

# Impact of Delayed Initiation to Stroke Rehabilitation on Functional Outcomes and Medical Complications

## İnme Rehabilitasyonundaki Gecikmenin Fonksiyonel Sonuçlar ve Tıbbi Komplikasyonlar Üzerine Etkisi

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### Summary

**Objective:** To examine the effects of delayed admission to rehabilitation on functional outcomes and medical complications in stroke patients.

**Materials and Methods:** The inpatient discharge records of 60 stroke patients who admitted to a Physical Medicine and Rehabilitation Department for first ever unilateral stroke patients were reviewed. The patients were divided into 2 groups as early (<30 days) and delayed admission group (>30 days) based on the length of time from stroke event to admission to the rehabilitation unit. Potential differences between early and delayed admission groups were examined in terms of demographic and clinical features, rehabilitation outcomes and medical complications.

**Results:** The patients beginning rehabilitation in the first month following stroke had a better Functional Independent Measurement Scores gain than the patients beginning rehabilitation longer than one month (12.65±5.59 vs. 8.59±5.50, p=0.008). The number of complications was higher in the delayed admission group than the early admission group (3.16±1.36 vs. 1.91±1.12, p=0.001). Shoulder pain and spastic upper limb was detected more frequently in patients with delayed group (p=0.01 and p=0.01, respectively).

**Conclusion:** Delayed admission time to rehabilitation caused poorer functional outcomes, increased number of medical complications in stroke patients. *Türk J Phys Med Rehab 2007;53:45-9.*

**Key Words:** Stroke, rehabilitation, functional outcomes, complications

### Özet

**Amaç:** İnmeli hastalarda rehabilitasyona geç başlanmasının fonksiyonel sonuçlar ve tıbbi komplikasyonlar üzerine etkisini belirlemektir.

**Gereç ve Yöntem:** İlk tek taraflı inme atağını takiben rehabilitasyon kliniğine başvuran 60 hasta çalışmaya alındı. Hastaların tıbbi dosyaları incelendi. Hastalar, inme olayı ile rehabilitasyona başvuru süresi arasında geçen süreye göre, erken başvuru (<30 gün) ve geç başvuru (>30 gün) grubu olarak 2 gruba ayrıldı. İki grup arasındaki demografik ve klinik özellikler, rehabilitasyon sonuçları ve tıbbi komplikasyonlar arasındaki farklar incelendi.

**Bulgular:** Rehabilitasyonuna inmeden sonraki 1 ay içinde başlanan hastalarda, 1 aydan geç başlanan hastalara göre Fonksiyonel Bağımsızlık Ölçeğinde daha fazla artış gözlemlendi. (12,65±5,59 ve 8,59±5,50, p=0,008). Geç başvuran hastalarda görülen tıbbi komplikasyon sayısı erken başvuran hastalardan daha fazla idi (3,16±1,36 ve 1,91±1,12, p=0,001). Omuz ağrısı ve spastik üst ekstremitte, rehabilitasyonu geciken hastalarda daha fazla bulundu (p=0,01 ve p=0,01).

**Sonuç:** İnmeli hastalarda rehabilitasyonun gecikmesi fonksiyonel sonuçları olumsuz etkilemekte ve tıbbi komplikasyonların artmasına neden olmaktadır. *Türk Fiz Tıp Rehab Derg 2007;53:45-9.*

**Anahtar Kelimeler:** İnme, rehabilitasyon, fonksiyonel sonuçlar, komplikasyonlar

### Introduction

Stroke is a major cause of long-term disability worldwide. Several studies on stroke rehabilitation has been conducted to evaluate the predictors of functional recovery because the amount of the recovery is variable among the patients. Age,

gender, marital status, previous stroke, urinary continence, consciousness at onset, severity of paralysis, sitting balance, admission Functional Independence Measurement score (FIM), age and onset to admission interval (OAI) was identified as prognostic factors influencing rehabilitation programs and amount of recovery (1-6). Of these predictors, delayed OAI is a

particularly important problem for developing countries, such as Turkey, mainly due to the insufficient number of stroke rehabilitation units and limited bed availability. The potential for rehabilitation to promote neurological recovery appears to be greatest early in the post-stroke period and not to engage in a rehabilitation program at that time may cause poorer outcomes (7-10). The specific influence of delayed OAI on rehabilitation results in Turkey was not clearly demonstrated before.

