

## The Relationship Between Type of Stroke and Complications and Rehabilitation Outcomes

*Strok Tipi ve Komplikasyonların Rehabilitasyon Sonuçlarıyla İlişkisi*

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Başvuru tarihi / Submitted: 04.07.2005 Kabul tarihi / Accepted: 25.08.2005

**Objectives:** We examined cases of hemiparesis with various aetiological reasons, before and after treatment in order to analyse the factors which may affect functional recovery rates, motor development and complications.

**Patients and Methods:** Eighty-two patients (52 males; mean age  $57.06 \pm 15.43$ ; range 8-82 and 30 females; mean age  $56.17 \pm 14.41$ ; range 18-78) were retrospectively evaluated. Patient characteristics including age, gender, side of hemiparesis, type of stroke, mental condition, speech ability, the onset to rehabilitation admission interval, Brunnstrom values, the Ashworth index, the Functional Ambulation Categories (FAC), Barthel index (BI) on admission and before discharge from the hospital, complications and length of inpatient stay were recorded.

**Results:** There were significant differences between admission and discharge Brunnstrom values, BI and FAC's in all the patients. There was a negative correlation between the onset to rehabilitation admission interval and the rate of change after treatment. A positive correlation was observed between the length of inpatient stay and the rate of change in the scores. It was determined that infections negatively affected the changes in BI and FAC's after treatment.

**Conclusions:** Our results suggest that the functional outcome of hemiparetic patients was positively affected by rehabilitation, and that the aetiological reasons and complications did not affect the results of the treatment.

**Key Words:** Cerebrovascular accident/rehabilitation; treatment outcome.

**Amaç:** Çeşitli etyolojik nedenli hemiparezisi olan olgular tedavi öncesi ve sonrası incelenerek fonksiyonel geri dönüşüm oranları, motor gelişimleri, oluşan komplikasyonlar ve bunlar üzerinde etkisi olabilecek faktörler araştırıldı.

**Hastalar ve Yöntemler:** Rehabilitasyona alınan 82 hasta (52 erkek; ort. yaşı  $57.06 \pm 15.43$ ; dağılım 8-82 ve 30 kadın; ort. yaşı  $56.17 \pm 14.41$ ; dağılım 18-78) retrospektif olarak değerlendirildi. Olguların yaş, cinsiyet, tutulan taraflar, etyolojik neden, mental durum, lisan özelliği, rehabilitasyona başlayana kadar geçen süre, giriş ve taburcu öncesi Brunnstrom değerleri, Ashworth indeksleri, fonksiyonel ambulasyon evreleri (FAE), Barthel indeksleri (BI), takip süresince ortaya çıkan komplikasyonlar ve hastanede toplam yatış süreleri kaydedildi.

**Bulgular:** Tüm hastaların hastaneden çıkış öncesi Brunnstrom değerleri, BI ve FAE'leri hastaneye yatrışlarına göre anlamlı düzeyde farklıydı. Rehabilitasyona başlayana kadar geçen süre ile tedavi sonrası değişim oranı arasında negatif korelasyon vardı. Hastanede yatış süresi ile skorlardaki değişim oranının pozitif korelasyon gösterdiği görüldü. Takip sırasında gelişen enfeksiyonların BI ve FAE'deki değişimi olumsuz etkilediği saptandı.

**Sonuç:** Çalışmamızın bulguları hemiparezik olguların fonksiyonel durumlarının rehabilitasyonla olumlu yönde etkilendiğini, bu değişimin etyolojik nedenlerle ilişkisiz olduğunu ve komplikasyonların tedavi sonuçlarını etkilemediğini göstermektedir.

