

MOTOR AND FUNCTIONAL REHABILITATION OUTCOMES OF 1000 TURKISH HEMIPLEGIC PATIENTS

HEMİPLEJİK 1000 TÜRK HASTANIN MOTOR VE FONKSİYONEL REHABİLİTASYON SONUÇLARI

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ABSTRACT

Aim: The aim of this study is to describe nature of functional recovery of 1000 Turkish first stroke survivors who were referred for inpatient rehabilitation.

Methods: Demographic data, disease and lesion characteristics together with concomitant diseases were recorded on admission. Brunnstrom stage (BS), Barthel index (BI) and Functional Ambulation Category (FAC) were recorded both on admission and at discharge. Recovery was quantified by the change in these scores between admission and discharge. Primary outcome measures were discharge scores and recovery rates of the BI, BS and FAC from admission to discharge.

Results: No significant difference between genders was found in overall recovery rates. However, males had better functional outcome than females according to discharge scores. There was a moderate negative correlation between age and hand BS recovery rate and FAC recovery rate. However, significant positive correlation was observed between the education level, and upper and lower extremity BS recovery rates. In addition to these, right sided hemiplegic patients had better hand BS recovery rates and FAC discharge values than left hemiplegic patients. Among the concomitant diseases, hypertension and coronary heart disease were related with poor discharge values. The results also pointed out that a longer duration of rehabilitation leads to better recovery rates.

Conclusions: Motor and functional recovery in patients depend on age, initial motor and functional status, the side of hemiplegia, education level, concomitant cardiac diseases, duration before admission to the hospital and duration of rehabilitation. Knowledge of these predictors can contribute to more appropriate treatment and discharge planning.

Key words: Cerebrovascular Disorders, Outcome Assessment, Rehabilitation

ÖZET

Amaç: Bu çalışmanın amacı ilk kez inme geçiren ve yataklı rehabilitasyon için gönderilen 1000 Türk hastanın fonksiyonel iyileşmesini tanımlamaktır.

Metod: Yatışta demografik veriler, hastalık ve lezyon özellikleri kayıt edildi. Brunnstrom skoru (BS), Barthel İndeksi (BI) ve Fonksiyonel Ambulasyon Sınıflaması (FAS) yatış ve çıkışta uygulandı. İyileşme yatış ve çıkış skorları arasındaki fark ile değerlendirildi. Primer sonuç ölçümleri BI, BS ve FAS çıkış skoru ve yatıştan çıkışa kadar iyileşme yüzdesiydi.

Bulgular: İyileşme yüzdeleri açısından cinsler arasında fark yoktu. Ancak erkeklerin fonksiyonel sonuçları çıkış skorları açısından kadınlardan daha iyiydi. El BS ve FAC iyileşme skorları ile yaş arasında düşük negatif korelasyon vardı. Üst ve alt BS iyileşme skorları ile eğitim düzeyi arasında anlamlı pozitif ilişki vardı. Sağ hemiplejiklerin el BS ve FAC iyileşme skorları sol hemiplejiklerden daha yüksekti. Eşlik eden hastalıklar içinden hipertansiyon ve koroner arter hastalığı düşük çıkış skorları ile ilişkili bulundu. Rehabilitasyon süresi uzadıkça iyileşme oranı artmaktaydı.

Sonuçlar: İnmeli hastalarda motor ve fonksiyonel sonuç yaşa, ilk motor ve fonksiyonel düzeye, hemiplejik vücut tarafına, eğitim düzeyine, eşlik eden hastalıkların varlığına, rehabilitasyona kadar geçen süre ve rehabilitasyonun süresine bağlıdır. Bu belirleyicilerin bilinmesi uygun rehabilitasyon programı ve taburculuk planlarının yapılabilmesine yardımcı olabilir.

