ISSN 2522-1906 (Print) ISSN 2522-1914 (Online)

Physical rehabilitation and recreational health technologies

Original article

Vol. 7 No 4

Effectiveness of physical therapy of a person with a hemorrhagic stroke during the recovery period: a clinical case

Lyudmila Kletsenko[1], Lesia Klevaka[1], Yevgenia Vyshar[2], Anatoliy Levkov[1]

[1]National University "Yuri Kondratyuk Poltava Polytechnic", Poltava, Ukraine
[2]Poltava Institute of Economics and Law of the Higher Educational Institution "University of Human Development "Ukraine", Poltava, Ukraine

DOI: 10.15391/prrht.2022-7(4).26

Received: 14.11.2022
Accepted: 09.12.2022
Published: 30.12.2022

Citation:

Kletsenko, L., Klevaka, L., Vyshar, Ye., & Levkov, A. (2022). Effectiveness of physical therapy of a person with a hemorrhagic stroke during the recovery period: a clinical case. *Physical rehabilitation and recreational health technologies*, 7(4), 151-162. https://10.15391/prrht.2022-7(4).26

Corresponding author:
Lesia Klevaka
National University "Yuri Kondratyuk Poltava Polytechnic", Poltava, Ukraine
orcid.org/0000-0001-6924-8221
e-mail: klevakaalesi@ukr.net

Lyudmila Kletsenko
orcid.org/0000-0003-0092-381X

Yevgenia Vyshar
orcid.org/0000-0003-0937-7042

Anatoliy Levkov
orcid.org/0000-0003-0596-440X

Abstract

Purpose: to scientifically substantiate and develop a program of physical therapy for a patient after a hemorrhagic stroke (during the recovery period) and check its effectiveness.

Material & Methods: the study was conducted on the basis of the "Skalyansky Clinic" Medical Center. The organization of the study involved conducting a comparative analysis of the dynamics of indicators obtained with the help of clinical tools for assessing the patient's functional state in the process of applying the author's physical therapy program. A 71-year-old patient with a diagnosis of "Acute cerebrovascular hemorrhagic disorder: subarachnoid-parenchymal hemorrhage with the formation of a stroke-hematoma of the left temporal-subcortical area of the brain with breakthrough into the ventricular system with right-sided hemiplegia, sensorimotor aphasia" by a multidisciplinary team (doctor, physical therapist, speech therapist and psychologist) an individual program of physical therapy was developed. In order to evaluate the effectiveness of the experimental methodology, a formative experiment was conducted. Clinical tools for assessing the functional state of the patient during the research were domains in the form of the ICF-core-set tool (a set of ICF basic categories) (ICF Research Branch, 2022) for complex stroke: Lovett's test, Barthel scale, Gait Velocity (GV) tests and Berg Balance scale (BBS), Montreal Scale of Cognitive Assessment (MoCA), Get Up and Go Tests, Trunk Control Test, Functional Independence Measure (FIM). The developed individual program of physical therapy for hemorrhagic stroke in the recovery period is a comprehensive course of physical therapy, occupational therapy, which is carried out in stages and includes the following components: therapeutic gymnastics classes; electrical stimulation of the shoulder, psychological (psychological counseling, psychological support, developmental classes for the recovery of cognitive impairments) and speech therapy (speech therapy gymnastics, articulation exercises, Su-Jok (massage ball and ring) component. After applying the specified author's individual physical therapy program, qualitatively positive changes in the functional and psychophysical state of the patient, in particular: b7301.4 to b7301.2; d550.2 to d550.1; d510.3 to d510.2; d520.3 to d520.2; d540.3 to d540. 2; d598.3 to d598.2; d4100.3 to d4100.2; d450.3 to d450.2; d469.4 to d469.3; d330.3 to d330.1; d355.3 to d355.3; d998.3 to d998.2.

Results: after applying the author's program of physical therapy, we found qualitatively positive changes in the functional and psychophysical state of the patient, as evidenced by the positive dynamics of the studied indicators. The psychological and speech therapy work carried out contributed to the improvement in the process of restoring the patient's cognitive functions (from moderate to mild impairment), stabilization of his emotional state, acquisition of stress resistance skills, harmonization of the patient's system of relationships with himself,

ISSN 2522-1906 (Print) ISSN 2522-1914 (Online)
Fizicna Reabilitacia ta Rekreacijno-Ozdorovci Tehnologii
Vol. 7 No 4

micro- and macro-society, formation of a new concept of life.

