

The relationship between admission time, mode of transfer, and outcome in patients with stroke

İnme geçiren hastaların başvuru saatleri, transfer şekilleri ve sonlanımları arasındaki ilişki

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Abstract

Introduction: Studies have shown that admission time and mode of transfer to hospital may affect outcomes in patients with acute ischemic stroke (AIS). In this study, the relationship between admission time [regular working (RW)/out-of-office (OO) hours], mode of transfer, and outcome in patients with AIS who received intravenous thrombolytic treatment (ITT) and/or mechanical thrombectomy (MT) was assessed.

Methods: Forty-two patients with AIS who presented between September 1st, 2017, and October 1st, 2018, were included in the study. Patients were divided into groups according to admission hours, and mode of transfer to hospital. Demographic data, treatment, mRS score at admission and 1 month, change in mRS score, and symptom-onset-to-treatment (SOT) time were recorded.

Results: The male/female ratio was 26/17. The mean age was 69.55 ±13.6 years. Eighteen patients (42.9%) received ITT, 16 (38.1%) MT, and 8 (19%) both ITT and MT. Thirteen patients (31%) presented in RW hours and 29 (69%) in OO hours. Thirty patients (71.4%) arrived by ambulance, 7 (16.7%) by private transport, and 5 (11.9%) had stroke in hospital. Admission hour and mode of transfer had no effect on mRS scores at any time points. The SOT time was longer in patients admitted in OO hours (202.9 ±77.2 vs. 133.5±60.8 min; p=0.047) and was shorter in patients who had stroke in hospital (71.7±50.1 vs. 179.1±65.2 vs. 255±84.8 min; p=0.027).

Conclusion: Although the SOT time was shorter in patients who presented in RW hours and had stroke in hospital; admission time and mode of transfer to hospital did not negatively affect outcome in patients with AIS who were treated with ITT and/or MT.

Keywords: Admission time, Acute ischemic stroke, Outcome, Intravenous thrombolytic treatment, Mechanical thrombectomy

Öz.

Amaç: Çalışmalar, akut iskemik inme (Aİİ) tanılı hastaların hastaneye geliş zamanları ve geliş şeklinin sonlanım üzerinde etkili olabileceğini göstermektedir. Bu çalışmada, intravenöz trombolitik tedavi (İTT) uygulanan ve/veya mekanik trombektomi (MT) uygulanmak üzere yönlendirilen hastalarda mesai saatleri içinde veya dışında başvuru, hastaneye geliş şekli ve hastaların sonlanımı arasındaki ilişki araştırılmıştır.

Materyal ve Metot: Hastanemize 1 Eylül 2017 ve 1 Ekim 2018 tarihleri arasında Aİİ ile başvuran İTT uygulanan ve/veya MT uygulanmak üzere yönlendirilen 42 erişkin hasta bu retrospektif çalışmaya dahil edilmiştir. Hastalar, mesai saatleri içinde ve dışında başvuranlar şeklinde ve ayrıca hastaneye geliş şekillerine göre gruplara ayrılmıştır. Hastaların demografik özellikleri, hastalara uygulanan tedavi, hastaların girişteki ve 1.aydaki modifiye Rankin Skalası (mRS) skorları, mRS skorundaki değişimleri ve şikayet başlangıcı-tedavi (ŞBT) süreleri kaydedilmiştir.

Bulgular: Hastaların 26'sı erkek (%61,9) ve 17'si kadındı (%38,1). Yaş ortalaması 69,55 ±13,6 (32-93) yıl idi. On sekiz (%42,9) hastaya sadece İTT, 16 hastaya (%38,1) sadece MT, 8 (%19) hastaya İTT ve MT uygulandı. On üç hasta (%31) mesai saatleri içerisinde, 29 hasta (%69) mesai saatleri dışında başvurdu. Hastaların 30'u (%71,4) ambulans ile, 7'si (%16,7) kendi imkanları ile başvurdu, 5'i (%11,9) hastanede yatarken inme geçirdi. Hastaneye geliş zamanı ve geliş şekli ile hastaların giriş mRS skoru, 1. ay mRS skoru ve mRS skoru değişimi arasında bir ilişki bulunmadı. Mesai saatleri dışında başvuran hastalarda mesai saatleri içinde başvuranlara kıyasla ŞBT süreleri daha uzundu (202,9 ±77,2 dk vs 133,5±60,8 dk; p=0,047). Hastanede yatarken inme geçiren hastalarda ambulansla ve kendi imkanları ile gelenlere kıyasla ŞBT süreleri daha kısaydı (71,7±50,1 vs 179,1±65,2 vs 255±84,8 dk; p=0,027).

