

MOTOR FUNCTION RECOVERY OF PEOPLE OF MATURE YEARS AFTER STROKE BY MEANS OF PHYSICAL REHABILITATION

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Annotation. The results of applying the complex technology of physical rehabilitation are described for patients with cerebral ischemic stroke during the phase of in-patient rehabilitation. The experiment involved 36 male patients aged 45-50 years. The rehabilitation program included treatment by changing position, complex of therapeutic gymnastics (based on sanogenetic approach to the problem of motor function recovery in accordance with the stages of postnatal ontogenesis), magnetic therapy, thermotherapy of large joints of the affected extremities. Findings show that the use of the mentioned methods of treatment leads to increase of the range of motion in the hip and shoulder joints: passive of 15-20%, and active of 10-30%, muscle strength of 10-30%, improvement of motor activity indices (scale of Bobaht) and quality of life (scale of Barthel).

Key words: physical, rehabilitation, stroke, motor, function.

Introduction

The problem of cerebral apoplexy is extremely urgent in connection with its prevalence, high indicators of mortality and incapacitating effects. Apoplexy is the third by frequency reason of death in most of developed European countries, in USA and in Ukraine [8, 11]. One third of people, who sustained apoplexy, are the person of capable to work age; only every fifth from them returns to labor. Complete professional rehabilitation occurs only with 8% of cases [3].

After apoplexy, nearly 85% of diseased manifest motion abnormalities [10]. Motion abnormalities in acute period are peculiar to $\frac{3}{4}$ of the diseased. One month after apoplexy only 55% of patients can freely move; after 2 months – nearly 80%. In half a year steady motion defect is observed at 53% of patients, who sustained apoplexy [1, 4].

Rehabilitation of diseased with abnormalities of cerebral blood circulation is the problem, which attracts attention of many specialists, who deal with such category of diseased, at different stages of rehabilitating treatment. Difficult tasks of psychic and physical activation, social and labor adapting of hard contingent of after-apoplexy diseased is solved the most successfully within the system of complex rehabilitation [2, 6, 12]. It stipulates application of different means, oriented on restoration of motion function (medical therapy, massage, therapeutic exercises, physiotherapy, orthopedics).

Therapeutic physical culture (TPC) and, in particular, therapeutic exercises (TE) are the most important kinds of rehabilitating treatment, the foundation of different therapeutic complexes [5, 7, 9]. However, as on to day, with all variety of rehabilitating methods for diseased with cerebral apoplexy, there is no integral system of differentiated application of TPC means and methods, which would consider not only specificity of cerebral apoplexy's development, but also specific features of motion function normal development in the process of ontogenesis, the stage character of spontaneous functions' restoration after cerebral apoplexy, possibilities of rational combination of kinesio therapy with the treatment of a certain diseased.

Thus, it seems to be purposeful to create and test new differentiated rehabilitation programs for persons with cerebral apoplexy on the base of modern knowledge about polymorphic clinic structure of the disease, patho-physiological mechanisms of its formation and spontaneous compensation, about specificity of formation and regulation of motion skills, that can facilitate more efficient restoration of the upset functions.

The work has been fulfilled as per plan of scientific & research works of Zaporozhye national university.

Purpose, tasks of the work, material and methods

The purpose of the research – is to check the efficiency of technology of complex methods' application for physical rehabilitation of patients after cerebral apoplexy on the stage of recreational treatment.

The tasks of the research:

1. To ground main principles of complex, differentiated physical rehabilitation of patients with cerebral apoplexy.
2. To carry out comparative study of motion function restoration mechanisms of patients with cerebral apoplexy in the process of rehabilitation.
3. To estimate efficiency of the offered program of complex physical rehabilitation of patients with cerebral apoplexy on the stage of recreational treatment.

Organization of the research. The research covered 36 patients (male) of 45-50 years old, who sustained cerebral hemispheric ischemic apoplexy in the area of inner carotid artery. Two groups were formed: main group (MG) – 18 patients, who fulfilled the offered program of physical rehabilitation and control group (CG) – 18 patients, who were rehabilitated as per common method [6].

For both groups complex of recreational measures included treatment by positioning, physical exercises (complex TE), magnetic therapy, warming up of big joints of the affected limbs. In MG the complex of differentiated

TE was used, which was based on sano-genetic approach to the problem of motion function restoration of cerebral apoplexy patients, according to the stages of postnatal ontogenesis. In CG the complex of differentiated TE, based on analytical- patho-genetic approach to the problem of motion function's restoration was used. All patients were divided into clinic sub-groups: "hemiplegia" (1), "plegia of superior limb and paresis of lower limb" (2), "hemiparesis" (3).

