Prediction of Functional Outcome in Stroke Survivors Following Inpatient Rehabilitation

Yatarak Rehabilitasyon Uygulanan İnmeli Hastalarda Fonksiyonel Sonucun Tahmin Edilmesi

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ABSTRACT

Objective: To examine the functional recovery of stroke survivors admitted for inpatient rehabilitation and to identify the factors influencing the level of disability at the time of discharge from hospital.

Methods: A total of 200 consecutive patients (96 women, 114 men) admitted to our inpatient rehabilitation facility over a 5-year period from January 2006 to January 2011 were reviewed retrospectively. Demographic and clinical features including age, gender, type and side of stroke, disease duration, length of stay (LOS), and functional outcome measure (FIM) admission-discharge scores were recorded.

Results: The mean age of the patients was 64.8 ± 13.8 years. The most common stroke type was ischemic (80%). The median value of disease duration was determined as 2.5 months. The mean of LOS was 24.8 ± 12.2 days. The mean values of FIM score on admission and discharge were 69.6 ± 31.3 and 82.1 ± 32.4, respectively. There was a statistically significant improvement in the FIM scores from the time of admission to the time of discharge, with a median gain of 6.5. No significant differences in disease duration, LOS, FIM admission score, FIM discharge score and FIM gain were found in patients grouped according to gender, side and type of stroke. The FIM scores at discharge was best predicted by the FIM score on admission, LOS and age.

Conclusion: The importance of the FIM score on admission, age, and LOS should always kept in mind for planning rehabilitation goals and therapy programs in patients with stroke.

Keywords: Stroke, rehabilitation, functional outcome

ÖZET

Amaç: Yatarak rehabilitasyon programına alınan inme hastalarının fonksiyonel iyileşme düzeylerini incelemek ve hastaneden taburculukları sırasındaki özürlülük düzeylerine etki eden faktörleri belirlemektir.

Yöntemler: Ocak 2006 ile Ocak 2011 yılları arasındaki 5 yıl boyunca inme rehabilitasyonu için servise kabul edilen ardışık toplam 200 hasta (96 kadın, 114 erkek) retrospektif olarak değerlendirildi. Yaş, cinsiyet, inmenin etyolojisi, etkilenen taraf, hastalık süresi, hastanede yatış süresi ve yatış-çıkış fonksiyonel bağımsızlık ölçeği (FBÖ) skorları da dahil olmak üzere demografik ve klinik özellikler kaydedildi.

Bulgular: Hastaların ortalama yaşı 64,8±13,8 idi. En sık görülen inme tipi iskemikti (%80). Hastalık süresinin ortanca değeri 2,5 ay olarak belirlendi. Ortalama hastanede yatış süresi ise 24,8±12,2 gündü. Yatış ve çıkış FBÖ skorları ortalamaları sırasıyla 69,6±31,3 ve 82,1±32,4 idi. Hastaların yatışından çıkışına geçen zamanda, ortanca kazanım değeri 6,5 olmak üzere, FBÖ skorlarında istatistiksel olarak anlamlı düzeyde artış mevcuttu. Hastalar yaş, cinsiyet, inme tipi ve etkilenen tarafa göre gruplandırıldığında hastalık süresi, yatış süresi, yatış FBÖ skoru, çıkış FBÖ skoru ve FBÖ kazanımı arasında belirgin bir fark saptanmadı. Çıkış FBÖ skorunun en önemli belirleyicileri yatış FBÖ skoru, yatış süresi ve yaş olduğu tespit edildi.

Sonuçlar: İnmeli hastalarda tedavi programlarını ve rehabilitasyon hedeflerini belirlerken yatış FBÖ skoru, yaş ve yatış süresinin önemli faktörler olduğu mutlaka akılda tutulmalıdır.