Sonuç: Bu çalışmanın verilerine göre; ŞBT süreleri mesai saatleri içinde başvuranlarda ve hastanede inme geçirenlerde daha kısa olsa da; Aİİ ile başvuran, İTT uygulanan ve/veya MT uygulanmak üzere yönlendirilen hastalarda, hastaneye geliş zamanı ve geliş şekli hastaların sonlanımı üzerinde negatif bir etkiye sahip değildir.

Anahtar kelimeler: Başvuru zamanı, Akut iskemik inme, Sonlanım, İntravenöz trombolitik tedavi, Mekanik trombektomi

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Introduction

Early treatment with either intravenous thrombolytic treatment (ITT) or mechanical thrombectomy (MT) is the key to improved acute ischemic stroke (AIS) outcome (1). Admission time and mode of transfer to hospital may affect receiving early treatment of patients with AIS. Studies have shown that admission time and mode of transfer to hospital may affect outcomes in patients with AIS (2-4). In this study, it was aimed to assess whether admission time and mode of transfer of the patients with AIS who were treated with ITT and/or MT had effect on their outcomes.

Materials and Methods

Forty-two patients with AIS who presented between September 1st, 2017, and October 1st, 2018 and who were treated with ITT and/or MT were included in the study. Patients were divided into groups according to admission hours (regular working [RW] hours or out-of-office [OO] hours) and mode of transfer to hospital (by ambulance, by self-transport or having stroke in hospital). Demographic data, treatment, modified Rankin Scale (mRS) score at admission and 1 month, change in mRS score, outcome, mortality and symptom-onset-to-treatment (SOT) time were recorded. First month mRS score was measured in the follow-up in outpatient clinic or via telephone. Modified Rankin Scale score 0-2 was accepted as good outcome and ≥ 3 was accepted as bad outcome.

RW hours were accepted as hours between 08.00 and 17.00 in weekdays and OO hours were accepted as hours between 17.00 and 08.00 in weekdays and any hours in weekends and holidays.

MT could not be performed in our hospital and patients with AIS who were eligible for MT were transported to the comprehensive stroke center which was 11 km away. Patients were transported to the center by the ambulance of emergency medical services which was called "112" in Turkey. After MT, patients were transported back to our hospital by 112, if we had enough beds or otherwise they stayed in the comprehensive stroke center.

This observational study was approved by the local ethics committee and was performed in accordance with the current Declaration of Helsinki. The relatives of the patients were informed about ITT and MT and informed consent was taken from them.

Statistical analysis

The data were analyzed by using SPSS (Version 18 for Windows, SPSS Inc, Chicago, IL, USA). Continuous variables were expressed as mean \pm standard deviation and categorical variables were expressed as numbers. Chi-square test was used to compare groups with categorical variables and Mann Whitney U test was used to

compare groups with continuous variables. A non-parametric test (Mann Whitney U test) was used to compare groups, because there were small number of patients in the groups. $P < 0.05$ was considered statistically significant.

Results

The male/female ratio was 26/17. The mean age was 69.55 ± 13.6 years. Eighteen patients (42.9%) were treated with ITT, 16 (38.1%) with MT and 8 (19%) with both ITT and MT. Thirteen patients (31%) were admitted in RW hours and 29 (69%) in OO hours. Thirty patients (71.4%) were transported by ambulance, 7 (16.7%) by private transport and 5 (11.9%) had stroke in the hospital.