Conclusions: the effectiveness of using the author's individual program of physical therapy is confirmed by the dynamics of qualitatively positive changes in the functional and psychophysical state of the patient.

Key words: cerebral hemorrhagic stroke, physical therapy, occupational therapy, kinesiotherapy, recovery period.

Анотація

Людмила Клеценко, Леся Клевака, Євгенія Вишар, Анатолій Левков. Ефективність фізичної терапії особи із геморагічним інсультом у відновлювальний період: клінічний випадок. Мета: науково обґрунтувати та розробити програму фізичної терапії для пацієнта після перенесеного геморагічного інсульту (у відновлювальний період) та перевірити її ефективність. **Матеріал і методи:** дослідження проводилося на базі Медичного центру "Клініка Скалянського". Організація дослідження передбачала проведення порівняльного аналізу динаміки показників, отриманих за допомогою клінічних інструментів оцінки функціонального стану пацієнта у процесі застосування авторської програми фізичної терапії. Пацієнту віком 71 років з діагнозом "Гостре порушення мозкового кровообігу за геморагічним типом: субарахноїдально-паренхіматозний крововилив із формуванням інсульт-гематоми лівої скронево-підкіркової ділянки головного мозку із проривом у шлуночкову систему із правобічною геміплегією, сенсомоторною афа-зією" мультидисциплінарною командою (лікар, фізичний терапевт, логопед та психолог) було розроблено індивідуальну програму фізичної терапії. З метою оцінки ефективності експериментальної методики проведено формувальний експеримент. Клінічними інструментами оцінки функціонального стану пацієнта при проведенні наукового дослідження були домени у вигляді інструменту ICF-core-set (набір базових категорій МКФ) (ICF Research Branch, 2022) для комплексного інсульту: тест Ловетта, шкала Бартела, тести Швидкість ходьби (GV) та Берга на рівновагу (BBS), Монреальська шкала оцінки когнітивних функцій (MOCA), тести "Встань та йди", Trunk Control Test, Визначення функціональної незалежності (FIM). Розроблена нами індивідуальна програма фізичної терапії при геморагічному інсульті в відновлювальний період являє собою комплексний курс фізичної терапії, ерготерапії, який здійснюється поетапно і містить такі складові: заняття з лікувальної гімнастики; електрична стимуляція плеча, психологічний (психологічне консультування, психологічний супровід, розвиваючі заняття з відновлення когнітивних порушень) і логопедичний (логопедична гімнастика, артикуляційні вправи, Су-Джок (масажний м'ячик та кільце) компонент. Після застосування зазначеної авторської індивідуальної програми фізичної терапії відбулися якісно позитивні зміни у функціональному та психофізичному стані пацієнта, зокрема: b7301.4 на b7301.2; d550.2 на d550.1; d510.3 на d510.2; d520.3 на d520.2; d540.3 на d540.2; d598.3 на d598.2; d4100.3 на d4100.2; d450.3 на d450.2; d469.4 на d469.3; d330.3 на d330.1; d355.3 на d355.3; d998.3 на d998.2. **Висновки:** обробка емпіричних даних здійснювалася за допомогою порівняння функціонального стану пацієнта до та після проведення експериментального дослідження. Ефективність застосування авторської індивідуальної програми фізичної терапії підтверджена динамікою якісно позитивних зрушень у функціональному та психофізичному стані пацієнта.

Ключові слова: мозковий геморагічний інсульт, фізична терапія, ерготерапія, кінезотерапія, відновлювальний період.

Introduction

According to the WHO, in the developed countries of the world, 100 to 300 strokes are registered annually for every 100,000 people. According to official statistics of the Public Health Center of the Ministry of Health of Ukraine, cerebrovascular diseases are the number 2 cause of mortality in Ukraine (100,000-110,000 deaths, about 14% of all deaths). Every year, 100,000-110,000 strokes occur (more than a third of them – in people of working age), 30-40% of stroke patients die within the first 30 days and up to 50% – within a year of the onset of the disease; 20-40% of surviving patients become dependent on third-party care (12.5% primary disability) and only about 10% return to a full life (Public Health Center of the Ministry of Health of Ukraine, 2020).

Physical therapy of persons who have suffered cerebral hemorrhagic stroke is an important and integral component in the complex treatment of such patients.. The majority of patients who survived a stroke become disabled, 20-25% of them need outside help for the rest of their lives, a large part of them need the care of relatives of working age, which determines the socio-economic significance of this problem (Kelly et al., 2003; Sidhartha et al., 2015; Teasell et al., 2020).