Anahtar kelimeler: Serebrovasküler hastalık, sonuç değerlendirmesi, rehabilitasyon

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INTRODUCTION

A significant number of stroke survivors every year are left with residual hemiplegia. A number of uncontrolled studies have suggested that the functional status in hemiplegia can be improved by rehabilitation programs (1,2). The purpose of stroke rehabilitation is to increase patients' functional independence despite impairment. Although rehabilitation can reduce disability by optimizing the performance on everyday tasks, many individuals are still significantly disabled and handicapped on discharge.(3) In stroke rehabilitation, early prediction of the obtainable level of functional recovery is desirable so as to deliver efficient care, set realistic goals, and provide proper discharge planning. The assessment of treatment effectiveness through outcome measures of different types is highly important to describe the consequent neurologic deficits, to monitor the effects of treatment and natural recovery, and to understand the relationship between reductions in disability and improvements in impairment. (4-13)

The aim of this retrospective study was to describe nature of functional recovery of 1000 Turkish first stroke survivors who were referred for inpatient rehabilitation. We described our hemiplegic patient profile, investigated the rate and extent of their motor and functional recovery, and determined the factors associated with it by using both motor recovery and functional outcome for determining motor and functional status on admission and at discharge, in addition to motor and functional gain during rehabilitation after the first stroke. Differences in functional recovery between subgroups of patients distributed according to the gender, side of lesion, and side involvement were also investigated.

MATERIALS ve METHODS

The sample consisted of a total of 1,000 patients who experienced stroke and were treated at Ankara Physical Medicine and Rehabilitation Education and Research Hospital, Inpatient Rehabilitation Department between January 1998 and January 2004. The criteria for the recruitment of subjects were: 1) first stroke, 2) unilateral hemiplegia, and 3) age over 20. The exclusion criteria included: 1) multiple strokes, 2) bilateral hemiplegia, and 3) etiologies except CVA.

On admission to the rehabilitation center, factors such as age, gender, occupation and education level were recorded for each patient, as were the stroke etiology (ischemia versus hemorrhage) and side of hemiplegia (right versus left). The duration between the stroke onset and admission to the rehabilitation center, the length of stay in hospital, and computerized brain tomography findings were also noted for each patient. In addition to this, patients were screened for the five clinically important preexisting medical conditions; hypertension, coronary heart disease, valvular disease, diabetes mellitus and lung disease. Sensory dysfunction and spasticity were recorded both on admission and discharge. The Ashworth scale was used to measure the severity of spasticity.(14) The motor recovery was assessed by Brunnstrom staging whereas the Barthel Index (BI) and Functional Ambulation Scale (FAC) were used for the assessment of the activity of daily living and ambulation status. The validity of all outcome measures used in this study have been shown in previous studies.(5,7,8)

To determine the recovery rate in patients, we referred to the change in BS, BI and FAC scores from admission to discharge. Patients were divided into groups by side of weakness: right or left hemiplegia, type of lesion: ischemia or hemorrhage, site of lesion: cortical or sub cortical, gender: male or female, age: younger than 65 or 65 and older, education level: primary school - university, occupation: (unemployed + retired), (public + private sector employee) and worker, presence of concomitant diseases: hypertension (HT), coronary artery disease (CAD), diabetes mellitus (DM), valvular disease (VD) and lung disease, presence of sensory deficit, the severity of the spasticity: Modified Ashworth 0-4.

All data was compiled in a database for later analysis (SPSS, version 11,5 for Windows; SPSS Inc, Chicago; IL). Mann Whitney-U test and Kruskal Wallis Test were used to compare the differences between groups. Spearman's correlation coefficients were used to correlate recovery rates and related variables. Wilcoxon signed rank test was used to compare all values before and after the rehabilitation program. The level of statistical significance was set at $p < 0.05$ for all tests.

RESULTS

Of the patients, 530 were female and 470 were male. 517 were right hemiplegic while 483 were left hemi-

Tablo-I
Characteristics of the patients

	N=1000
Age (year)	61.07 ± 12.28
Duration until admission (days)	140.07 ± 352
Hospitalization duration (days)	38.14 ± 21.16
Type of lesion	
• Ischemia	71.8
• Hemorrhage	28.2
Gender	
• Male	47
• Female	53
Sensory dysfunction	
• light touch	34.2
• proprioceptive	26.2
Site of lesion	
• Cortical	84
• Sub cortical	16

Values are expressed as mean±SD for continuous variables, or (%) for categorical variables

plegic. Their characteristics are given in Table I and the mean outcome values in Table II. Table III shows comparisons and table IV shows correlations between patient characteristics and recovery rates. In table V comparisons between patient characteristics and discharge scores are given.

