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RESEARCH ARTICLE **ÖZGÜN ARAŞTIRMA**

FOCAL AND NON-FOCAL NEUROLOGICAL SYMPTOMS BEFORE ACUTE ISCHEMIC STROKE

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ABSTRACT

INTRODUCTION: Transient ischemic attack (TIA) is a precursor to stroke, and a person who experiences TIA has a 10-fold increased risk of stroke. There are previous studies showing transient neurological attacks (TNA) that include symptoms not certainly accepted for TIA also increase the risk of stroke. In this study, the presence of focal and non-focal neurological symptoms before acute ischemic stroke (AIS) or TIA was compared with the control group of similar age without any neurological diseases.
METHODS: Between January 2018 and April 2020, all patients who were admitted to the neurology clinic with diagnosis of AIS or TIA were included in the study. The control group consisted of the patients with similar age who were admitted to the geriatric clinic or applied to the their outpatient clinics, and did not have any neurological disease. The focal and non-focal neurological symptoms in the last month were questioned in patients with AIS or TIA and patients without any neurological disease.
RESULTS: In this study, a total of 65 AIS or TIA patients and 68 control patients were prospectively evaluated. Vertigo, imbalance, blurred vision, visual phenomena, numbness, unsteady gait, and multiple symptoms were significantly more frequent in the patient group than in the control group ($p<0,05$). Vertigo was significantly more common in the PCS ($p=0,015$). In multiple regression analysis, there was a significant correlation between vertigo, imbalance, visual phenomena, multiple symptoms and AIS/TIA. A significant correlation also existed between the PCS and dizziness ($p<0,05$).
DISCUSSION AND CONCLUSION: Clinicians should be careful about the risk of stroke in patients presented with TNA such as isolated vertigo, imbalance, nonspecific visual symptoms or with a combination of transients neurological symptoms. However, we believe that further prospective studies including more patients is needed.
Keywords: Acute ischemic stroke, transient ischemic attack, transient neurological attacks.

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AKUT İSKEMİK İNME ÖNCESİNDE GÖRÜLEN FOKAL VE NON-FOKAL NÖROLOJİK BELİRTİLER

ÖZ

GİRİŞ ve AMAÇ: Geçici iskemik atak (GİA) inme habercisi olup, yaklaşık 10 kat artmış inme riski taşır. Tek başına GİA belirtisi olup olmadığı tartışmalı olan belirtileri içeren geçici nörolojik atakların (GNA) da inme riskini artırdığına dair veriler vardır. Bu çalışmada akut iskemik inme öncesinde son bir ayda görülen fokal ve non-fokal nörolojik belirtilerin varlığını herhangi bir nörolojik hastalığı bulunmayan benzer yaş grubundaki kişilerle karşılaştırmayı amaçladık.
YÖNTEM ve GEREÇLER: Ocak 2018 ve Nisan 2020 tarihleri arasında akut iskemik inme veya GİA tanısıyla yatan hastalar çalışmaya alınmıştır. Kontrol grubunu ise aynı dönemde geriatri kliniğinde yatan veya ayaktan başvuran ve herhangi bir nörolojik hastalığı bulunmayan benzer yaş grubundaki kişiler oluşturmuştur. Akut iskemik inme/GİA öncesinde ve herhangi bir nörolojik hastalığı bulunmayan benzer yaş grubundaki kişilerde son 1 ayda görülen fokal ve non-fokal nörolojik belirtiler sorgulanmıştır.
BULGULAR: Bu çalışmada toplam 65 akut iskemik inme veya GİA hastası ve 68 kontrol grubu prospektif olarak incelenmiştir. Baş dönmesi, dengesizlik, bulanık görme, görsel fenomenler, uyuşukluk, sarhoşvari yürüme ve çoklu belirtiler akut iskemik inme/GİA grubunda, kontrol grubuna göre istatistiksel olarak daha fazla idi ($p<0,05$). Baş dönmesi posterior dolaşım inmelerinde anlamlı olarak daha sıktı ($p=0,015$). Çoklu regresyon analizi yapıldığında akut iskemik inme ile baş dönmesi, dengesizlik, görsel fenomenler ve çoklu belirtiler arasında ve posterior sulama alanındaki iskemik inme ile baş dönmesi arasında anlamlı ilişkili bulunmuştur ($p<0,05$).
TARTIŞMA ve SONUÇ: Klinisyenler, izole baş dönmesi, dengesizlik, nonspesifik görsel belirtiler şeklinde GNA veya çoklu geçici nörolojik belirtiler ile başvuran hastalarda inme riski açısından dikkatli olmalıdır. Ancak bu konuda daha fazla hastanın dahil edildiği prospektif çalışmalara ihtiyaç olduğu kanaatindeyiz.

