
				Other	1 (25.0)
CCT: Cranial Computerized Tomography; MRI: Magnetic Resonance Imaging.					

Discussion

Vertigo is one of the most common complaints in Emergency Departments (EDs). These patients usually show benign progression, however this is sometimes the first sign of an important diseases. It is known that these patients were sometimes given a false diagnosis in the emergency department and also left the emergency department before finding out the right diagnosis [9-11]. So emergency department physicians use neurological imaging techniques while evaluating patients with vertigo [12]. History and physical examination findings are often sufficient to distinguish central from peripheral vertigo; nevertheless, many clinicians prefer to use neurological imaging techniques. Nonetheless, clinical findings of central vertigo are sometimes similar to those of peripheral vertigo. Lee et al. showed that 10% of patients, where history and physical examination findings showed vestibular neuritis, had cerebellar infarction in a study conducted with patients with complaints of isolated vertigo; based on this study, the authors emphasized the importance of cranial imaging [13]. In another study, patients with anterior inferior cerebellar infarction were found to present vertigo and deafness which can easily be incorrectly diagnosed as peripheral vertigo; neuroimaging was recommended for patients with high risk of vascular diseases [14].

Even though there were no predisposing diseases in any of the patients hospitalized in our study with peripheral vertigo diagnosis, all our patients diagnosed with cerebral/cerebellar infarction had chronic accompanying diseases that lay the foundation for vascular pathology such as hypertension and diabetes mellitus. Hence, we are also of the opinion that patients with risk factor are good candidates for cranial imaging. In a study conducted with 200 patients admitted to emergency department with complaints of dizziness, which obtained cranial computerized tomography scans and evaluated the cost-effectiveness of cranial computerized tomography, none of the patients' cranial computerized tomography scans detected acute neuropathology [4]. In this study, half of the patients' cranial computerized tomography scans revealed normal and chronic changes and infarcts were found in the other half. Thus, the authors concluded that the use of cranial computerized tomography was not cost-effective in patients admitted to emergency departments with complaints of vertigo. In our study, cranial computerized tomography or magnetic resonance imaging techniques were important in guiding the diagnosis, but perhaps only because hospitalized patients were evaluated.

It is known that magnetic resonance imaging has higher sensitivity than cranial computerized tomography in detecting posterior fossa pathologies and ischemic infarcts which are the common causes of central vertigo [5-7]. However, lowering the cost of the method of choice for neurological imaging in Emergency Departments (EDs) is an important issue. In a study related with cost-effectiveness, Ahsan et al. noted that obtaining magnetic resonance imaging scans from all of the patients presented to emergency department with complaints of dizziness was neither practical nor useful. In addition, they suggested obtaining magnetic resonance imaging scans from the patients with dizziness and other neurological signs or symptoms [15]. However, in this study, 48% of patients presented to Emergency Departments (EDs) had a cranial

computerized tomography scan taken; 5% of patients had a magnetic resonance imaging scan. Positive findings were reported for 6 patients using cranial computerized tomography and 11 patients with magnetic resonance imaging. In our case, cranial computerized tomography and magnetic resonance imaging findings about the last known diagnoses were present for 63 patients. In a large study conducted on this issue, Kim et al. evaluated 20,795 patients with dizziness admit-ted to Emergency Departments (EDs) in 20 different centers [3]. In that study, each center used different ratios of cranial computerized tomography and magnetic resonance imaging techniques and a total of 339 (1.6%) patients received the diagnosis of stroke within 7 days. However, it was shown that the frequency of increasing the use of either cranial computerized tomography or magnetic resonance imaging did not in-crease the frequency of diagnosis of stroke. However, in this study, other diagnoses were not examined. Additionally, the benefits of using cranial computerized tomography and magnetic resonance imaging were not compared.

Recently, in another study that compared the imaging techniques for patients in Emergency Departments (EDs), for 10 of 448 patients that obtained cranial computerized tomography scans, important findings were detected [16]. When patients obtained a magnetic resonance imaging scan after the cranial computerized tomography scan, it could be seen that this new technique contributed 16% additional benefits, although the obtained control Cranial computerized tomography scan did not contribute any additional benefit. In conclusion, magnetic resonance imaging is described as playing an important role for selected patients. Even if this study's design is different from our study, the findings of this are compatible with our study. As in our case, when comparing the cranial computerized tomography and magnetic resonance imaging techniques, it was detected that cranial computerized tomography did not contribute any additional benefit after magnetic resonance imaging. Beydilli et al. established a high rate (25%) of metabolic and/or hemodynamic disturbance in their study which evaluated 410 patients with dizziness [17]. Metabolic disturbance was detected in only 4 patients (6.3%) in our study. It was thought that the reason for a low metabolic disturbance rate during evaluation was due to the fact that only hospitalized patients were considered. In our study, in evaluating patients admitted to Emergency Departments (EDs), where cranial computerized tomography and magnetic resonance imaging scans were obtained followed by hospitalization, it was noted that a majority of these patients (75%) were hospitalized with the diagnosis of stroke. In our study, which aimed at the determination of the diagnostic accuracy of neurological imaging techniques, it was shown that obtaining a cranial computerized tomography scan after obtaining a magnetic resonance imaging scan did not contribute any additional benefit. However, obtaining a magnetic resonance imaging scan after a cranial computerized tomography scan contributed to additional diagnostic benefits in 25 (53.2%) patients.

