Epidemiological Study of the Patients Diagnosed as Ischemic Stroke in the Emergency Department

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Abstract

Objective: Stroke, heart disease and cancer is the third cause of death in the world and the most important reason of disability. To increase the level of one's living standards and treatment of cases of stroke, the epidemiological and etiological factors should be carefully examined and reported.

Material and Methods: One hundred and two patients admitted to the emergency department and hospitalized in the neurology service were included the study. Their demographic properties, co-morbid diseases, laboratory results, electrocardiogram (ECG), computed tomography (CT), magnetic resonance imagining (MRI) a Doppler ultrasonography (USG) data were evaluated retrospectively.

Results: Eighteen (17.6%) of the patients died during follow-up. Seventeen patients (16.7%) were regular smokers, and 4 (3.9%) used alcohol regularly. In 25 (24.5%) of the patients, atrial fibrillation was detected with ECG. In the echocardiographic examinations, 18 (24.3%) patients were shown to have an ejection fraction (EF) of less than 50%, while 6 patients were found to have less than 35% of EF. Ischemia could not be diagnosed with CT in 16 of the patients; the diagnoses of these patients were made using diffusion MRI. Doppler ultrasound examination of patients showed the following results: Complete or more than 50% occlusion was detected with Doppler USG in the right internal carotid artery (ICA) in 20.6%, and in the left ICA in 10.3%. Asymptomatic plaques were detected in the right common carotid artery in 54.4% of patients, and in the left common carotid artery in 50%.

Conclusion: The early diagnosis and treatment of stroke and the preventable risk factors such as atrial fibrillation (AF), hypertension (HT), hyperlipidemia (HL) and diabetes mellitus (DM) will reduce morbidity associated with stroke. *(JAEM 2014; 13: 10-4)*

Key words: Ischemic stroke, epidemiology, morbidity

Introduction

The term of stroke describes a sudden neurologic syndrome that develops due to cerebrovascular disease (CVD). The World Health Organization describes the stroke as "rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin" (1).

Stroke still stands for a leading cause of mortality and morbidity (2). In the USA, annually, nearly 795.000 people experience a stroke; 77% of them are first and the 23% of them are recurrent strokes (3). Stroke is the third most common cause of death following cardiac diseases and cancer, and the most important cause of morbidity in the world (4). Although there is no country-wide survey in Turkey, according to the results of the Turkish Multicentre Stroke Survey, it is estimated that every year, 125.000 new cases of cerebrovascular disease are seen in Turkey. In this survey, the mortality rate is given as 24% (5).

Stroke has great importance because of its high mortality and morbidity, and also its financial and social burden to the family, population and health services. In order to increase the life standard of patients and success of therapy, epidemiologic and etiologic factors should be determined and investigated carefully.

Determination of risk factors and causes of ischemic stroke by epidemiologic studies is important for preventive medicine (Table 1) (1). There is no clear data of ischemic stroke in our country due to insufficient data and irregular records. The aim of this study is to investigate the ischemic stroke patients and make a contribution to the determination of epidemiological risk factors.

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Table 1. Stroke risk factor classification

	Controllable Risk Factors	
Uncontrollable risk factors	**Certain factors**	**Uncertain factors**
• Age	• Hypertension	• Alcohol
• Sex	• Diabetes mellitus	• Obesity
• Race	• Hyperinsulinemina and glucose intolerance	• Dietary habits
• Family history	• Hearth diseases	• Physical activity
• Diabetes mellitus	• Hyperlipidemia	• Hyperhomosistinemia
	• Smoke	• Drug addiction
	• Asymptomatic carotid artery stenosis	• Hormone therapy
	• Sickle cell anemia	• Hypercoagulability
		• Fibrinogen
		• Inflammation

Material and Methods

This study is planned as a retrospective descriptive study. The patients admitted to the Dışkapı Yıldırım Beyazıt Education and Research Hospital Emergency Department with ischemic stroke and hospitalized in the neurology services and neurology intensive care unit between 1st October, 2010 and 1st April, 2011, were included the study. The hospital file and computer system records were investigated retrospectively. Among these, hemorrhagic cerebrovascular diseases, transient ischemic attacks, central nervous system infections, seizures, conditions that can increase intracranial pressure and metabolic causes were excluded the study. Ethical approval was obtained from Dışkapı Yıldırım Beyazıt Education and Research Hospital Ethical Committee on 7.02.2012 with decree number 01/17.

