Turkish Journal of Cerebrovascular Diseases 2022; 28(2): 94-105 Türk Beyin Damar Hastalıkları Dergisi 2022; 28(2): 94-105
Turk J Cereb Vasc Dis
doi: 10.5505/tbdhd.2022.08216

RESEARCH ARTICLE **ÖZGÜN ARAŞTIRMA**

DATA OF THE INDEPENDENT STROKE UNIT IN THE STATE HOSPITAL

Refik KUNT[1], Rahime ASLAN[2]

[1]Freelance Neurologist, Aydın, TÜRKİYE
[2]Aydın State Hospital, Stroke Unit, Aydın, TÜRKİYE

ABSTRACT

INTRODUCTION: Through to the stroke units, mortality and morbidity rates in acute cerebrovascular diseases decrease, quality of life increases and clinical outcomes are better. The data on the stroke unit in our country are based on publications reported by tertiary healthcare institutions. There is no data on state hospitals, which are usually the first application places of patients. With this article; It is aimed to contribute to the literature of our country by presenting the first 6 months data collected on patients hospitalized in the stroke unit, which are independent (different from the neurology service and intensive care unit) in the secondary state hospital.
METHODS: The data including sociodemographic, etiological and clinical characteristics of the patients hospitalized during the first six months after the stroke unit was opened were retrospectively analyzed.
RESULTS: A total of 88 patients, 48 of whom were women (55%), with an average age of 70 years were included. 82% of the patients were diagnosed with ischemic stroke. The most common risk factor was hypertension(82%). When ischemic stroke was etiologically classified according to TOAST, the most common cause was the group whose cause could not be determined (51%). The most common lesion localizations; parietal lobe(36%) in patients with ischemic stroke and putamen / globus pallidum (50%) in hemorrhagic stroke patients. Intravenous thrombolytic therapy was applied to 21% of ischemic stroke patients and the median (±standard deviation) time of symptom-door, door-imaging, door-needle, symptom-injection in minutes was found to be 92±55, 17±10, 82±41 and 195±41, respectively. Intracranial hemorrhage complication occurred in 2 patients (13%) who were given thrombolytic therapy. 11% of all patients died within the first month.
DISCUSSION AND CONCLUSION: Through to the design of the stroke units outside of the neurology service and neuro-intensive care, referrals and hospitalizations from different branches and other hospitals will be prevented, thus the concept of stroke bed will gain importance.
Keywords: Stroke unit, state hospital, ischemic stroke, hemorrhagic stroke, transient ischemic attack, stroke bed.

Address for Correspondence: Assoc. Prof. Refik Kunt, M.D. Efeler Mh. 1438 Sk. No:18, D:1, 09020 Efeler, Aydın, Türkiye
Phone: +90551 037 78 77 **E-mail:** rekunt@yahoo.com.tr
Received: 18.03.2022 **Accepted:** 28.05.2022
ORCID IDs: Refik Kunt 0000-0003-4561-1844, Rahime Aslan 0000-0002-8301-4656.
Please cite this article as following: Kunt R, Aslan R. Data of the independent stroke unit in the state hospital. Turkish Journal of Cerebrovascular Diseases 2022; 28(2): 94-105. doi: 10.5505/tbdhd.2022.08216

BİR DEVLET HASTANESİ BÜNYESİNDE BULUNAN BAĞIMSIZ NİTELİKTEKİ İNME ÜNİTESİNİN VERİLERİ

ÖZ

GİRİŞ ve AMAÇ: İnme üniteleri sayesinde akut beyin damar hastalıklarında mortalite ve morbidite oranları azalmakta, yaşam kalitesi artmakta ve klinik sonlanımlar daha iyi olmaktadır. Ülkemizde inme ünitesi ile ilgili veriler üçüncü basamak sağlık kuruluşlarının bildirdiği yayınlara dayanmaktadır. Hastaların genellikle ilk başvuru yeri olan devlet hastaneleri ile ilgili veri yoktur. Bu yazı ile; ikinci basamak devlet hastanesinde bağımsız özellikte (nöroloji servisi ve yoğun bakımdan farklı) olan inme ünitesinde yatan hastalar ile ilgili toplanan ilk 6 aylık veriler sunularak ülkemiz literatürüne katkıda bulunmak amaçlanmaktadır.

YÖNTEM ve GEREÇLER: İnme ünitenin açıldığı tarihten itibaren ilk altı aylık süre zarfında yatan hastaların sosyodemografik, etiyolojik ve klinik özelliklerini içeren verileri retrospektif olarak incelendi.

BULGULAR: Çalışmaya; yaş ortalaması 70 yıl olan, 48'i kadın (%55) toplam 88 hasta alındı. Hastaların %82'si iskemik inme, %11'i hemorajik inme ve %7'si geçici iskemik atak tanılıydı. En sık rastlanan risk faktörü hipertansiyondu (%82). İnme Sonrası değerlendirme ölçeklerine göre ağır nörolojik tabloda ve fonksiyonel olarak bağımlı olan hastalar hemorajik inmelilerdi. İskemik inme etiyolojik olarak TOAST'a göre sınıflandırıldığında en sık sebep nedeni belirlenemeyen gruptu (%51). En sık görülen lezyon lokalizasyonları; iskemik inmeli hastalarda parietal lob (%36), hemorajik inmelilerde ise putamen/globus pallidum (%50) olarak belirlendi. İskemik inmelilerin % 21'ine intravenöz trombolitik tedavi uygulandı ve bu hastaların semptom-kapı, kapı-görüntüleme, kapı-iğne, semptom-iğne zamanlarının medyan değerleri (±standart sapma) dakika olarak sırası ile 92±55, 17±10, 82±41 ve 195±41 saptandı. Trombolitik tedavi verilen 2 hastada (%13) intrakranial hemoraji komplikasyonu oldu. %13'ü iskemik, %17'si hemorajik alt grupta olmak üzere tüm hastaların %11'i ilk bir ay içinde kaybedildi.

TARTIŞMA ve SONUÇ: İnme ünitelerinin nöroloji servisi ve nöroyoğun bakım dışında dizayn edilmesi sayesinde, farklı branştan ve başka hastanelerden gelebilecek sevklerin ve yatışların önüne geçilecek böylece inme yatağı kavramı önem kazanacaktır.

