

# Rehabilitation of the Patient's Paralyzed Limbs and Effectiveness of Mobile Application "Stroke Help"

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**Abstract** Stroke rehabilitation - the main goal of recovery is to restore the patient's lost or damaged functions due to a stroke, to help him to social and psychological readaptation, and to prevent another stroke. The recovery process takes years: the patient has to relearn almost everything. For the first time, we have created the mobile application "STROKE HELP" in Uzbek language in order to provide methodical support to patients' relatives in these procedures. In patients who used the mobile application, we observed a better recovery of muscle strength and degree of paralysis in dynamics, and a decrease in the level of spasticity. "STROKE HELP" mobile application is a methodical guide for patient's relatives and helps to prevent arthrosis and contractures, one of the bad complications of stroke.

**Keywords** Stroke, Stroke help, Mobile application, Post-stroke rehabilitation

## 1. Introduction

Strokes are the most common diseases of the nervous system, acute disorders of cerebral blood circulation, lasting more than 24 hours or ending with death, focal neurological and general syndromes [1] The brain tragedy starts suddenly, the patient has weakness of arms and legs (hemiparesis) [3], loss of speech (aphasia) [2], facial distortion. The increase in mortality and disability after ischemic strokes [4] requires the relevance of this direction, its comprehensive development and optimization of various approaches to restorative treatment.

Stroke rehabilitation - the main goal of recovery is to restore the patient's lost or damaged functions due to a stroke [5], to help him to social and psychological readaptation [6], and to prevent another stroke. The recovery process takes years: the patient has to relearn almost everything. Because we pity and love our patient [7], when he becomes sick, we want to help our dear person in all his difficulties: even if he drinks water on his own, we help him to drink, even if he reaches down to take something, we give it to him. we try to help even if he is self-sufficient, we are even ready to perform gymnastics and exercises for him. But don't we make our patient prematurely disabled by this? The patient gradually becomes submissive, relaxed, the unused functions begin to fade, he stops doing his favorite work. Everyone loses from this: the patient, who feels weak, and the person helping, who is tired of waiting for the result. Untimely medical measures lead to irreversible anatomical and functional changes in the patient's body.

According to the recommendations of the EUSI (European Stroke Initiative, 2004), post-stroke rehabilitation measures should be started as early as possible. The goal of early hospitalization of stroke patients is not only rapid diagnosis and drug treatment [8], but also determines the need to start movement recovery early, because the peak of movement recovery is 3 months after the stroke and continues for another 3 months.

What neurologic problems occur in the average stroke patient? [9]

1. Paralysis - paralysis of an arm or leg - movement disorders [10];
2. Balance disorders;
3. Pain and sensory disturbances;
4. Difficulty swallowing - dysphagia;
5. Disorders of the urinary organs - urinary incontinence or constipation;
6. Bed sores;
7. Speech disorders – aphasia [11];
8. Cognitive disorders - difficulty understanding, dementia;
9. Seizures;
10. Sleep disorders;
11. Psychological disorders - anxiety and severe depression;
12. Social problems - need for self-support, family conflicts, impairment of working capacity.

If the lesion of the brain due to a stroke is large, sepsis-internal poisoning, cardiovascular dysfunction - arrhythmias and myocardial infarction can also be observed in patients with additional, related diseases [12].

Therefore, the sooner the diagnosis of stroke is made and the earlier treatment is started, the duration of stroke

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complications will be shortened and the severity of the neurological symptoms after the disabling stroke will decrease in the patient.

## 2. Materials and Methods

**The purpose of scientific research.** Evaluating the effectiveness of the mobile application "STROKE HELP" in the rehabilitation of movement disorders during acute and convalescent brain strokes.

### Research materials and methods of investigation

During 2022-2023, in the Department of Neurology and Intensive Neurology of the Tashkent Medical Academy, we examined patients with movement disorders who had acute circulatory disorders in the area of the left middle artery of the brain. The presence of comorbid diseases in all patients: heart disease, diabetes, ischemic heart disease was taken into account. Patients underwent clinical neurological, laboratory tests, neurovisualization methods (cranial CT scan, MRT). We divided 60 stroke patients in the department into 2 groups. Group 1 included 30 patients treated in the intensive neurology department during the acute period of stroke. The prototype of the "Stroke Help" mobile application was downloaded to the Android phones of the relatives of 1 group of patients, and the operation of the application was explained. Group 2 patients were 30 patients who were treated without such guidelines during the acute period of stroke. We used the NIHSS (National Institute of Health Stroke Scale) scale to dynamically assess the severity of neurological symptoms during the acute period of stroke, and the Rivermid scale, which sheds light on the dynamics of the patient's movements during the stroke recovery period. The neurological condition of the patients was examined 3 times: 1) 3 days during the acute period of the stroke; 2) between 7-21 days in the acute period; 3) early recovery period after the patient is discharged home.

## 3. Results and Discussions

In the rehabilitation of stroke complications, the greatest emphasis is placed on the patient's family and relatives, because it is the patient's relatives who are considered the main motivators and advocates of the patient's recovery. Relatives of group 1 patients were given a prototype of the "Stroke Help" mobile application, which explains how to care for a stroke patient in the acute phase of the disease, the causes of neurological disorders (hemiparesis, aphasia) observed in the patient, complications that can be observed in bed patients, and how to prevent complications caused by stroke. the principles of prevention were explained.