**Anahtar Sözcükler:** Serebrovasküler olay/rehabilitasyon; tedavi sonuçları.

Trakya Univ Tip Fak Derg 2006;23(2):76-83

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Hemiplegia (paralysis) or hemiparesis (weakness) of one side of the body opposite the site of the lesion are the classic signs of neurovascular disease of the brain. It is one of many manifestations of neurovascular disease, and it occurs with strokes involving the cerebral hemisphere or brainstem. A stroke, or cerebrovascular accident (CVA), results in a sudden, specific neurological deficit. Although hemiplegia may be the most obvious sign of a stroke and a major concern of therapist, other symptoms are equally disabling, including sensory dysfunction, aphasia or dysarthria, visual defects, and mental and intellectual impairment. Stroke can be classified according to pathological type of infarction (thrombosis or embolus) or hemorrhage (intraparenchymal or subarachnoidal).<sup>[1-3]</sup>

Stroke is the third major cause of death in developed countries. Besides the high morbidity, it causes important social and economical problems by causing permanent disabilities.<sup>[4]</sup> The essential goal of rehabilitation is to restore the best possible performance and independence. For the survivor of stroke, relevant functional parameters usually include swallowing, communication, walking, other activities of daily living, cognitive function, socialization, the living setting in the community, family function, and, when appropriate, return to work.<sup>[5]</sup>

Several factors might influence the specific outcome of an individual patient who is involved in a stroke rehabilitation program. Potentially important factors include age, type, severity, location and size of stroke, cognitive, language, communication and learning ability, emotional state, initial functional status, types and severity of comorbid medical conditions and ongoing health functions such as congestive heart failure, onset to admission interval (OAI), length of hospital stay (LOHS). The medical complications such as infections, shoulder pain, deep vein thrombosis, pressure ulcer can limit the patient's ability to participate in a therapeutic exercise program, inhibit functional skill performance, and reduce the likelihood of achieving favorable outcomes from rehabilitation.<sup>[2,6]</sup>

The purpose of this study was to identify the efficacy of inpatient stroke rehabilitation, to evaluate the relationship between clinical characteristics and functional outcome, and to determine factors predicting functional outcome at discharge.

## PATIENTS AND METHODS

Eighty-two patients (52 males; mean age  $57.06 \pm 15.43$ ; range 8 to 82 years and 30 females; mean age  $56.17 \pm 14.41$ ; range 18 to 78 years), with stroke due to various reasons, admitted for rehabilitation to the physical medicine and rehabilitation clinic between the years 2000-2004 were retrospectively evaluated.

The patients' age, gender, affected side (right-left), the type of stroke, mental condition, ability of speech, the onset to rehabilitation admission interval (day), complications which occurred during treatment and the length of time spent in hospital (days) were recorded. The patients were divided into groups according to these features. According to the speech ability; those who had no speech problems were placed in the first group and aphasic and dysarthric patients were placed in the second group. Since scores given in the detailed investigation of the patients' mental condition were not found in the information files, two simple groups were identified. The first group consisted of those who could understand simple and complex commands, whereas the second group consisted of those who could not understand simple and/or complex commands.

The Brunnstrom values of upper extremities, hand and lower extremities, the Ashworth indexes of upper and lower extremities, the Barthel index (BI) and Functional Ambulation Categories (FAC) values both on admission and discharge from the hospital were recorded after physical examinations.

The differences between the Brunnstrom values, Ashworth indexes, FAC and BI of all the patients on admission and discharge from the hospital were examined. The presence of a relationship between the age of the patients and the change obtained after treatment was investigat-

ed. The effect on the difference obtained after treatment of the affected side, aetiological reasons, gender, mental condition, ability of speech, complications, onset to rehabilitation admission interval and the length of inpatient stay were evaluated. The correlation between the Brunnstrom values with BI and FAC's were investigated.

Student's t-test (Mann Whitney U-test for the nonparametric groups) was used in the evaluation of the difference between the two averages of the independent groups, one-way analysis of variance (ANOVA) test (Kruskal Wallis test for the nonparametric groups) was used for the evaluation of the difference between more than two averages of the independent group and Pearson correlation analysis was used in the evaluation of correlations. The Student t-test (Wilcoxon test for nonparametric groups) was used for the importance test on the difference between two averages in the analysis of dependent groups.

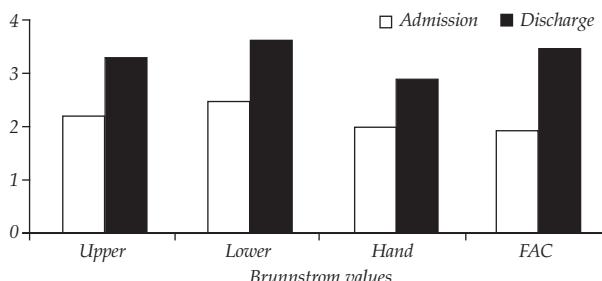
## RESULTS

A total of 82 patients with an average age of  $56.73 \pm 14.98$  were included in the study. Diagnostically, 47.6% of the patients had right hemiparesis ( $n=39$ ) and 52.4% had left hemiparesis ( $n=43$ ).