Anahtar sözcükler: İnme, rehabilitasyon, fonksiyonel sonuç

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Introduction

Stroke is a leading cause of disability that necessitates the expenditure of considerable resources for the rehabilitation of its victims (1.) Stroke rehabilitation is the process of assisting a person who has become disabled as a result of a stroke to return to an optimal level of health, activity, and participation within the limits of the persisting stroke impairment (2). In order to achieve the most efficient use of rehabilitation services, it is important to identify predictors of outcome in patients with stroke. The most commonly used outcome parameters in stroke survivors include the patients' functional status at discharge, the length of stay (LOS) in hospital and the discharge location (3). Because the last two parameters are highly dependent on cultural and social factors, functional status measures are commonly used for evaluation of the effectiveness of a rehabilition pogram (4). For this purpose, the Functional Independence Measure (FIM) is one of the most commonly used instrument. The FIM has well-established reliability and validity (5) and responsiveness to change (6) in patients with stroke.

The objectives of the present study were to examine the functional recovery of stroke patients admitted for inpatient rehabilitation and to identify the possible factors influencing functional outcome. In addition, the differences between stroke survivors grouped according to gender, side and type of stroke were investigated.

Subjects and Methods

The documents of stroke patients admitted to our inpatient rehabilitation facility over a 5-year period from January 2006 to January 2011 were reviewed retrospectively. The study was approved by the local ethics committee of Hacettepe University. All patients shared the common characteristics of stroke, defined by the World Health Organization as a vascular lesion of the brain that resulted in radiply developing clinical signs, or focal or global loss of brain function that lasted at least 24 hours (7). The diagnosis of stroke was confirmed by detailed history, physical examination and neuroradiological findings. Demographic and clinical features including age, gender, type and side of stroke, disease duration and LOS were recorded.

A hemiplegia rehabilitation program including active and passive range of motion, progressive resistive, neurophysiological exercises, balance-coordination-walking training and occupational therapy were individualized for each patient. The usual treatment consists of therapy for 45-60 minutes per day during weekdays. Physical agents were used and assistive devices were provided when necessary. Timing of discharge was considered when the patients had reached the initial goals at the beginning of the program or a plateau of improvement. In order to assess the patients' functional status, the FIM had been conducted on admission and discharge by a physiotherapist. The FIM scale includes 18 items assessing 6 areas of function; self care, sphincter control, mobility, locomotion, communication and social cognition. Each item on the FIM is scored on a 7-point Likert scale, and the score indicates the amount of assistance required to perform each item (1 = total assistance in all areas, 7= total independence in all areas). A final summed score is created and ranges from 18-126, where 18 represents complete dependence/total assistance and 126 represents complete independence. It has been demonstrated that the Turkish adaptation of the FIM is reliable and valid in stroke patients (8). The FIM gain was calculated by substracting the FIM admission score from the FIM discharge score indicating functional improvement after rehabilitation therapy.

Data were analyzed using the SPSS 11.5 for Windows package program. Descriptive data were presented as mean±standart deviation for continous variables and as frequencies and percentages for categorical variables. The change in FIM scores was documented using Wilcoxon's matched-pairs test. Mann Whitney U test was performed to test the differences in clinical features according to gender, stroke type and side. The Spearman correlation coefficient was calculated to test for relationships between FIM gain and other variables. Multiple regression analysis was performed with the dependent variable FIM score at discharge whereas the independent variables were age, disease duration, type of stroke, FIM score on admission, and LOS. A p value <0.05 was considered to be statistically significant.

Results

A total of 200 consecutive patients (96 women, 114 men) were included in the study. The mean age of the patients was 64.8 ± 13.8 (range, 24-90) years. The most common stroke type was determined as ischemic (%80). Ninety-one (%45.5) of the stroke survivors had right sided hemiplegia. The disease duration widely ranged between 7 days and 15 years with a median value of 2.5 months. The interval between stroke onset and admission to our rehabilitation service was ≤1 year in %84 of the patients. The mean of LOS was 24.8 ± 12.2 (range, 3-95) days.

The mean values of FIM score on admission and discharge were 69.6 ± 31.3 (range= 18-126) and 82.1 ± 32.4 (range= 18-126), respectively. There was a statistically significant improvement in the FIM scores from the time of admission to the time of discharge ($p<0.001$), with a median gain of 6.5 (range= -7–64). All patients were

divided into groups according to their gender, side and type of stroke. Intergroup differences were demonstrated in Table 1. Female patients were older than male stroke survivors (66.6 ± 14.4 vs. 63.0 ± 13.0) (p=0.034). But, the mean age of the patients grouped according to the type and side of stroke were similar. No significant differences for FIM admission, FIM discharge, and FIM gain were found between the patients grouped by gender, side and type of stroke.

