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Functional Outcomes in Anterior and Posterior Circulation Ischemic Strokes

Anterior ve Posterior Dolaşımlı İskemik İnmedeki Fonksiyonel Sonuçlar

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Summary

Objective: To compare the demographic and some of the clinical characteristics, and functional outcomes of patients with anterior circulation (AC) infarction with posterior circulation (PC) infarction subtype of ischemic stroke patients after inpatient rehabilitation.
Materials and Methods: Medical records of 245 patients diagnosed with stroke were retrospectively reviewed. The patients, who had AC or PC ischemic infarct, were divided into two subgroups. Demographic characteristics, Functional Independence Measure (FIM) scores, and Functional Ambulation Scale (FAS) stages of the patients in both groups were recorded and compared.
Results: One hundred eight patients' infarcts were located in the AC territory and twenty two patients' infarcts were located in the PC territory. Except the longer length of stay in AC stroke groups (p=0.022); there were no significant differences between the two groups in demographic and clinical characteristics (p>0.05). The comparison of the FIM scores revealed that the AC stroke group had significantly lower cognitive FIM scores at admission and discharge than the PC stroke group (p=0.016 and p=0.029, respectively). However; there were no statistically significant differences between the groups in terms of motor FIM scores, gain FIM scores and FAS stages at admission and discharge (p>0.05).
Conclusion: According to the results of the present study, although patients with AC infarction subtype of ischemic stroke had longer length of stay and lower cognitive FIM scores, there were no significant differences in functional outcomes between patients with AC and PC infarction subtype of ischemic stroke. *Turk J Phys Med Rehab 2013;59:13-7.*
Key Words: Functional outcome, ischemic stroke, rehabilitation, vascular territory

Özet

Amaç: Yatarak rehabilitasyon sonrası anterior dolaşımda iskemik enfarktı olan inmeli hastaların demografik ve bazı klinik özelliklerini, ve fonksiyonel sonuçlarını posterior dolaşımda iskemik enfarktı olan inmeli hastalarla karşılaştırmak.
Gereç ve Yöntem: İnme tanısı almış 245 hastanın tıbbi kayıtları retrospektif olarak incelendi. İnmeli hastalardan anterior ve posterior dolaşımında iskemik enfarktı olanlar iki gruba ayrıldı. Bu iki gruptaki hastaların demografik özellikleri, fonksiyonel bağımsızlık ölçümü (FBÖ) skorları ve fonksiyonel ambulasyon skalası (FAS) evreleri kaydedildi ve karşılaştırıldı.
Bulgular: Yüz sekiz hastanın enfarktı anterior dolaşım bölgesine; 22 hastanın enfarktı posterior dolaşım bölgesine lokalizeydi. Anterior dolaşımlı inme grubundaki uzun yatış süresi (p=0,022) hariç demografik ve klinik özellikler açısından her iki grup arasında anlamlı bir fark yoktu (p>0,05). FBÖ skorları karşılaştırıldığında anterior dolaşımlı inme grubunun giriş ve çıkış kognitif FBÖ skorlarının posterior dolaşımlı inme grubuna göre anlamlı bir şekilde düşük olduğu görüldü (sırasıyla p=0,016 ve p=0,029). Ancak giriş ve çıkış motor FBÖ, kazanç FBÖ ve FAS evrelerine göre her iki grup arasında istatistiksel olarak anlamlı bir fark yoktu (p>0,05).
Sonuç: Bu çalışmanın sonuçlarına göre iskemik inmenin anterior dolaşımlı alt grubundaki hastaların uzun yatış süreleri ve düşük kognitif FBÖ skorlarına rağmen fonksiyonel sonuçlar açısından iskemik inmenin anterior ve posterior dolaşımlı alt gruplarındaki hastalar arasında istatistiksel olarak anlamlı bir fark yoktu. *Türk Fiz Tıp Rehab Derg 2013;59:13-7.*
Anahtar Kelimeler: Fonksiyonel sonuçlar, iskemik inme, rehabilitasyon, vasküler bölge

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Introduction

The World Health Organization defines stroke as rapidly developing clinical signs of focal or global disturbances of cerebral function, with symptoms lasting more than 24 hours, or leading to death, without an apparent nonvascular cause (1). It is the third leading cause of death after heart disease and cancer. Besides the high mortality rate, stroke is ranked first among the diseases that cause mental and physical disabilities in patients who survive (2,3).