All patients were analyzed for: self feeling, frequency and character of pain sensations, tolerance of the recreating treatment procedures. Determination of the scope of movements in joints was carried out by standard method with the help of combined angle meter. For evaluating of the extent of muscular strength decay, manual muscular test by Lavett's scale was used. The state of muscular tonus was estimated as per modified spasticity scale of Ashfort; research of motion activity dynamics was fulfilled by Barthel's scale. Statistic processing of experimental results was conducted on 5% level of significance.

Results of the research

The results of the research show that the offered TE complex permits to obtain positive dynamics of patients' neurological semiotics (see fig.1). In MG up to the end of rehabilitation period there was no patient with hemiplegia, the quantity of persons with plegia of superior limb and paresis of lower limb shortened two times, because all mentioned patients came to subgroup with hemiparesis. In CG such changes were much less expressive.

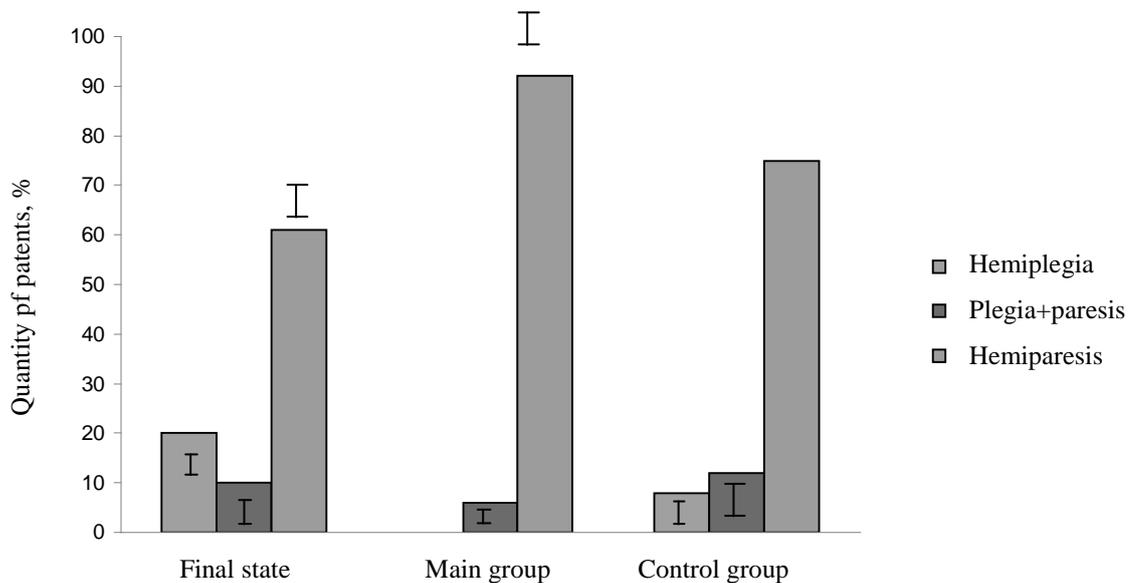


Fig.1 Dynamics of patients' quantity in the process of recreational treatment

Analysis of deep sensitivity state of cerebral apoplexy patients after rehabilitation witnesses about authentic improvement of both groups patients' state, but in MG the indicator's dynamics is three times higher.

With studying of surface sensitiveness state an increase of patients with increased sensitiveness was registered. In MG this process is expressed more distinctly ($p < 0,05$), 18,3% of subgroup 3 patients showed normalized sensitivity. With analyzing of final state of these patients it was fixed, that they had the least expressed changes of sensitiveness at the beginning of experiment, but at CG such phenomenon was not observed.

Coordination abnormalities at the end of rehabilitation period were manifested by hypermetria, instability in Romberg's posture by 88.3% of MG patients. Their expressiveness was different, but it took place on both sides of body. The best dynamics of coordination indicators were subgroups 1, 3 of MG. At CG no authentic dynamics of coordination functions were observed.

The study of free motor function of apoplexy patients at the end of research witnessed about the presence of abnormalities of static and dynamic motion functions of arm and leg, coordinated action of arms and legs, head, torso, but all they are different by expressiveness in both groups.