There were no differences between patients who presented in RW or OO hours in terms of age, gender, mode of transfer, treatment, mRS score at admission or at 1 month, change in mRS score, mortality and outcome. The SOT time was significantly shorter in patients who presented in RW hours than in patients who presented in OO hours ($p=0.047$). There were data of SOT time in 22 of 42 patients (Table 1).

There were no differences between patients who were transported by ambulance, by self-transport or had stroke in hospital in terms of gender, admission time, treatment, mRS score at admission or at 1 month, change in mRS score, mortality and outcome. The patients who were transported by ambulance were significantly older than others ($p=0.028$). The SOT time was significantly shorter in patients who had stroke in hospital than in others ($p=0.027$), (Table 2).

Discussion

According to the results of this study; the admission time and mode of transfer did not affect outcome of the patients with AIS who were treated with ITT and/or MT; although the SOT time was shorter in patients who presented in RW hours and had stroke in hospital. International guidelines recommend transporting of patients with AIS to hospital by ambulance rather than self-transport (5, 6). However, only half of them are transported by ambulance (7). Although transporting of patients with AIS to hospital by ambulance is recommended, it has not been clearly shown that transport by ambulance improves stroke care (8). The rate of transport by ambulance to hospital in patients with AIS varies between countries. In a study from England, this rate was 80%, and it was 72% in a study from Germany, whereas it was only %17 in a study from Brazil which was explained in the study that the universal phone number for emergency calls was largely unknown by Brazilians and the majority of

Table 1. Demographic and clinic features, treatment, mode of transfer and outcome of the patients with acute ischemic stroke who presented in regular working or out-of-office hours

	Regular working hours	Out-of-office hours	P value
Age (years), (mean±S.D.)	71.85±9.96	68.52±15	NS‡
Gender			
Male	8	18	
Female	5	11	
Treatment			NS+
ITT	8	10	
MT	3	13	
ITT+MT	2	6	
Mode of transfer			NS+
Ambulance	8	22	
Self-transport	2	5	
Stroke in hospital	3	2	
mRS score (mean±S.D.)			NS‡
mRS score at admission	3.85±1.4	4.52±1	
mRS score at 1 month	2.54±2.4	3.4±2.1	
Change in mRS score	1.31±1.8	1.1±2	
Mortality (number of deaths)	3	5	NS+
Outcome			NS+
mRS score 0-2	7	9	
mRS score 3-6	6	20	
SOT time (min), (n=22) (mean±S.D.)	133.5±60.8	202.9±77.2	0.047‡

ITT: Intravenous thrombolytic therapy; MT: Mechanical thrombectomy; mRS: modified Rankin Scale; SOT: Symptom onset to treatment; NS: Not significant; S.D.: Standard deviation

‡:Mann Whitney U test, +:Chi Square test

Table 2. Demographic and clinic features, treatment, admission time and outcome of the patients with acute ischemic stroke who were transported by ambulance, by self-transport or had stroke in hospital

	Ambulance	Self-transport	Stroke in hospital	P value
Age (years), (mean±S.D.)	72.6±13.6	60.6±12.8	64±7.2	0.028‡
Gender				NS+
Male	17	5	4	
Female	13	2	1	
Treatment				NS+
ITT	12	2	4	
MT	11	4	1	
ITT+MT	7	1	0	
Admission time				NS+
RW hours	10	4	2	
OO hours	20	3	3	
mRS score (mean±S.D.)				NS‡
mRS score at admission	4.47±1	3.57±1.5	4.4±1.3	
mRS score at 1 month	3.27±2.23	2.43±2.1	3.4±2.3	
Change in mRS score	1.2±1.83	1.14±2.67	1±1.87	
Mortality (number of deaths)	6	1	1	NS+
Outcome				NS+
mRS score 0-2	10	4	2	
mRS score 3-6	20	3	3	
SOT time (min), (n=22) (mean±S.D.)	179.1±65.7	255±84.8	71.7±50.1	0.027‡

ITT: Intravenous thrombolytic therapy; MT: Mechanical thrombectomy; mRS: modified Rankin Scale; SOT: Symptom onset to treatment; RW: regular working; OO: out-of-office; S.D.: Standard deviation; NS: Not significant

‡:Mann Whitney U test, +:Chi Square test

the Brazilian cities lacked an acute stroke protocol and specific stroke training (2-4). In this study, 71.4% of the patients were transported by ambulance, similar to the rate in Europe.