Anahtar Sözcükler: İnme ünitesi, devlet hastanesi, iskemik inme, hemorajik inme, geçici iskemik atak, inme yatağı.

INTRODUCTION

The World Health Organization has defined stroke, which is a serious health problem in society, as a serious clinical picture that develops suddenly as a result of infarction or hemorrhage in the cerebral, spinal, or retinal regions and can progress from focal neurological deficit to death (1). Stroke is classified into two main categories. If it develops due to thrombosis, embolism, or systemic hypoperfusion, it is classified as ischemic, and if it develops due to intracerebral or subarachnoid hemorrhage, it is classified as hemorrhagic stroke.

Stroke is the second most common cause of death after ischemic heart diseases worldwide and also the third most common cause of mortality and disability after neonatal disorders and ischemic heart diseases in all age groups (2, 3). According to the data from the Turkish Statistical Institute, 35,575 people died of a stroke in 2019 in Turkey and stroke was the fourth most common cause of death after heart diseases, cancer, and respiratory system diseases with a rate of 8% among all deaths (4). In other words, one person died of stroke every 15 minutes in 2019 in Turkey. In addition, it is stated that approximately 132,000 new cases of stroke are encountered every year in our country and there are approximately 191,000 people who continue to live with stroke and its complications (2,5).

In recent years, death rates due to cerebrovascular diseases have decreased as a result of increasing the awareness of healthcare professionals about stroke, regulation of the in-hospital stroke organization by algorithms and increasing the number of stroke units and stroke centers (6,7). In addition, it is expected that these rates will continue to decrease with the groundbreaking developments in the treatment of stroke. Reperfusion strategies developed especially for opening the occluded blood vessel and surgical clipping (such as thrombolytic and mechanical thrombectomy) or angiographic embolization methods to the ruptured blood vessel in the early period have been saving lives (8).

According to the 2021 data of the General Directorate of Public Hospitals of the Ministry of Health of the Republic of Turkey (university hospitals are not included in these data), stroke centers and units are located in 35 health facilities

in 23 provinces in total (9). One of these facilities is the Stroke Unit of Aydın State Hospital, which was planned and opened as a primary stroke center according to the metrics determined by the Turkish Cerebrovascular Diseases Society on 01.10.2018 and licensed by the Ministry of Health within one month. According to the data of the Ministry, this unit is the first and only stroke unit in secondary state hospitals in our country that is physically independent in terms of neurology clinic and intensive care and has its nurse, physician, and healthcare professionals.

The data on stroke units in our country are based on the publications reported by tertiary health institutions. There is no data on public hospitals, which are usually the first places where patients apply. This article aimed to contribute to the literature of our country by presenting the data of the first 6 months concerning the patients hospitalized in the stroke unit of a secondary state hospital.

METHODS

The study was carried out in accordance with the ethical rules specified in the Helsinki Declaration. Approval was obtained from Aydın Adnan Menderes University, Faculty of Medicine, Non-Interventional Clinical Research Ethics Committee (Date: 11.03.2021, Number: 2021/45.). The data of the inpatients were recorded during the first 6 months from the date of the opening of the unit. The data collection form included demographic characteristics of the patients (age, gender, marital status, education level), medical histories (risk factors, drugs used, history of any previous stroke, presence of carotid disease), quality metrics of acute stroke treatment (symptom to door, door to hospitalization, door to imaging, door to needle, symptom to needle, referral and length of hospital/stroke unit stay), examination findings [modified Rankin Scale (mRS) and the National Institutes of Health Stroke Scale (NIHSS) scores], clinical features [type of stroke, localization of lesions, TOAST classification according to stroke etiological subtype (Trial of ORG 10172 in Acute Stroke Treatment)], administration of intravenous (IV) tissue plasminogen activator (t-PA), if administered, complications and reasons for non-administration], laboratory tests at the time of admission and follow-up [glucose, creatine, blood urea nitrogen (BUN), lipid profile, hemogram, serum aspartate aminotransferase (AST), serum alanine aminotransferase (ALT), Vitamin B12 levels, thyroid function tests, prothrombin time (International Normalization Ratio-INR) values], brain [computed tomography (CT), diffusion magnetic resonance imaging [MRG)], vascular imaging [CT Angiography or MRG Angiography or doppler ultrasound (USG)], and cardiac examinations [electrocardiogram (ECG), echocardiography (ECO), holter ECG, if any)].

The patients were divided into 3 subgroups: Ischemic stroke, hemorrhagic stroke, and transient ischemic attack (TIA). According to the localization of the lesions, the ischemic stroke group was grouped as the frontal, parietal, temporal, occipital, brainstem, cerebellum, deep white matter, border zone, multiple anterior system, multiple posterior system, and multiple anterior-posterior system infarct areas, and the hemorrhagic stroke group was grouped as the thalamus, putamen, lobar, brainstem, and cerebellum. Patients with symptoms of transient focal arterial ischemia (<24 hours) and no evidence of infarction on pathological examination or imaging were accepted as TIA.

Neurological evaluations at the time of admission were standardized with NIHSS and disability due to stroke was standardized with mRS. Based on the NIHSS score, 0 points were classified as normal, 1-4 as mild, 5-14 as moderate, 15-20 as moderate-severe, and a score of ≥21 were classified as severe stroke (10,11). According to the mRS, 0-2 indicated functional independence, 3-5 dependence, and 6 indicated death (11,12). Etiological evaluations of patients with ischemic stroke were performed according to the TOAST classification (13).

The presence of atrial fibrillation (AF) was documented by ECG and in some patients by 24-hour Holter ECG monitoring. The diagnosis of AF was confirmed by the cardiologists consulted. Guidelines adopted in our country were used in the diagnosis of hypertension, diabetes mellitus, and hyperlipidemia. Patients who were grouped as hypertensive were divided into two groups as (1) patients with known hypertension and using antihypertensive drugs, and (2) patients with a systolic blood pressure of 140 mmHg and diastolic blood pressure of 90 mmHg during discharge, therefore in need of antihypertensive medication

since post-stroke hypertension could generally continue until the end of the first week due to cerebral autoregulation (14,15). Diabetic patients were grouped as (1) patients with known diabetes and using anti-diabetic drugs, and (2) patients with fasting plasma glucose ≥126 mg/dl, random plasma glucose ≥200 mg/dl, or HbA1c ≥6.5% (16). The presence of hypercholesterolemia was defined as (1) patients with known hypercholesterolemia and under treatment, and (2) patients with serum LDL level >130 mg/dl, regardless of risk factors (17).