The most fundamental nosologic classification of stroke is hemorrhagic and ischemic stroke (4). In developed countries, ischemic stroke represents the most common type of stroke and may be further classified into additional subtypes (5). Many ischemic strokes subtyping systems have been developed for use in randomized clinical trials or epidemiological studies (6).

The role of rehabilitation in reducing functional disability after stroke has been well established (7). In the stroke rehabilitation literature, functional outcome studies have described disability outcomes after stroke in specific vascular territories (8,9) or brain locations (10). Although these studies provide important information in terms of rehabilitation and prognosis for a certain stroke subtypes, they do not address the comparison between functional outcomes across stroke subtypes.

The aim of this study was to determine and to compare the demographic data, some of the clinical characteristics and functional outcomes of anterior circulatory (AC) and posterior circulatory (PC) stroke patients admitted to a rehabilitation program in our clinic.

Materials and Methods

A retrospective comparison study consisting of a review of the medical records of 245 patients who were diagnosed with stroke and admitted to our inpatient rehabilitation unit between January 2000 and December 2008 was conducted. Patients receive comprehensive and intensive rehabilitation based on a multidisciplinary approach that consists of individualized activities of daily living training (bed mobility, wheelchair mobility and transfers etc.), physical therapy and occupational therapy (especially to improve hand and upper extremity functions) (usually 60 minutes each). The rehabilitation period is not predetermined but continues until the patients show no further response to the therapy.

We defined stroke according to the World Health Organization criteria, and in all patients, the diagnosis was confirmed by brain computed tomography (CT) scan or/and brain magnetic resonance imaging (MRI). Patients with a previous history of stroke (30 patients) were excluded from the study. According to CT or/and MRI of the brain, the following patients were also excluded: 1) those with hemorrhagic stroke (64 patients), 2) those with ischemic lesions in both the AC and PC territories (16 patients); and 3) those with lacunar ischemic stroke (5 patients). Of the remaining 130 patients, 108 infarcts were located in the AC territory, and 22 infarcts were located in the PC territory.

Demographic data, including age at the time of admission and gender, were collected for the records of the eligible patients. The location of the lesion (right or left hemisphere), stroke onset-to-admission time interval and the length of stay (LOS) in days were also documented. The functional state of the patients at admission and discharge were also recorded using the motor and cognitive components of the Functional Independence Measure (FIM) instrument (11). The FIM is the most widely used standardized functional outcome measure in medical rehabilitation. It consists of 18 test items rated on a 7-point Likert scale in the following categories: self-care, sphincter control, mobility, locomotion, communication, and social cognition. Two uni-dimensional subscales comprised 13 items that assess motor function and five items assess cognitive function (12). The FIM instrument has been translated and adapted into the Turkish language. Its validity and reliability at measuring disability in Turkish neuro-rehabilitation patients has been documented (13). Functional gain during the rehabilitation period was calculated for each individual by subtracting the FIM admission score from the FIM discharge score. Ambulatory status was assessed at admission and at discharge, using the Functional Ambulation Scale (FAS), which was developed by the Massachusetts General Hospital and is used for the evaluation of ambulation. The FAS consists of a total of 6 categories that are each evaluated by stages from 0 to 6; stage 0 represents non-functional ambulation, stage 1 represents ambulation with level II help, stage 2 represents ambulation with level I help, stage 3 represents ambulation that is dependent on monitoring, stage 4 represents independent ambulation on level ground, and stage 5 represents independent ambulation. The FAS is a scale that evaluates the need for human assistance rather than devices and supports (14,15). Infections of the urinary tract or aspiration pneumonia that occurred during rehabilitation were also recorded.

