Functional Spatially-Oriented Rehabilitation Of Elderly Patients After Cerebral Stroke.

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ABSTRACT

A comparative analysis of the effectiveness of training sessions in the complex of functional spatially-oriented rehabilitation (FSR) for personified readaptation of the patient to the implementation of social and everyday life skills and motor function restoration in comparison with traditional methods of physical therapy and occupational therapy among 40 patients, 84.5±1.2 years old, with a moderate degree of motor disorders that have suffered from AVCC in the pool of the right middle cerebral artery was made. The patients were divided into 2 groups: the main group (n=20) received comprehensive training sessions in the FSR device, the control group patients (n=20) received a standard rehabilitation program (therapeutic gymnastics classes with a physical therapy instructor, ergotherapy procedures). The duration of the course is 21 days. As a result of the study, the following data were obtained in patients of the main group in comparison with the control group: Rivermid mobility index was 10.2±0.6 points and 6.3±0.7 points (p=0.0006), respectively, and the Bartel index was 14.7±0.5 points and 10.3±0.7 points (p=0.0001), respectively, data on the Rankin scale (disability) 2.1±0.2 points and 3.05±0.1 points (p=0.001), respectively. The results indicate the effective use of the FSR method in the framework of complex social and household rehabilitation of elderly patients after AVCC.
Keywords: rehabilitation, stroke, old age, occupational therapy, virtual reality, spatially-oriented rehabilitation

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INTRODUCTION

According to experts of the National Association for Stroke Control, the incidence of stroke in Russia in the last decade has increased from 1.5 to 5.1 cases per 1 thousand people and is 450-500 thousand patients per year [1]. The social consequences of acute violation of cerebral circulation (AVCC) are extremely severe, as the resulting neurological deficit leads to loss of self-service skills and ability to work. The medical and social significance of cerebrovascular diseases is explained by the fact that 30 out of 100 cases are people who have sharply lost their usual level of independence in everyday life due to the brain disaster [7]. Stroke imposes special obligations on all family members of the patient and puts a heavy socio-economic burden on society. At the same time, according to the experts of the World Health Organization (WHO), the task of achieving household independence in at least 70% of patients after suffering from AVCC is real. The fundamental in solving this problem is well-established rehabilitation assistance at all stages [1].

Post-stroke defects – central paralyses and paresises, speech disorders and other cortical functions, sensitivity disorders, extrapyramidal and cerebellar disorders, arthropathy, contractures – do not only invalidate patients, but also have a strong psychotraumatic effect, as they violate life plans, complicate relations with others and the implementation of household multi-aspect skills [7]. The percentage of disability because of AVCC is particularly high in patients of the older age group, this is determined, as a rule, with cognitive impairment, with the predominant forms of dementia from 13 to 63% [9, 12, 15] and delirium from 20 to 27 % [14,17], as well as a decrease in motivation for post-stroke rehabilitation. In the elderly this symptom complex may be exacerbated by the phenomena of anosognosia (the patient's absence of critical assessment of defect or disease) [7, 10].

Taking into account all the above, the group of elderly patients certainly requires a personalized approach and the search for new forms of social rehabilitation, allowing patients to readapt to the existing post-stroke defect, thereby improving the quality of life (QL) [5]. And it is in this group of patients that the task of not so much recovery as compensation and adaptation of the elderly patient to the developed symptom complex for the fastest and most effective return of the patient to his usual environment and circle of his social and household duties becomes paramount.

MATERIALS AND METHODS

40 patients (28 men and 12 women), 84.5±1.2 years old, who underwent AVCC of ischemic type in the pool of the right middle cerebral artery, with a prescription of 2.2±1.4 months were examined. The inclusion criteria were: AVCC in the pool of the right middle cerebral artery, left-sided hemiparesis with the degree of severity in the left upper limb from 0 to 4 points, in the left lower limb from 2 to 4 points on the MRS scale (the degree of severity of peripheral paresis). Muscle tone in the left limbs was from 0 to 3 points on the Ashfort muscle spasticity scale. Exclusion criteria: age less than 80 and more than 90 years old, left-sided hemiparesis in the left lower limb 0-1 point on MRS scale, more than 4 points on the Ashfort muscle spasticity scale, presence of gross speech and cognitive disorders. The duration of the rehabilitation course was 21 days. The patients were divided into two groups: the 1st (main) group (n=20), in which patients received a course of spatially-oriented ergotherapy in the complex with functional spatially-oriented rehabilitation (FSR) and the 2nd (control) group (n=20), included patients, whose rehabilitation treatment was carried out according to the standard scheme (therapeutic exercises and ergotherapy procedures). Classes in both groups were held daily.

The FSR technique provides for maximum immersion of the patient in a simulated (virtual) environment, imitating common household and role-playing situations, where the actions of patients are difficult because of the formed complex of motor and neuropsychological disorders – for example, going to the store. The training system of the FSR complex is located in the physical therapy hall, which is equipped with specially designed equipment, ideologically closed in the reproduction and implementation of a certain multi-faceted target skill, in particular the patient's trip from home to the grocery store, taking into account the use of public transport. Specially developed software through the reproduction of computer graphics recreates on the walls of the hall the target stages of ideologically completed role-playing functioning of the patient.