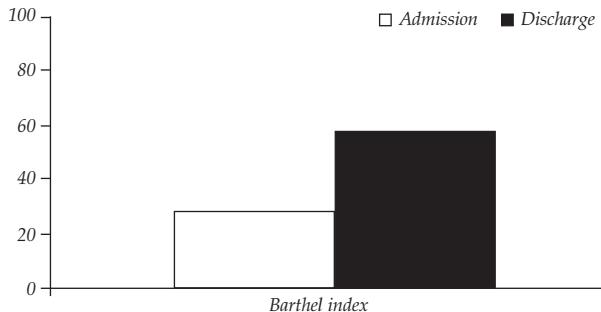
A statistically significant level of difference was found when the Brunnstrom values (upper extremity  $t=-7.15$ ,  $p=0.000$ ; hand  $t=-4.63$ ,  $p=0.001$ ; lower extremity  $t=-4.63$ ,  $p=0.001$ ), FAC's ( $t=-7.27$ ,  $p=0.000$ ) and BI ( $t=-5.95$ ,  $p=0.000$ ) before discharge from hospital were compared with the first values obtained on

admission to hospital (Fig. 1, 2). There was, however no difference between the Ashworth indexes ( $p>0.05$ ). The Brunnstrom values after treatment were found to be strongly correlated with the changes observed in the BI's and FAC's ( $p<0.001$ ) (Table 1). According to the BI's calculated during the patients' evaluations on admission, 46 patients were totally dependent (56.1%), 25 patients were dependent at an advanced level (30.5%) and 11 patients were dependent at a moderate level (13.4%); at the stage of discharge, 13 patients were totally dependent (15.9%), 25 were dependent at an advanced level (30.5%) 33 were dependent at a moderate level (40.2%), 8 were dependent at a slight level (9.7%) and 3 were totally independent (3.7%).

When the aetiological reasons of stroke in each case were investigated, it was observed that, 32 had thrombotic (39.0%, mean age:  $60.13 \pm 9.71$ ), 23 embolic (28.0%, mean age:  $59.83 \pm 13.84$ ), 14 intracerebral haemorrhagic (17.1%, mean age:  $60.50 \pm 8.13$ ) and 13 patients had subarachnoidal haemorrhagic stroke (15.9%, mean age:  $38.85 \pm 20.89$ ). In all the groups, there was a statistically significant difference between before and after treatment Brunnstrom values, BI's and FAC's ( $p<0.05$ ) and the values were higher after treatment. Besides, there was no significant difference between the groups with respect to the changes obtained with treatment ( $p>0.05$ ). When the average ages were evaluated, the average age of the haemorrhagic stroke group was lower than the other groups. The length of inpatient stay did not differ between groups ( $p>0.05$ ).



**Fig. 1.** The differences of the Brunnstrom values and FAC's values between discharge and admission to hospital. FAC: Functional ambulation categories.



**Fig. 2.** The differences of the Barthel index between the values obtained at discharge and admission to hospital.

**Table 1. The correlation among the changes of Brunnstrom, BI's and FAC's values after rehabilitation**

		Brunnstrom upper extremity	Brunnstrom hand	Brunnstrom lower extremity	BI	FAC
Brunnstrom upper extremity	r	–	0.638	0.814	0.757	0.727
	p	–	0.000*	0.000*	0.000*	0.000*
Brunnstrom hand	r	0.638	–	0.559	0.608	0.580
	p	0.000*	–	0.000*	0.000*	0.000*
Brunnstrom lower extremity	r	0.814	0.559	–	0.739	0.726
	p	0.000*	0.000*	–	0.000*	0.000*
BI	r	0.757	0.608	0.739	–	0.864
	p	0.000*	0.000	–	–	0.000*
FAC	r	0.727	0.580	0.726	0.864	–
	p	0.000*	0.000*	0.000*	0.000*	–

\*: p<0.05 (statistical significant); FAC: Functional ambulation categories; BI: Barthel index; r= Correlation coefficient.