Limitations

Our study had a few limitations. The first limitation of the study was the limited number of subjects fulfilling the inclusion criteria. The second limitation of the study was that it was a single-centre study. The third limitation of the study was its retrospective design. Many multi-central and prospective studies carried out with a greater number of patients are needed in this field.

Conclusion

It was determined in our study as a result of the evaluation of patients hospitalized at the emergency department with vertigo diagnosis that magnetic resonance imaging yields to a more accurate diagnosis in comparison with cranial computerized tomography. According to our findings, it will help the clinicians in making the diagnosis if patients with central vertigo risk are clinically determined and if magnetic resonance imaging is directly planned for them.

References

1. Chase M, Joyce NR, Carney E, Salciccioli JD, Vinton D. ED patients with vertigo: can we identify clinical factors associated with acute stroke. Am J Emerg Med 2012; 30: 587-591.
2. Kroenke K, Hoffman RM, Einstadter D. How common are various causes of dizziness-a critical review. South Med J 2000; 93: 160-167.
3. Kim AS, Sidney S, Klingman JG, Johnston SC. Practice variation in neuroimaging to evaluate dizziness in the ED. Am J Emerg Med 2012; 30: 665-672.
4. Wasay M, Dubey N, Bakshi R. Dizziness and yield of emergency head CT scan: is it cost effective. Emerg Med J 2005; 22: 312.
5. Seemungal BM, Bronstein AM. A practical approach to acute vertigo. Pract Neurol 2008; 8: 211-221.
6. Chalela JA, Kidwell CS, Nentwich LM. Magnetic resonance imaging and computed to-mography in emergency assessment of patients with suspected acute stroke: a prospective comparison. Lancet 2007; 369: 293.
7. Kerber KA. Vertigo and dizziness in the emergency department. Emerg Med Clin North Am 2009; 27: 39-50.
8. American College of Radiology. American College of Radiology (ACR) appropriateness criteria: vertigo and hearing loss, 2008.
9. Kerber KA, Brown DL, Lisabeth LD, Smith MA, Morgenstern LB. Stroke among patients with dizziness, vertigo, and imbalance in the emergency department: a population-based study. Stroke 2006; 37: 2484-2487.
10. Newman-Toker DE, Hsieh YH, Camargo CA, 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: 765-775.

11. Kerber KA, Meurer WJ, West BT, Fendrick AM. Dizziness presentations in U.S. emergency departments, 1995-2004. Acad Emerg Med 2008; 15: 744-750.
12. Newman-Toker DE, Cannon LM, Stofferahn ME, Rothman RE, Hsieh YH. Imprecision in patient reports of dizziness symptom quality: a cross-sectional study conducted in an acute care setting. Mayo Clin Proc 2007; 82: 1329-1340.
13. Lee H, Sohn SI, Cho YW, Lee SR, Ahn BH. Cerebellar infarction presenting isolated vertigo: frequency and vascular topographical patterns. Neurol 2006; 67: 1178-1183.
14. Son EJ, Bang JH, Kang JG. Anterior inferior cerebellar artery infarction presenting with sudden hearing lost and vertigo. Laryngoscope 2007; 117: 556-558.
15. Ahsan SF, Syamal MN, Yaremchuk K, Peterson E, Seidman M. The costs and utility of imaging in evaluating dizzy patients in the emergency room. Laryngoscope 2013; 123: 2250-2253.
16. Lawhn-Heath C, Buckle C, Christoforidis G, Straus C. Utility of head CT in the evaluation of vertigo/dizziness in the emergency department. Emerg Radiol 2013; 20: 45-49.
17. Beydilli I, Topcuoglu OB, Korkmaz I, Yilmaz F, Eren SH, Ayan M. Is it Really a Neurological Emergency. J Clin Anal Med 2012; 3: 419-421.

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