The time of initial brain imaging was accepted as the time of imaging-admission to the hospital. The reason why brain CT or diffusion MRI imaging times were not examined separately was that there was no need for diffusion MRI imaging when hematoma was detected in some patients or that there was no data confusion arising from performing CT when infarction was detected in MRI. There was an imaging center in all of the hospitals admitted with referral; however, the data of the patients admitted with referral were not calculated while calculating the imaging time because the exact data regarding the first admission and imaging times of the patients in these hospitals could not be accessed.

According to the criteria of the North American Symptomatic Carotid Endarterectomy Trial (NASCET), ≥50 stenoses in the internal carotid artery were defined as a carotid disease (18). In case the patient died without vascular imaging, it was considered as a stroke of undetermined cause. The effective value of INR was taken as the range of 2 and 3. The use of an effective new oral anticoagulant (NOAC) was defined as the amount of medication to be taken on time. Patients, who were administered IV-tPA, were recorded in the "Thrombolytic Therapy for Acute Ischemic Stroke" prepared by the Cerebrovascular Diseases Study Group of the Turkish Neurological Society, and they were administered thrombolytic therapy upon the written consent of the patients or their relatives. Published algorithms were used during treatment (19).

Statistical Analysis: The statistical analysis was performed using IBM SPSS Statistics (Version 21.0. Armonk, NY: IBM Corp.). Continuous variables were expressed as mean or median (median; interquartile range) ± standard deviation with minimum and maximum values, while categorical data were expressed as numbers and percentages.

RESULTS

A total of 95 patients were admitted to the stroke unit in 6 months covering the dates of 01.10.2018 and 01.04.2019. Among these inpatients, 88 were hospitalized due to cerebrovascular diseases. Of the remaining patients, 5 were diagnosed with epilepsy, one with a primary brain tumor, and one with gastric cancer with metastasis of the brain. None of these patients were hospitalized due to a preliminary diagnosis of stroke or diseases mimicking stroke. Since there was no bed in the relevant departments at that moment, they were temporarily hospitalized in the intensive care units and transferred to the relevant departments when the beds were available. The mean age of 88 brain vascular patients included in the study was 70 (30-101). Among these patients, 48 were female (55%), 82% had ischemic stroke, 11% had hemorrhagic stroke, and 7% had a diagnosis of TIA. While 26% of the inpatients did not have any school degrees, 3% were graduates of university (Table 1). Of these patients, 14% were referred from other hospitals, and 5% were patients who had a stroke while hospitalized in other clinics in the hospital.

The median values (± standard deviation) of the significant times were examined and the symptom-to-door time was determined as 179±366 (min-max: 0-2301; mean: 294) minutes, the door-to-hospitalization as 106±84.5 (min-max: 0-364; mean: 129) minutes, and the door-to-brain imaging time as 18±40 (min-max: 3-244, mean: 30) minutes. The mean referral time of 11 patients admitted to the hospital with referral was 58 (10-180) minutes. While the mean length of stay in the stroke unit was 4 (1-20) days, the mean total length of stay of the same patients was 16 (1-71) days (Table 1). Hypertension (82%) was the most common risk factor and 35% of the patients with hypertension did not use any antihypertensive agent. While 57% of the patients had a history of smoking and 18% had a history of stroke at some point in their lives, 35% had coronary artery disease (Table 1).

In 51% of the patients, the mRS scores at the time of admission were between 0-2. In addition, 54% of the patients with ischemic stroke and 17% of the patients with hemorrhagic stroke were

functionally independent at the time of admission. According to NIHSS, 46.2% of all strokes were mild, 46.8% were moderate, and 9.1% were moderate-severe. The rate of patients who were mild according to NIHSS was 46.5% among the patients with ischemic stroke and 16.7% among the patients with hemorrhagic stroke (Table 1). AF was detected in 30 patients (34%). Among these patients, 30% had an ischemic stroke while using warfarin and 16.6% had an ischemic stroke while using an effective dose of NOAC. In addition, 40% (n: 12) were newly diagnosed with AF. 24-hour rhythm Holter ECG was performed on all patients who were not determined to have AF with routine ECG, and AF was detected in 4 of these patients. The INR of 8 patients using warfarin was inactive, while one patient had a stroke while their INR was active (in the range of 2-3).

Table 1. Data including sociodemographic characteristics, risk factors, neurological status, and some significant times of patients in the stroke unit..

	Ischemic Stroke	**Hemorrhagic Stroke**	**Transient Ischemic Attack**	**All Patients**	**Patients Administered IV tPA**
Number (n,%)	72 (82%)	6 (11%)	10 (7%)	88	15 (21%)*
Age (n,mean)	71 (31-101)	67 (51-84)	61 (30-79)	70 (30-101)	73 (49-101)
Gender (female,%)	38 (53%)	5 (83%)	5 (50%)	48 (55%)	8 (53%)
Marital status (married, n, %)	37 (51%)	5 (83%)	9 (90%)	51 (58%)	6 (40%)
Educational status (%)					
Illiterate	8 (11%)	1 (17%)	-	9 (10%)	1 (7%)
Literate	13 (18%)	-	1 (10%)	14 (16%)	1 (13%)
Primary school	36 (50%)	4 (66%)	6 (60%)	46 (53%)	9 (60%)
Middle school	8 (11%)	-	1 (10%)	9 (10%)	1 (7%)
High school	5 (7%)	1 (17%)	1 (10%)	7 (8%)	2 (13%)
University	2 (3%)	-	1 (10%)	3 (3%)	-
Significant times (min) (median, min-max)					
SDT	199 (0-2301)	151 (109-720)	155 (85-1439)	179 (0-2301)	92 (0-178)
DAT	103 (0-364)	153 (67-319)	171 (59-364)	106 (0-364)	60 (0-166)
DIT	19 (3-172)	11 (8-162)	15 (6-244)	18 (3-244)	17 (8-44)
Risk Factors (%)					
HT / Number of patients with no treatment	59 (82%)	5 (83%)	8 (80%)	72 (82%) 25 (35%)	11 (73%)
DM / Number of patients with no treatment	35 (49%)	1 (17%)	5 (50%)	41 (46%) 12 (29%)	3 (20%)
HL/ Number of patients with no treatment	17 (24%)	0	2 (20%)	19 (21%), 9 (47%)	3 (20%)
AF/ Patients who did not receive anticoagulants	27 (38%)	1 (17%)	2 (20%)	30 (34%) 16 (53%)	8 (53%)
History of Stroke	13 (18%)	1 (17%)	2 (20%)	16 (18%)	-
Smoking (current and former smokers)	38 (53%)	5 (83%)	7 (100%)	50 (57%)	8 (53%)
NIHSS at the time of admission (n,%)					
Normal	-	-	-	-	-
Mild	33 (46%)	1 (17%)	-	34 (44%)	-
Moderate	33 (46%)	4 (66%)	-	37 (47%)	10 (67%)
Moderate-Severe	6 (8%)	1 (17%)	-	7 (9%)	5 (33%)
Severe	-	-	-	-	-
mRS at the time of admission (n,%)					
Independent	39 (54%)	1 (17%)	-	40 (51%)	-
Dependent	33 (46%)	5 (83%)	-	38 (49%)	15 (100%)
Length of stay at the unit/hospital	4 / 15 days	7 / 34 days	3 / 8 days	4 / 22 days	4 / 23 days
Number of exitus	9 (12.5%)	1 (17%)	-	10 (11%)	4 (26.7%)

