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(RESEARCH ARTICLE)

The effect of pre-rehabilitation and rehabilitation period on functional status in hospitalized stroke patients

Aylin Ayyıldız [1,*], Kutay Can Çamlıca [2], Selda Çiftci [2] and Banu Kuran [2]

[1] *Department of Physical Medicine and Rehabilitation, Ministry of Health, Avcılar Murat Kölük State Hospital, Istanbul, Turkey.*
[2] *Department of Physical Medicine and Rehabilitation, University of Health Sciences, Şişli Hamidiye Etfal Training and Research Hospital, Istanbul, Turkey.*

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Abstract

Objective: In this study, we aimed to investigate the effect of pre-rehabilitation and rehabilitation hospitalization periods on the functional status of the patient.

Methods: In this retrospective study, stroke patients hospitalized in our rehabilitation clinic were screened. Patients' age, gender, type of stroke, affected hemisphere, spasticity, functional ambulation category (FAC), mini-mental status, length of pre-rehabilitation and rehabilitation period, Brunsstrom staging, and Barthel index were investigated.

Results: One hundred eight patients were included in the study. The mean age was 64.9±14.8. The mean length of pre-rehabilitation was 16.2±12.8 and rehabilitation was 20.7±9.1 days. A significant negative correlation was observed between the length of the rehabilitation period and all Brunnstrom sub-assessments after rehabilitation. A significant positive correlation was observed between the length of the rehabilitation period and the change in Brunnstrom stage for upper and lower extremity values, the stroke effect scale after rehabilitation, and the change in stroke impact scale value. A significant negative correlation was observed between pre-rehabilitation time and the Barthel index before and after rehabilitation.

Conclusion: The prolongation of the pre-rehabilitation period is not a negative factor for functional gain in rehabilitation. The rehabilitation period of the patient should be decided by considering the functional status of the patient.

Keywords: Length of Stay; Physical Functional Performance; Rehabilitation; Stroke; Stroke Rehabilitation

1. Introduction

Stroke, which has high morbidity and mortality rates, is also an important cause of disability. In 2017, the incidence of stroke in Europe was 1.12 million and the prevalence was 9.53 million; it is thought that there will be a 3% increase in incidence and a 27% increase in prevalence within 30 years [1]. After a cerebrovascular event, 2 out of 3 survivors are enrolled in a rehabilitation program [2]. Worldwide, 1 in 3 stroke survivors continues their lives with disabilities. This causes a great burden on the family and society [3]. The financial burden increases especially with the increase in the duration of hospitalization. However, the patient's participation in the community in the future is also of great importance in reducing this burden.

Rehabilitation has an important place in preventing immobility, functional dependence, loss of autonomy, and returning the patient to daily life activities as a result of medical morbidities. [4]. Recently, it is recommended to start stroke

* Corresponding author: Aylin Ayyıldız

rehabilitation at the earliest period [5]. However, depending on the hemodynamic status of the patient and the health systems of the countries related to the lack of stroke units, this period may increase. Although there are no organized stroke units in our country too, patients may have problems accessing rehabilitation in the early post-stroke period.

While some of the patients who need rehabilitation after stroke receive inpatient treatment, others complete their rehabilitation program with outpatient rehabilitation centers. Indications for inpatient treatment are not clearly specified in the literature. Although ambulatory patients generally are referred to outpatient rehabilitation centers, inpatient rehabilitation may be applied because of cardiovascular diseases, other musculoskeletal problems, and sometimes for social reasons [6]. Likewise, there is no recommendation with a high level of evidence regarding the length of hospitalization.

There are many studies in the literature on the duration of rehabilitation, the time between stroke and rehabilitation, and the frequency and intensity of rehabilitation. However, there is currently no protocol approved. [7]. In this study, we aimed to investigate the effect of pre-rehabilitation and rehabilitation hospitalization periods on the functional status of the patient.

2. Material and method

In this study, stroke patients hospitalized in our physical medicine and rehabilitation (PM&R) clinic between September 2017 and September 2022 were retrospectively screened. This study was organized by the criteria of the STROBE guideline. The trial is registered with Clinicaltrials.gov, number NCT05655039.

Patients' age, gender, type of stroke (hemorrhagic or ischemic), involved hemisphere, history of intensive care, presence of spasticity, functional ambulation category (FAC), and mini-mental state exam (MMSE) results were investigated. The length of stay of the patients in the pre-rehabilitation services and in our rehabilitation service was determined through the hospital information system. Brunnstrom staging for upper extremity, lower extremity and hand, Barthel index, and Stroke Impact Scale (SIS), which were evaluated at admission to the rehabilitation service and at discharge, were recorded.

Inclusion criteria were 40-90 years of age, having had an ischemic or hemorrhagic stroke, and having hemodynamic stability capable of participating in the rehabilitation process. Patients with serious comorbidity that would prevent rehabilitation, the presence of malignancy, aphasic patients, patients with serious perception problems or psychiatric disease, and patients with a history of stroke were excluded. During their hospitalization, stroke patients were given exercises in accordance with the conventional stroke rehabilitation program for 1 hour a day, 5 days a week. Electrotherapy was also applied to patients with indications.