Patients who have had an acute stroke are at risk of developing a wide range of complications secondary to their stroke such as falls, pressure ulcers, urinary tract infection, chest infection, depression, confusion, painful shoulder, deep venous thrombosis, pulmonary embolism and seizures (11-14). Many of the complications described are potentially preventable and treatable if recognized. Besides the negative effect on the functional outcome, delays in starting stroke rehabilitation may avoid prevention, recognition and management of avoidable medical complications which cause severe distress for patients and their families. Little is known about the effect of delayed initiation of stroke rehabilitation on medical complications (14).

The purpose of this study is to evaluate the effects of delayed admission to rehabilitation on functional outcomes and medical complications in Turkish stroke patients.

## Materials and Methods

### Patients

In this retrospective study, we reviewed the medical records of 71 patients with first-ever stroke, who were admitted to in-patient clinic of Süleyman Demirel University Medical School between December 2002 and September 2006.

Stroke was defined as an acute event of cerebrovascular origin causing focal or global neurological dysfunction lasting greater than 24 hours (15) and the diagnosis was confirmed by both clinician and radiographic means. Presence of previous cerebrovascular accident (CVA), transient ischemic attacks, subarachnoid hemorrhage, bilateral cerebral lesion, or a history of other neurological or psychiatric disease that may compromise cognitive functioning were excluded from the study. Among the 71 stroke patients, 60 patients fulfilled the criteria.

Demographic variables of the patients recorded were age, sex and marital status. Medical co-morbidities (hypertension, diabetes, heart disease), type of lesion (ischemic, hemorrhage, emboli) and site of stroke (right or left hemisphere involvement), OAI and length of hospital stay (LOHS) were noted.

Two medical doctors (SS and EI) reviewed the medical records of each patient individually for the medical complications which were present on admission and during hospital stay and made an original list together. The definitions of medical complications were made according to Davenport et al. (13). Post-stroke depression was diagnosed according to the criteria of DSM-III by a psychiatrist. Heterotopic ossification was defined with the clinical diagnosis, elevated serum alkaline phosphatase levels and imaging evidence from bone scintigraphy. Spasticity was defined as a velocity-dependent increase in muscle resistance against passive lengthening while the presence of the position of adduction and internal rotation of the shoulder, pronation of the forearm, flexed wrist and clasped fingers due to spasticity was defined as spastic upper limb (16). Deep vein thrombosis was defined with the clinical diagnosis and/or imaging evidence from Doppler ultrasound test (13).

Functional disability within the first 48 hours of admission and at discharge was assessed using FIM. The FIM has been documented to be a valid and reliable measure of disability, and a useful screening tool for Turkish patients (17). The degree of disability was categorized as (1) mild-initial FIM>100; (2) moderate-initial FIM 50 to 100; (3) severe- initial FIM <50 (11). The FIM gain indicating functional improvement after rehabilitation therapy (an amount that is calculated by subtracting the FIM admission score from FIM discharge score) was calculated for each patient (5). Discharge FIM and FIM gain was used for functional outcome measures. Motor performance was assessed at the time of admission by a physical therapist, using Brunnstrom's Stages of motor recovery (BMRS) (18).

The patients were divided into 2 groups based on the length of time from stroke to admission to the rehabilitation unit. A time to rehabilitation admission of 30 days or less from stroke event represented early admission, while a length of time from stroke event to admission longer than 30 days was considered as delayed admission. The cut-off value of 30 days was used based on the previous literature (7,10).

Potential differences between early and delayed admission groups were examined in terms of demographic and clinical features, rehabilitation outcomes and medical complications.