Approval for this study was obtained from the Ethics Committee of Baskent University.

Statistical Analysis

Statistical analyses in this study were conducted using the Statistical Package for Social Sciences (SPSS) program for Windows, version 13.0. Data are represented as mean± standard deviation, median and percentage. The independent samples t-test was used to compare the parametric variables with a normal distribution. The Wilcoxon test was used to compare within-group parametric variables that did not have a normal distribution, and the Mann-Whitney test was used for between-group comparisons. The chi-square test was used to evaluate categorical variables and Spearman's rank correlation coefficient was used to analyze correlations. A p value of less than 0.05 with a 95% confidence level was considered to be significant.

Results

The demographic characteristics observed in patients in the AC and PC stroke groups are presented in Table 1. The mean and median age of the patients with AC and PC stroke were 66.03±10.2 (median: 67.5) years and 63.04±11.9 (median: 62), respectively. In the AC stroke group, 57 (52.8%) of patients were male and 51 (47.2%) were female. In the PC stroke group, 14 (63.6%) of patients were male and 8 (36.4%) were female. In terms of locations of strokes, 62 (57.4%) patients with AC stroke were affected on the right side, and 46 (42.6%) were

affected on the left side; 14 (63.6%) patients with PC stroke were affected on the right side, and 8 (36.4%) were affected on the left side. The mean and median stroke onset-to-admission interval was 44.8±50 (median: 22, min-max: 4-250) days in the AC stroke group and 31.1±39.4 (median: 19, min-max: 9-166) days in the PC stroke group. There were no significant differences between the two groups in terms of age, gender, side of lesion or stroke onset-to-admission interval (p=0.179, p=0.351, p=0.589, and p=0.233, respectively).

In the AC and PC stroke groups, the mean and median LOS were 39.7±25.1 (median: 35, min-max: 4-117) days and 26.1±15.4 (median: 24, min-max: 6-61) days, respectively. There was a statistically significant difference in the LOS between the groups (p=0.022).

In the AC stroke group, the median motor and cognitive FIM scores were 30 ((interquartile range-[IQR] 30.25) and 30 (IQR 17.25), respectively, at admission and 58 (IQR 32) and 32 (IQR 10.25), respectively, at discharge. In the PC stroke group, the median motor and cognitive FIM scores were 39 (IQR 30.5) and 35 (IQR 20.5), respectively, at admission and 59 (IQR 22.5) and 35 (IQR 4.5), respectively, at discharge. The comparison of the FIM scores between the two groups revealed that the AC stroke group had significantly lower cognitive FIM scores at admission and discharge compared to the PC stroke group (p=0.016 and p=0.029, respectively). However, the difference between the two groups in terms of admission and discharge motor FIM scores was not statistically significant (p=0.67 and p=0.7, respectively). Similarly, no statistically significant differences were found between the groups based on cognitive and motor FIM gain scores (p=0.762 and p=0.486, respectively) (Table 2).

The ambulation in the two groups according to the FAS is shown in Table 3. The AC group contained 49 (45.4%) patients at the FAS 0 stage, 3 (2.8%) patients at the FAS 4 stage and 9 (8.3%) patients at the FAS 5 stage on admission; in addition, the AC group contained 15 (13.9%) patients at the FAS 0 stage, 4 (3.7%) patients at the FAS 4 stage and 33 (30.6%) patients at the FAS 5 stage on discharge. The PC group contained 10 (45.5%) patients at the FAS 0 stage, 2 (9.1%) patients at the FAS 4 stage and 1 (4.5%) patient at the FAS 5 stage on admission; in addition, the PC group contained 4 (18.2%) patients at the FAS 0 stage, 2 (9.1%) patients at the FAS 4 stage and 8 (36.4%) patients at the FAS 5 stage on discharge. The median FAS score was stage 1 at admission and stage 3 at discharge both in the AC and PC stroke groups. There was no statistically significant difference between the groups at admission (p=0.970) or at discharge (p=0.634).

