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Functional Recovery of Patients After Stroke

[1]Amela Čičkušić, [2]Osman Sinanović, [1]Maida Zonić-Imamović, [1]Suada Kapidžić-Duraković

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Introduction. Rehabilitation of patients after the stroke is very demanding and complex process, because in addition to damage of motor functions, the patients suffer from the range of other dysfunctions and complications. Timely and early initiation of rehabilitation treatment can reduce the degree of disability; it can result in increased mobility, independent functioning and shorter period of hospitalization.

Aim. of this study was to determine the outcome of early rehabilitation treatment of patients suffering from ischemic and hemorrhagic stroke, in relation to their age, sex, degree of disability, and activities of daily living.

Subjects and methods. This was a prospective study, which included 50 patients suffering from ischemic stroke and 50 patients suffering from hemorrhagic stroke. All patients were tested on admission and discharge from the hospital. Age and sex of the patients was analyzed, in addition to Rankin scale, used for evaluation of functional disability, and Barthel index used for evaluation of activities of daily living.

Results. The outcome of early rehabilitation treatment was negatively influenced by the older age of patients,(Spearman's rank correlation coefficient Rankin -0.178; Barthel -0.209; p=0.03). Males showed significantly better functional recovery from females (Rankin-males 3.22; females 3.61; p=0.03. Barthel males 1.93 ; females 1.71; p= 0.2). The values of Rankin scale and Barthel index showed significant recovery in all patients on discharge Rankin scale (Wilcoxon test Z= 8.1 ; p<0.001) ; Barthel index (Wilcoxon test Z = 6.65; p<0.001). These values were statistically more significant in patients with hemorrhagic stroke Rankin scale (Mann-Whitney test Z= 2.19; p=0.03); Barthel index (Mann- Whitney test Z= 2.04; p=0.04), with 95% statistical significance (p< 0.05).

Conclusion. Older age of patients negatively affects the outcome of early rehabilitation treatment. Male stroke patients showed better results of early rehabilitation treatment. The degree of disability is significantly reduced, while the degree of activity of daily living is significantly improved with the early rehabilitation treatment. However, this was more prominent in patients suffering from hemorrhagic stroke.

Keywords. *stroke, early rehabilitation, functional recovery*

Institutions
[1]Clinic for Physical Medicine and Rehabilitation
[2]Clinic for Neurology

University Clinical Center Tuzla
Tuzla, Bosnia and Herzegovina

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Corresponding author
Amela Čičkušić
Clinic for Physical Medicine and Rehabilitation
University Clinical Center Tuzla
Trnovac bb, 75000 Tuzla
Bosnia and Herzegovina

Phone: +387 61 895-510
Email: c-amela@hotmail.com

Competing interests
The authors declare no competing interests.

INTRODUCTION

In developed countries acute stroke is a third cause of death and first cause of disability. Stroke is a very common disease with the high mortality rate (30% in first month, especially in a case of hemorrhagic stroke). Stroke is also a neurological disorder with high disability rate. Only half of all stroke survivors are able to be independent and capable of resuming usual working and other activities, while over 30% of them are not capable of survival on their own [1].According to the World Health Organization, stroke is defined as a rapid development of focal or global symptoms and signs of cerebral dysfunction that last longer than 24 hours or lead to death; also, they are the result of pathological processes of vascular origin [2]. According to Roth and Harvey (1996), there are five main tasks in stroke rehabilitation, and those are: prevention, recognition and management of intercurrent diseases and intercurrent medical complications; training for maximum functional independence; facilitating the adaptation and psychosocial coping with the disease for the patients and families; promoting reintegration into the community, including return to home, family, recreational activities, and speech activities; and improving the quality of life [3].

If the rehabilitation process is initiated during the first 72 hours after the stroke, it will result in increased activity, independent functioning and shorter hospitalization [4]. This early rehabilitation process begins in intensive care unit after first or second day of acute treatment is carried out, imme-

Table 1. The impact of patient's gender on the outcome of early rehabilitation treatment
*Rankin=Rankin disability scale; Barthel = Barthel Index of activities of daily living; p-value = statistical significance; *p< 0.05*

	The average difference between score values at discharge and admission			
	Rankin		Barthel	
	m	f	m	f
	3.22	3.61	1.93	1.71
p-value	0,03*		0,2	

diately after the acute diagnostics and acute medical intervention is administered. The goals of these methods are following: prevention of formation of ulcers, respiratory and urinary infections, thrombophlebitis, assessing swallowing, bladder control and early mobilization of patients, during the first 24 to 48 hours since the onset of the disease [5, 6]. Several previous studies pointed out the importance of early application of rehabilitation treatments and therapeutic procedures in the stroke unit, which results in reduced mortality, shorter hospitalization and better functional recovery of patients after stroke [7, 8, 9].