### Rehabilitation

The Physical Medicine and Rehabilitation Department at Süleyman Demirel University Medical School is located in Isparta, located in south-west Turkey. Stroke incidence in Isparta is 151 per 100.000 (19).

Our department has 22 beds and 5-beds are occupied by patients with stroke (23% of all beds). Our department is the only department performing stroke rehabilitation in the city. The average length of stay in Neurology department of our hospital and in state hospitals is about a month. All stroke survivors except the patients who can not participate actively in rehabilitation and can not tolerate daily treatment can admit the rehabilitation program. Because of the considerable patient load and the limited number of our stroke beds, patients are put on a waiting list according to a prioritizing scheme, discharged to home with a home program, and called according to the priority on the waiting list. List is managed by the residents of our department. Average admission time is 2.5-3 months.

### Data Analysis

Analyses were performed using the soft ware program SPSS Statistics 11.0 (SPSS International BV, Chicago, IL, USA). Results were given as mean  $\pm$  standard deviation (SD) and range. Descriptive statistics of demographic and clinical features, as well as medical complications were calculated. Comparison of the early and delayed admitted patients for demographic and clinical features, functional outcome parameters and medical complications was made with Mann Whitney-U test for nonparametric parameters and T-test test for parametric parameters. Spearman correlation was used to express the strength of the association between OAI and number of medical complications. The significance level was set at  $p<0.05$  for all tests.

## Results

The mean age of patients was  $65.73\pm 7.93$  (38-80) years. Twenty-nine patients were female and 31 patients were male. Fifty-two patients were married, 1 patient was single and 7 patients were widows. The most prevalent risk factor for stroke

was hypertension (66.7%). The most common type was ischemic stroke (81.7%). Thirty-one patients suffered left hemisphere stroke with right-side hemiplegia. Age, sex, marital status, risk factors, type of stroke and the side of stroke were not different between the early and delayed admission groups ( $p>0.5$ ). The mean OAI of all patients was  $86.48\pm65.04$  (16-270) days. Twenty-three patients (38.3%) were admitted in the rehabilitation program within 30 days (early admission group) while 37 patients (61.7%) were admitted after 30 days (delayed admission group). The mean LOHS of all stroke patients was  $26.25\pm9.25$  (12-58) days. The mean LOHS was not different between the groups ( $p=0.1$ ). Comparison of the demographic and clinical features of the groups is presented in Table 1.

The mean FIM score of the groups was  $48.86\pm18.72$  (15-95) at the admission and  $59.01\pm18.99$  (24-108) at discharge and the mean FIM gain was  $10.15\pm5.84$  (0-20). FIM on admission was significantly correlated with the FIM at discharge ( $r=0.95$ ,  $p<0.0001$ ). The patients beginning rehabilitation in the first month following stroke had better FIM gain ( $12.65\pm5.59$  vs  $8.59\pm5.50$ ,  $p=0.008$ ) and discharge FIM ( $66.21\pm21.67$  vs  $54.54\pm15.83$ ,  $p<0.01$ ) than the patients beginning rehabilitation longer than one month. There were no correlations between age, type, side of the lesion, the preexisting medical conditions and the mean FIM gain ( $p>0.5$ ). Table 2 illustrates FIM severity on admission, total FIM score on admission and discharge, FIM gain and BMRS on admission in the early and delayed admitted groups.