The research of passive movements' scope showed positive dynamics of indicator (see table 1): expressed increase and equalization of movements' scope both on healthy and affected sides. The highest by amplitude changes are observed in subgroup 1, but the most coordinated positive dynamics of the indicator on both sides of body was registered in subgroup 3. The least dynamics of passive movements' scope in both groups was observed in subgroup 2. The amplitude of indicator's positive changes in MG is much higher. With studying of passive movements' scope dynamics it was noticed that the highest indicator's change was in hip and shoulder joints: in MG – in subgroup 3, in CG – in subgroup 1. In knee and elbow joints the changes are analogous but less by value ($p < 0,05$).

Table 1

*Dynamics of passive movements' scope of patients with cerebral ischemic apoplexy
(% from proper value (M±m))*

Subgroup of the researched	Final state		Main group after rehabilitation		Control group after rehabilitation	
	Affected side	Healthy side	Affected side	Healthy side	Affected side	Healthy side
Hemiplegia	68,1±5,5	66,8±6,8	85,6±3,2***	86,4±4,0***	80,5±6,7*	82,9±7,4***
Paresis+ plegia	70,8±6,2	75,9±7,0	86,6±4,3***	89,6±4,4***	80,5±7,0***	85,5±7,3**
Hemiparesis	71,6±6,1	74,5±5,4	90,2±4,4***	90,4±4,6***	82,5±6,6***	84,7±7,4***

Note. Here and below: *** $p < 0,01$, ** $p < 0,05$, * not confident.

The process of active movements' scope changes is ambiguous (see table 2). In MG on both sides of body active movements' scope changes to the largest extent in subgroup 1; in subgroup 2 changes of indicator differ from final values, but they are nearly equal between each other; in subgroup 3 this indicator's dynamics are nearly 2 times higher than on healthy side. The trend of active movements' scope at CG is equal on both sides of body, but it is different by amplitude. The highest dynamics was observed on healthy side in subgroup 1.

Table 2

*Dynamics of active movements' scope of patients with cerebral ischemic apoplexy
(% from proper value (M±m))*

Subgroup of the researched	Final state		Main group after rehabilitation		Control group after rehabilitation	
	Affected side	Healthy side	Affected side	Healthy side	Affected side	Healthy side
Hemiplegia	0	52,2±2,3	19,4±1,1***	82,3±2,4***	5,4±0,9***	79,8±6,4***
Paresis+ plegia	17,7±0,9	67,4±3,6	34,3±3,0***	85,1±4,3*	23,4±3,5*	79,7±6,6*
Hemiparesis	38,39±2,7	66,6±3,2	49,3±2,8***	87,2±4,3***	45,3±5,5***	81,3±6,9***

Concerning the researched parameter, the best results were achieved at MG, in subgroup 1, in shoulder and hip joints; in subgroup 2 – in shoulder, hip and knee joints; in subgroup 3 – in shoulder, hip, knee and, especially, in elbow joints. In CG positive changes occurred, mainly, on healthy side, in hip joint (in all subgroups) and, to much less extent, in elbow joint (in subgroup 3). This, in our opinion, is connected with different tasks of physical exercises' complexes and with concentration of patients' attention on lower limbs.

When analyzing muscular strength changes, it was registered that the biggest changes were achieved in muscles of affected side (for all MG subgroups) (see table 3). The highest amplitude of indicators' change was observed in subgroup 1. It should be noted that the more motion abnormality is, the stronger rehabilitation influence of physical exercises expresses. The offered method manifests more expressed effect owing to the fact that in the process of TE fulfillment, limbs sequentially take supporting function and with it isometric component of muscular work increases that raises muscular strength. With different final tonus equalization of muscular strength occurs on both sides of body at MG. In CG to highest extent muscular strength changed on affected side in subgroup 1. However, the amplitude of parameter change on affected side in subgroups 1, 3 was much less than in MG and probably less than in subgroup 2. Preservation of the least values of muscular strength with high tonus attracts attention.