In the descriptive statistics of the data, mean, standard deviation, median minimum, maximum, frequency, and ratio values were used. The distribution of variables was measured with the Kolmogorov-Smirnov test. Wilcoxon test was used in the analysis of dependent quantitative data. Spearman correlation analysis was used in the correlation analysis. SPSS 28.0 program was used in the analysis.

3. Results

A total of 172 patients were screened for our study; A total of 108 patient data were evaluated by inclusion and exclusion criteria. The demographic characteristics of the patients are shown in Table 1.

Post-Rehabilitation Brunnstrom all sub-assessments, Barthel index, and Stroke impact scale showed a significant increase compared to pre-rehabilitation ($p<0.05$). There was no significant correlation between the length of the pre-rehabilitation and rehabilitation period, the changes in functional status, and "age, gender, type of stroke, affected cerebral hemisphere, spasticity, stay in intensive care unit" ($p>0.05$).

A significant ($p< 0.05$) negative correlation was observed between the length of the rehabilitation period and all Brunnstrom sub-assessments after rehabilitation. A significant ($p < 0.05$) positive correlation was observed between the length of the rehabilitation period and the change in Brunnstrom stage for upper and lower extremity values, the stroke effect scale after rehabilitation, and the change in stroke impact scale value. No significant ($p >0.05$) correlation was observed between the length of stay in rehabilitation and the change in Brunnstrom stage for hand, the Barthel index value before and after rehabilitation, and the Barthel index change value.

Table 1 The Demographic Characteristics of the Patients

		Min-Max	**Median**	**Mean±SD/n-%**
Age		23.0 - 88.0	67.5	64.9 ± 14.8
Sex	Female			57 52.8%
	Male			51 47.2%
Length of Pre-Rehabilitation Period (days)		0.0 - 70.0	12.0	16.2 ± 12.8
Length of Rehabilitation Period (days)		4.0 - 58.0	18.5	20.7 ± 9.1
Functional Ambulation Category		0.0 - 5.0	3.0	2.3 ± 1.4
Mini-mental State Exam		2.0 - 30.0	19.0	19.3 ± 6.3
Type of Stroke	Hemorrhagic			43 39.8%
	Ischemic			65 60.2%
Affected Cerebral Hemisphere	Dominant			46 42.6%
	Non-Dominant			62 57.4%
Stay in Intensive Care Unit	-			70 64.8%
	+			38 35.2%
Spasticity	-			73 67.6%
	+			35 32.4%
Brunnstrom for Upper Extremity				
Pre-Rehabilitation		1.0 - 6.0	3.0	3.2 ± 2.0
Post-Rehabilitation		1.0 - 6.0	4.0	3.7 ± 1.9
Brunnstrom for Hand				
Pre-Rehabilitation		1.0 - 6.0	3.0	3.1 ± 2.0
Post-Rehabilitation		1.0 - 6.0	4.0	3.5 ± 2.0
Brunnstrom for Lower Extremity				
Pre-Rehabilitation		1.0 - 6.0	4.0	3.6 ± 1.7
Post-Rehabilitation		1.0 - 6.0	4.0	4.2 ± 1.6
Barthel Index				
Pre-Rehabilitation		15.2- 97.6	60.0	59.3 ± 20.8
Post-Rehabilitation		20.0 -100.0	64.0	63.8 ± 19.5
Stroke Impact Scale				
Pre-Rehabilitation		10.0- 80.0	36.5	41.8 ± 18.5
Post-Rehabilitation		24.0-97.0	55.0	57.2 ± 17.6

Min: Minimum, Max: Maximum, SD: Standard deviation

A significant ($p < 0.05$) negative correlation was observed between the change in the FAC and the SIS. No significant ($p>0.05$) correlation was observed between the FAC and the change in all Brunnstrom sub-assessments.

No significant ($p >0.05$) correlation was observed between the MMSE score and the change in all sub-assessments of Brunnstrom, and the change in the SIS.

There was no significant (p >0.05) correlation between the length of the pre-rehabilitation period and Brunnstrom all sub-assessments and change, SIS all values and change, Barthel index change. A significant (p < 0.05) negative correlation was observed between pre-rehabilitation time and the Barthel index before and after rehabilitation (Table 2).

Table 2 Correlation of "Pre-rehabilitation and Rehabilitation Periods, Functional and Mental Status" and Functional Development of Patients