The aim of this study was to determine the outcome of early rehabilitation treatment of patients suffering from ischemic and hemorrhagic stroke in relation to age, sex, level of disability, and activities of daily living.

SUBJECTS AND METHODS

This was a prospective study conduced at the Neurology Department of University Clinical Center Tuzla in the period from 01.04.2008 to 01.03.2009. The study included 50 consecutive patients with ischemic stroke and 50 consecutive patients with hemorrhagic stroke. The study included patients with ischemic or hemorrhagic stroke located on the hemispheres and with the present neuromotor deficit. Patients who suffered from stroke in lower regions of the brain as well as patients with brain hemorrhage were not included in the study. In addition, this study did not include patients who have been in a coma for more than 72 hours as well as cardiopulmonary unstable patients. Aside from the medical history and clinical examination, the diagnosis of stroke was confirmed by computerized tomography. Immediately after stabilization of vital functions patients were involved in rehabilitation treatment, along with close monitoring of blood pressure, pulse and respiration. Patients were tested on admission and discharge from the clinic of neurology. For evaluation of a degree of disability Rankin scale was used[10], where score of 0 represented full recovery, while score of 5 represented severe disability. Score 0 - No symptoms, 1 - No significant disability, able to carry out all usual activities, despite some symptoms. 2 - Slight disability, able to look after own affairs without assistance, but unable to carry out all previous activities. 3 - Moderate disability, requires some help, but able to walk unassisted. 4 - Moderately severe disability, unable to attend to own bodily needs without assistance, and unable to walk unassisted. 5 - Severe disability, requires constant nursing care and attention, bedridden, incontinent.

Modified Barthel index was used for evaluation of the degree of activity of daily living[11]. The test quantifies the ability of patient to participate in 10 activities of daily living, which were chosen and weighted in order to evaluate the importance and possible need for the necessary outside assistance. The maximum score of 100 represented complete independence of the patient (even if the neurological deficit is present), while the minimum score of 0 represented complete inability of the patient to participate in activities of daily living without the outside assistance. The patients were rated as very dependent (0-20), severely dependent (21-60), moderately dependent (61-90), hardly dependent (91-99), or completely independent in activities of daily living (100).

Table 1. Correlation of the age of patients and the outcomes of early rehabilitation treatment
*Rankin=Rankin disability scale; Barthel = Barthel Index of activities of daily living; p-value = statistical significance; *p< 0.05; Values are Spearman's rank correlation coefficient*

		The average difference between score values at discharge and admission	
		Rankin	Barthel
Age	Spearman's rank correlation coefficient	-0,178	-0,209
	p-value	0,076	0,037*

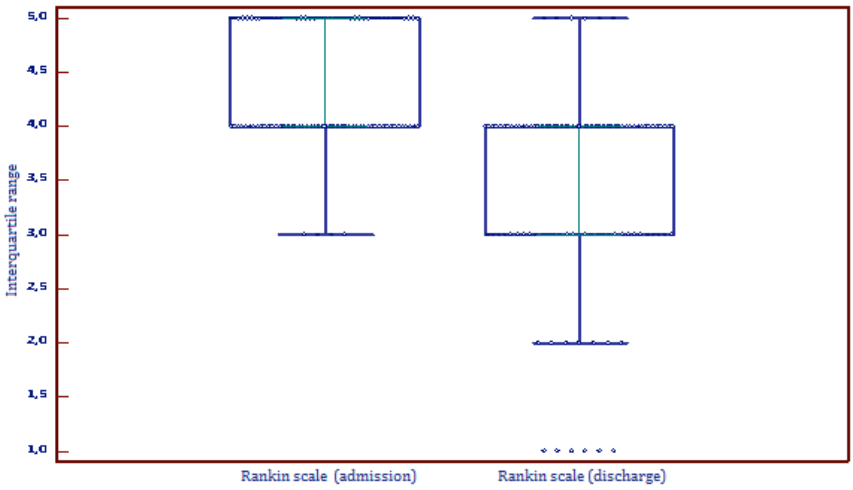

Figure 1. Values of Rankin scale at admission and discharge for all subjects
Wilcoxon test Z=8.1; p<0.001