There was no relationship ( $p>0.05$ ) between the patients' Brunnstrom values, BI and FAC changes obtained with treatment, and with the affected extremity, the patients' age, gender, ability of speech and mental condition.

The success level of the treatment showed a negative correlation with the onset to rehabilitation admission interval and a rather statistically significant and positive inclination of correlation ( $p<0.05$ ) was observed with the length of inpatient stay (Table 2).

Complications developed in 61 patients (74.4%). These complications were; psychiatric disorders in 34 patients (41.4%), infections in 21 patients (25.6%), shoulder pain in 39 patients (47.6%), deep vein thrombosis in 1 patient (1.2%), pressure ulcer in 1 patient (1.2%) and epileptic seizures in 1 patient (1.2%). More than one complication was observed in some of the

patients. Among those with psychiatric disorders, 29 (35.4%) were diagnosed as depression, 3 (3.7%) panic disorder and 2 (2.4%) as psychosis. Among the 21 patients who had infections, 17 (20.7%) had urinary tract infection and 4 (4.9%) had lower respiratory tract infection. When patients with shoulder pain were evaluated in detail, shoulder subluxation was observed in 22 patients (26.8%), complex regional pain syndrome in 8 patients (9.8%), impingement syndrome in 7 patients (8.5%) and spasticity in only 2 patients. The age and the time of starting rehabilitation were not different from the group without complications ( $p>0.05$ ). Gender did not have any effect on the development of complications ( $p>0.05$ ). The length of inpatient stay of the group with infections was longer than the group without infections ( $t= -2.15$ ,  $p=0.035$ ). No relationship was found between the developmental level of patients

**Table 2. The correlation between the length of interval before rehabilitation, the length of inpatient stay and the changes of Brunnstrom, BI's and FAC's values after rehabilitation**

		Brunnstrom upper extremity	Brunnstrom hand	Brunnstrom lower extremity	BI	FAC
The onset to rehabilitation admission interval	r	-0.378	-0.289	-0.351	-0.190	-0.237
	p	0.000*	0.009*	0.001*	0.088	0.032*
The length of inpatient stay	r	0.377	0.228	0.380	0.237	0.209
	p	0.000*	0.039*	0.000*	0.032*	0.060

\*: p<0.05 (statistical significant); FAC: Functional ambulation categories; BI: Barthel index; r= Correlation coefficient.

after treatment and the length of inpatient stay with psychiatric problems and shoulder pain ( $p>0.05$ ).

## DISCUSSION

Stroke is the most common reason of mortality and morbidity in neurological diseases.<sup>[7]</sup> There are a great number of factors affecting the independency state of the patient after the incidence in respect to daily activities. In our study, an important improvement was observed between the admission Brunnstrom values, BI and FAC's of all the patients at the end of the rehabilitation period. This explains the increase in the independency level in the daily activities.

It was observed that patient age was not related with the results of rehabilitation. There are a number of publications in literature stating that age is an important prognostic factor. Musicco et al.,<sup>[8]</sup> in a study in which they evaluated 1716 patients with stroke, have stated that being younger positively affects the results of rehabilitation. Similarly, Paolucci et al.<sup>[9]</sup> have stated that the probability of mobility is lower in patients over the age of 75 with stroke. The fact that there were only 8 patients over the age of 75 in our study may explain the reason why rehabilitation results were not affected by age. Macciocchi et al.<sup>[10]</sup> investigated the factors which affected the final functional condition in patients with ischaemic stroke. As a result of this study, the functional results were found to be higher in younger patients. In a study expressing a different view, however, it was stated that higher functional rehabilitation was observed in older patients compared to younger patients at the end of the rehabilitation program.<sup>[11]</sup>

The effect of gender and the affected side on rehabilitation results is not clear. The treatment results in our study are not related to gender and the affected side. In a study by Laufer et al.<sup>[12]</sup> with patients of right and left hemiparesis, the BI and FAC changes were found to be similar. Morin-Martin et al.<sup>[13]</sup> in a study in which they carried out with patients suffering from stroke, assessed the effect of gender. They

observed that,, the BI values in females were lower and more permanent disabilities were observed after stroke.