IV t-PA: intravenous thrombolytic, SDT: symptom-to-door time, DAT: door-to-admission time, DIT: door-to-imaging time, HT: hypertension, DM: diabetes mellitus, AF: atrial fibrillation, NIHSS: National Institutes of Health Stroke Scale, mRS: the modified Rankin Scale, min: minute, *the rate of administration of intravenous thrombolytic among the patients with ischemic stroke.

CT angiography was performed in 87.5% of all patients with ischemic stroke, and large vascular disease was detected in 16.7% (n: 12). While the two most common localizations of cerebral infarction were parietal and deep white matter regions (Figure 1), the most common region of parenchymal hematomas was the putamen (Figure 2).

Among the inpatients of the unit, 10 (11.5%) died during hospitalization. When the causes of etiological ischemic stroke were classified according to TOAST, 51% (n: 37) were in the group with undetermined causes, while the others were cardioembolic and lacunar strokes according to their frequency (Figure 3). Looking at the distribution of ischemic strokes with undetermined causes by subgroups, it was found that 16.2% (n: 6) had two or more potential causes, and 24.3% (n: 9) had an incomplete examination for the diagnosis. It was determined that the cause of ischemic stroke could not be identified with the examinations performed according to the hospital conditions of the remaining patients (n: 22, 59.5%). When patients diagnosed with TIA and hemorrhagic stroke were removed, 15 (20.5%) of the remaining 73 patients with ischemic stroke were administered IV t-PA. The two most common reasons for the inability to administer thrombolytics were time (34.1%) and low NIHSS (≤4 points) (19.3%). Looking at the median values (± standard deviation) of the significant times of intensive care unit, have separate physicians and the patients who were administered thrombolytic treatment, symptom-to-door time was 92±55 (min-max: 0-178, mean: 100) minutes, door-to-imaging time was 17±10 (min-max: 8-44, mean: 18.5) minutes, door-to-needle time was 82±41 (min-max: 48-173, mean: 97) minutes, and symptom-to-needle time was 195±41 (min-max: 117-255, mean: 195) minutes (Table 2). Demographic data of those receiving thrombolytic therapy are presented in Table 1. The most important reason for prolonging the door-to-needle time was found to be the waiting time for the blood laboratory test results of the patients. Among these blood parameters, the value that resulted in the longest time (~40 minutes) was determined to be INR. Two patients (13.3%) who were administered thrombolytics had intracranial hemorrhage complications in the type of hemorrhagic transformation. Since one patient had an ischemic stroke after coronary angiography, there was bleeding from the groin entry site after the administration of systemic thrombolytic. The treatment was not stopped and bleeding was stopped with tight compression. One of the patients who received thrombolytic treatment was referred to the university hospital in the province for mechanical thrombectomy, and the patient was readmitted to the unit after the thrombectomy procedure. Demographic data of the patients receiving thrombolytic therapy are presented in Table 1.

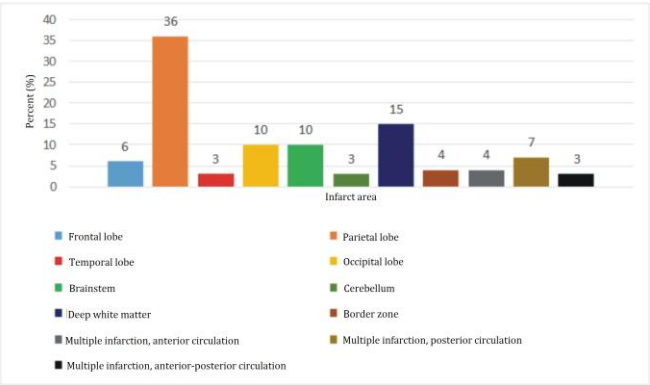

Figure 1. Infarct areas in patients with ischemic stroke.

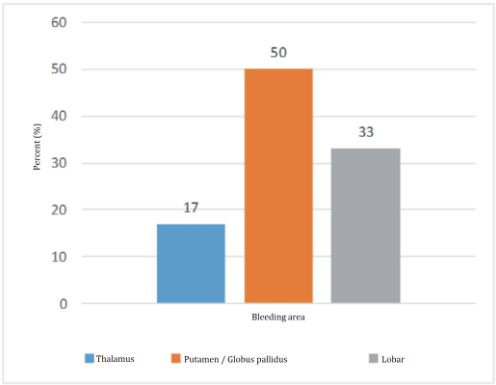

Figure 2. Bleeding areas in patients with hemorrhagic stroke.

DISCUSSION AND CONCLUSION

Stroke units are special units where only patients who had a stroke are admitted, have a level between the general neurology clinic and the nurses, and the vital functions of patients are monitored (20). Mortality and morbidity rates decrease, quality of life increases, and clinical

Table 2. Some important times (minutes) in patients receiving intravenous thrombolytic therapy.

