

# Analysis of acute stroke patients admitted to the emergency department

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## Abstract

**Aim:** In this study we investigated the demographics and medical characteristics of acute stroke patients who applied to emergency department (ED) and were admitted to neurology department (ND).

**Material and Methods:** This study was conducted in a tertiary hospital. The patients' medical records were reviewed; age, gender, diagnosis, comorbid diseases, previously anticoagulant treatment, brain computerized tomography reports, brain magnetic resonance imaging reports, hospitalized unit, length of hospital stay, vitamin B<sub>12</sub> levels, electrocardiography recordings, and the outcome of patients.

**Results:** In the including time of the study, 523 patients were hospitalized to the ND from ED. The patients with cerebrovascular diseases (CVD) were 68.7% (n=357) of the hospitalized patients. The patients with acute ischemic stroke (AIS) were 74.8% (n=267) of the patients with CVD. In AIS, the most common comorbid disease was hypertension, followed by atrial fibrillation (AF). The rate of AF was 31% in AIS. AF was newly diagnosed in 46% (38 patients) of patients with AIS, and these patients had no anticoagulation therapy. Vitamin B<sub>12</sub> levels were found to be low in 58 (21.7%) of AIS patients.

**Conclusion:** A large number of patients with undiagnosed AF are diagnosed following AIS. Therefore, it is important that these patients should be followed closely for AF and its management, and it is also important to treat vitamin B<sub>12</sub> deficiency to prevent stroke development.

## INTRODUCTION

Cerebrovascular diseases (CVD) are the second most common cause of death and the first cause among of the causes of morbidity (1). The occlusive type of cerebrovascular diseases that constitute 80-85% are the most common and most frequent causes of death in neurological disease (2). Stroke is the most common cause of epilepsy in the elderly patients and the second most common cause of dementia, and additionally the common cause of depression.

Stroke is a chronic disease that patients in stroke are admitted to intensive care and have a high disability rate, have a long hospital stay and are needed continuous medical treatment. This disease causes emotional and financial burden on patients and their relatives. In order to reduce this burden in all countries of the world, especially in developed countries, efforts are being planned to apply

to emergency department (ED) at the time which has golden value for acute ischemic stroke (AIS), to diagnose AIS in time and to activate the treatment algorithms quickly and correctly. The "Stroke Team" was established for this purpose and has revolutionized the organization of patients in AIS (3,4).

The aim of our study is to provide detailed profiles of the demographic characteristics, symptoms, clinical and laboratory signs of the patients who present with acute stroke in the emergency department, and to provide the results that could help in diagnosis and treatment of CVD to the emergency physicians.

## MATERIAL and METHODS

This study was performed retrospectively after receiving the approval of the hospital ethics committee. This study was conducted in acute stroke patients were admitted to the ED and hospitalized to Neurology Clinic in a tertiary

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hospital between September 20, 2012 and March 20, 2013 for a period of six months. In this study, the patients who are in adult age group (age ≥ 18 years) and who were hospitalized to Neurology Clinic or intensive care unit from ED were included. The patients who are in children age group (age <18) and who were hospitalized to neurology clinic from another clinic/hospital were excluded from study.

The information on the automation system and the patients' medical records were reviewed; age, gender, hospitalization diagnosis, comorbid diseases, previously anticoagulant treatment, brain computerized tomography (Brain CT) reports, brain magnetic resonance imaging (Brain MRI) reports, echocardiography reports, hospitalized unit, recurrent hospitalization, whether or not to apply to the hospital within the first 4.5 hours of symptom onset, whether or not to take fibrinolytic therapy, length of hospital stay (days), vitamin B<sub>12</sub> levels, electrocardiography (ECG) recordings and the outcome of patients. It was considered low when vitamin B<sub>12</sub> was <180 pg/dl.

Statistical data were recorded and analyzed in SPSS (Statistical Package for Social Science) for windows 21.0 program. Continuous variables were expressed as mean ± standard deviation, and intermittent variables as number and percentage. Chi-square test (Pearson Chi-square and Fisher's exact test) was used for group comparisons of discrete variables and Mann-Whitney U test was used for group comparison of continuous variables. For all results, p <0.05 was considered significant.

In the including time of the study, 523 patients were hospitalized to the neurology department from ED. The patients with CVD were 68.7% (n=357) of the hospitalized patients. The patients with AIS were 74.8 % (n=267) of the patients with CVD (Table 1). In patients with CVD, the mean age was 67.36±13.85 (32-88) in transient ischemic attack (TIA), the mean age was 71.08±12.16 (23-100) in the AIS and the mean age was 69.61±14.02 (26-89) in acute hemorrhagic stroke (AHS) (p=0.567). Of the study patients, 168 (47%) were female and 189 (53%) were male. There was no difference in gender distribution of patients with AIS, AHS, and TIA (p=0.991).