		Length of Rehabilitation Period		**Functional Ambulation Category**		**Mini-mental State Exam**		**Length of Pre-Rehabilitation Period**	
		r	**p**	**r**	**p**	**r**	**p**	**r**	**p**
Brunnstrom for Upper Extremity	Pre-Rehabilitation	-0.215	**0.026**	0.626	**0.000**	0.389	**0.000**	-0.105	0.279
	Post-Rehabilitation	-0.143	0.141	0.592	**0.000**	0.377	**0.000**	-0.078	0.424
	Pre-Post Change	0.210	**0.029**	-0.094	0.331	-0.082	0.401	0.097	0.320
Brunnstrom for Hand	Pre-Rehabilitation	-0.193	**0.045**	0.580	**0.000**	0.364	**0.000**	-0.088	0.364
	Post-Rehabilitation	-0.196	**0.042**	0.613	**0.000**	0.362	**0.000**	-0.091	0.351
	Pre-Post Change	-0.007	0.940	0.089	0.357	-0.006	0.954	0.000	0.998
Brunnstrom for Lower Extremity	Pre-Rehabilitation	-0.299	**0.002**	0.627	**0.000**	0.547	**0.000**	-0.176	0.069
	Post-Rehabilitation	-0.276	**0.004**	0.690	**0.000**	0.520	**0.000**	-0.179	0.064
	Pre-Post Change	0.207	**0.032**	-0.016	0.872	-0.155	0.109	-0.003	0.972
Barthel Index	Pre-Rehabilitation	-0.042	0.663	0.675	**0.000**	0.562	**0.000**	-0.267	**0.005**
	Post-Rehabilitation	-0.028	0.777	0.685	**0.000**	0.561	**0.000**	-0.252	**0.008**
	Pre-Post Change	0.132	0.173	-0.166	0.085	-0.149	0.124	0.122	0.207
Stroke Impact Scale	Pre-Rehabilitation	-0.003	0.975	0.484	**0.000**	0.314	**0.001**	0.152	0.116
	Post-Rehabilitation	0.266	**0.005**	0.342	**0.000**	0.262	**0.006**	0.152	0.116
	Pre-Post Change	0.592	**0.000**	-0.259	**0.007**	-0.171	0.076	-0.046	0.636

4. Discussion

In the literature, it has been shown that the long hospital stay of stroke patients is an important parameter that increases the financial burden of rehabilitation. Therefore, recent studies suggest shortening the length of stay [8-11]. The length of stay in rehabilitation units after stroke varies between countries: 16.5 days in the USA, 23-49 days in Canada, 28 days in Australia, 30 days in New Zealand [9,12-14]. In studies conducted in our country, the average length of stay in

rehabilitation units varies between 28-59 days [15,16]. In our study, the average length of stay in the rehabilitation unit was 20.9±9.1 days In the study of Reistetter et al., it was emphasized that the length of stay should be determined according to the functional status of the patient, regardless of regional changes [17].

In their study, Bindawas et al. divided the patients into 4 groups according to the rehabilitation period and evaluated the functional development of the patients. They showed that patients in short and intermediate-term hospitalizations did not functionally result poorly in other groups [9]. In our study, the length of stay of the patients was consistent with these recommended groups. However, in our study, mostly positive correlation was found between rehabilitation period and functional development. In the study conducted by McClure et al. evaluating the length of rehabilitation hospitalization in patients with mild functional deficit, it was shown that short-term hospitalization was sufficient to provide functional improvement [10]. The fact that relatively well-functioning patients were included in this study may have caused this. We think that the required length of hospital stay is longer because we included patients who were functionally worse off in our study. We can explain this with the inverse correlation between FAC and SIS.

In the literature, it is emphasized that stroke patients should be taken to early rehabilitation, but this is not always possible in practice [18-20]. After the first 24 hours are completed and if the patient's hemodynamic stability has been achieved, it is recommended to be included in the rehabilitation program [19]. This situation becomes more difficult especially in countries that do not have stroke units, such as in our country. In our study, the duration of the patients before starting the rehabilitation program was 16 days. The reasons for this were the failure to achieve hemodynamic stability and some social reasons. Again, it is thought that the effect of rehabilitation may decrease in patients with delayed hemodynamic stability. However, in our study, we observed that there was no correlation between the time elapsed before rehabilitation and the functional gain that the patient would receive during the rehabilitation period. We observed that factors such as age, gender and stroke type, which we think have an effect on hemodynamic stability, do not have an effect on the functional response to rehabilitation. In the study of Saxena et al., it was shown that these factors do not have an effect on functional gain and this is consistent with the literature [21-24].

Deterioration in cognitive status impairs patients' participation and compliance in rehabilitation, especially in stroke patients. In our study, no correlation was shown between mental status assessment and functional gain. We attribute this situation to the fact that the mental status of the patients was not bad at the beginning and therefore to the ground effect.

Limitations of this retrospective study; First of all, the number of patients is a relatively small group. In addition, there are no groups to compare the length of rehabilitation periods.

5. Conclusion

As a result, although it is recommended in the literature to include patients in the rehabilitation program early, this is not always possible. However, even when the patient is taken to rehabilitation when hemodynamic stability is achieved, there is no loss in response to rehabilitation and functional gain. Also, the rehabilitation period of the patient should be decided by considering the functional status of the patient.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that they have no financial of non-financial competing interest and conflict of interest.

Statement of ethical approval

The present research work does not contain any studies performed on animals/humans subjects by any of the authors.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

Authorship Contributions

Concept – BK; Design – KÇ; Supervision – BK; Materials – AA, HA; Data collection &/or processing – AA, SÇ; Analysis and/or interpretation – KÇ; Literature search – AA; Writing – AA; Critical review – AA, BK, KÇ

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