Since, according to international multicenter studies, the ratio of ischemic and hemorrhagic strokes is 4:1, the greater attention of scientists is focused on the problems of ischemic stroke and the number of works on the study of hemorrhagic stroke is critically small. In the literature, there is not enough information about original programs of physical therapy, occupational therapy for patients with hemorrhagic strokes in the early rehabilitation period, which take into account scientifically based approaches to the implementation of clinical

practice based on the principles of evidence-based medicine of the developed countries of the world, there is no data on the appointment of complex methods using complementary methods in multidisciplinary rehabilitation (Yukhymchuk, Kh.V., 2018).

The purpose of the study is to scientifically substantiate and develop an individual program of physical therapy for a patient after a hemorrhagic stroke (during the recovery period) and check its effectiveness.

Material and methods of research

The experimental study was carried out for six months (from March 1, 2022 to August 30, 2022) on the basis of the "Skalyansky Clinic" Medical Center. The organization of the study involved conducting a comparative analysis of the dynamics of indicators obtained with the help of clinical tools for assessing the patient's functional state in the process of applying the author's physical therapy program.

Participants

We developed an individual program of physical therapy for a 71-year-old patient with a diagnosis of "Acute cerebrovascular hemorrhagic disorder: subarachnoid-parenchymal hemorrhage with the formation of a stroke-hematoma of the left temporal-subcortical region of the brain with a breakthrough into the ventricular system with right-sided hemiplegia, sensorimotor aphasia".

The study was carried out in accordance with the ethical standards of the Declaration of Helsinki, the patient gave consent for the study and publication.

Methods

Clinical tools for assessing the functional state of the patient during the research were domains in the form of the ICF-core-set tool (a set of ICF basic categories) (Stroke Foundation, 2020) for complex stroke: Lovett's test, Barthel scale, Gait Velocity (GV) tests and Berg Balance Scale (BBS), Montreal Scale of Cognitive Assessment (MoCA), Get Up and Go Tests, Trunk Control Test, Functional Independence Determination (FIM).

Empirical data processing was carried out by comparing the patient's functional state before and after the experimental study.

Procedure

The research was conducted in three stages. At the first stage, a theoretical analysis of literary sources was carried out according to the problem of the research, the anamnesis and epicrisis of the patient were investigated, based on the data of which a clinical characteristic was formed and an individual program of physical therapy was developed for the specified patient (1.03 – 15.03, 2022).

At the second stage, the approbation and verification of the effectiveness of the physical therapy program of the patient with the diagnosis «Acute violation of cerebral blood circulation of the hemorrhagic type: subarachnoid-parenchymal hemorrhage with the formation of a stroke-hematoma of the left temporal-subcortical area of the brain with a breakthrough into the ventricular system with right-sided hemiplegia, sensory motor aphasia" (March 15 – August 30, 2022). In order to evaluate the effectiveness of the experimental methodology, a formative experiment was conducted.

The third stage of the research is generalizing. It included the analysis, generalization and discussion of all the results of the experiment, the formulation of the general conclusions of the study, and the preparation of the manuscript of the scientific paper.

Considering the patient's clinical diagnosis "Acute cerebrovascular hemorrhagic disorder: subarachnoid-parenchymal hemorrhage with the formation of a stroke-hematoma of the left temporal-subcortical area of the brain with breakthrough into the ventricular system with right-sided hemiplagia, sensorimotor aphasia", our multidisciplinary team consisted of a doctor, specialists from physical therapy, occupational therapy, a speech therapist and a psychologist, who carried out a comprehensive approach to the physical therapy of a patient with a hemorrhagic stroke during the recovery period.

Statistical analysis

The organization of the study included a clinical case study – conducting a comparative analysis of the dynamics of the functional status assessment indicators of one patient, obtained with the help of clinical tools in the process of applying the author's physical therapy program. The domains in the form of the ICF-core-set tool (a set of ICF basic categories) (ICF Research Branch, 2022) for complex stroke were clinical tools for assessing the patient's functional status during the research. All relevant categories are listed in the core set of the ICF, and their use in interdisciplinary assessments is a guaranteed factor in taking into account important aspects of the functioning of each patient. These qualifiers support standardization and understanding of functioning in interdisciplinary assessment; they allow all team members to quantify the extent of problems, even in areas of functioning where a particular rehabilitation team member is not an expert.