In this study, 102 patients were included. Admission date, chronic or previous diseases [hypertension (HT), diabetes mellitus (DM), coronary artery diseases (CAD), chronic obstructive pulmonary disease (COPD), coronary heart failure (CHF), cerebrovascular disease (CVD), hyperlipidemia (HL), chronic renal failure (CRF)], substance addiction (smoke, alcohol), electrocardiogram (ECG), transthoracic echocardiography findings, brain computed tomography, diffusion weighted magnetic resonance imagining (MRI), carotid Doppler ultrasonography, lipid profile (total cholesterol, triglyceride, LDL, HDL) and the in-hospital mortality rates of patients were recorded. Total cholesterol ≥240 mg/dL, triglyceride ≥200 mg/dL, HDL <50 mg/dL for women and <40 mg/dL for men, LDL ≥100 mg/dL were accepted as pathologic (6). According to the Mannheim Carotid Intima Thickness Consensus Report, over50% of the thickness of intima media and the conditions that narrow the artery lumen more than 0.5 mm are accepted as plaques (7). Furthermore, Yurdakul et al. (8) in the internal carotid artery and Visonà et al. (9) in the vertebral artery, showed that, below 50% occlusion there was no change in flow velocity. In our study, more than 50% occlusion in carotid arteries was accepted as positive and equal and below 50% was accepted as asymptomatic.

Statistical Analysis

Statistical Package for Social Science (SPSS) 17.0 for Windows package program was used for statistical analysis. Continuous variables that are normally distributed were given as mean ± standard deviation; continuous variables that are not normally distributed were given as median (minimum-maximum); ordinal variables were given as median and mode, nominal variables were given with number and percent values. Normal distribution of continuous variables were determined by histogram and "One-Sample Kolmogorov-Smirnov Test"; $p>0.05$ was accepted as normal distribution. The difference between normally distributed independent variables I was determined by "Independent Samples-t Test" and "Mann-Whitney U Test" was used for variables not normally distributed. Values that could affect the mortality such as age and lipid profile were evaluated by logistic regression analysis. All hypotheses were evaluated two-tailed and $p<0.05$ was accepted as significant. The relationship between nominal values were determined by "Pearson Chi Square Test" and Fisher's Exact Test" and $p<0.05$ was accepted as significant.

Results

Demographic characteristics of the patients are given in Table 2. The mean age was 70.7±12.9 (range 37-98). The number of patients was highest between 71-80 of ages (Table 2). The co-morbid diseases of the patients are given in Table 2; additionally 17 (16.7%) patients had smoke history, 4 (3.9%) had a history of one or less than one glass of alcohol usage per day.

Echocardiography was evaluated in 70 (68.6%) patients. Coronary heart failure was present in 17 (24.3%) patients and among these patients 6 had an ejection fraction of less than 35%. Mitral valve regurgitation was present in 9 (12.9%) patients; mitral valve stenosis in 2 (2.9%); aortic valve stenosis in 5 (7.1%) and aortic valve regurgitation in one patient. Ejection fraction of the dead patients was lower than the others ($p=0.002$).

Brain computed tomography was evaluated in 100 patients. In 49 patients ischemia was detected in the right cerebrum, in 4 ischemia was in the right cerebellum, in one of the patients ischemia was in the left cerebellum. Two of the patients rejected the CT and MRI scan so they were diagnosed by physical examination.

There was no pathology in 28 patients, therefore they were diagnosed by diffusion weighted MRI. MRI was evaluated in a total of 60 patients; among these, ischemia was detected in 40 (66.7%) in the left cerebrum, 22 (36.7%) in the right cerebrum, among 2 in the right cerebellum, and 3 in the left cerebellum. When we evaluated the CT and MRI findings together in 100 patients, in 5 there was no ischemic

Table 2. Demographic characteristics of patients

	All Patients		Dead Patients	
	n	%	n	%
Age				
31-40	3	2.9	1	5.6
41-50	7	6.9	0	0
51-60	12	11.8	3	16.7
61-70	18	17.6	1	5.6
71-80	41	40.2	5	27.8
81-90	19	18.6	3	16.7
>90	2	2.0	0	0
Gender				
Male	42	41.2	8	44.4
Female	60	58.8	10	55.6
Co-morbid diseases*				
HT	76	74.5	14	77.8
CAD	30	29.4	9	50.0
DM	25	24.5	7	38.9
CHF	10	9.8	2	11.1
COPD	9	8.8	2	11.1
HL	8	7.8	2	11.1
CRF	2	2.0	0	0
Previous CVD	**9**	**8.8**	**3**	**16.7**