Patient	Symptom-to-door time	Door-to-imaging time	Door to needle time	Symptom-to-needle time
1	92	14	118	210
2	88	20	107	195
2	164	21	76	195
4	178	10	52	230
5	99	9	51	150
6	47	31	150	187
7*	0	14	117	117
8	32	24	173	205
9	70	44	170	240
10	170	21	70	240
11	153	14	77	230
12	77	8	73	150
13	157	-	48	255
14	118	20	82	170
15	60	8	90	150
Mean	107.5 ‡	18.4 §	97	195
Median±SD	92±55	17-10	82±41	195±41

*; Patients who had a stroke in the hospital, †; Patients referred from another hospital, ‡; Mean of patients other than the patients who had a stroke in the hospital, §; Mean of patients other than the patients referred from another hospital whose imaging times were unknown. SD: standard deviation.

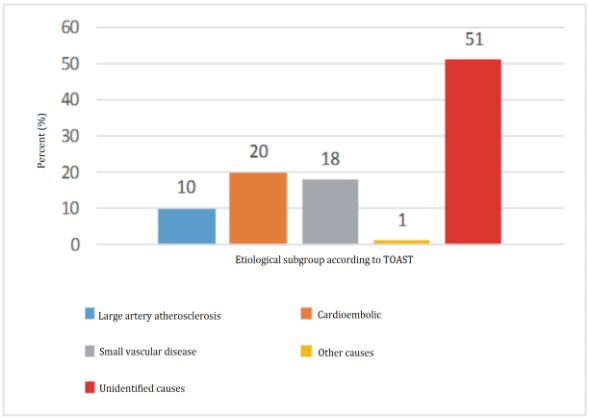

Figure 3. Etiological classifications of patients with ischemic stroke according to Trial of Org 10172 in Acute Stroke Treatment (TOAST).

results get better as a result of the admission of patients with acute cerebrovascular diseases to stroke units (21). Some studies reported that the clinical outcomes of patients with acute stroke admitted to the stroke units were significantly more positive compared to the patients admitted to the neurology clinic or other hospital clinics and units. According to these studies, a decrease of 3-28% was achieved in mortality rate and 8-11% in the length of hospital stay, and, most importantly, an increase of 7-19% was achieved in the rate of discharge with independence thanks to the follow-ups in the stroke unit (20).

Aydın State Hospital, which provides IV thrombolytic treatment in acute stroke since 2014, is the central hospital of the province. It has a second-line neurology intensive care unit with a capacity of 8 beds and a neurology clinic with a capacity of 27 beds. Formerly, thrombolytic treatment could not be administered to patients with acute ischemic stroke due to the high bed occupancy rates and the lack of appropriate services or intensive care beds for close monitoring, regardless of the type of admission to the hospital. Therefore, performing the treatment of acute stroke effectively and in line with the guidelines required having a stroke unit with its healthcare team, independent of the neurology clinic and general intensive care unit.

A stroke unit, which was planned according to the criteria determined by the Turkish Cerebrovascular Diseases Society (21) was opened in our hospital on 01.10.2018. Features of the stroke unit are as follows: 1) The four monitored beds qualify as basic intensive care beds. 2) There is a twelve outlet electrical panel fixed on the wall separately for each bed, a bedside panel with an oxygen and vacuum system, as well as a hand washing sink located at an appropriate distance to the stroke beds. 3) There is an area for cleaning and storing bedpan and urine containers outside the patient area and in a separate area inside the unit. 4) There are no toilets and bathrooms in the patient areas of the stroke unit and they are located in a separate section inside the unit. 5) Patients are constantly monitored with a separate central monitoring system to which bedside monitors are connected. 6) Each bed has an invasive bedside monitoring system and, invasive/non-invasive blood pressure when necessary, pulse and ECG, respiratory rate and rhythm, and oxygen saturation are continuously

monitored throughout the hospitalization of the patient. 7) There is a transport ventilator that may be required to provide life support during the transfer of patients from the unit to intensive care units when necessary. 8) A nurse and a caregiver work in the stroke unit throughout the day. 9) At least one responsible neurologist works in the unit and performs two patient visits per day during working hours. Neurologists stay in the hospital for duty outside working hours on weekdays and are on call on the weekends while on duty. With these features, the stroke unit was licensed by the Republic of Turkey Ministry of Health within one month. Therefore, an isolated section was arranged where only patients with stroke are admitted and patients of other departments are not admitted. Nevertheless, seven neurological patients with no stroke had to be hospitalized in the stroke unit during the six months due to the insufficient number of beds in the clinic, albeit for a short time.

The awareness about patients with stroke and care beds for patients with stroke has gradually increased in our hospital with the opening of the stroke unit. With in-hospital training meetings, the use of algorithms, and the arrangements made, interventions for patients with stroke have become quick and more effective in our hospital. Some of these regulations are as follows: 1) The most important practice is that the neurologists, who used to be on call, have started to be present in the hospital for 24 hours after the unit is opened and perform their duties. Therefore, there is a significant shortening in the time the physician comes to the hospital and evaluates the patient during duty. 2) In-service theoretical training programs were provided to the healthcare personnel working in the stroke unit at frequent intervals. Nurses participated in stroke nursing meetings of the National Neurology Congress to ensure that they were up-to-date on stroke, and training programs were organized for patient caregivers on the care of patients with stroke. All these training activities have enabled the healthcare staff of the stroke unit to provide more qualified intervention and care to patients with stroke. 3) Thanks to the presence of a stroke unit in the hospital, more thrombolytic drugs were procured for the hospital, and problems regarding drug supply were overcome. 4) Approach and intervention algorithms were prepared for patients with stroke in the emergency department and in-service training was provided to the physicians and staff of the emergency department. Thus, the systematic approach of the healthcare team that first encountered the patients with stroke has enabled the saving of time by ensuring that the patients with stroke are intervened as quickly as possible. 5) Blood tests and brain imaging results of patients with stroke were monitored to ensure that they were concluded as soon as possible, and the time of thrombolytic administration was shortened.

Ischemic strokes constitute 87% of all strokes, 10% are intracerebral, and 3% are subarachnoid hemorrhages (22). Looking at the patients with acute stroke in our study (patients with TIA were excluded), the rate of ischemic stroke was 92.3% and the rate of hemorrhagic stroke was 7.7%. The rate of patients with ischemic stroke in our study was higher compared to the rates reported in the comprehensive INTERSTROKE study (78%) (23.24) and previous studies in Turkey (66-85%), which investigated the contribution of different risk factors to stroke burden worldwide (25-28). The reason for this can be interpreted as the fact that patients with hemorrhagic stroke, which causes more severe neurological and vital problems compared to ischemia, are not hospitalized in our stroke unit, which does not qualify as an intensive care unit, since they are followed up in the intensive care unit. Our rate of patients with TIA (7%) was consistent with the recent Turkish data (6.1-6.6%) (27,28).