### The main goal of acute stroke rehabilitation:

1. Early patient activation;
2. Prevention of pathological conditions caused by stroke (spastic contractures and arthropathies, thrombophlebitis

and bedsores and pneumonias);

3. Restoring voluntary movements of the patient.

Factors to initiate patient activation included:

1. Cessation of destructive disorders of the brain (brain tumor, dislocation of the brain stem and structures);
2. Improvement of the patient's hemodynamic indicators;
3. Improvement of the patient's well-being.

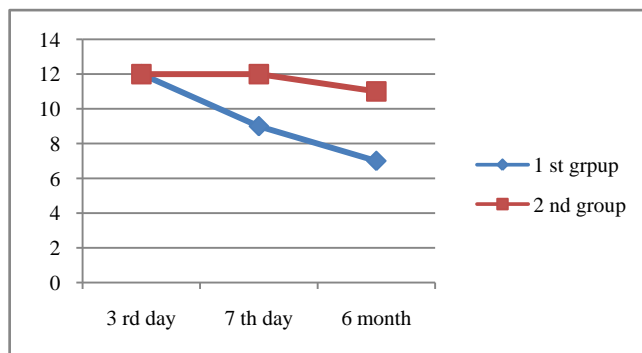
In the obtained results, men made up 45-75%, women made up 15-25%. By age,  $64.8 \pm 1.1$  was considered the average age.

**Table 1.** Average age of study patients

	Young		
	General.	W	M
Group I (n=30)	$64.6 \pm 1.8$		
Group II (n=30)	$65.6 \pm 2.3$		
General	$64.8 \pm 1.1$	$67.0 \pm 2.4$	$64.0 \pm 1.3$

**Table 2.** Dynamics of NIHSS scale indicators of patients in the study NIHSS scale indicators

Groups	Day 3	Day 7	After 1 month
Group 1	12 points	9 points	7 points
Group 2	12 points	12 points	11 points



**Diagram 1.** Dynamics of NIHSS scale indicators of patients included in the study

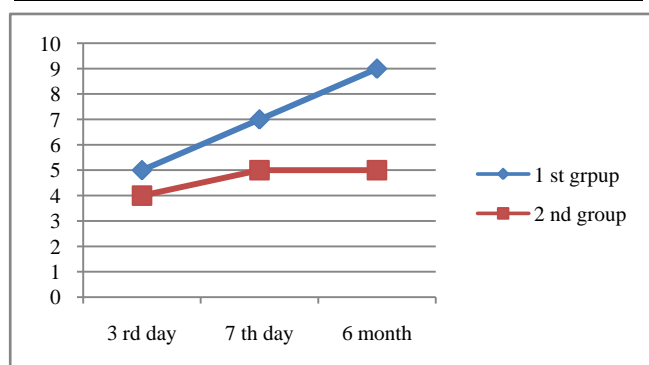
As can be seen from the diagram and scale above, both group 1 and 2 patients had moderate neurological impairment at the beginning of the study in the acute period of stroke from 12 points. This means that although there were almost no mood disorders (sopor, coma, somnolence), central paralysis of the facial nerve, central hemiparesis in the hands and feet, hemiataxia, sensory disorders - hemihypaesthesias, speech disorders - aphasias were observed. In dynamics, speech disorder-aphasia to dysarthria, facial asymmetry and ataxia decreased in group 1 patients. On the 7th day, this rating decreased to 9 points, and at the end of the month, it decreased to 7 points. Because the patient's relatives knew about the disease through the application, the patient tried to prevent hand and foot contractures and measures to prevent shoulder arthrosis. This means that the patient was able to get up earlier, self-care began more quickly, and the level of need for others decreased.

The paralyzed arm and leg of patients of the 2nd group remained in motion for a long time. Although the neurologic deficit stabilized somewhat due to neuroplastic processes, it was unchanged on the 7th day of the stroke, and by 1 month, the patient's neurologic status had not changed significantly.

When assessing stroke recovery using the Rivermead scale, we observed the following changes:

**Table 3.** Rivermead scale scores in early stroke recovery

Groups	1 month	3 months	6 months
Group 1	5 points	7 points	9 points
Group 2	4 points	5 points	5 points



**Diagram 2.** The Rivermead scale

As can be seen from the Rivermead scale in the diagram above, group 1 patients had an increasing trend in self-care skills in dynamics: 1-month-5 points, 3-month-7 points and 9 points in 6 months. The peak of movement recovery in stroke patients occurred 3 months after the stroke and continued for another 3 months. In patients of the 2nd group, almost no changes were observed in the observation indicators. 50% of patients of the 2nd group had shoulder arthrosis and arthropathies of various degrees, increased muscle tone, and early contractures.

Neurological changes observed in both groups proved the importance of neurorehabilitation, prevention of arthrosis and contractures in patients of group 1.

Our study showed that patients in group 1 who used the mobile application "Stroke Help" recovered better in 3.7 and 1 month from neurological disorders.

Rehabilitation of movement disorders during acute and convalescent brain strokes should be started during the rehabilitation period. "HELP FOR STROKE" mobile application is a methodical guide for patient's relatives and helps to prevent arthrosis and contractures from bad complications of stroke.

## 4. Conclusions

As a conclusion of the scientific work, we created a prototype of the first national mobile application in the Uzbek language, "Stroke Help", which helps to work with stroke patients for the first time in our republic, and recommended it for neurological practice. The use of the

mobile application "Stroke Help" has been shown to be effective in improving the degree of paralysis (dynamic recovery, spasticity reduction, muscle strength in dynamics, and speech improvement in patients). This application is an effective methodological guide for relatives of stroke patients. It accelerated the functions of the areas of the brain responsible for movement and speech, which were saved, but temporarily paralyzed, and helped the intensive passage of neurodynamic processes.

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