The class consists in passing a "circular" training session with a special system of ceiling suspensions for dynamic unloading of the patient's body weight, which allows ensuring the safety of the patient and isolating the patient in the hall (the instructor is in the control room) for self-realization and training tasks

without assistance (Fig. 1B). During the training session, the patient performs a set of sequential actions specified by the current simulation program of daily activity. In the classroom, along with a virtual projection of the situation and objects, as well as high-tech simulators models and real everyday items are used (Fig. 1A), the results of the patient's work are recorded by the electronic system, with the formation of the training report. The primary and dynamic diagnostic procedures in the complex of FSR allows evaluating the implementation of the complex task of implementing the skill in the time and functional aspects, which in the future is a highly effective criterion for the quality of training and the success of rehabilitation.

A

B

Fig. 1. Training session of the patient after underwent AVCC in the system of functional spatially-oriented rehabilitation. A – items that the patient must consistently take off the shelf, displayed in a virtual projection on the wall, when the patient takes the right thing, it disappears from the image; B – the upper plan provides an overview of the training room from the control room, where the instructor is located; in the lower plan there is a virtual reconstruction of the store, which is also projected in the room where the patient is.

The effectiveness of the therapy was evaluated in both groups of patients before, in the middle (the 11th course procedure) and at the end of the course. The evaluation was conducted on evaluation scales. Neurological status: stroke scale of the National Institute of Health (NIHSS) – contains 15 points that characterize the main functions, most often impaired due to cerebral stroke. Functions are evaluated in points. Level of daily activity: Bartel index covers 10 points related to the sphere of self-service and mobility. The assessment is made by the sum of points determined in the patient for each section of the test. The total score varies from 0 to 100. From 0 to 20 – complete dependence of the patient, from 21 to 60 – expressed dependence, from 61 to 90 and 91 to 99 – moderate and easy dependence.

The main goal is to establish the degree of independence from any physical or verbal assistance. Degree of mobility: the Rivermid mobility index – in the test the ability to perform certain movements is reflected, but not specific daily actions. The test contains sections "General functions", "Leg and body", "Hand". The test result is estimated by points in the range from 0 to 38. The 6-minute walk test was used to assess exercise tolerance and objectification of functional status of patients. To assess the degree of impairment of life: Rankin scale is estimated in points from 0 to 5 (0 – no symptoms, 5 - gross impairment of life). Emotional status assessment: Beck depression scale includes 21 categories of symptoms and complaints selected by the authors from among the most significant for the clinical picture of depression.

RESULTS AND CONSIDERATION

As a result of the study, the following results were obtained: in the main group, compared with the initial data, there was a decrease in the severity of the outcome of ischemic stroke (NIHSS): there was an improvement in the motor stereotype in the functioning of both the upper and lower limbs on the side of the lesion. As a result of training sessions in the complex of FSR, patients demonstrated the expansion of the motor regime, a significant reduction in dependence on external assistance, increased mobility and daily activity, according to the Rankin (impairment of vital activity) scale, a decrease in vital activity from initially moderate to mild level was determined. In the main group, compared with the control group, there was a significant positive dynamics of recovery of mobility disorders (Rivermid mobility index): overcoming stairs, walking without auxiliary means, the transition from sitting to standing position, positive changes in the functioning of the upper limb. At the same time, the Rivermid and Bartel mobility index were significantly higher in the patients of the main group of comparison (the patients of the main group became more independent from any outside help in performing tasks), and the data on the Rankin scale were lower than in the control group (table 1).

Table 1: Dynamics of neurological status, mobility, daily activity in the FSR group and control group (before the course and at the end of the course)

Criteria	FSR group (n=20)		Control group (n=20)	
	initially (M±m)	In the end of the course (M±m)	initially (M±m)	In the end of the course (M±m)
Neurological status (NIHSS) (point)	8.5±0.5	5.2±0.4*	* 10.3±0.6	6.3±0.5*
Bartel index (point)	9.1±0.6	14.7±0.5*,+++	4.6±1.03	10.3±0.7*
Rivermid mobility index (point)	4.4±0.5	10.2±0.6*, ++	3.0±0.4	6.3±0.7*
Beck depression scale (BDI) (point)	15.5±3.4	9,5±5,52**	15.3±3.3	10.3±6.03**
Rankin scale (point)	2.4±0.1	2.1±0.2*,+	3.2±0.1	3.05±0.1*
6-minute walk test, speed (min/steps)	0.36 ± 0.03	0.27±0.03++++	0.35 ± 0.03	0.14±0.03++++

*- differences between the indicator and the initial are reliable, p=0,001; ** - differences from the original are reliable, p<0,05; + - differences in the indicator in the FSR and control groups are reliable, p=0,001; ++ - differences in the indicator in the FSR and control groups are reliable, p=0,0006; +++ - differences in the indicator in the FSR and control groups are reliable, p=0,0001,++++ - differences in the indicator in the FSR and control groups are reliable p = 0,006.