During the rehabilitation period, urinary tract infections were observed in 31 (88.6%) patients in the AC stroke group and 4 (11.4%) patients in the PC stroke group. Aspiration pneumonia was observed in 7 patients in the AC stroke group and none of the patients in the PC stroke group. No statistically significant difference was found between the groups based on infectious complications (p>0.05).

Table 1. Demographic and clinical characteristics of the patients.

	AC Group	PC Group	p value
Age, years (mean±SD)	67.5±14	62±13	0.179
Gender, male (n, %)	57 (52.8%)	14 (63.6%)	0.351
Side of lesion			0.589
Right hemisphere (n, %)	62 (57.4%)	14 (63.6%)	
Left hemisphere (n, %)	46 (42.6%)	8 (36.4%)	
Stroke onset-to-admission, days (median, IQR)	22 (40)	19 (13)	0.233
Length of stay in rehabilitation, days (median, IQR)	35 (41)	24 (21.5)	0.022

p<0.05, statistically significant, n: number, SD: Standard Deviation, IQR: Interquartile Range, AC: Anterior Circulation, PC: Posterior Circulation

Table 2. Motor and cognitive components of the Functional Independence Measurement for patients with stroke in both groups at admission and at discharge.

	AC Group Median (IQR)	PC Group Median (IQR)	p
Admission FIM - M	30 (30.25)	39 (30.5)	0.67
Admission FIM - C	30 (17.25)	35 (20.5)	0.016
Discharge FIM - M	58 (32)	59 (22.5)	0.7
Discharge FIM - C	32 (10.25)	35 (4.5)	0.029
FIMG - M	18 (25)	15 (27)	0.762
FIMG - C	0.0 (3.25)	0.0 (3.25)	0.486

p<0.05, statistically significant , IQR: Interquartile Range, AC: Anterior Circulation, PC: Posterior Circulation, FIM: Functional Independence Measure, FIMG: Gain Functional Independence Measure, M: Motor, C: Cognitive

Discussion

Stroke is the most common serious neurologic disorder (16), and every year a significant number of stroke survivors are left with residual disabilities. Stroke rehabilitation focuses on increasing the functional independence of these patients (17). The success of rehabilitation depends on many factors, which may be patient-related (demographic and general medical characteristics), lesion-related (pathology, lesion site and size), intervention- and therapy-related, or psychosocially-related (18). In this study, we aimed to determine the role of ischemic stroke subtype on functional improvement following rehabilitation in patients with hemiplegia.

In the present study, stroke was classified as either ischemic or hemorrhagic type, and the majority of the patients had ischemic stroke. Similar results have been reported in the literature (4,6); this discrepancy was ascribed to the variations in the relative proportion of hemorrhagic strokes in different racial or ethnic groups globally (19). Ischemic stroke was then further subdivided into AC and PC categories according to the brain CT or MRI scans.

In our study, the proportion of AC stroke was approximately five times greater than the proportion of PC stroke. This may be due to the lower rates of rehabilitation-unit admissions in patients with PC strokes compared to those with AC strokes (20). Although their exact incidence is unknown, in general, PC strokes are less common than AC strokes (21). Additionally, patients with PC strokes may experience minimal functional or cognitive deficits after stroke, and thus, may less frequently require rehabilitation. These patients are typically discharged home directly from neurology clinics. Alternatively, patients who experience catastrophic brainstem strokes have either low survival rates or profound deficits that preclude their participation in rehabilitation programs (10,22). Differences in the rate of progression of the atherosclerotic processes also could be a factor in the higher proportion of patients with AC stroke (23). Sternby et al. (24) reported that the amount of atherosclerosis present in the various cerebral arteries increased with age but at a higher rate for the carotid arteries than for the vertebral and basilar arteries.

Table 3. Functional Ambulation Scale for patients with stroke in both groups at admission and at discharge.