According to the phase 1 and phase 2 data of INTERSTROKE, the ten most common causes of potentially modifiable risk factors were found to be responsible for 90% of all strokes (23,24). Age is one of the most important risk factors related to stroke. The risk of stroke increases twice every 10 years after the age of fifty-five (29). In the 2020 stroke statistics (22), it has been reported that approximately 70% of patients who had a stroke are over 65 years of age, which is in line with our study data (78%). In the NöroTek study (27), which determined a large number of neurological critical data, especially the stroke quality metric, with the point prevalence method in Turkey in 2021, the mean age of 1070 patients hospitalized due to stroke and TIA (68.8±13.6) was found to be significantly higher compared to the patients hospitalized with other neurological diagnoses. All these values indicate that advanced age is an

important risk factor in terms of patients with stroke.

Hypertension is known to be the most important risk factor leading to both ischemic and hemorrhagic stroke (7,23-28). In our study, hypertension (82%) was the most common comorbid disease in all cerebrovascular disease groups, and other risk factors were smoking for a while, DM, and AF, according to the order of frequency. AF in all age groups independently increases the risk of ischemic stroke by approximately 5 times and is the cause of approximately 20% of all ischemic strokes (29). In addition, AF is seen at a rate of 1.5% in the 50-59 age range and 23.5% in the 80-89 age range (7). The total rate of AF in patients with ischemic stroke was 28.4% in Neurotek (27) and 12.4% in the E-Kip study (28). In our study, we believe that the reason for the higher incidence of AF in patients with ischemic stroke compared to the literature was the higher mean age.

Consistent with previous studies, spontaneous intracerebral hemorrhages were most commonly localized in the supratentorial region among our patients and the areas with the most bleeding were putamen/globus pallidus and thalamus (30). Although it was reported in NöroTek that the amount of lobar bleeding was common (31%) alone, the rates of the thalamus (28.6%) and basal ganglia (24.6%) were also quite high (27). Ischemic stroke, on the other hand, develops most frequently in the middle cerebral artery area (OSA), which is the largest branch of anterior circulation with the highest flow rate and irrigation area (31). Similarly, in our study, infarcts were observed to be localized in the areas most commonly fed by OSA, especially the parietal lobe.

Determining the subtype of ischemic stroke is of great importance in terms of preparing the treatment and follow-up protocols for etiological factors. In general, the causes and distribution of the subtypes of ischemic stroke are 25% large artery atherosclerosis, 25% small vascular disease, 25% undetermined causes, 20% cardioembolic, and 5% other undetermined causes (32,33). In our study, etiological evaluations of patients diagnosed with ischemic stroke were performed according to the TOAST classification. The two most common subtypes were the group with undetermined causes and the cardioembolic group, respectively. In the E-Kip study (28), the two most common etiological subgroups were small vascular disease (41%) and the group with undetermined causes (31%). The TOAST system includes patients with multiple etiologies in the group of strokes with undetermined causes. This approach was used to increase the accuracy in other etiological classes, approximately half of the patients with stroke are included in the group with undetermined causes as in our study since multiple possible etiologies are frequently detected according to the current stroke tests (34).

Neurological examinations of patients with stroke are frequently evaluated with NIHSS and their disability status is evaluated with mRS (12). When the data of both scoring systems were recorded in our study, approximately half of the patients with ischemic stroke and 17% of the patients with hemorrhagic stroke had mild neurological deficit (NIHSS<5), while the rate of patients discharged in independent status according to the mRS score (mRS≤2) was higher in ischemic stroke while the rate of patients discharged in the dependent status (mRS:3-5) was higher in hemorrhagic stroke. These data are consistent with the literature indicating that the neurological status of patients with hemorrhagic stroke is more severe compared to the patients with ischemic stroke (7,28).

A person dies of a stroke approximately every 3 minutes and 35 seconds worldwide (22). The maximum time of death is the first 30 days. The main goal of stroke units is to prevent the development of systemic complications in the acute period and to immediately notice and treat the neurological deterioration that develops in the early period. In summary, stroke units directly affect mortality and disability. In the literature data that do not include the recent period, 30-day mortality rates vary between 17-20% (26,35). When the 30-day mortality rates including the recent period in our country were examined, they were found to be 6.4% and 10% in ischemia, 26.2% and 15% in hemorrhage, and 7.7% and 11% in total in E-Kip (28) and NöroTek (27) studies, respectively. In our study, this rate was 11%. It is believed that this decrease in 30-day mortality rates will decrease further thanks to recent activities about stroke awareness, in-hospital stroke organizations, and stroke units.

In Aydın State Hospital, 70 patients underwent thrombolytic treatment during the five years from 2014, when IV t-PA treatment was

started for the first time in patients with acute ischemic stroke, until 2019, when the stroke unit was opened. The number of patients treated by years until the unit was opened was nine in 2014, twelve in 2015, fourteen in 2016, nine in 2017, eighteen in 2018, and eight in 2019. IV t-PA was administered to 15 patients within 6 months after the unit was opened.

This number refers to 21% of patients with ischemic stroke hospitalized in the stroke unit. Nevertheless, since patients with severe stroke and minor stroke hospitalized in the intensive care unit were not included in the data analysis, this rate would decrease further when all patients with ischemic stroke hospitalized were considered.

In 2020, a study was published concerning the meta-analysis of studies involving patients administered thrombolytics in stroke in Turkey (36). The mean symptom-to-needle time was 111 minutes in the meta-analysis and 195 (median value: 195±41) minutes in our study. Despite the fact that all patients, who underwent thrombolytic treatment recipients in our unit had presented within the first 3 hours, the symptom-to-needle time was longer compared to what was reported in the Turkey meta-analysis. Improving symptom-to-door time requires raising public awareness of stroke and developing a home-to-hospital transport system (112 ambulance system). The length of door-to-needle time stemmed from the lack of organization within the hospital. In our hospital, the door-to-imaging time is in line with the values stated in the guidelines (<25 minutes) with eighteen minutes, while the imaging-to-needle time is longer at 79 minutes (21). When the causes of prolonged imaging-to-needle time were investigated, it was found that the longest loss of time was due to waiting for the blood INR level, which resulted in a longer time (~40 minutes) compared to the other blood parameters of the patients.