Anahtar Sözcükler: Akut iskemik inme, geçici iskemik atak, geçici nörolojik atak.

INTRODUCTION

Transient ischemic attack (TIA) is a precursor of stroke, and a person who has had one or more TIAs has an approximately 10-fold increased risk of stroke compared to a person of the same age and gender (1-4). According to the new definition, even if the patient's findings have improved, when an acute ischemic lesion is detected on diffusion-weighted imaging, it is not considered TIA (5). Therefore, TIA diagnosis is mostly a clinical diagnosis.

There are studies showing that transient neurological dysfunction attacks, called transient neurological attacks (TNA), are also seen before stroke (6-11). Although conventional diagnostic criteria for TIA are clear, how TNAs should be classified and treated is unclear. None of the non-focal TNAs meet the criteria for TIA; however, combined TNAs with focal and non-focal symptoms are mostly classified as TIA by both neurologists and general practitioners. In both TIAs and TNAs, differential diagnosis can be difficult since the symptoms often disappear in a short time period, even without treatment. Many patients with transient neurological symptoms do not report them. Studies questioning TNAs days and weeks before stroke have been conducted; however, there are no studies comparing with people in a similar age group without any neurological disease (6-11).

In this study, we aimed to compare the presence of focal and non-focal neurological symptoms in the last one month before acute ischemic stroke with people of a similar age group without any neurological disease. Whether these symptoms are predictive of anterior and posterior circulation areas in acute ischemic stroke was examined.

MATERIALS AND METHODS

All patients hospitalized in the neurology clinic with the diagnosis of acute ischemic stroke or TIA between January 2018 and April 2020 and who wanted to participate in the study were included. In the control group, people in the same age group without any neurological disease hospitalized or admitted to the geriatric clinic for non-stroke reasons were included. Patients who did not want to participate in the study, patients who had a hemorrhagic stroke, could not cooperate due to confusion, were aphasic, or had dementia were excluded from this study. Whether all of the patients who were included in the study had in the last 30 days isolated vertigo, dysarthria, dysphagia, visual symptoms, diplopia, visual phenomena, unsteady gait, dizziness, confusion, imbalance, weakness, blurred vision, headache, amnesia, lethargy, and feeling unwell were

questioned by using a standard data collection form. The details of the questioning are given in Table 1. Vertigo, dysarthria, dysphagia, visual symptoms, diplopia, visual phenomena, and unsteady gait were classified as focal symptoms, while dizziness, confusion, imbalance, weakness, blurred vision, headache, amnesia, lethargy, and feeling unwell were classified as non-focal symptoms.

Table 1. Details of questionings regarding focal and non-focal symptoms of patients.

Symptoms	How was it questioned?*
Vertigo	Do you feel like you or your surrounding are turning around?
Dysarthria	Have you had lisping in your tongue, talking like a drunk, speaking nasally
Dysphagia	Have you had difficulty swallowing?
Dizziness	Have you felt dizzy?
Confusion	Have you had any confusion?
Imbalance	Have you had any imbalance?
Diplopia	Have you had a double vision or double seeing?
Weakness	Have you had weakness in the arms and legs?
Blurred vision	Have you had temporary blurred vision in one or both eyes (as if looking around through a smoke screen, through fogged glass)?
Headache	Have you had a headache? The location, character, severity, and accompanying characteristics of the headache were questioned.
Amnesia	Has there been any newly developed forgetfulness or an increase in old forgetfulness?
Lethargy	Loss of sensation, numbness, tingling in the arms and legs?
Visual phenomena	Have you had temporary, short-term flashing or shimmering lights, zigzagging lines in front of one or both eyes? Did you have a headache afterwards?
Unsteady gait	Did you walk like a drunk, fell to one side while walking?
Feeling unwell	Have you ever felt unwell, sick, sluggish or tired?

*Questioned if it happened in the 30 days before the last event.