No statistically significant difference were found between the two genders in overall recovery rates. However, there was a significant difference in discharge FAC values between men and women. Men had better functional outcome than women according to discharge FAC values. There was a moderate negative correlation between age and hand BS recovery rate and FAC recovery rate. The younger group had better FAC and BI discharge values and no difference was observed between the younger and older group for motor outcome scores. Significant relationships were found between education levels and upper and lower extremity BS recovery rate. When the patients were categorized into two groups according to their education levels, the discharge values of FAC and BI were significantly better in the higher educated group. No statistically significant difference was found between occupation groups, either in overall recovery rates or discharge values. No relationship was determined between concomitant disease and recovery rates. All recovery rates were slightly lower in patients with diabetes mellitus, coronary heart disease and hypertension than in those patients without concomitant disease. Lower discharge values were observed in patients with hypertension and coronary heart disease, as were hand BS discharge values in lung disease patients.

Tablo-II

Mean scores of outcome measures on admission and at discharge

	H-BS	UL-BS	LL-BS	BI	FAC
On admission	2.50±1.629	2.49±1.488	2.98±1.306	50.14±23.012	1.24±1.518
At discharge	2.73±1.645	2.74±1.473	3.34±1.243	67.71±24.158	2.96±1.985

Values are expressed as mean ± SD.

(H-BS: Hand Brunnstrom stage, UL-BS: Upper Limb Brunnstrom stage, LL-BS: Lower Limb Brunnstrom stage, FAC: Functional ambulation category, BI: Barthel Index)

Tablo-III

Comparisons between patient characteristics and recovery rates

	H-BS RR	UL-BS RR	LL-BS RR	FAC RR	BI RR
Gender	NS	NS	NS	NS	NS
Education level	NS	p=0.042*	p=0.008*	NS	NS
Occupation	NS	NS	NS	NS	NS
Concomitant disease	NS	NS	NS	NS	NS
Side of weakness	p=0.000*	NS	NS	NS	NS
Etiology	NS	NS	NS	NS	NS

NS: Not significant

* Statistically significant differences between groups

(H-BS RR: Hand Brunnstrom stage recovery rate, UL-BS RR: Upper Limb Brunnstrom stage recovery rate, LL-BS RR: Lower Limb Brunnstrom stage recovery rate

FAC RR: Functional ambulation category recovery rate, BI RR: Barthel Index recovery rate)

Tablo-IV

Correlations between patient characteristics and recovery rates

	H- BS RR	UL-BS RR	LL-BS RR	FAC RR	BI RR
Duration of rehabilitation	r=0.195*	r=0.232*	r=0.320*	r=0.519*	r=0.445*
Duration until admission	r=-0.222*	r=-0.195*	r=-0.193*	r=-0.254*	r=-0.133*
Age	r=-0.069**	NS	NS	r=-0.153*	NS
Site of lesion	NS	NS	NS	NS	NS

NS: Not significant

* Statistically significant correlation ($p < 0.01$)** Statistically significant correlation ($p < 0.05$)

(Hand BS RR: Hand Brunnstrom stage recovery rate, UL BS RR: Upper Limb Brunnstrom stage recovery rate, LL BS RR: Lower Limb Brunnstrom stage recovery rate, FAC RR: Functional ambulation category recovery rate, BI RR: Barthel Index recovery rate)

Tablo-V

Comparison of discharge scores among groups

	Hand BS discharge	UL-BS discharge	LL-BS discharge	FAC discharge	BI discharge
Gender	NS	NS	NS	p=0.000*	NS
Age	NS	NS	p=0.026*	p=0.000*	p=0.000*
Education level	NS	NS	NS	p=0.000*	p=0.038*
Occupation	NS	NS	NS	NS	NS
Concomitant disease					
▪ ASHD	NS	NS	NS	p=0.019*	NS
▪ HT	NS	NS	NS	p=0.001*	NS
▪ VD	NS	NS	NS	NS	NS
▪ DM	NS	NS	NS	NS	NS
▪ LD	P=0.040*	NS	NS	NS	NS
Side of weakness	NS	NS	NS	p=0.029*	NS
Etiology	p=0.017*	NS	NS	NS	NS
Site of lesion	p=0.000*	p=0.000*	p=0.001*	NS	NS

