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ORIGINAL ARTICLE **ÖZGÜN ARAŞTIRMA**

EARLY REHABILITATION FOR ISCHEMIC STROKE PATIENTS: SHOULD IT BE INITIATED IMMEDIATELY?

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ABSTRACT

INTRODUCTION: Nowadays early rehabilitation studies in stroke patients have gained momentum. Although early rehabilitation is reported to be more effective, what is really meant of the term "early" is not clear. The term early can sometimes refer to minutes, sometimes to hours, while sometimes even to days. The aim of the present study was to determine whether the initiation time of rehabilitation has an effect on impairment, trunk function and degree of recovery in ischemic stroke patients.
METHODS: Twenty-one patients with acute ischemic stroke diagnosis who were admitted to the hospital were included in the study. The rehabilitation was initiated as early as possible and the elapsed time; from the stroke occurrence to initiation of rehabilitation, was noted. Glasgow Outcome Scale, National Institutes of Health Stroke Scale and Trunk Impairment Scale were used to measure the effect of treatment. Evaluations were made at baseline and at discharge.
RESULTS: All of the patients were discharged and no complication aroused in any patient. The elapsed time; from the stroke occurrence to initiation of rehabilitation was 12 hours in the earliest patient and 234 hours at the latest (median (IQR): 79.5 (58,5/107,5). When the results were examined, no statistically significant relationship was present in between the initiation time of rehabilitation on impairment, trunk function and on degree of recovery ($p > 0,05$).
DISCUSSION AND CONCLUSION: The results of this study showed that time of initiation of rehabilitation does not have a direct effect on recovery. Ischemic stroke patients included in the early rehabilitation program have shown improvements when compared to baseline. However, controlled studies are needed to determine the extent to which early rehabilitation contributes to recovery.
Keywords: Early, rehabilitation, ischemic, stroke.

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İSKEMİK İNMELİ HASTALARDA ERKEN REHABİLİTASYON: HEMEN REHABİLİTASYONA BAŞLANMALI MIDIR?

ÖZ

GİRİŞ ve AMAÇ: Günümüzde inmeli hastalarda erken rehabilitasyon çalışmaları hız kazanmıştır. Erken rehabilitasyonun daha etkili olduğu bildirilse de, gerçekten "erken" teriminin ne anlama geldiği açık değildir. Erken terimi bazen saatlerle, bazen de günlerle ifade edilmektedir. Bu çalışma, iskemik inmeli hastalarda erken rehabilitasyonun başlama zamanının bozukluk, gövde fonksiyonu ve iyileşme derecesi üzerinde bir etkisi olup olmadığını araştırmaktır.

YÖNTEM ve GEREÇLER: Akut iskemik inme tanısı alan ve hastaneye yatırılan 21 hasta çalışmaya dahil edildi. Rehabilitasyona mümkün olan en erken sürede başlandı ve inme oluşumundan rehabilitasyon başlangıcına kadar geçen süre kaydedildi. Ölçüm yöntemi olarak Glasgow Sonuç Ölçeği, Ulusal Sağlık Enstitüleri İnme Ölçeği ve Gövde Bozukluğu Ölçeği kullanıldı. Tüm ölçümler ilk seanstan önce ve taburculukta yapıldı.

BULGULAR: Tüm hastalar taburcu edildi ve hiçbir hastada rehabilitasyona bağlı komplikasyon gelişmedi. İnme oluşumundan rehabilitasyon başlangıcına kadar geçen süre en erken hastada 12 saat ve en geç hastada 234 saat olarak kaydedildi (ortanca (IQR): 79.5(58,5/107,5)). Sonuçlar incelendiğinde rehabilitasyonun başlama zamanı ile bozulma, gövde fonksiyonu ve iyileşme derecesi arasında istatistiksel olarak anlamlı bir ilişki olmadığı görüldü (p> 0,05).

TARTIŞMA ve SONUÇ Bu çalışmanın sonuçları, rehabilitasyonun başlama zamanının iyileşme üzerinde doğrudan bir etkisi olmadığını göstermiştir. Erken rehabilitasyon programı alan iskemik inme hastaların başlangıca göre daha iyi klinik bulgu verdiğini gösterilmiştir ancak erken rehabilitasyonun iyileşmeye katkısının ne ölçüde olduğunun belirlenmesi için kontrollü çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: Erken, rehabilitasyon, iskemik, inme.