The age, gender, and background history of all patients were recorded at the time of admission. The history of hypertension (HT), hyperlipidemia (HL), diabetes mellitus (DM), atrial fibrillation (AF), coronary artery disease (CAD), congestive heart failure (CHF), previous stroke and/or TIA, smoking, and alcohol use were questioned. Previously used drugs, especially antiaggregant, anticoagulant, antilipidemic, antidiabetic, and antihypertensive drugs, were recorded. Physical and neurological examinations of the patients were performed. Then, the National Institutes of Health Stroke Scale (NIHSS) scores at the first admission were calculated. Of all the patients who were examined, complete blood count, fasting blood glucose (FBG), postprandial blood glucose (PPG), kidney function tests and electrolytes (BUN, creatine, Na, K, GFR), HbA1c, lipid profile, computerized brain tomography (CBT), electrocardiography (ECG), diffusion-weighted magnetic resonance imaging (MRI), brain-neck computed tomography angiography (CTA) or magnetic resonance angiography (MRA), carotid vertebral Doppler ultrasonography (USG), 24-hour ECG monitoring, transthoracic echocardiography (TTE) and/or transesophageal echocardiography (TEE) results were recorded. Automated CCS (Causative Classification System) was used to determine the etiologic type of ischemic stroke (12). It was evaluated whether a subacute infarct could be compatible with TNA in the diffusion-weighted MRI of all patients and the CBT of the patients without MRI. The mRS scores at discharge were calculated.

In this study, the presence of focal and non-focal neurological symptoms in the last one month before acute ischemic stroke was compared with people of a similar age group without any neurological disease. It was examined whether these symptoms are predictive of anterior and posterior circulation areas in acute ischemic stroke.

The study was started after the approval of the Ankara University Faculty of Medicine Clinical Research Ethics Committee (Date: 25.12.2018, Number: 21-1422-1), and our study was carried out in accordance with the ethical rules stated in the Declaration of Helsinki. The informed consent form was obtained from all patients following their signatures.

Statistical analysis: Data analysis was performed in SPSS Windows 15 package program. Descriptive statistics are shown as mean ± standard deviation (SD) for variables with normal distribution, as median (min-max) for variables with non-normal distribution, and as the number of cases and (%) for nominal variables. When the number of groups was two, the significance of the difference between the groups in terms of means was investigated with the t-test, and the significance of the difference in terms of median values was

investigated with the Mann-Whitney U test. When the number of groups was more than two, the significance of the difference between the groups in terms of means was investigated with a one-way analysis of variance, and the significance of the difference in terms of median values was investigated with the Kruskal Wallis test. Nominal variables were evaluated with Pearson Chi-Square or Fisher's exact test. The risk factors affecting the dependent variable were made with logistic Regression Analysis. For P<0.05, the results were considered statistically significant.

RESULTS

In this study, a total of 65 patients with acute ischemic stroke or TIA (34 patients with ischemic stroke in the anterior circulation area, 20 patients with ischemic stroke in the posterior circulation area, 4 patients with ischemic stroke in the anterior and posterior circulation area, 1 patient who could not undergo MRI due to platinum, 6 patients with TIA) and control group (16 patients hospitalized in the geriatric clinic for non-stroke reasons and without neurological disease, 52 people of similar age who were not hospitalized and did not have a neurological disease) were examined prospectively. The mean age in the patient group was 67.65±11.29 years, while it was 61.69±9.04 years in the control group (p=0.07). Of the patients in the patient group, 25 (38.5%) were female, while this rate was 33 (48.5%) in the control group (Table 2).

Two groups were compared in terms of ischemic stroke risk factors. HT, DM, AF, hyperlipidemia, and coronary artery disease were found to be statistically significantly more common in the patient group than in the control group (p<0.05). There was no significant difference between the two groups in terms of other risk factors. Patients with acute ischemic stroke have a median NIHSS of 4 (0-17) at the time of admission and a median mRS score of 2 (0-5) at discharge (Table 2). The etiologies of ischemic stroke of the patients are given in Table 2.

The two groups were compared in terms of focal and non-focal neurological symptoms. Vertigo was the most common symptom in both groups. Vertigo, imbalance, blurred vision, visual phenomena, lethargy, and unsteady gait were statistically significantly more common in the acute ischemic stroke group (p<0.05). Headache has been questioned in patients with visual phenomena. Only one patient had visual phenomena and headache together; however, the headache did not show migraine characteristics and did not start with or after visual phenomena. There was no statistically significant difference between the two groups in other focal and non-focal neurological symptoms. Patients whose multiple (two or more) focal and non-focal neurologic symptoms were classified were found to be statistically significantly higher in the patient group (p<0.001) (Table 3).