The comorbid diseases with CVD were hypertension

(HT), diabetes mellitus (DM), atrial fibrillation (AF), hyperlipidemia (HL), and heart valve disease, in decreasing order of frequency. In AIS, the most common comorbid disease was HT, followed by AF. The rate of AF was 10% in TIA and 31% in AIS (Table 1). AF was newly diagnosed In 46% (38 patients) of patients with AIS, and these patients had no anticoagulation therapy. In addition, 91 patients had previously diagnosed with AF. ASA was being used by 44.5% of the patients and warfarin was being used by 22.3% of the patients. Totally 77.8% of the 91 patients were receiving anticoagulant therapy.

Vitamin B<sub>12</sub> levels were found to be low in 14 (23.7%) of TIA patients, 58 (21.7%) of AIS patients and 5 (16.2%) of AHS patients.

Brain CT reports of 124 (60%) patients were normal in 207 patients with AIS whose Brain CTs' were accessed by authors and the images of only 2 (1%) patients were interpreted as acute ischemic area. (Table 2).

In brain MR imaging, acute ischemic area was detected in 81% of AIS patients and 4% of TIA patients, and hemorrhagic area was found in 66% of patients with AHS.

Diffusion magnetic resonance (Diffusion MR) imaging showed restricted diffusion in 92.5% of AIS patients, 40% of AHS patients, and 7% of TIA patients.

**Table 1. Comorbid Diseases in CVD\***

CVD*	Heart Valve Disease	HL <sup>¶</sup>	DM <sup>¶¶</sup>	HT <sup>**</sup>	AF <sup>**</sup>
<b>AIS<sup>†</sup> (n:267)</b>	5 (% 2)	15 (%6)	79(%30)	172(%64)	82(%31)
<b>AHS<sup>‡</sup> (n:31)</b>	1(%3)	1 (%3)	6(%19)	17(%55)	3(%9)
<b>TIA<sup>§</sup> (n:59)</b>	1(%2)	3 (%5)	18(%31)	31(%53)	6(%10)
<b>Total (n:357)</b>	7(%2)	19 (%5)	103(%29)	220(%61)	91(%25)

\*CVD: Cerebrovascular Diseases, †AIS: Acute Ischemic Stroke, ‡AHS: Acute Haemorrhagic Stroke, §TIA: Transient Ischemic Attack, ¶HL: Hyperlipidemia, ¶¶DM: Diabetes Mellitus, \*\*HT: Hypertension, \*\*AF: Atrial Fibrillation

**Table 2. Brain CT findings in cerebrovascular diseases**

Disease	Normal	Acute Ischemic Area	Subacute Ischemic Area	Chronic Ischemic Area	Hemorrhagic Area	Total N (%)
<b>AIS*</b>	124 (%60)	2 (%1)	59 (%28)	22 (% 11)	-	207 (%100)
<b>AHS*</b>	2 (%7)	-	2 (%7)	-	26 (% 86)	30 (%100)
<b>TIA<sup>‡</sup></b>	32 (%70)	-	3 (%6)	11 (% 24)	-	46 (%100)

\*AIS: Acute Ischemic Stroke, \*AHS: Acute Hemorrhagic Stroke, ‡TIA: Transient Ischemic Attack

In the study, 1.5% of patients with AIS and 9.6% of patients with AHS, who had applied to ED in the first 4.5 hours were in only 2% of patients with CVD. None of the TIA patients applied to the hospital within the first 4.5 hours.

In the including time of the study, 35.5% of patients with AHS and 10.9% of patients with AIS had been hospitalized in intensive care unit. There was no intensive care unit admission in patients with TIA.

There was a significant difference regarding the length of hospital stay in vascular diseases ( $p=0.001$ ). The longest hospital stay was in AHS patients with  $13.39 \pm 9.47$  days and the shortest hospital stay was in TIA patients with  $6.76 \pm 3.28$  days. The length of hospital stay was  $10.96 \pm 9.73$  days for AIS.

Regarding the outcome of the CVD group, full recovery was most in patients with TIA (84.4%). Exitus was most common in patients with AHS (16.1%) (Table3).

Atrial fibrillation was detected in 50% of patients who died due to AIS.

**Table 3. Tables of results of vascular diseases**

Disease	Partially Recovery	Full Recovery	Exitus	Total (n)
AIS*	241(%90.2)	12(%4.5)	14(%5.2)	267
AHS†	21(%67.7)	5(%16.1)	5(%16.1)	31
TIA‡	7(%11.9)	51(%84.4)	1(%1.7)	59
Total	269(%75.4)	68(%19)	20(%5.6)	357(%100)

\*AIS: Acute Ischemic Stroke, †AHS: Acute Haemorrhagic Stroke, ‡TIA: Transient Ischemic Attack

## DISCUSSION

The neurological conditions are complex, acute and severe diseases; therefore, the patients are often referred to emergency services (5). Carroll et al (1). found that 78% of patients admitted to neurology service and intensive care unit were hospitalized from emergency medicine clinics. Similarly, in our study, 57.8% (523) of the patients admitted to the neurology service were hospitalized from ED. These results are important in showing that neurological emergency diseases are important in emergency department admissions.

Similar to our study, CVD is the leading cause of neurological diseases in other studies. Cerebrovascular diseases constitute the majority of the neurological diseases referred to the emergency services, as well as about half of the patients in the neurology clinics. These patients have a long hospital stay, and high morbidity and mortality rates. The lowest rates are seen in TIA, but the results are much worse in AHS (6,7). Similarly, in our study, the longest hospital stay and the highest mortality rate were found in AHS. The low rates in TIA indicate the importance of preventing the development of acute neurological conditions.