The 30-day mortality rate of patients, who underwent systemic thrombolytic treatment, was 26.7%, and it was higher compared to the meta-analysis of studies involving patients, who underwent thrombolytic treatment in stroke in Turkey (36), the Turkish National IV Thrombolysis Registration Study (37), the NINDS rtPA study (38), which demonstrated the beneficial effect of IV t-PA for the first time, and the 15-25% range reported in the results of current meta-analyses (39). Our rate of cerebral hemorrhage due to thrombolytic treatment was 13% higher compared to the rate (5.6%) in the meta-analysis of studies involving patients, who underwent thrombolytic treatment in stroke in Turkey. Pool analysis of studies including thrombolytic treatment data in stroke worldwide has indicated that the sooner thrombolytic treatment is started, the better the result and the less symptomatic bleeding that may develop (40). When compared with the literature data, we believe that the reason for both symptomatic bleeding and high mortality rates is related to the symptom-to-needle time.

Although the design of the study was to compare the data of a stroke unit in a secondary state hospital with the data in the literature, the most important limitation of the study was that it could not be compared before and after the opening of the stroke unit. When the one-year data before the opening of the unit was examined retrospectively, no comparison could be made due to the high number of lacking in patient information and epicrises. The second important limitation was the small number of patients.

The positive effect of the stroke unit alone on the prognosis of cases with acute stroke should not be neglected. In well-organized stroke units, patients have lower mortality and disability rates, shorter hospital stays, and higher rates of returning home and gaining independence (41). As a result, stroke units should be independent as a facility and in terms of the healthcare team; in other words, they should be designed separately outside the neurology service and neurointensive care units. Thus, they will remain as beds for patients with stroke, which will not be affected by patients from different clinical fields, patients in the hospital, and patients in need of intensive care to be referred from outside the hospital. Data on stroke units in our country generally come from tertiary hospitals and/or non-independent units. In this study, the data shared belonged to the independent stroke unit in Aydın State Hospital, which was a second-line hospital.

REFERENCES

1. Sacco RL, Kasner SE, Broderick JP, et al. An updated definition of stroke for the 21st century: A statement for healthcare professionals from the American Heart Association/American Stroke Association. Stroke 2013; 44(Suppl 7): 2064-2089.