In our study, we found that the ability of speech and mental condition did not affect rehabilitation results. This may be due to the simplicity of the physical evaluations used to assess the ability of speech and mental condition and due to the fact that the scoring system that we used did not permit objective quantitative evaluation. Also, in this context, the changes at the end of the treatment were not investigated but the patients' values on admission were taken into consideration. There are publications in literature which state that aphasia and mental deterioration affects rehabilitation negatively.<sup>[14-17]</sup>

An increase in independency in daily life activities, ambulation and motor development was observed in all groups after treatment, whatever the aetiological reason was. This increase was not different among the groups. In a study investigating the effect of aetiology on the final condition, 25 haemorrhagic and 25 non-haemorrhagic patients with stroke were investigated. The study results were similar to our results and no difference in the functional independency between the two groups was found.<sup>[18]</sup> In a study carried out by Kelly et al.,<sup>[19]</sup> a large patient group consisting of 871 patients with obstructed stroke (thrombotic and embolic) and 193 patients with intracranial haemorrhagia were evaluated. Although the functional insufficiency was higher in the haemorrhagic group after treatment, these patients were reported to have a better walking ability.

The functional walking ability and motor development were found to advance further in patients who started rehabilitation at an early stage. However there was no correlation between the Barthel values and the time elapsed before rehabilitation. The importance of early rehabilitation has been stressed in many studies.<sup>[8,20]</sup> There are also publications which have notified that the initiation period of rehabilitation does not affect the final condition.<sup>[21]</sup>

In our study the length of inpatient stay shows a positive correlation with the patients' motor development level, functional stages of walking and the degrees of independency in their daily life. In literature, the effect of the length of inpatient stay on the final condition is controversial.<sup>[14,22,23]</sup>

Shoulder pain was the most common complaint among our patients. Complications identified in order of frequency were; depression, shoulder subluxation, urinary tract infection, RSD and impingement syndrome. Treatment was applied for the complications in a multi-disciplinary manner with early diagnosis. Therefore it was thought that rehabilitation treatment results were not affected by these complications. 73 hemiplegic patients were evaluated in a study carried out by Pinedo and de la Villa.<sup>[24]</sup> The authors reported that in the first year after stroke various types of complications were observed in 82% of the patients, the most frequent of these were shoulder pain (40%) followed by contractures (23%) and RSD (15%). Again in many similar studies concerning the aftermath of stroke, the most frequent complication was reported to be shoulder pain.<sup>[25-27]</sup> McLean<sup>[28]</sup> evaluated 133 patients with stroke and stated that the 4 most frequently identified complications were; depression (26%), shoulder pain (24%), falls (20%) and urinary tract infections (15%). There were no falls in our study group. Doshi et al.<sup>[29]</sup> stated that the stroke aftermath complication rates were higher in females and that age was not related with the development of complications. Dromerick and Reding<sup>[30]</sup> informed that BI and the length of inpatient stay correlated with the complications in stroke cases. In this study, similar to our study, it was stated that there was no relationship between development of complication and patients' age, gender, the onset to rehabilitation admission interval and aetiological reasons. The relationship between the intensity of the motor deficit with shoulder pain was evaluated by some authors.<sup>[31]</sup> This, relationship was not determined in our study. Gillen et al.<sup>[32]</sup> evaluated 348 patients with stroke. They reported that the length of inpatient stay was longer in

patients with depressive syndromes but there was no relationship between the rehabilitation results and depression. There are other studies which have stated that depression did not affect the patients' final functional condition.<sup>[33,34]</sup> However, Carod-Artal et al.<sup>[35]</sup> mentioned the relationship of depression with quality of life. Studies presenting views different from our study results, have mentioned that the development of depression is more frequently observed in females and in those over the age of 70.<sup>[36]</sup> In a study by Gainotti et al.<sup>[37]</sup> the development of depression after stroke and the effect of anti-depressant treatment on motor development and on reduction in the disability were investigated. These authors have stated that the motor and functional development in patients who were treated for depression, were not different than the group who did not have depression. The patients with psychiatric problems in our study were diagnosed and treated early.

## CONCLUSION

The rehabilitation period is very important in the increase of the functional independency level of the patients after stroke. Aetiological reasons and complications do not have an important effect on the rehabilitation results.

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