Patients with AIS who were transported by ambulance to hospital arrived hospital faster, received brain imaging faster and had an increased frequency of receiving ITT compared with patients who were transported by self-transport (2-4). But, patients transported by ambulance had more severe stroke, were older and had a high level of pre-stroke dependency and after adjusted for age and severity of stroke, functional outcome did not differ between transport by ambulance or self-transport and even patients transported by ambulance could have higher inpatient mortality and more need for daily carers compared with patients transported by self-transport (2, 4). In this study, patients transported by ambulance were older as in the literature. The SOT time was shorter in patients who had AIS in hospital. There was no difference between groups of mode of transfer in terms of mRS score at admission, outcome and mortality in our study.

Patients with AIS who present to hospital in OO hours may have higher mortality (9-12). However, no difference in mortality between weekend and weekday admissions was also reported in a study (13). Higher mortality and disability in patients with AIS who presented in off-hours may be due to difference in rates and timeliness of fibrinolytic treatment, availability of immediate brain imaging, access to immediate care by stroke specialists, early screening and management for dysphagia and aspiration pneumonia, and provision of care at stroke units by skilled staff or stroke care teams (10-12, 14). Also higher mortality could be due to increased concentration of patients with more severe and early-onset stroke in patients presented in off-hours (9). However, a recent review and meta-analysis showed that the mortality increase during off-hours remained significant among studies which reported outcomes adjusted for stroke severity (15). This meta-analysis also showed that patients with AIS who presented during off-hours had higher short-term mortality and disability at discharge which was decreased in patients presented to stroke centers (15).

Compared to weekday admissions, ITT rate of patients with AIS tends to be lower and the outcome is either similar or worse in admissions at weekend (10, 13, 16). In a study from Polish Stroke Centers; admission time did not show association with symptomatic intracranial hemorrhage, 7-day mortality, and neurological improvement >4 points in the National Institutes of Health Stroke Scale (NIHSS) score at day 7 in patients with AIS who were treated with ITT (17). Also, patients admitted during night hours had lower odds for achieving favorable outcome (mRS score 0-2). They concluded that there is no bad time for ITT (17).

Admission time may affect the outcome in patients with AIS treated with MT because team members may not be readily available or other services such as anesthesia may be required prior to the procedure. Delays can be due to loss of time in obtaining consent for the procedure and in preparing the angiography catheters and devices (18). In a study in patients with AIS, the effectiveness of MT during evenings and weekends and whether this had an impact on the outcome were assessed. Although median imaging to reperfusion time was significantly longer in patients presented in off-hours; successful reperfusion rate and the proportion of patients with a 90-day favorable outcome were not different between patients presented in off-hours or in regular working hours (18). All patients who were treated with ITT and/or MT were included in our study. There were no data of median imaging to reperfusion time and successful reperfusion rate; because MT was not performed in our hospital and patients were sent to the comprehensive stroke center. According to the results of this study, mode of transfer and admission time did not affect mortality and outcome.

Low number of patients, retrospective design and lack of data for SOT time (There were data in 22 of 42 patients) were the limitations of this study. This is the first study performed in Turkey on this topic, which makes this study valuable. In conclusion, whether presenting in OO hours or being transported by self-transport did not affect outcome and mortality in patients with AIS who were treated with ITT and/or MT. These results should be replicated in further prospective studies with larger number of patients in Turkey.