INTRODUCTION

Early rehabilitation following ischemic stroke has favorable effects on musculoskeletal, cardiovascular and respiratory systems and reduces complications related to immobility (1). When effective rehabilitation programs are applied in the early phase of stroke, the rate of morbidity and mortality can be reduced, as well as duration of treatment, possible complications and treatment costs can be reduced. Many studies have stated that rehabilitation should be initiated as early as possible in patients with stroke (2-4). There is evidence that late-onset rehabilitation leads to poor prognosis, whilst early-onset rehabilitation increases the likelihood of survival, decreases complications and shortens hospitalization period (5). However, the optimal content and schedule of rehabilitation that is necessary in the early phase of stroke is still undefined.

Along with the understanding of the neural infrastructure of cerebral healing, early rehabilitation programs have become more important for stroke victims. In these studies; it is suggested that there is a critical period which the brain responds the most to motor learning programs. Studies supporting this view suggest that motor learning programs initiated on the 5th day following stroke are more effective than the programs initiated on the 14th or 30th day (6). In the systematic review of the Stroke Unit Trialists Collaboration, it was stated that patients were able to reach a better clinical status during the discharge phase with early onset rehabilitation (7). It is advocated that early, intensive and repetitive training may contribute to motor learning due to the principles of plasticity. Therefore, it is important to manage the rehabilitation process after stroke precisely.

When the concept of early rehabilitation is examined, it is observed that the initiation time varies according to the publications, researchers, or the professionals' practices. In some publications, the initiation of early rehabilitation is measured with days, while in others it is measured with hours. In stroke patients, according to Bernhardt et al., when the time period concerning early rehabilitation is examined; Physiotherapy initiated in the first 24 hours is expressed as a "very early rehabilitation", and rehabilitation initiated after 24 hours is referred to as "early rehabilitation" (8).

Early rehabilitation programs are planned according to the patients' general clinic condition. Even though it is important to initiate rehabilitation programs early and intensely, when put into practice, it is not known whether the

duration of the applied physiotherapy programs is sufficient and appropriate. When the principles of motor learning are taken into consideration, increasing the duration and quality of the treatment and initiating rehabilitation in the early phase in stroke patients are believed to be beneficial. Therefore, the aim of the present study is to investigate the time dependent effect of rehabilitation programs on impairment, postural control of trunk and degree of recovery in acute ischemic stroke patients.

METHODS

Patients who were diagnosed with acute ischemic stroke by a neurologist were included in the study. The inclusion criteria were set as: being older than 18 years of age, having a disability level of ≤4 according to the Modified Rankin Scale and being able to understand verbal commands. Participants with; a history of previous stroke, those who had; concomitant progressive neurological disturbances, acute coronary disease, severe heart failure, concomitant rheumatologic diseases, a fracture or an acute orthopedic disorder that would prevent mobilization were excluded from the study. The ethical approval was obtained from Gazi University Clinical Research Ethical Committee (Number: 196, Date: 11.04.2016) and the authors conformed to the ethical guidelines of the 1975 Declaration of Helsinki. Written consents were obtained from participants or their caregivers prior to the study.

Outcome Measures: All participants who agreed to participate in the study were evaluated before initiating the rehabilitation program. The demographic variables such as age, gender, side of stroke, the initiation time of the physiotherapy after the stroke and total length of stay in the hospital were recorded. All evaluations were performed at baseline and at discharge.

Glasgow Outcome Scale: The Glasgow Outcome Scale (GOS) is a scale used for rating functional outcome following brain injury. The scale rates patient status into one of five categories: Dead, Vegetative State, Severe Disability, Moderate Disability or Good Recovery (9).

National Institutes of Health Stroke Scale: The National Institutes of Health Stroke Scale (NIHSS) is a tool used to objectively quantify the impairment caused by stroke. The NIHSS is comprised of 11 items, rated between 0 and 4. For each item, a score of 0 indicates normal function in that specific ability, while a higher score indicates impairment. The scores from each item are summed in order to calculate a total NIHSS score. The maximum score is 42, with the minimum score being 0 (10).

The Trunk Impairment Scale examines trunk coordination and static and dynamic sitting balance. The maximum score for the static and dynamic sitting balance and coordination subscale is 7, 10 and 6 points, respectively. The total score ranges between 0 and 23 points, a higher score indicates better trunk performance (11).