The relationships between FIM scores, age, disease duration and LOS are shown in Table 2. Significant positive correlations were found between FIM scores on admission and dicharge (r = 0.90). The patients's age was negatively correlated with FIM admission (r = -0.29) and FIM discharge (r = -0.38) scores, but not with FIM gain (p = 0.57). FIM gain was significantly correlated with disease duration (r = -0.35), LOS (r = 0.44) and FIM discharge score (r = 0.27). However, there was no significant relationship between FIM gain and FIM scores on admission (p = 0.371).

Multiple regression analysis revealed that the FIM scores at discharge was best predicted by FIM score on admission (p<0.001), LOS (p<0.001) and age (p=0.001). Type of stroke (p=0.105) and disease duration (p= 0.063) had no statistically significant contribution to the regression model. The regression equation explaining %83.6 (R^2) of the variation for FIM score at discharge was determined as FIM discharge= 27.16 + 0.90 FIM admission + 0.36 LOS – 0.26 age. The FIM score on admission was the strongest predicting variable.

Table 1. The comparison of age, functional measure scores, disease duration and length of stay according to the patients' gender, side and type of stroke.

	Age	FIM Admission	FIM Discharge	FIM Gain	Disease Duration (Month)	LOS (Day)
Gender						
Female	66.6 ± 14.4	67.2 ± 31.7	80.2 ± 34.3	6.5 (-2–64)	2.5 (0.25–120)	24.5 ± 12.9
Male	63.0 ± 13.0	71.9 ± 31.0	84.0 ± 30.6	6.5 (-7–55)	2.5 (0.50–180)	25.1 ± 11.5
p value	**0.034**	0.314	0.523	0.979	0.967	0.453
Side of stroke						
Right	65.1 ± 13.2	67.1 ±32.7	80.1 ± 32.9	8 (-2–64)	2.5 (0.25–120)	25.1 ± 13.1
Left	64.5 ± 14.3	71.8 ± 30.2	83.9 ± 32.0	6 (-7–55)	2.5 (0.25–180)	24.6 ± 11.5
p value	0.985	0.261	0.448	0.737	0.787	0.795
Type of stroke						
Infarction	65.9 ± 12.7	68.9 ± 31.6	80.5 ± 32.6	6 (-2–64)	2.0 (0.25–180)	25.1 ± 12.0
Hemorrage	60.2 ± 16.8	72.8 ± 30.4	88.8 ± 31.1	14.5 (-7–58)	3.0 (0.25–72)	23.9 ± 13.0
p value	0.066	0.476	0.136	0.064	0.404	0.374

FIM: Functional Independence Measure, **LOS:** Length of stay

Table 2. Correlations among age, disease duration, length of stay and functional measure scores.

	FIM Discharge	FIM Gain	Age	Disease Duration (Month)	LOS (Day)
FIM admission	0.90*	-0.06	-0.29*	0.18*	-0.04
FIM discharge		0.27*	-0.38*	-0.01	0.08
FIM gain			-0.14	-0.35*	0.44*
FIM efficiency			-0.14**	-0.31*	0.27*
Disease duration					-0.12

FIM: Functional Independence Measure, **LOS:** Length of stay

* p< 0.001, **p<0.05

Discussion

In the present study, we used the functional status at discharge measured by the FIM instrument as the outcome parameter for inpatient stroke rehabilitation. The FIM is highly responsive to change over time, its use as the measurement instrument allows quantification of recovery with greater accuracy (9). Because there are no long-term care facilities in our country, all the patients were discharged back to their home. The results of this study revealed that there was a significant improvement in the patients' functional status from admission to discharge. The prediction of functional outcome after stroke inpatient rehabilitation has been studied with a great interest for many years. It has been well-documented that age, gender, marital status, educational level, lesion size and location, associated medical problems, previous stroke, urinary and bowel incontinence, visuaospastial deficits, balance, motor status, cognitive impairment, communication impairment, depression, level of social support and motivation are all predictors of post-stroke function (1,10-12).