Table 3 shows the comparison of all medical complications seen in our early and delayed admitted stroke patients. In all patients, shoulder pain, spastic upper limb, deep vein thrombosis,

Table 1. Comparison of the demographic and clinic features of the patients (n=60).

|                     | Early admission group (n=23) | Delayed admission group (n=37) |
|---------------------|------------------------------|--------------------------------|
| Age (years)         | 64.13±6.57                   | 66.72±8.61                     |
| OAI (days)          | 25.43±5.55                   | 124.43±55.26*                  |
| LOHS (days)         | 34±9.79                      | 30.08±8.23                     |
| Sex (n)             |                              |                                |
| Female              | 11                           | 18                             |
| Male                | 12                           | 19                             |
| Marital status (n)  |                              |                                |
| Married             | 21                           | 31                             |
| Widow               | 2                            | 1                              |
| Single              | 0                            | 5                              |
| Co-morbidities (n)  |                              |                                |
| Hypertension        | 12                           | 28                             |
| Diabetes            | 5                            | 14                             |
| Heart disease       | 8                            | 11                             |
| Type of stroke (n)  |                              |                                |
| Infarct             | 17                           | 32                             |
| Hemorrhage          | 4                            | 4                              |
| Emboli              | 1                            | 1                              |
| Side of paresis (n) |                              |                                |
| Right               | 12                           | 19                             |
| Left                | 11                           | 18                             |

\* $p<0.05$ , OAI: Onset to admission interval, LOHS: Length of hospital stay.

pressure ulcer and heterotopic ossification was present at admission. The other complications developed during the hospital stay. The number of complications was correlated with OAI in all patients ( $r=0.41$ ,  $p=0.01$ ). Number of complications was higher in the delayed admission group than the early admission group ( $3.16\pm1.36$  vs.  $1.91\pm1.12$ ,  $p=0.001$ ). The number of shoulder pain and spastic upper limb was higher in the delayed admission group compared with the early admission group ( $p=0.01$  and  $p=0.01$ , respectively). The number of patients with depression, incontinence, urinary tract infection, complex regional pain syndrome-type 1, deep venous thrombosis and heterotopic ossification was higher in the delayed admission group but it was not statistically significant ( $p>0.05$ ). The presence of medical complications did not effect FIM gain in both groups ( $p>0.05$ ).

Table 2. FIM severity and rehabilitation outcomes of the groups (n=60).

|                                 | Early admission group (n=23) | Delayed admission group (n=37) |
|---------------------------------|------------------------------|--------------------------------|
| FIM severity                    |                              |                                |
| Mild                            | 3                            | 0                              |
| Moderate                        | 9                            | 16                             |
| Severe                          | 11                           | 21                             |
| FIM on admission                | 53.56±22.51                  | 45.94±15.15                    |
| FIM on discharge                | 66.21±21.67*                 | 54.54±15.83                    |
| FIM gain                        | 12.65±5.59†                  | 8.59±5.50                      |
| Upper extremity BMRS, admission | 2.69±1.71                    | 2.16±1.28                      |
| Hand BMRS, admission            | 2.30±1.66                    | 1.97±1.57                      |
| Lower extremity BMRS, admission | 3.34±1.64                    | 3.18±1.26                      |

\* $p<0.05$ , † $p<0.001$ . FIM: Functional Independence Measure. BMRS: Brunnstrom's Stages of motor recovery.

Table 3. Medical complications seen in our stroke patients (n=60).

|                                       | Early admission group (n=23) | Late admission group (n=37) |
|---------------------------------------|------------------------------|-----------------------------|
| Number of medical complications       | 1.91±1.12                    | 3.16±1.36*                  |
| Shoulder pain                         | 13                           | 32†                         |
| Depression                            | 11                           | 25                          |
| Spastic upper limb                    | 6                            | 22†                         |
| Incontinence                          | 5                            | 11                          |
| Complex regional pain syndrome-type 1 | 4                            | 5                           |
| Urinary tract infection               | 3                            | 7                           |
| Deep vein thrombosis                  | 2                            | 4                           |
| Pressure ulcer                        | 0                            | 3                           |
| Heterotopic ossification              | 0                            | 2                           |
| Falls                                 | 1                            | 2                           |

\* $p<0.001$ , † $p<0.05$ .