NS: Not significant

* Statistically significant differences between groups

(Hand BS RR: Hand Brunnstrom recovery rate, UL BS RR: Upper Limb Brunnstrom recovery rate, LL BS RR: Lower Limb Brunnstrom recovery rate, FAC RR: Functional ambulation category recovery rate, BI RR: Barthel Index recovery rate, ASHD: Atherosclerotic heart disease, HT: Hypertension, VD: Valvular disease, DM: Diabetes Mellitus, LD: Lung Disease)

All recovery rates were higher in right-sided hemiplegia but statistically significant difference was found only in hand BS recovery rate. Right hemiplegic patients also had better discharge values than left hemiplegics. There was a strong positive correlation between recovery rates and the duration of rehabilitation. A moderate negative correlation between recovery rates and duration until admission was observed. There was no significant difference between recovery rates in ischemic and hemorrhagic lesion type. Only the hand BS discharge value was significantly better in hemorrhagic lesions.

We could not find any correlation between recovery rates and brain lesion location. However, we found the lowest discharge hand, upper limb and lower limb

BS scores in patients with cortical lesions. All discharge values were better than admission values. There was no statistically significant relation between light touch sensation disturbance and either recovery rates or discharge values. While all mean discharge values were lower in patients who had position sense disturbance, only the FAC recovery rate was significantly different in these patients. Muscle tonus was not related with recovery rates or discharge outcome values. At discharge, the rate of ambulatory patients was 24.9%, tripod assistance was required for ambulation in 54.9%, walker assistance in 4.6%, and the rate nonambulatory patients was 15.3%. Of these patients, 61.5% used no orthotics, 33.3% used ankle foot orthosis, and 4.8% had knee ankle foot orthosis.

DISCUSSION

Hemiplegia after stroke is the most common neurologic impairment and is a primary reason for admission to rehabilitation hospitals. This retrospective study consists of hemiplegic patients who were hospitalized in one of the two biggest national rehabilitation hospitals in Turkey which receives patients from all over the country. In this hospital, we use traditional rehabilitation approach such as conventional and neurophysiological therapies for all of the stroke patients and, biofeedback and functional electric stimulation if needed.(15)

In the present study, there were significant motor and functional gains at the end of the rehabilitation program regarding BS, FAC and BI values. All discharge values were higher than those at the time of admission. The admission status of BS, FAC, and BI are predictive of discharge disposition, and can be used to establish a rehabilitation program, to inform the patient and family about the possibility of recovery, and to assess the amount and quality of care given in the home or discharge placement. Inouye et al., in their two different studies (16,17) analysing 464 and 243 stroke patients, reported that the functional levels of the patients predicts the degree of functional gain after rehabilitation. Similar to the results reported in the literature (6,18), our study also concluded that a rehabilitation program was useful for hemiplegic patients. However, Murakami and Inouye (19) showed lower rehabilitation efficiency for Japanese patients.

In our study, whereas the duration of rehabilitation was positively correlated with motor and functional outcomes, the duration before admission to the rehabilitation center was negatively correlated. The mean duration before admission to our rehabilitation center was subject to a long waiting list of patients applying for the small number of beds in Turkey. This is a real handicap for our rehabilitation policy as we know that an early program is necessary for better functional outcome. It has been shown that most stroke patients show considerable recovery of function over the first few months. Being in hospital promotes recovery and few patients improved after discharge.(3,11) Some authors (1,20) concluded that early initiation of rehabilitation was more important than the total amount of physiotherapy administered. Our results have suggested that the late initiation of rehabilitation program was beneficial for hemiplegic patients. However, some studies (21) have shown that hospital-based and home rehabilitation have the same effect on functional out-

come. A home exercise program is given to our patients prior to admission to the rehabilitation hospital but we observe that most of our patients do not follow it during the waiting time. This may be due to the low sociocultural status of our patient population. The education level of our patients was generally low and the worst recovery rates occurred amongst the least educated. This finding may be associated with poor adaptation to the rehabilitation program due to low perception in poorly educated people.