Medical Interventions: Biochemical and hematologic parameters, electrocardiography (ECG) and computerized tomography (CT) were conducted for each patient. The CT was used to differentiate between ischemic and hemorrhagic stroke. Amongst patients who were diagnosed with ischemic stroke and who were admitted to the hospital within the first 6 hours; those who had a National Health Institute Stroke Scale (NIHSS) score above 4 were evaluated by the vascular neurologist for specific treatments for acute stroke. In appropriate patients, intravenous thrombolytic therapy was given and mechanical thrombectomy was performed. For secondary prevention anticoagulant or anti-aggregant treatment was initiated according to the cardio embolic athero-thrombotic risk factors. Patients who were diagnosed with stroke and whose treatment was initiated were admitted to in-patient neurology service or intensive care unit at the earliest possible time, and magnetic resonance imaging (MRI) and CT examinations were performed when necessary. To determine the vascular etiology, CT angiography or supra aortic MRI angiography was performed according to the patient's renal function. Echocardiography (ECG) and 24-hour rhythm holter monitoring were requested routinely in terms of cardio embolic stroke etiology. When necessary, advanced blood tests such as vasculitis markers and thrombophilia panels were performed. Patients were discharged after their evaluations and treatment were completed.

Rehabilitation Interventions: The criteria for the application of physiotherapy was: having a systolic blood pressure between 120 and 220 mmHg, having an oxygen saturation >92% (with or without O2 support), having a heart rate of 40 to

100 beats/min, having a body temperature of <38.5°C (8). The rehabilitation program was performed with two sessions per day; for five days a week, each session lasting 30-60 minutes. The participants were included in the rehabilitation program as early as possible and the program continued until the participants were discharged. Exercises were implemented according to the status of the participants and were used to maintain and improve muscle strength and endurance. The unaffected and affected sides were both included in rehabilitation process. The exercises given were designed to be simple, understandable, task-oriented and repetitive and were performed in supine, sitting and standing positions. Mobilization was initiated in the first session and in accordance to their conditions, the participants were mobilized in sitting or standing position. Mobilization level was gradually increased by changing the participants' position (sitting on the edge of the bed, sitting in a chair, walking) and increasing duration of exercise and walking distance. Alongside basic extremity exercises, weight transfer exercises and balance training were applied. During the exercises, the importance of the quality of the movement was emphasized, and external support was provided if necessary.

Statistical Analysis: Statistical analyses of the study were carried out with "statistical package for social sciences" (SPSS) version 21.0 (SPSS INC., Chicago, IL, USA) software. The normal distribution of the data was analyzed with visual (histogram and probability graphs) and analytical (Shapiro-Wilk test) methods. Wilcoxon Test was used to analyze the measurements performed before and after rehabilitation, and to determine the difference of measurement differences. The correlations coefficients and their significance were calculated using the Spearman correlation test. Statistical significance was set at $p < 0.05$.

RESULTS

Duration of hospitalization of the patients were between 9 to 16 days. A total of 21 acute ischemic stroke patients were enrolled in this study (Male/female:10/11, mean age: 67,8±11,4). All of the patients were discharged, all measurement scales have demonstrated improvement and no complication occurred in any patient (Table I, p> 0,05).

Table I. Rehabilitation group scores in patients with acute stroke.

	Onset Median (IQR)	**Discharge** Median (IQR)	**P**
GOS	3 (3/3)	4 (3/4)	< 0.001
NIHSS	6 (4,5)7	3 (0/4)	< 0.001
TIS	8 (3/12)	16 (14/18,5)	< 0.001

NIHSS: National Institutes of Health Stroke Scale, TIS: Trunk Impairment Scale, GOS: Glasgow Outcome Scale, p<0,05.

The patients were included in the rehabilitation program for an average of 8 days (IQR=7-10) and 15 sessions (IQR=13.5-19.5). The number rehabilitation programs performed was between 11 to 20 sessions per patient. The average length of hospitalization was 13 (IQR=11-14.5) days. The elapsed time; from the stroke occurrence to initiation of rehabilitation was 12 hours in the earliest patient and 234 hours at the latest (median (IQR): 79.5 (58,5/107,5). When the results were examined, no statistically significant relationship was present in between the initiation time of rehabilitation on impairment, trunk function, degree of recovery or on duration of rehabilitation. (Table II, Figure I, p> 0,05).

	Δ-Median (IQR)	**Time to start rehabilitation**	
		r	P
Δ-GOS	1 (0/1)	0,052	0,824
Δ-NIHSS	-3 (-4/-1,5)	-0,140	0,546
Δ-TIS	9 (5,5/19,5)	-0,179	0,407
TRS	13 (11/14,5)	-0,099	0,669

Δ-: (score at discharge-score at onset), NIHSS: National Institutes of Health Stroke Scale, TIS: Trunk Impairment Scale, GOS: Glasgow Outcome Scale, TRS: Total rehabilitation session, p<0,05.