No subacute infarcts that could be compatible with TNA were detected in diffusion-weighted MRI of all patients and in CCT of those who did not have MRI. The epidemiological and clinical characteristics of patients with acute ischemic stroke in the anterior and posterior circulation area were also compared in the patient group.

Table 2. Demographic characteristics of patients, risk factors, etiological subgroups of ischemic stroke.

	Acute ischemic stroke/TIA group n=65	Control group n=68	p
Age, year, *Mean±SD*	67.65± 11.29	61.69± 9.04	0.07
Gender (F/M), *n(%)*	25/40 (38.5/61.5)	33/35 (48.5/51.5)	0.242
Risk factors			
Hypertension, n(%)	44(67.7)	34(50)	**0.038**
Diabetes mellitus, *n(%)*	35(53.8)	15(22.1)	**<0.001**
Known AF, n(%)	11(16.4)	2(2.9)	**0.007**
Hyperlipidemia, *n(%)*	25(38.5)	10(14.7)	**0.002**
CAD, *n(%)*	20(30.8)	3(4.4)	**<0.001**
CHF, *n(%)*	7(10.8)	3(4.4)	0.165
PAD, *n(%)*	1(1.5)	2(2.9)	0.586
Smoking, *n(%)*	11 (17.2)	15 (22.1)	0.482
Admission NIHSS, *Mean±SD*	4.88±4.025		
Median (Min-Max)	4 (0-17)		
Discharge mRS, *Mean±SD*	2.02± 1.615		
Median (Min-Max)	2 (0-5)		
CCS			
LAA	15(23.1)		
CE	25(38.5)		
SAO	13(20)		
OC	0(0)		
Stroke with unidentified cause	12(18.5)		

SD; Standard deviation, NIHSS; national ınstitutes of health stroke scale, mRS: modified Rankin Scale, DM; Diabetes Mellitus, AF; Atrial Fibrillation, CAD; Coronary artery disease, CHF; Congestive heart failure, PAD; peripheral artery disease, TIA; Transient ischemic attack, CCS; Causative Classification System, LAA; Large artery atherosclerosis, CE; Cardio-aortic embolism, SAO; Small artery occlusion, OC; Other causes.

Table 3. Focal and non-focal neurological symptoms seen in acute ischemic stroke and control group.

	Acute ischemic stroke /TIA group n=65	Control group n=68	p
Vertigo, *n(%)*	25(38.5)	6(8.8)	**<0.001**
Dysarthria, *n(%)*	2(3.1)	0 (0)	0.145
Dysphagia, *n(%)*	1(1.5)	1(1.5)	0.974
Dizziness, *n(%)*	2(3.1)	1(1.5)	0.533
Confusion, n(%)	0 (0)	0 (0)	
Imbalance, *n(%)*	15(23.4)	0 (0)	**<0.001**
Diplopia, *n(%)*	3(4.6)	0 (0)	0.073
Weakness, *n(%)*	5(7.7)	1(1.5)	0.084
Blurred vision, *n(%)*	4(6.2)	0 (0)	**0.038**
Headache, *n(%)*	6(9.2)	3(4.4)	0.269
Amnesia, *n(%)*	3(4.6)	2(2.9)	0.612
Lethargy, *n(%)*	6(9.2)	1(1.5)	**0.045**
Visual phenomena, *n(%)*	10(15.4)	0 (0)	**0.001**
Unsteady gait, *n(%)*	4(6.2)	0 (0)	**0.036**
Feelinh unwell, *n(%)*	3(4.6)	2(2.9)	0.612
Multiple symptoms, *n(%)*	25 (38.5)	3(4.4)	**<0.001**
Focal symptoms, *n(%)*	33 (50.8)	7 (10.3)	**<0.001**
Non-focal symptoms, *n(%)*	29 (44.6)	4 (5.9)	**<0.001**

There was a total of 34 patients with ischemic stroke in the anterior circulation area (mean age 66.85±11.23 years, female n=12 [35.3%]), and a total of 20 patients with ischemic stroke in the posterior circulation area (mean age 69.25 ±9.846 years, female n=8 [40%]). When patients with ischemic stroke in the anterior and posterior circulation areas were compared in terms of risk factors, no statistically significant difference was found between the two groups (Table 4).