Table 3

*Dynamics of muscular strength of patients with cerebral ischemic apoplexy
(% from proper value (M±m))*

Subgroup of the researched	Final state		Main group after rehabilitation		Control group after rehabilitation	
	Affected side	Healthy side	Affected side	Healthy side	Affected side	Healthy side
Hemiplegia	13,9±2,7	73,4±6,2	43,4±3,3***	78,3±6,8**	30,8±4,0***	77,7±6,8*
Paresis+ plegia	40,2±3,8	79,2±5,4	61,2±4,0***	84,5±7,3**	56,2±4,8***	80,7±7,0*
Hemiparesis	58,1±4,4	84,6±5,8	72,3±5,9***	89,7±7,7***	64,3±5,8***	85,1±7,6***

Analysis of muscular tonus state as per Ashfort's scale (table 4) shows that at final state the patients are characterized by increasing of this indicator. Up to the end of stationary rehabilitation period, the change of muscular tonus's state of the affected side can be characterized in the following way: the trend to normalization of muscular tonus with increasing of muscular strength indicators is manifested by the patients with final mean or normal values both of tonus and muscular strength. Also it is manifested by the patients with high final tonus and weak muscular strength. The patients with final low tonus and muscular strength showed gradual growth of muscular strength, of tonus, but tonus increment was less by value than of the patients with final high tonus. In MG the trend to tonus reduction and muscular strength increment was more expressed.

Table 4

*Dynamics of muscular tonus of patients with cerebral ischemic apoplexy
(% from proper value (M±m))*

Indicator	Final state		Main group after rehabilitation		Control group after rehabilitation	
	Affected side	Healthy side	Affected side	Healthy side	Affected side	Healthy side
Hemiplegia	6,1±0,2	32,4±3,6	32,4±5,2***	35,2±4,5*	34,5±4,0***	40,7±6,2**
Paresis+plegia	18,6±1,3	36,0±5,5	38,5±7,1***	43,5±6,8**	44,7±6,3***	46,3±7,3***
Hemiparesis	44,0±6,1	38,1±8,1	46,3±7,4**	42,2±6,3**	52,3±7,1***	50,3±6,9***

Muscular tonus of healthy side is characterized by the same trends that of the affected – reduction of tonus and increment of muscular strength. In subgroup 1 the trend to increment of muscular tonus against the background of muscular strength increasing is more expressed than in other subgroups.

It should be noted that MG patients, especially in subgroup 3, showed reduction of spasticity's plastic component, complete disappearance of "pinion" symptom, reduction of patients' quantity with expressed motion tremor, practically full disappearance of limb tremor in rest. In CG static tremor indicators practically did not change, while dynamic tremor manifested periodically as increasing and reducing.

Comparative analysis of strength and tonus of muscles shows that in MG increase of muscular strength with less significant increase of muscular tonus is more expressed; on affected side insignificant increase of strength is accompanied by reduction of muscular tonus. In CG, at affected side the following trend is observed: increase of tonus more than strength, while on opposite side – on the contrary – strength prevails over tonus that is less favorable for coordination function.

Analysis of patients' motion activity by Bobaht's scale at the end of rehabilitation period shows that in MG activity in different final positions and stable verticality are increased. In CG activity in different positions occurs mainly owing to healthy side and much slower. In upright position and during free walking MG patients are more stable, than CG patients, their movements are more sure and free.

Evaluation of patients' life quality dynamics by Barthel's scale witnesses that life quality indicator is statistically ($p < 0,05$) higher in MG than in CG, and it confirms higher efficiency of the conducted recreational treatment of patients with ischemic apoplexy with application of the offered complex program of physical rehabilitation.

Conclusions

Restoration of motion function of patients with cerebral apoplexy is determined by the level of regulatory processes' dissociation and must be based on sano-genetic principles concerning the stages of postnatal ontogenesis of human motion function. With cerebral apoplexy therapeutic exercises must solve the task of simulation of symmetric physiological hierarchic control over motion function by nervous system, i.e.: restoration of static and then dynamic motion stereotypes sequentially in all final positions, from horizontal to vertical, on the base of using of controlling influence on motion sphere of spinal cord, oblongata, vestibular-cerebellum complex, central and other sections of brain.

Application of complex physical rehabilitation program for patients with cerebral apoplexy results in increase of movements scope in hip and shoulder joints: passive by 15-20%, active – by 10-30%; muscular strength – by 10-30%; improvement of motion activity indicators by Bobaht's scale and life quality by Barthel's scale.

The offered complex differentiated program of using of therapeutic exercises means and methods for patients with cerebral apoplexy manifests more expressed therapeutic effect with earlier application in acute and early recreational periods. It permits to efficiently realize both: special task (reduction of motion deficit level) and general task – improvement of functional state of cerebral apoplexy patient. The obtained results make easier preparation to next stage of recreational measures out of hospital.

The prospects of further researches. It is envisaged to develop and test complex technologies of patients after cerebral ischemic apoplexy, considering the level of disease heaviness, age and sex.

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