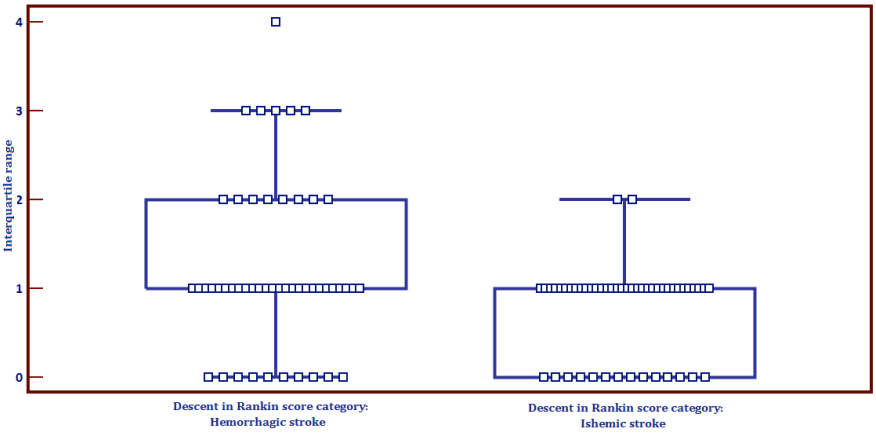

Figure 2. Reducing Rankin scale at discharge in patients with ischemic and hemorrhagic stroke
Mann-Whitney test Z= 2.19; p=0.03

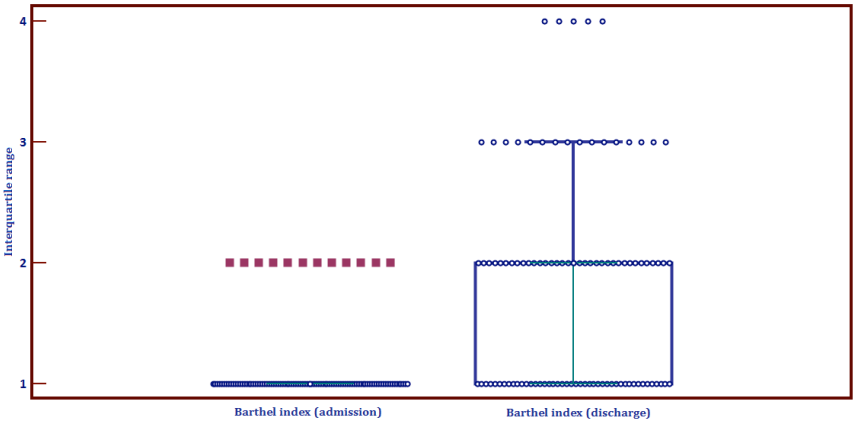

Figure 3. Barthel index at admission and discharge for all subjects
Wilcoxon test Z = 6.65 p<0.001

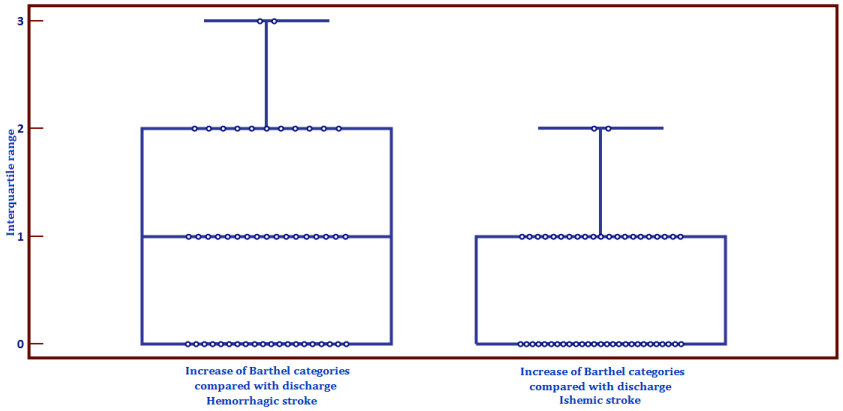

Figure 4. Increase of Barthel index at discharge in patients with ischemic and hemorrhagic stroke
Mann- Whitney test Z= 2.04; p= 0.04

RESULTS

The results of this study showed that entire sample of 100 subjects consisted of 52 (52%) females and 48 (48%) males.

The average age of all subjects was 69.5 SD ± 8.4 years. In the group of patients with the ischemic stroke average age was 69.9 SD ± 7.3 years, while in the group of patients with hemorrhagic stroke the average age was 69.1 SD± 9.4 years. There was no significant difference between two subject groups regarding age (p=0.92).