	AC Group		PC Group	
	Admission	Discharge	Admission	Discharge
	n (%)	n (%)	n (%)	n (%)
FAS 0	49 (45.4%)	15 (13.9%)	10 (45.5%)	4 (18.2%)
FAS	25 (23.1%)	7 (6.5%)	6 (27.3%)	
FAS 2	14 (13%)	7 (6.5%7)	1 (4.5%)	1 (4.5%)
FAS 3	8 (7.4%	42 (38.9%)	2 (9.1%)	7 (31.8%)
FAS 4	3 (2.7%)	4 (3.7%)	2 (9.1%)	2 (9.1%)
FAS 5	9 (8.4%)	33 (30.6%)	1 (4.5%)	8 (36.4%)

n: number (%), FAS: Functional Ambulation Scale,
AC: Anterior Circulation, PC: Posterior Circulation

In the literature, it has been reported (25) that the PC infarction subtype of ischemic stroke more commonly occurred in younger patients according to the Oxfordshire Community Stroke Project (OCSP) classification, and the AC infarction subtype of ischemic stroke typically occurred in older patients who were more likely to be male. However, in our study, there was no significant difference between the AC and PC stroke groups based on age and gender.

Except for the lower cognitive FIM scores in the AC stroke group, there were no significant differences between the strokes groups in terms of motor and gain FIM scores, and FAS scores. Although we expected low cognitive FIM scores in the AC stroke group, the other results are not consistent with previous studies (26-29). Total AC infarction subtype of ischemic stroke according to the OCSP classification is typically associated with the greatest severity and worse outcome, whereas the PC infarction subtype is typically associated with the most favorable outcomes. This discrepancy may be due to the small sample size of the PC stroke group in our study; moreover, the instruments used to measure the outcomes are not identical across various studies, which make study comparisons difficult.

However, in our study, there were no differences between the stroke groups according to the stroke onset-to-admission interval; LOS was significantly longer in the AC stroke group compared to the PC stroke group. As we previously reported, the patients with the AC infarction subtype of ischemic stroke according to the OCSP classification were more disabled and more severely handicapped (25-28), and were more likely to be discharged to an institution or rehabilitation hospital rather than to home which prolonged the LOS. We can also explain the longer LOS in the AC stroke group by the association with lower cognitive FIM scores. Fong et al. (30) reported that patients tended to stay in rehabilitation longer when their cognitive deficits persisted. However, this finding is not consistent with previous results (31) which indicated that the presence of cognitive dysfunction did not increase the length of hospitalization because such patients often made such little progress that their slow functional recovery mandated early discharge.

Lower respiratory tract infections are probably the most severe adverse events that are related to dysphagia in the early period after stroke, and it is more common in patients with oropharyngeal dysphagia and aspiration (32). It has been reported in the literature (33-35) that large cortical hemispheric lesions, low FIM scores and a reduced level of cognitive function can increase the incidence of dysphagia. Other studies (36,37) confirmed that PC strokes (brainstem and cerebellar stroke) are not significantly associated with a higher prevalence of dysphagia. Similarly, in our study, the incidence of lower respiratory tract infections during the rehabilitation period was lower in the PC stroke group compared to the AC stroke group.

The retrospective design is the major limitation of this study. Sub-grouping of ischemic stroke based on radiological findings is another limitation of the study because the classification of ischemic stroke into AC and PC categories based on brain CT or MRI scans has several drawbacks. First, if CT is performed in the acute phase, up to 50% of the scans will fail to show any abnormality (38). Second, the lesions change substantially in

volume over time (39). Third, there is some variation in the spatial resolution of scanning equipment; therefore, the results of studies in which an imaging technique is used as the primary method of defining the subgroups are not always comparable because of the differences in the scanning equipment (29). The small sample size, especially in the PC stroke group, may also present limitations to the study.

In conclusion, although patients with AC infarction subtype of ischemic stroke had longer LOS and lower cognitive FIM scores, there were no significant differences in functional outcomes between AC and PC infarction subtype of ischemic stroke patients. As the retrospective design and the small sample size in the stroke subgroups is the limitation of this study, further prospective research with larger numbers of patients will be required to explore better discrimination of strokes subtypes in respect of clinical characteristics, complications and functional outcomes.

Conflict of Interest
Authors reported no conflicts of interest.

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