## Discussion

The onset of admission interval varies between 60-70 days even in the greatest rehabilitation centers of Turkey with a relatively greater bed availability (3,4,20). The significant delay between the clinical stability of stroke and admission to stroke rehabilitation units occurs in developing countries compared with developed countries mainly due to the insufficient number of stroke rehabilitation units and limited bed availability. For example OAI in Thailand is 53 days (1), 271.5 days in Brazil (21) compared with 20 days of OAI in United States (22) and Italy (23). The mean OAI of the Turkish patients was 86 days in the present study.

Stroke rehabilitation is believed to modulate the pattern of recovery, probably by interacting with the underlying healing processes (24) and the potential for rehabilitation to promote neurological recovery appears to be greatest early in the post-stroke period (7). The majority of functional recovery has been reported to occur within the first 30 days of a stroke event (25,26) and even with optimal rehabilitation procedures the recovery process in stroke is accepted to plateau by 6 months (24,27,28). Delay in starting stroke rehabilitation, the patients may catch the most valuable time for improving their functional outcomes. Our stroke patients who admitted to rehabilitation within 30 days had favorable functional gains from rehabilitation and our result supports the previous data which suggests that the potential for rehabilitation to promote neurological recovery appears to be greatest early in the post-stroke period (7-10). Salter et al. (7) examined the impact of admission time in 435 stroke patients and showed that patients admitted to stroke rehabilitation within 30 days experienced greater functional gains. In a study of Maulden et al. (8), fewer days from stroke symptom onset to rehabilitation admission is associated with better functional outcomes at discharge in 969 stroke patients. Maulden et al. hypothesized that the optimal window for increased synaptic plasticity may occur early in the post stroke period, allowing for greater gains if rehabilitation is carried out during this critical interval. Paolucci et al. (9) assessed the specific influence of OAI on rehabilitation results in stroke patients after age and disability matching to rule out the influence of recognized strong prognostic factors and suggested that, stroke patients who began to rehabilitation treatment within the first 20 days was associated with a significantly greater improvement than delayed treatment. Musicco et al. (10) examined the effect of timing of initiation of rehabilitation on early and long-term outcome of 1716 stroke patients and found that patients who initiated the rehabilitative procedures early (within 7 days after stroke) had better long term outcomes than did those who initiated the rehabilitation after more than one month.

Medical complications are believed to be an important problem after acute stroke and present potential barriers to optimal recovery (11). The prevention, recognition and management of medical complications after stroke form an integral part of stroke rehabilitation (29). When stroke rehabilitation is delayed, some avoidable but distressing medical complications may develop. The number of medical complications was correlated with the OAI in the present study. This correlation was not found in the studies of Dromerick & Reding (14) and

Roth (12). However their mean OAI was 37 days and 17 days respectively. These OAIs are very short compared with our OAI of 86 days. Our delayed admission group had more shoulder pain and spastic upper limb when compared with the early admission group and these complications were detected on hospital admission. Shoulder pain and spastic upper limb are two disabling but avoidable complications which can be properly managed when detected on time (30,31). Moreover, although not statistically significant, depression, incontinence, urinary tract infection, complex regional pain syndrome-type 1, deep venous thrombosis and heterotopic ossification were more common in the delayed admission group. Not to find a statistical difference may be due to the low number of patients in our study. The frequency of the most commonly seen medical complications was quite high in the present study. Shoulder pain occurred in a frequency of 75%, depression 60% and spastic upper limb 47% in our patients. The high medical complication rates are in line with the results of the previous studies from Turkey (3,4). Delayed admission in stroke rehabilitation among Turkish stroke patients might be a reason for increased medical complications.

The presence of medical complications was not correlated with the functional recovery in the present study. Except deep vein thrombosis, the medical complications we detected in this study were not life threatening and they did not interrupt the rehabilitation program. This may be an explanation for this result.

In conclusion, delayed onset to rehabilitation caused poor functional outcome and increased number of medical complications in Turkish stroke patients. Shoulder pain and spastic upper limb was the main medical complications in our delayed admitted stroke patients. Greater efforts to initiate rehabilitation as soon as possible should result in improved functional outcomes and reduced number of medical complications in most patients with stroke.

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