The mean NIHSS (5.82±4.56) in patients with ischemic stroke in the anterior circulation area was found to be significantly higher than the mean NIHSS (4.85±2.89) in patients with ischemic stroke in the posterior circulation area (p=0.049). There was no significant difference between the mean mRS scores of the two groups at discharge (Table 4).

In the comparison of stroke aetiology in patients with ischemic stroke in the anterior and posterior circulation areas, LAA was significantly higher in the group with ischemic stroke in the anterior circulation area, while SAO was significantly higher in the group with ischemic stroke in the posterior circulation area (p= 0.041, Table 4).

Pre-stroke focal and non-focal neurologic symptoms encountered in patients with ischemic stroke in the anterior and posterior circulation areas were compared. Vertigo was the most common symptom in both groups. Vertigo was detected in 9 (26.5%) patients in the anterior group and 12 (60%) patients in the posterior group, and it was found to be significantly higher in the posterior group (p=0.015). There was no significant difference between anterior and posterior systems in terms of other symptoms. When multiple (two or more) focal and non-focal neurological symptoms were classified and analyzed between groups, no significant difference was found between the two groups (Table 5).

When multiple regression analysis was performed, a significant correlation was found between acute ischemic stroke/TIA and DM, CAD, vertigo, imbalance, visual phenomena, and multiple symptoms (p<0.05). The significant correlation between ischemic stroke and vertigo in the posterior circulation area also continued when multiple regression analysis was performed (Table 6).

Table 4. Demographic characteristics, risk factors, etiological subgroups of ischemic stroke in patients with ischemic stroke in the anterior and posterior circulation area.

	Anterior n=34 (63)	Posterior n=20 (37)	p
Age, year, *Mean±SD*	66.85±11.23	69.25±9.846	0.292
Gender (F/M), *n(%)*	12/22 (35.3/64.7)	8/12 (40/60)	0.729
Risk factors			
Hypertension, n(%)	24(70.6)	13(65)	0.669
Diabetes mellitus, *n(%)*	16(47.1)	12(60)	0.358
Known AF, n(%)	5(14.7)	4(20)	0.614
Hyperlipidemia, *n(%)*	14(41.2)	7(35)	0.653
CAD, *n(%)*	9(26.5)	5(25)	0.905
CHF, *n(%)*	4(11.8)	2(10)	0.842
PAD, *n(%)*	0(0)	1(5)	0.188
Smoking, *n(%)*	5(15.2)	2(20)	0.649
Admission NIHSS, *Mean±SD*	5.82±4.56	4.85±2.89	**0.049**
Median (Min-Max)	5 (0-17)	5 (1-13)	
Discharge mRS, *Mean±SD*	2.12±1.66	2.15±1.42	0.167
Median (Min-Max)	2 (0-5)	2 (0-5)	
CCS			
LAA	12(35.3)	3(15)	**0.041**
CE	12(35.3)	6(30)	
SAO	4(11.8)	9(45)	
OC	0(0)	0(0)	
Stroke with unidentified cause	6(16.6)	2(10)	

SD; Standard deviation, NIHSS; national ınstitutes of health stroke scale, mRS: modified Rankin Scale, DM; Diabetes Mellitus, AF; Atrial Fibrillation, CAD; Coronary artery disease, CHF; Congestive heart failure, PAD; Peripheral artery disease, TIA; Transient ischemic attack, CCS; Causative Classification System, LAA; Large artery atherosclerosis, CE; Cardio-aortic embolism, SAO; Small artery occlusion, OC; Other causes.

Table 5. Anterior ve posterior sulama alanında iskemik inmesi olan hastaların belirtileri

	Anterior n=34(60)	Posterior n=20(40)	p
Vertigo, *n(%)*	9(26.5)	12(60)	**0.015**
Dysarthria, *n(%)*	2(5.9)	0(0)	0.269
Dysphagia, *n(%)*	0(0)	0(0)	****
Dizziness, *n(%)*	1(2.9)	0(0)	0.439
Confusion, n(%)	0(0)	0(0)	****
Imbalance, *n(%)*	7(20.6)	5(25)	0.706
Diplopia, *n(%)*	2(5.9)	1(5)	0.891
Weakness, *n(%)*	3(8.8)	1(5)	0.604
Blurred vision, *n(%)*	2(5.9)	1(5)	0.891
Headache, *n(%)*	3(8.8)	1(5)	0.604
Amnesia, *n(%)*	0(0)	1(5)	0.188
Lethargy, *n(%)*	4(11.8)	1(10)	0.842
Visual phenomena, *n(%)*	6(17.6)	3(13.6)	0.801
Unsteady gait, *n(%)*	1(2.9)	2(10)	0.274
Feelinh unwell, *n(%)*	2(5.9)	1(5)	0.891
Multiple symptoms, *n(%)*	11(32.4)	8(40)	0.570
Focal symptoms, *n(%)*	14 (41.2)	13 (65)	0.091
Non-focal symptoms, *n(%)*	14 (41.2)	9 (45)	0.784