*HT: hypertension; CAD: coronary artery disease; DM: diabetes mellitus; CHF: congestive heart failure; COPD: chronic obstructive pulmonary disease, HL: hyperlipidemia; CRF: chronic renal failure

lesion in CT and MRI and these patients were diagnosed by physical examination findings only The ischemic regions in the combination of CT and MRI findings are summarized in Table 3.

In carotid Doppler ultrasonography, the most frequently seen occlusion of more than 50% was in the right internal carotid artery. Bilateral occlusion was infrequent but plaques causing occlusion of less than 50% were frequently seen (Figure 1).

When we investigated the lipid profiles of the patients, LDL was high in 67.7%, HDL was low in 63.4%, and total cholesterol was high in 16.1%.

Atrial fibrillation was detected in 25 (24.5%) patients. Death occurred in 18 (17.6%) patients. The demographic characteristics of the dead patients are given in Table 2. Mortality was high in patients with coronary artery disease history (p=0.03, χ^2=4.46); there was no relationship between mortality and co-morbid diseases, smoke and alcohol usage (p values are as follows; HT: 0.76; DM: 0.11; HL: 0.57; CHF: 0.83; CRF: 0.50; COPD: 0.70; previous CVO: 0.19; smoke: 0.48; alcohol: 0.69). Logistic regression analysis was evaluated for the relationship between mortality and age, lipid profile; there was no relationship (p values are as follows; age: 0.49; total cholesterol: 0.86; LDL: 0.94; TG: 0.93; HDL: 0.67).

Discussion

Acute strokes can be hemorrhagic or ischemic. Ischemic stroke is more commonly seen (10).

Table 3. CT and MRI findings of ischemia

n=100	n
Cerebral infarct	
Only right	29
Only left	50
Bilateral	15
Cerebellar infarct	
Only right	5
Only left	3
Bilateral	1
Bilateral infarct both in cerebrum and cerebellum	1

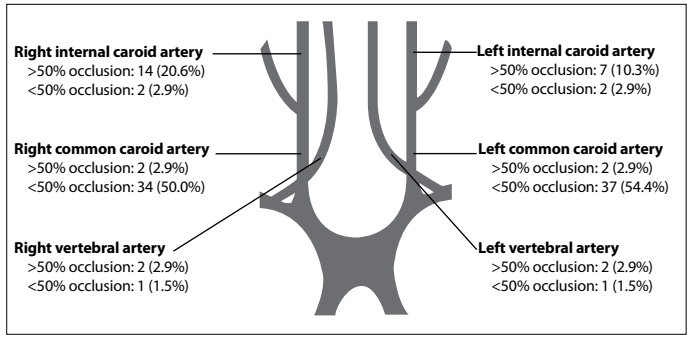

Figure 1. Neck venous doppler ultrasonography findings

In our study, 58.8% patients were female. Kıyan et al. (11) reported that 56.5% of the patients with ischemic stroke were male and 43.5% were female. Also Koyuncu et al. (10) reported that 48% of the patients with ischemic stroke were male and 52% female. Additionally, Leoo et al. (12) reported that 57% of the patients with recurrent ischemic stroke were male.

Ischemic stroke rate increases with age. Framingham reported that the ischemic stroke rate increases 1.66 fold in males and 1.93 fold in females with a 10 year increase of age (13). In our study, ischemic stroke was frequent in males after 60 and in females after 70 years of age.

In our study, when we investigated the co-morbid diseases, HT was present in 74.5%. In the Turkish Multicentre Stroke Survey, HT was detected in 62.7% of patient histories (14). Leoo et al. (12) detected HT in 78% of the ischemic stroke patients. Wolf et al. (15) reported that stroke risk increases proportionally with systolic and diastolic blood pressure increase. In the same study, it was reported that the stroke frequency was decreased 36% by treatment of hypertension alone. According to results of a meta-analysis including seventeen surveys, 38% of the decrease in stroke risk is provided by control of hypertension (16). Thus, hypertension is a primary and modifiable risk factor for all types of stroke (17).