2. Kablan Y. İnme: Epidemiyoloji ve Risk Faktörleri. Gökçe M, editör. İnme - I. Ankara: Türkiye Klinikleri; 2018. p.1-19.
3. GBD 2019 Stroke Collaborators. Global, regional, and national burden of stroke and its risk factors, 1990-2019: A systematic analysis for the Global Burden of Disease Study 2019. Lancet Neurol 2021; 20(10): 795-820.
4. Türkiye İstatistik Kurumu Haber Bülteni. Erişim tarihi: 20 Şubat 2021. Available from: https://data.tuik.gov.tr/Bulten/Index?p=Olum-ve-Olum-Nedeni-Istatistikleri-2019-33710
5. Hacettepe Üniversitesi Ulusal Hastalık Yükü Çalışması Sonuçları ve Çözümleri. Erişim tarihi: 20 Şubat 2021. Available from: http://www.tip.hacettepe.edu.tr/ekler/pdf/ulusal_program.pdf
6. Jauch EC, Saver JL, Adams HP Jr, et al. Guidelines for the early management of patients with acute ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke 2013; 44(Suppl 3): 870-947.
7. Benjamin EJ, Virani SS, Callaway CW, et al. Heart Disease and Stroke Statistics-2018 Update: A Report From the American Heart Association. Circulation 2018; 137(Suppl 12): e67-e492.
8. Kunt R. İskemik İnme & İntraparankimal Kanama. In: Oskay A, Yılmaz A, Özlü C, Özen M, Seyit M (eds). Acil Yaklaşımlar. 1. Baskı. Ankara: Akademisyen Kitabevi 2019: 327-344.
9. TC Sağlık Bakanlığı Kamu Hastaneleri Genel Müdürlüğü. Erişim tarihi: 20 Şubat 2021. Available from: https://verimlilik.saglik.gov.tr/
10. Lyden P, Brott T, Tilley B, et al. Improved reliability of the NIH Stroke Scale using video training. Stroke 1994; 25(11): 2220-2226.
11. van Swieten JC, Koudstaal PJ, Visser MC, et al. Interobserver agreement for the assessment of handicap in stroke patients. Stroke 1988; 19(5): 604-607.
12. Chalos V, van der Ende NAM, Lingsma HF, et al. National Institutes of Health Stroke Scale: An Alternative Primary Outcome Measure for Trials of Acute Treatment for Ischemic Stroke. Stroke 2020; 51(Suppl 1): 282-290.
13. Adams HP Jr, Bendixen BH, Kappelle LJ, et al. Classification of subtype of acute ischemic stroke. Definitions for use in a multicenter clinical trial. TOAST. Trialof ORG 10172 in Acute Stroke Treatment. Stroke 1993; 24(1): 35-41.
14. Türkiye Endokrinoloji ve Metabolizma Derneği. Erişim tarihi: 28 Şubat 2021. Available from: https://temd.org.tr/admin/uploads/tbl_kilavuz/20190506163904-2019tbl_kilavuz5ccdcb9e5d.pdf
15. Erkent I, Topcuoglu MA, Sorgun MH, et al. Determinants of preventable stroke-Ankara ACROSS stroke preventability study. J Stroke Cerebrovasc Dis 2020; 29(Suppl 7): 104825.
16. Türkiye Endokrinoloji ve Metabolizma Derneği. Erişim tarihi: 28 Şubat 2021. Available from: https://temd.org.tr/admin/uploads/tbl_kilavuz/20190819095854-2019tbl_kilavuzb48da47363.pdf
17. Türkiye Endokrinoloji ve Metabolizma Derneği. Erişim tarihi: 28 Şubat 2021. Available from: https://temd.org.tr/admin/uploads/tbl_kilavuz/20190506163838-2019tbl_kilavuz61855bdd04.pdf
18. The North American Symptomatic Carotid Endarterectomy Trial Collaborators. Beneficial effect of carotid endarterectomy in symptomatic patients with high-grade carotid stenosis. N Engl J Med 1991; 325(7): 445-453.
19. Türk Nöroloji Derneği. Erişim tarihi: 20 Şubat 2021. Available from: https://www.noroloji.org.tr/TNDData/Uploads/files/TND-TPA-AKUT-ISKEMIK-TPA-2019-rev.pdf
20. Kutluk K. İskemik Ünitesi ve İnme Merkezleri. In: Kutluk K (ed). İnme Tanı ve Tedavi. 1. Baskı. İzmir: O'Tıp Kitabevi ve Yayıncılık 2016; 42-48.
21. Topçuoğlu MA, Arsava EM, Özdemir AÖ, Uzuner N. İnme Ünitesi: Genel ilkeler ve standartlar. Türk Beyin Damar Hastalıkları Dergisi 2015; 21(1): 4-22.
22. Virani SS, Alonso A, Benjamin EJ, et al. Heart Disease and Stroke Statistics-2020 Update: A Report From the American Heart Association. Circulation. 2020; 141(9): e139-e596.
23. O'Donnell MJ, Xavier D, Liu L, et al. Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the INTERSTROKE study): A case-control study. Lancet 2010; 376(9735): 112-123.
24. O'Donnell MJ, Chin SL, Rangarajan S, et al. Global and regional effects of potentially modifiable risk factors associated with acute stroke in 32 countries (INTERSTROKE): A case-control study. Lancet 2016; 388(10046): 761-775.
25. Özdemir G, Özkan S, Uzuner N, Özdemir Ö, Gücüyener D. Türkiye'de beyin damar hastalıkları için major risk faktörleri. Türk çok merkezli stroke çalışması. Türk Beyin Damar Hastalıkları Dergisi 2000; 6(2): 31-35.
26. Kumral E, Ozkaya B, Sagduyu A, et al. The Ege Stroke Registry: a hospital-based study in the Aegean region, Izmir Turkey. Analysis of 2,000 stroke patients. Cerebrovasc Dis 1998; 8(5): 278-288.
27. Topçuoğlu MA, Arsava EM, Özdemir AÖ ve ark. Türkiye'de hastanede nörovasküler hastalık yönetimi: Mantık, hipotez, yöntemler ve tanımlayıcı karakteristikler (NÖROTEK: Türkiye Nöroloji Tek Gün Çalışması). Türk Beyin Damar Hastalıkları Derg 2021; 27(3): 217-241.
28. Kunt R, Çınar BP, Yüksel B et al. Clinical-epidemiological and radiological characteristics of stroke patients: A multicentre study. Int J Clin Pract. 2021; 75(12): e14963.
29. Kutluk K. Risk Faktörleri. In: Kutluk K (ed). İnme Tanı ve Tedavi. 1. Baskı. İzmir: O'Tıp Kitabevi ve Yayıncılık 2016; 5-14.
30. Delcourt C, Sato S, Zhang S, et al. Intracerebral hemorrhage location and outcome among INTERACT2 participants. Neurology 2017; 88(15): 1408-1414.
31. Stroke and Cerebrovascular Diseases. In: Ropper AH, Samuels MA, Klein JP, Prasad S (eds). Adams and Victor's Principles of Neurology. 11th Edition. New York: McGraw-Hill Medical Pub. Division. 2020; 798-905.
32. Hart RG, Diener HC, Coutts SB, et al. Embolic strokes of undetermined source: the case for a new clinical construct. Lancet Neurol 2014; 13(4): 429-38.
33. Jensen M, Thomalla G. Causes and Secondary Prevention of Acute Ischemic Stroke in Adults. Hamostaseologie 2020; 40(1): 22-30.
34. Ay H, Benner T, Arsava EM, et al. A computerized algorithm for etiologic classification of ischemic stroke: The Causative Classification of Stroke System. Stroke 2007; 38(11): 2979-2984.
35. Carandang R, Seshadri S, Beiser A, et al. Trends in incidence, lifetime risk, severity, and 30-day mortality of stroke over the past 50 years. Jama 2006; 296(24): 2939-2946.

36. Çetiner M, Arsava EM, Topçuoğlu MA. İnmede trombolitik tedavi: Türkiye'den basılmış çalışmaların meta-analizi. Turk J Neurol 2020; 26: 138-141.
37. Kutluk K, Kaya D, Afsar N, et al. Analyses of the Turkish National Intravenous Thrombolysis Registry. J Stroke Cerebrovasc Dis 2016; 25(5): 1041-1047.
38. National Institute of Neurological D, Strokert PASSG. Tissue plasminogen activator for acute ischemic stroke. N Engl J Med 1995; 333(24): 1581-1587.
39. Wardlaw JM, Murray V, Berge E, et al. Thrombolysis for acute ischaemic stroke. Cochrane Database Syst Rev 2014; 2014(7): CD000213.
40. Hacke W, Donnan G, Fieschi C, et al. Association of outcome with early stroke treatment: pooled analysis of ATLANTIS, ECASS, and NINDS rt-PA stroke trials. Lancet 2004; 363(9411): 768-774.
41. Langhorne P, Ramachandra S, Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke: network meta-analysis. Cochrane Database Syst Rev 2020; 4(4): CD000197.

Ethics

Ethics Committee Approval: The study was approved by Non-Interventional Clinical Researchs Ethics Committee of Aydın Adnan Menderes University (Date: 11.03.2021, Number: 2021/45).

Informed Consent: The authors declared that informed consent was not obtained from the patients because of the retrospective study design.

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

Peer-review: Internally peer-reviewed.

Authorship Contributions: Surgical and Medical Practices: RK, RA. Concept: RK, RA. Design: RK, RA. Data Collection or Processing: RK, RA. Analysis or Interpretation: RK, RA. Literature Search: RK, RA. Writing: RK, RA.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

*Authors would like to thank neurologists who followed patients in the stroke unit and contributed to the opening, operation and development of the unit; Dr. Behice Bircan, Dr. Cennet Nalan Kuş Soyder, Dr. Güllü Kardaş, Dr. Dilek Demir Kıylıoğlu, Dr. Bengi Gedik Topçu, Dr. Özcan Güneş and all nurses and health personnel who worked in Aydın State Hospital Stroke Unit.