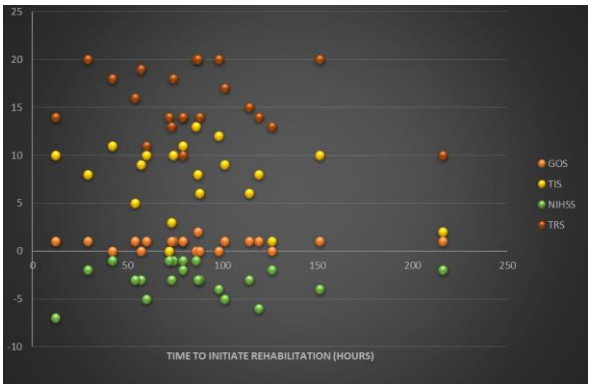

Figure I. The effect of induction time of rehabilitation on impairement, postural control of trunk, on degree of recovery and total rehabilitation session (NIHSS: National Institutes of Health Stroke Scale, TIS: Trunk Impairment Scale, GOS: Glasgow Outcome Scale, TRS: Total rehabilitation session, y-axis shows the scores of the measurement methods).

DISCUSSION AND CONCLUSION

The main aim of the present study was to investigate the time dependent effect of rehabilitation on functional recovery in the early phase of an ischemic stroke. According to our results, no significant differences were observed at discharge in terms of impairment, postural control of the trunk and degree of recovery in ischemic stroke patients.

In literature there are studies supporting this finding and also advocating the contrary. In some trials, functional recovery was better at discharge in patients who underwent early rehabilitation whereas in other studies early rehabilitation had no effect on functional recovery (12, 13). This difference in findings may be due to the baseline characteristics of the patients such as; severity of stroke, age of the patient or to the different rehabilitation methods used (14). In the aforementioned studies, the baseline characteristics of the patients are inherently all different. Therefore, findings from these studies have clearly demonstrated that statements stating "more is better" or "earlier is beneficial" can be misleading when discussing mobility protocols for patients with stroke (15).

In early rehabilitation process following stroke, patients need to be evaluated by a multifaceted perspective. In this period, the assessments performed by the physiotherapist should not only identify motor, sensory, functional and cognitive deficiencies or potentials, but must also consider the patients' medical condition. This is essential in order to determine the content of physiotherapy applications and to carry out these applications at the appropriate time. Although physiotherapy applications in the acute period following stroke are roughly standardized, it should be kept in mind that alterations may be required according to each individual's medical condition.

Many methods are used to retrieve the lost function in stroke patients. The timing of these rehabilitation methods is just as significant as their content. Rehabilitation approaches applied in the chronic period may not fully show their effects due to the decrease in healing and plasticity processes. Additionally, the effects of brain plasticity can be benefited more prominent in the early period. Patients acquire compensation process against loss of function after stroke and this is inevitable. The development of compensation process leads to disorders in gait, a decrease in quality of movement and accordingly, an increased dependence to others in daily life activities. In order to prevent these negative effects, the main objective should be to achieve correct and high-quality movement via early intervention before these compensations are developed. In our study it can be perceived that early rehabilitation has positive effects on impairment, postural control of the trunk and degree of recovery in ischemic stroke patients.

Previous studies have reported that early rehabilitation applications following stroke improved activities of daily living at discharge (16, 17). According the results of our study, early rehabilitation has led to improvements in the functional state of patients and this finding is in line with literature.

According to our results, negative outcomes such as; death, premature interruption of rehabilitation program, absence of any improvement at hospital discharge were not encountered. This reveals that early rehabilitation is safe to use in the early phase of ischemic stroke. When literature is analyzed, the results are in accordance with ours. The results of observational studies and meta-analyses imply that for most of the patients with acute stroke, early mobilization is not harmful (18). Early rehabilitation seems to be unrelated to death or morbidity and beneficial since it reduces the risks of adverse effects arising due to immobilization.

The present study had some limitations. The lack of a control group made it difficult for comparative analysis in order to determine whether delayed therapy also produced the same outcomes. Also, the small number of patients included and the heterogeneity of ischemic stroke types were the other limitations.

As a conclusion, the results of this study showed that time of initiation of rehabilitation does not have a direct effect on recovery. Ischemic stroke patients included in the early rehabilitation program have shown improvements when compared to baseline. However, controlled studies with more patient participation are needed to determine the extent to which early rehabilitation contributes to recovery.

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Ethics

Ethics Committee Approval: The study was approved by the Gazi University Clinical Research Ethical Committee (Number: 196, Date: 11.04.2016).

Informed Consent: Written consent was obtained from all participants or their caregivers.

Copyright Transfer Form: Copyright Transfer Form was signed by all authors.

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