Imaging studies are used to exclude hemorrhage, assess the degree of brain damage, and identify responsible

vascular lesions in patients with acute stroke (2). In our study, in 207 patients with AIS and the images of only 2 (1%) patients were interpreted as acute ischemic area. In patients with TIA, acute ischemic area was not detected in any patient and 70% was considered as normal. Hemorrhage was detected in brain CT images in 86% of patients with AHS.

Despite the practical problems with the use of brain MR imaging in the treatment of acute stroke, multimodal MR can provide useful information for accurate stroke diagnosis, assessment of risks, and estimation of benefits and outcomes of thrombolysis (8). In brain MR imaging, acute ischemic area was detected in 81% of AIS patients and 4% of TIA patients, and hemorrhagic area was found in 66% of patients with AHS. Diffusion MR imaging showed restricted diffusion in 92.5% of AIS patients and 7% of TIA patients. These results show that diffusion MR imaging is more successful in showing the ischemic area and that it is useful in the early stage of emergency surveillance, and brain CT imaging should be done to exclude hemorrhage.

It has been observed that most of the CVDs are AIS in studies conducted in the world and in our country, and that AHS and TIA are in the second and third place in studies. The AIS rate ranges from 60 to 85% (2,6,9). Our study is compatible with the literature and the most frequent was AIS with 74.8%. Risk factors that increase atherogenesis and atherothrombotic complications and ischemic stroke risk factors largely overlap. Hypertension has been identified as the most important risk factor for all types of CVD. In the conducted studies, the rate of HT is reported as 25-75% in patients with CVD (2,3). In our study, this rate was 61.6%.

Non-valvular atrial fibrillation (NVAF) is an important risk factor for ischemic stroke. It is especially seen in the elderly and is an important cause of cardioembolic stroke (10). In a study by Borowsky LH et al (11) in 856 patients with AIS, they found that previous AF was 10.5% and newly diagnosed AF was 18%. In our study, AF rate for AIS was 31% and it was found to be a significant risk factor for AIS. In 46% of these patients, AF was newly diagnosed with AIS and these patients did not have previous anticoagulant therapy regimen. In addition, 77.8% of patients with AF diagnosis, 44.5% on ASA and 22.3% on warfarin, had stroke while receiving anticoagulant treatment. Atrial fibrillation was also detected in 50% of patients who died due to AIS. This result suggests that AF is a very important parameter in AIS, and also that patients with AF should be closely monitored and managed in terms of stroke.

Hyperhomocysteinemia is one of the undetermined risk factors that can be altered in ischemic stroke (12). Vitamin B<sub>12</sub> is used as a cofactor and folate is used as a substrate during Homocysteine (Hys) metabolism. Hys levels were found to be elevated in the absence of these vitamins, and Hys levels were also found to decrease with folate alone or folate in combination with vitamin B<sub>12</sub> and B<sub>6</sub> (13,14). In our study, vitamin B<sub>12</sub> levels were low in 21.6% of all CVDs. Ninety three point five percent of vascular diseases

with low vitamin B<sub>12</sub> levels were ischemic (AIS+TIA) and 6.5% were hemorrhagic. No folate deficiency was detected in our study. These results are important in indicating hyperhomocysteinemia as a treatable risk factor in patients with ischemic stroke.

Currently, tissue plasminogen activator administration within the first 4.5 hours after early diagnosis in patients with suspected ischemic stroke has been shown to be effective in decreasing mortality and positively contributing to quality of life (15). The delay in the onset of acute stroke treatment occurs at various stages, but the most waste of time is seen outside the hospital. Important factors in delaying medical demand are that stroke symptoms are not known, its severity is not recognized, the disease is ignored and the expectation of spontaneous recovery (16). Studies conducted in terms of the time from the onset of stroke symptoms to the time of emergency service admission indicate both vast majority of patients referring to the hospital within the first three hours of the onset of symptoms (3) and 44.4% of patients referring to the hospital more than three hours later. (17). In our study, only 2% of the patients with vascular diseases applied to the hospital within the first 4.5 hours. One point four percent of patients with AIS and 29% of patients with AHS were admitted to the hospital within the first 4.5 hours and none of the TIA patients admitted to the hospital within the first 4.5 hours. For this reason, we believe that people in our country should be educated about the stroke and education programs should be organized for the public. Since no "Stroke Team" was established in our hospital during the period of our study (20 September 2012-20 March 2013), no fibrinolytic treatment was given to the patients with AIS.

## CONCLUSION

In conclusion, Patients with AIS have very low rates of admission within the first 4.5 hours. "Stroke team" should be formed in the hospitals, and studies should be carried out to raise public awareness about stroke in our country at the same time. A large number of patients with undiagnosed AF are diagnosed following AIS. Therefore, it is important that these patients should be followed closely for AF and its management, and it is also important to eliminate vitamin B<sub>12</sub> deficiency to prevent stroke development.

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