Although in some studies (22) occupation was shown to be a significant factor affecting functional independence, we found that it does not influence recovery. This might be due to non-homogeneous distribution among the occupation groups. Regarding influence of age, Engeletzis et al. (18) showed that older group had significant lower functional outcome. Bagg et al. (23) showed that age alone was a significant predictor of total FIM score at discharge, but not FIM recovery rate. Inouye (24) proposed that age was useful to determine predictors of function at discharge for stroke outcome. Wade et al, in analysing 976 stroke patients, also determined that older patients have more severe strokes in terms of initial functional loss, and recover function less well. (10) In this study, age was negatively correlated with hand BS and FAC recovery rate. When compared to the younger group, lower limb BS, FAC and BI discharge values were lower in the older group.

Wade and Hewer (10) determined that young women appeared to suffer considerably more severe strokes in terms of initial functional loss. Engeletzis et al. (17) found that women had a lower FIM discharge score and recovery rate, and that the older group was statistically more likely to be women. They also pointed out that the major associations with a patient's gender were probably secondary to the fact that women tended to be older. However, in our study, the rate of men and women in the geriatric group was almost equal, and we could not find any significant difference between recovery rates in men and women. The only lower value in women was discharge FAC value. Inouye et al. (16) too reported that gender did not correlate with FIM discharge score .

In the present study, better hand BS recovery rate and discharge values were observed in right hemiplegic patients. This could be attributed to the visuospatial neglect in left hemiplegic patients. Visuospatial neglect, a frequent consequence of unilateral (usually right hemisphere) stroke, is associated with poor functional

recovery and in many patients is resistant to remedial treatment.(25) Other studies (12,6) also showed that patients with neglect had poorer functional ability and required longer periods of hospitalization. However, Wade and Hewer (10) could not find any significant difference between right and left hemiplegic patients according to BI.

Although it is known that patients with intracerebral hemorrhage have a worse outcome in the acute stage, no significant difference was found between stroke etiology (ischemia or hemorrhage) and recovery rates. This may be because the assessment of the patients in this study was performed at a late phase after the stroke. Other studies (9) have also not found any correlation between stroke pathology and motor and functional outcome. Although Chen et al. (9) showed that motor recovery and functional outcome after stroke correlated with brain lesion profile, there was no significant difference between recovery rates and lesion localisation in our study. Only in patients with cortical lesions did we find significantly less discharge BS values than other lesions. This finding was expected as we know the motor area of the brain is mainly supplied by MCA and cortical lesion was due to MCA lesion in most of our patients.

In some studies, (26) concomitant diseases in stroke are associated with both long term prognosis and outcome. In this study there was no association between recovery rates and concomitant diseases. Among the concomitant diseases, the preexisting hypertension and coronary heart disease were found to be related with discharge FAC value. These results are concordant with the literature (22,26) which indicates that prior heart problems affect functional outcome and increase the risk of death and stroke recurrence. However, since advanced age brings the risk of systemic disease, the negative effects that we have detected on motor and functional outcome may also be due to the ages of our patients. The finding that lung diseases affect hand BS was controversial because of the small number of lung disease patient.

Of the neurologic findings, only the proprioception was associated with functional outcome. Other findings such as light touch disturbance and spasticity did not effect motor and functional outcome. Although it is known that a loss of proprioception has a significant effect on joint protection, balance, coordination, and motor control, (27) to our knowledge, no study exists in the literature regarding the effect of proprioception on the functional outcome of stroke patients.

CONCLUSION

Turkish hemiplegic patients showed significant motor and functional improvements after rehabilitation despite the late initiation of rehabilitation program. Motor and functional outcome in hemiplegia correlated with age, education level, duration prior to admission, rehabilitation duration, hemiplegic side, concomitant diseases, site of lesion (related only to motor outcome) and loss of proprioception, but did not correlate with gender, occupation, type of lesion, or light touch sense disturbance. Being aware of these predictors can contribute to more appropriate treatment and discharge planning.

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