Table 6. Multiple regression analysis.

Multiple regression analysis in acute ischemic stroke and control group			
	Beta	95%, CI	p
DM, *n(%)*	0.207	1.232-2.078	**0.011**
CAD, *n(%)*	0.405	0.605-1.360	0.001
Vertigo, *n(%)*	0.256	0.90-4.45	**0.004**
Imbalance, *n(%)*	0.413	1.89-6.46	<0.001
Visual phenomena, *n(%)*	0.484	1.92-7.48	0.001
Multiple symptoms, *n(%)*	0.417	1.531-1.707	<0.001
Multiple regression analysis of patients with ischemic stroke in the anterior and posterior circulation area			
Vertigo, *n(%)*	0.324	0.55-2.24	**0.019**

DM; Diabetes Mellitus, CAD; Coronary artery disease.

DISCUSSION AND CONCLUSION

In the multiple regression analysis of this study, a significant correlation was found between acute ischemic stroke and vertigo, imbalance, visual phenomena, and multiple symptoms ($p<0.05$). The significant correlation between ischemic stroke and vertigo in the posterior circulation area also continued when multiple regression analysis was performed. Vertigo was also observed in 9 patients with ischemic stroke in the anterior circulation area. There were atherosclerotic changes in the posterior system arteries in 4 of these patients, and it was thought that this might be the reason. On the other hand, 2 patients also had AF, and cardioembolic stroke may also be the cause of isolated transient vertigo in these patients.

Vertigo and imbalance are also seen more commonly in patients with HT and DM (13, 14). Since HT and DM were significantly higher in the ischemic stroke group in our study, it was impossible to distinguish whether these transient complaints were a sign of transient ischemic attack or were associated with HT and DM.

Although it was more significant in focal symptoms, differentiation of TNAs from TIA is difficult. In the definition made by Millikan et al. in 1975, it has been emphasized that TIA is uncertain if vertigo, dysarthria, dysphagia, diplopia, amnesia, and confusion are isolated. Also, symptoms such as loss of consciousness, including syncope, diffuse sensory deficit, dizziness, imbalance, visual phenomena (such as glowing scotoma, flashes of light), and focal symptoms with migraine, have been suggested not to be defined TIA (15). However, with the development of imaging methods, acute ischemia has been observed in patients with TNA on diffusion-weighted MRI (16). In our study, since subacute infarcts that could be compatible with TNA were not detected in imaging methods, they could be differentiated from ischemic stroke. However, it is controversial whether some of the focal neurological symptoms we questioned were TIA.

In the community-based study of Bos et al., individuals aged 55 and over without stroke, myocardial infarction, and dementia diagnoses between 1990 and 1993 have been followed up until 2005, and TNA has been observed in 548 patients (282 focal, 228 non-focal, 38 combined) (6). It has been found that stroke and dementia were more common in patients with non-focal TNA, and stroke, ischemic heart disease, vascular death, and dementia were more common in patients with combined TNA compared to patients without TNA (6).

The prospective study conducted by Compter et al. has included 80 patients over the age of 18 who were hospitalized with the diagnosis of TIA or ischemic stroke between November 2010 - April 2011 and October 2011 - February 2012 (7). Non-focal symptoms have been found to be more common in patients with vertebral artery (VA) stenosis than in patients with carotid artery stenosis. The most commonly observed non-focal symptoms were non-rotational vertigo (21/75 posterior, 4/75 anterior system) (7). In our study, both focal and non-focal symptoms were found to be significantly higher in the patient group than in the control group. There was no significant difference between patient groups with ischemic

stroke in the anterior and posterior circulation area regarding focal and non-focal neurological symptoms observed before the stroke. Vertigo was the most common symptom in both groups, and a significant correlation was found between ischemic stroke and vertigo in the posterior circulation area.