References

1. Khatri P, Abruzzo T, Yeatts SD, Nichols C, Broderick JP, Tomsick TA. Good clinical outcome after ischemic stroke with successful revascularization is time-dependent. *Neurology*. 2009;73(13):1066-72.
2. Price CI, Rae V, Duckett J, Wood R, Gray J, McMeekin P, et al. An observational study of patient characteristics associated with the mode of admission to acute stroke services in North East, England. *PloS One*. 2013;8(10):e76997.
3. Minnerup J, Wersching H, Unrath M, Berger K. Effects of emergency medical service transport on acute stroke care. *Eur J Neurol*. 2014;21(10):1344-7.
4. Kuster GW, Bueno Alves M, Cendoroglo Neto M, Silva GS. Determinants of emergency medical services use in a Brazilian population with acute ischemic stroke. *J Stroke Cerebrovasc Dis*. 2013;22(3):244-9.
5. Guidelines for management of ischaemic stroke and transient ischaemic attack 2008. *Cerebrovasc Dis*. 2008;25(5):457-507.
6. Acker JE, 3rd, Pancioli AM, Crocco TJ, Eckstein MK, Jauch EC, Larrabee H, et al. Implementation strategies for emergency medical services within stroke systems of

- care: a policy statement from the American Heart Association/American Stroke Association Expert Panel on Emergency Medical Services Systems and the Stroke Council. *Stroke*. 2007;38(11):3097-115.
7. Kamel H, Navi BB, Fahimi J. National trends in ambulance use by patients with stroke, 1997-2008. *JAMA*. 2012;307(10):1026-8.
 8. Lacy CR, Suh DC, Bueno M, Kostis JB. Delay in presentation and evaluation for acute stroke: Stroke Time Registry for Outcomes Knowledge and Epidemiology (S.T.R.O.K.E.). *Stroke*. 2001;32(1):63-9.
 9. McKinney JS, Deng Y, Kasner SE, Kostis JB. Comprehensive stroke centers overcome the weekend versus weekday gap in stroke treatment and mortality. *Stroke*. 2011;42(9):2403-9.
 10. Palmer WL, Bottle A, Davie C, Vincent CA, Aylin P. Dying for the weekend: a retrospective cohort study on the association between day of hospital presentation and the quality and safety of stroke care. *Arch Neurol*. 2012;69(10):1296-302.
 11. Reeves MJ, Smith E, Fonarow G, Hernandez A, Pan W, Schwamm LH. Off-hour admission and in-hospital stroke case fatality in the get with the guidelines-stroke program. *Stroke*. 2009;40(2):569-76.
 12. Saposnik G, Baibergenova A, Bayer N, Hachinski V. Weekends: a dangerous time for having a stroke? *Stroke*. 2007;38(4):1211-5.
 13. Hoh BL, Chi YY, Waters MF, Mocco J, Barker FG, 2nd. Effect of weekend compared with weekday stroke admission on thrombolytic use, in-hospital mortality, discharge disposition, hospital charges, and length of stay in the Nationwide Inpatient Sample Database, 2002 to 2007. *Stroke*. 2010;41(10):2323-8.
 14. Albright KC, Savitz SI, Raman R, Martin-Schild S, Broderick J, Ernstrom K, et al. Comprehensive stroke centers and the 'weekend effect': the SPOTRIAS experience. *Cerebrovasc Dis*. 2012;34(5-6):424-9.
 15. Sorita A, Ahmed A, Starr SR, Thompson KM, Reed DA, Dabrh AM, et al. Off-hour presentation and outcomes in patients with acute ischemic stroke: a systematic review and meta-analysis. *Eur J Intern Med*. 2014;25(4):394-400. Epub 2014/04/12.
 16. Jauss M, Schutz HJ, Tanislav C, Misselwitz B, Rosenow F. Effect of daytime, weekday and year of admission on outcome in acute ischaemic stroke patients treated with thrombolytic therapy. *Eur J Neurol*. 2010;17(4):555-61.
 17. Karlinski M, Kobayashi A, Sobolewski P, Lisewski P, Romanowicz S, Fryze W, et al. Is there a bad time for intravenous thrombolysis? The experience of Polish stroke centers. *Neurol Neurochir Pol*. 2014;48(1):45-51.
 18. Almekhlafi MA, Hockley A, Desai JA, Nambiar V, Mishra S, Volny O, et al. Overcoming the evening/weekend effects on time delays and outcomes of endovascular stroke therapy: the Calgary Stroke Program experience. *J Neurointerv Surg*. 2014;6(10):729-32.