CONSIDERATION

The importance and effectiveness of the inclusion of targeted functional training in elderly patients is an urgent and important task at the "junction" of the two specialties – modern gerontology and medical rehabilitation, so in 31% of cases, elderly patients who have suffered a stroke, need outside care, 20% of them can not move independently, including due to fear of falling and fear of failure of basic household tasks [8]. The leading factor of disability in a significant number of patients is motor disorders – both in acute and chronic stages of the disease. In the acute stage, they are detected in 70-90% of patients, a year later the residual defect persists in at least half of patients [4]. The problem of quality recovery of patients is becoming more urgent every day, as it is assumed that the incidence of AVCC will increase due to the increase in the population of older people and high survival after a stroke. Many patients who underwent AVCC need rehabilitation, which should include both aspects of the restoration of lost or defective motor acts, and first of all, aspects of compensatory remodeling skills that in the group of elderly patients becomes a more important task in comparison with the desire to restore physiological motor patterns. Limiting the daily activity of the patient, which determines the level of his independence in everyday life, implies the emergence of the patient after discharge from the specialized medical institution of individual problems in the form of post-stroke depression and loss of contact with society, a sharp limitation of the role of the patient in the family and society. This emphasizes the importance of finding and developing new forms of rehabilitation to restore the activity of everyday life in patients with stroke [16], adapted to the reconstruction of basic household and social skills of an elderly person.

Currently, such methods as occupational therapy, classes with a physical therapy instructor, high-tech specialized methods of robotic and biofeedback-associated rehabilitation of patients are used to solve this problem. All the efforts of specialists in medical rehabilitation in relation to the restorative treatment of patients after suffering a stroke, aimed primarily at identifying and fragmentation of motor, speech, or neuropsychological deficits, namely insulated restoring walking stereotype, individual manipulative skills of the paretic upper limb disorders in speech and conceptual spheres. Among the most important shortcomings of modern neurorehabilitation, which make it difficult to achieve the most complete recovery of the patient with his further reintegration into his usual social and living environment, is an isolated recovery of those lost or defective motor and cognitive dysfunction in specialized centers, in a barrier-free environment. After the end of the rehabilitation program and return home, the patient is not able to use the full potential of the restored skills in everyday life, becoming dependent on others, losing skills newly acquired as a result of therapy. Thus, the patient's stay in an adapted environment for people with limited mobility (conditions of specialized rehabilitation environment) determines the further disintegration of the patient outside the walls of specialized medical institutions. To date, there are studies on the positive impact of personalized and prolonged, including non-stationary, approach to the rehabilitation of patients [2, 3].

Virtual reality and interactive video games have some advantages over traditional therapeutic approaches, as they can provide patients with the ability to imitate everyday skills that are difficult to implement in an adapted environment of medical institutions [11]. In addition to these effects, the available literature review includes studies that consider virtual technologies as a method of non-drug correction of post-stroke affective disorders. Virtual reality can be used in programs of restorative and adaptive nature for people of different ages, levels of mental and physical development, the degree of motivation for recovery, the effectiveness of virtual reality gaming systems in the rehabilitation of children with progressive muscular dystrophy has already been proven [6]. According to a recent systematic review, virtual reality methods are defined as the best modern method for restoring the motor function of the upper limb [13]. In turn, the synthesis of methods of motor therapy, occupational therapy, virtual, biofeedback-associated, high-tech forms of rehabilitation, combined with cognitive training in the ideologically closed reproduction of a specific role-playing problem is a new form of comprehensive rehabilitation of patients, demonstrated effectiveness in relation to the resocialization of elderly patients with post-stroke disorders.

In connection with all the above, the actualization of the clinical need for the implementation in the current comprehensive rehabilitation programs for elderly patients of specialized training systems, which will allow carrying out the formation and training of both regenerative and adaptive functions, in combination with personalized ergotherapeutic orientation of training sessions and the simultaneous conduct of motor and cognitive recovery, under the condition of isolated safe immersion of the patient in virtual and biofeedback-

associated modern technologies that reproduce the real environment of his daily functioning for the implementation of specific household or social tasks.

CONCLUSION

The results show that the method of FSR, as a method of personalized complex ergotherapy, contributes to a more effective compensation of social and household skills to improve the quality of life and independence in everyday life in elderly patients. The individualized approach helped in the diagnostic aspect of identifying the difficulties of the patient's performance of various daily and social tasks. The adaptation of the patient's existing motor potential to complex actions and situations for him both subjectively and objectively revealed a positive effect of the course. Patients became more independent in motor and cognitive functioning. The vast majority of the study group noted a decrease in fear of falling when overcoming obstacles in the form of stairs and forced changes in walking speed, the ability to perform some actions (for example, putting on a jacket, a rational arrangement of things for the convenience of their use, use of public transport, orientation in real and virtual space).

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