The results of this study showed that the difference of interquartile range of Rankin scale at admission (4-5) and discharge (3-4) for all subjects was statistically significant (p<0.001) (Figure 1).

The difference in interquartile range of Rankin scale, at admission and discharge, of patients with hemorrhagic stroke (1-2 category) as compared to the patients with ischemic stroke (0-1 categories), was statistically significant (p=0.03). Due to these results it can be concluded that patients suffering from hemorrhagic stroke had better functional recovery at discharge (Figure 2).

The values of Barthel index were compared at admission and discharge. The median value of Barthel index at admission was 1 (interquartile range: 1 to 1), while at discharge was 2 (interquartile range: 1 to 2), which was statistically significant (p<0.001) (Figure 3).

There was a statistically significant difference between patients with hemorrhagic stroke as compared to patients with ischemic stroke (p=0.04). These results showed better functional recovery and reduction in the degree of dependence in activities of daily living of patients suffering from hemorrhagic stroke (Figure 4).

DISCUSSION

Analysis of the impact of patient's gender on early rehabilitation treatment showed that males expressed significantly lower degree of disability. Stroke is much more common among men population than in woman population worldwide, but woman have severe neurologic deficite and higher mortality rate in first month of disease (12).The Sperman's rank correlation coefficient analysis of patient's age and the outcome of early rehabilitation treatment showed to be significant and negative, but less pronounced correlation between the improvement of Barthel score on one side and the age of the patient on the other side. This means that after the early rehabilitation treatment elderly patients would need more assistance in activities of daily living from the younger ones. Older age is the most significant risk factor for stroke. As the life span increases risk for this diseases increases proportionally. According to a recent study, each additional year increases the risk of stroke by 9% in males and 10% in females[13].

The results of this study showed that the difference of interquartile range of Rankin scale, at admission and discharge was statistically significant (p<0.001), which was more prominent in patients with hemorrhagic stroke (p=0.03). Providing the quantitative prognosis after the stroke is equally significant for the clinicians and patients, as well as for the scientists interested in predicting the results of clinical trials. Despite the lack of uniformity in existing studies, it was scientifically proven that Barthel index and modified Ranking score represent significant prognostic tools in predicting the outcome of rehabilitation. In addition, varying external factors, which are not linked to treatment, have to be taken into account. However, these external factors also determine the long-term rehabilitation outcome (eg social support)[14].

The results of this study showed that the difference of interquartile range of Barthel index, at admission and discharge, was statistically significant (p<0.001), which was more prominent in patients suffering from hemorrhagic stroke (p=0.04). At discharge, the total of 54 patients had higher median values of Barthel score, for one category, which was prognostically very significant. In the study of Granger, Dawis and Peters[15], prognostic values of Barthel scale was tested using intermediate values, where the sum of 20 or higher (in first days) or the sum of 40 or higher (at the time of starting the rehabilitation) was pointing out to the possibility of returning home two months after the stroke. Among patients who returned home, more than ¾ of them had the sum greater than 60, which corresponded to a basic independence in activities of daily living, such as sphincter control, washing, eating, and walking without any great assistance (assisted independence). Majority of patients with the sum of 85 was able to dress themselves and to independently transfer from the bed to the wheelchair, however, only 1/3 of them was capable of walking without assistance ("quasi-independence"). On the other side, the sum of 100 corresponded to full independence. In the study of Kwon et al.(2004), quantification of disability in patients after stroke and their ability to participate in activities of daily living, using Barthel index, the motor components for measuring functional independence (M-FIM), and the degree of disability, using modified Ranking scale, were analyzed. The values of all three tests were highly correlated, indicating the importance of applying these tests in practice [16].

CONCLUSION

Early rehabilitation treatment of patients with ishemic and hemorrhagic stroke forms a basis for further rehabilitation, and long-term forecast of patients recovery depends on that same basis. Because we live in enviroment and time in which hospital resources are very limited, and rehabilitation programs are not priority in society, we need to define and recognize factors that may help treatment of stroke patients. Our research confirms the importance of applying early rehabilitation treatments and functionality tests in everyday practice, because they are important in evaluation of achieved results. Male stroke patients have better outcome of early rehabilitation treatment. Older age has negative effect on the outcome of early rehabilitation treatment. The degree of disability significantly decreases, while the degree of activity of daily living significantly improves with early rehabilitation treatment. This was more prominent in patients suffering from

hemorrhagic stroke.

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