In the retrospective study conducted by Compter et al., 2409 patients (TIA n=723, ischemic stroke n=1686) who had TIA or minor ischemic stroke have been included (8). The correlation between non-focal symptoms and the risk of long-term vascular events and death has been examined in this study. It has been observed that 1/3 of these patients had both focal and non-focal neurological symptoms. No correlation has been found between non-focal symptoms and the risk of long-term vascular events or death (8).

Whether non-focal symptoms were associated with a history of cardiac disease and AF has been examined in a prospective study by Plas et al. The study has included 1265 patients, 995 (79%) with TIA and 270 (21%) with minor ischemic stroke. Of these patients, 243 (19%) have been found to be accompanied by one or more non-focal symptoms. The most common non-focal symptoms were non-rotational vertigo (n=174, 14%), followed by paresthesia (n=50, 6%) and amnesia (n=23, 2%). In the study, non-focal symptoms have been observed more frequently in posterior circulation TIAs, in patients with minor stroke (p=0.017), and obese people (p=0.047), while they have been found to be less common in minor strokes with significant carotid stenosis (p=0.024). No significant difference has been found in terms of non-focal symptoms between patients with a history of heart disease and patients with or without AF. Non-rotational vertigo was more common in posterior circulation TIAs, in minor stroke patients, and in obese patients, while paresthesia was more common in patients with TIA or ischemic stroke who smoked and used oral contraceptives. On the other hand, the frequency of paresthesia in males was significantly less than in females. Positive visual phenomena were more common in patients with peripheral arterial disease and a family history of vascular disease. It has been found that amnesia was more common in patients with AF. In conclusion, non-focal symptoms have been observed frequently in patients with TIA or ischemic stroke in this study, especially in attacks in the posterior circulation. In addition, no significant difference has been found between patients with a history of heart disease and patients with or without AF in terms of non-focal symptoms (9).

In a retrospective study by Ishihara et al., 1362 TIA patients have been analyzed. Non-focal symptoms have been found in 219 (16%) of these patients. Diffusion-weighted imaging of TIA patients with non-focal symptoms has shown acute ischemic lesions in the posterior circulation. However, arterial stenosis or occlusion has been found more frequently in the vascular imaging of these patients than in those without these symptoms. Although the one-year risk of ischemic stroke has not differed significantly between the groups, the risk of coronary artery disease has been found to be higher in TIA patients with non-focal symptoms (10). No significant difference was found in our study between the patient groups with ischemic stroke in the anterior and posterior circulation areas in terms of non-focal symptoms.

A retrospective study by Oudeman et al. has included 67 patients with carotid artery occlusion and 62 patients without carotid artery occlusion. It has been observed that 42 (33%) of all patients had one or more non-focal TNA in the previous six months. The most common was non-rotational vertigo (24%). The prevalence of two or more non-focal GNA has been found to be statistically significantly more frequent in patients with carotid artery occlusion. Non-focal symptoms have been found to be more frequent in patients with carotid artery occlusion with contralateral carotid or vertebral artery occlusion (11).

Several limitations should be considered when interpreting the results of this study. The fact that our study was carried out in a single centre, the inpatients were evaluated, and the small number of patients are the weaknesses of our study. The fact that our study is prospective and the patient control group was taken into consideration constitutes the advantages of our study.

In conclusion, our study revealed that vertigo, imbalance, and nonspecific visual complaints were seen significantly more frequently in the last month in patients with acute ischemic stroke. The presence of two or more nonspecific complaints for TIA was also more common in the ischemic stroke group. Most of these complaints are symptoms that can be overlooked in older

individuals. Vertigo is an expected finding to be seen more frequently in ischemic strokes in the posterior circulation area and emphasizes the need for careful differential diagnosis in individuals admitting with vertigo.

We think that care should be taken in terms of stroke risk in patients who present with vertigo, imbalance, nonspecific visual symptoms, and have multiple symptoms. However, we believe that there is a need for prospective studies on this subject, including a control group with more patients.

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Ethics

Ethics Committee Approval: The study was approved by Ankara University Faculty of Medicine Clinical Research Ethical Committee (Number: 21-1422-1, Date: 25,12.2018).

Informed Consent: The authors declared that informed consent was signed by the patients.

Copyright Transfer Form: Copyright Transfer Form was signed by the authors.

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