The strongest and most consistent predictor of discharge functional ability has been shown as functional disability on admission (1). Indeed, we found the FIM score at discharge was strongly correlated with the FIM score on admission and negatively correlated with age. In multiple regression analysis, it was found that the FIM discharge score was best predicted by the FIM admission score, LOS and the patients' age. The FIM score on admission was the strongest predicting variable. These results confirm that the patients who have greater function in the beginning of the inpatient rehabilitation program would have greater function at the time of discharge (4,13-17). Furthermore, younger age and longer LOS were significant independent predictors of better functional outcome. These findings support previous studies on prediction of functional outcome after stroke rehabilitation (9,18). Similarly, Gokkaya et al. have reported that 61% of the variation for the FIM scores at the time of discharge was explained by the FIM scores on admission and LOS (15).

It has been well-known that age is strongly associated with the functional status of stroke survivors. Nevertheless, it is not easy to determine whether age is significant in itself or indirectly through associated diseases. The increased incidence of chronic disease in elderly seems to be a possible explanation for the correlation between age and function at discharge (1). We found age to be negatively correlated with both the FIM admission and discharge scores but to have no association with FIM gain. This finding indicates that younger patients in the present study were less impaired and consequently had better functional status at discharge. However, the patients' age had no effect on functional gain after inpatient rehabilitation. Additionally, no significant correlation between severity of the functional impairment on admission and the gains obtained in the rehabilitation program were shown. On the other hand, FIM gain was found to be associated with disease duration and LOS stating that the patients with shorter disease duration and longer LOS in rehabilitation clinic, had greater functional gain. In another study (15), it has been also demonstrated that FIM gain was significantly correlated with onset to admission time and LOS, but not with age, comorbidities and the presence of medical problems. Similarly, Wang et al. (19) have recently reported that after controlling for patient demographics and initial medical conditions and functional status, shorter periods from stroke onset to admission were significantly associated with greater functional gains for the stroke patients during inpatient rehabilitation. They also stated that LOS in rehabilitation hospital contributed to functional gain.

In this study, comparison of the patients according to their gender, side and type of stroke showed no difference in terms of the FIM admission and discharge scores, FIM gain, disease duration and LOS. Although gender is considered as a prognostic predictor of stroke outcome, several studies conducted in the last decade concluded that gender was not an independent predictive factor for stroke outcome (4,14,15,20). Consistent with other studies (4,15,21), we found that the right- and left-sided stroke patients with compariable disease duration and functional disability had similar functional gain after inpatient rehabilitation. But, the results of previous studies investigating the influence of stroke etiology on functional recovery are conflicting. Chae et al. (22) compared the functional outcome of 25 hemorragic stroke patients with 25 nonhemorragic stroke patients matched on the basis of age and onset to admission interval. It has been revealed that there were no differences in admission, discharge FIM scores and FIM gain. However, the hemorragic group had a significantly shorter LOS with higher FIM efficiency (FIM gain/LOS). So, they have suggested that hemorragic stroke patients appear to exhibit functional gains somewhat faster than the others. In another retrospective study (9), it has been documented that although the patients with hemorragic stroke was more functionally impaired than the cerebral infarction group on admission, they made greater gains during inpatient rehabilitation with longer LOS and achieved compariable outcome. Similarly, Katrak et al. (18) have concluded that patients with intracerebral hemorrage had a greater level of disability on admission to rehabilitation, but they achieved significantly greater gains in function than patients with cerebral infarction

after rehabilition. On the contrary, it has been also reported that there was no significant difference in admission-discharge functional status and functional recovery between patients with ischemic or hemorragic stroke (4,14,15,21,23-25).

Prediction of functional outcome after rehabilitation is desirable to inform patient and family about the obtainable level of recovery, deliver efficient care and set realistic goals (4,14). The present study showed that the FIM score on admission, LOS and age have significant effect on predicting the FIM scores at discharge from hospital. Analysis of gender, side and type of stroke revealed no significant effect on the level of functional disability at discharge. In conclusion, these factors should be considered for planning rehabilitation goals and therapy programs in patients with stroke.

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