Diabetes mellitus is seen frequently with HT, HL, smoke, obesity and cardiovascular diseases; and when we exclude other factors, DM is an independent risk factor. Also in recurrent strokes, DM is the most important independent risk factor (18). It is estimated that DM affects 18% of the adult population and it is seen in 21-32% of stroke cases (19). Additionally, it is reported that DM increases both coronary and cerebral cases 4 fold, and in ischemic strokes DM increases risk 1.8-6 fold (20-21). In our study, DM was present in 29% of the patients; and this result is compatible with the previous studies.

Hyperlipidemia was present in 7.8% of the patients in our study. However, when we investigated the laboratory results, total cholesterol was high in 17.2%; LDL was high in 67.7%; TG was high in 16.1 and HDL was low in 63.4% of patients. Willey et al. (6) reported that, while the LDL level decreases, ischemic stroke decreases and in conditions where LDL level is above 130 mg/dL, ischemic stroke increases. Additionally, statins used in the management of coronary artery diseases decrease ischemic stroke (22). There is an inverse relationship between HDL and ischemic stroke (23, 24). TG is an independent risk factor in atherothrombotic cerebrovascular diseases (25). Also, in our study, HDL was low in 63.4% of the patients.

Possible causes of cardio embolic stroke are congestive heart failure (CHF), atrial fibrillation (AF), coronary artery diseases (CAD) and left ventricle thrombus. In our study, CHF was present in 9.8%. CHF affects over 400.000 Americans and is responsible for 10% of ischemic stroke cases. In our study, ejection fraction (EF) was lower than 35% in 8.3% and lower than 50% in 24.3% among patients who had echocardiography. Dries et al. (26) reported that, with every 5% decrease in EF, stroke risk increases 18%.

Generally, patients with cardiologic disease have a high risk of ischemic stroke (27). In our study, CAD history was present in 29.4% of the patients. Additionally, mortality was significantly high in patients with CAD history (p=0.03). Cardiac embolism resulted from AF in 50% of patients which could be detected in the ECG (28). In our study, AF was present in 24.5% of the patients. With these results, we indicate that AF is an important risk factor which should be kept under control. With continuous use of acetylsalicylic acid at a dose of 75 mg/day, this risk could be decreased by 6-10% (29).

In a five year survey, Prabhakaran et al. (30) reported that there is no difference in plaque localization and number in ischemic stroke development. Additionally, there is no difference between the carotid stenosis of 40% and 40-60% but in stenosis above 60%, recurrent ischemic stroke increases four fold. In our study, carotid stenosis above 50% was detected mostly in the right internal carotid artery. The stenosis both in the right and left common carotid arteries was not often seen but plaques that cause occlusion less than 50% were frequently seen (Figure 1).

The other factor that is important in ischemic stroke is smoking. In our investigation, 1.7% of our patients were regular smokers. It is hypothesized that smoking affects the fibrinogen level and hemoglobin concentration and accelerates atherosclerosis (31). With the increase in smoking duration, this risk increases more rapidly; the risk in smokers is twice that of non-smokers (32). In conclusion, giving up smoking will prevent the pathological formations so it allows a decrease in both ischemic heart disease and ischemic stroke risk. Therefore, smoking is a preventable risk factor for ischemic stroke.

The first choice of an imagining technique for diagnosis in ischemic stroke is computed tomography (CT) (33). CT shows pathological changes typically after 6-18th hours, but sometimes it can show ischemia in the first two hours (34). Diffusion weighted MRI is more sensitive than CT and it is frequently used for diagnosis of ischemic strokes (35, 36). In our study, in 16 of the patients there was no pathology in computed tomography and they were diagnosed by diffusion weighted MRI.

Conclusion

Although the relationship between mortality and morbidity with only coronary artery diseases is shown in our study, it is shown in the literature that ischemic stroke causes mortality and morbidity. Therefore, in ischemic stroke risk, mortality and morbidity rate due to stroke could be decreased by treatment and precautions against modifiable risk factors.

Ethics Committee Approval: Ethical approval was obtained from Dışkapı Yıldırım Beyazıt Education and Research Hospital Ethical Committee on 27.02.2012 with decree number 01/17.

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