Results of the study

The experimental program of physical therapy for hemorrhagic stroke in the recovery period was de-

veloped in accordance with the order of the Ministry of Health of Ukraine dated 04.17.2014 No. 275 "On the approval and implementation of medical and technological documents on the standardization of medical care for hemorrhagic stroke". A feature of the author's program of physical therapy for hemorrhagic stroke during the recovery period developed by us was the orientation to the latest current version of the Australian clinical guidelines for the care of patients after a stroke (Stroke Foundation, 2020). The author's program developed by us contains a step-by-step comprehensive course of physical therapy, which includes an author's complex of passive-active therapeutic gymnastics exercises in combination with electrical stimulation of the shoulder and psychological (psychological counseling, psychological support, developmental classes for the recovery of cognitive impairments) and speech therapy (speech therapy gymnastics, articulation exercises, Su-Jok (massage ball and ring) components (Vyshar, Ye., & Kletsenko, L., 2022abc).

According to Article 18 of the Law of Ukraine On Rehabilitation in the Health Care Sector, physical therapy is carried out by a multidisciplinary rehabilitation team – this is an organizationally organized, functionally separated group of rehabilitation specialists who are united by the common goal and tasks of rehabilitation and provide rehabilitation assistance of high and medium volume in inpatient and outpatient facilities in acute, post-acute and long-term rehabilitation periods. Effective rehabilitation of a patient with a hemorrhagic stroke involves participation in a multidisciplinary team of the following specialists: a physical therapist (physical rehabilitator), who ensures the restoration of motor functions, an occupational therapist (ensures the restoration of household skills), a doctor (consults in the medical field), a speech therapist (speech therapist – speech restoration and swallowing), a psychologist (monitors the patient's psychological state and prevents depression) (Knapp et al., 2020; Hyriavets & Pulyk, 2019; Khozbei et al., 2012).

An experimental program of physical therapy for a hemorrhagic stroke during the recovery period was developed for a 71-year-old male patient with a diagnosis of "Acute hemorrhagic cerebral circulation disorder: subarachnoid-parenchymal hemorrhage with the formation of a stroke-hematoma of the left temporal-subcortical area of the brain with a breakthrough in ventricular system with right-sided hemiplagia, sensorimotor aphasia". Objective data: the patient's condition is satisfactory, the skin is clean, the peripheral lymph nodes are not palpable, there are no wheezing in the lungs, the heart sounds are rhythmic, the pulse is 67, rhythmic, BP (on both arms) 140/100 mmHg, body temperature is 36.7, the abdomen is soft, painless, there is no swelling, stools and urination are controlled. The period is post-hospital, the movement regime is gentle and training.

After the examination of the patient, we carried out a quantitative assessment of the manifestation of disorders, limitations of the patient and assessed the role of environmental factors. The identified functional disorders are formulated in the ICF category, the results of the assessment of the patient's functional state and the rehabilitation diagnosis are presented in Table 1.
The individual program of physical therapy for hemorrhagic stroke during the recovery period developed by us is presented in Table 2.

Table 1. Assessment of the functional state of the patient before the application of an individual program of physical therapy

Clinical tools	Rehabilitation diagnosis before the application of an individual program of physical therapy
Lovett's scale (0 points – full – full restriction ability movements of the right upper and lower limbs 3 points – full – ability movements of the left upper and lower limbs only when overcoming the force of gravity)	Muscle strength of the right upper limb – b7301.4 (complete limitation of ability movements of the right upper limb). Muscle strength of the right lower limb – b7301.4 (complete limitation of the ability to move the right lower limb). Muscle strength of the left upper limb – b7301.1 (weak limitation of the ability to move the left upper limb). Muscle strength of the left lower limb – b7301.1 (weak restriction of the ability to move the left lower limb).
Barthel scale (60 points – moderate disability)	Eating – d550.2 (moderate limitations in the ability to eat). Taking a bath – d510.3 (severe limitations in the ability to take a bath). Personal hygiene – d520.3 (severe limitations in personal hygiene procedures). Dressing – d540.3 (severe restrictions on dressing). Control of defecation – b525.2 (moderate limitation in control of defecation). Control of urination – b620.2 (moderate limitation in control of urination). Toileting – d598.3 (severe limitations in toileting ability). Transfer (from bed to chair and back) – d4100.3 (severe limitations in movement). Ability to move on a flat plane – d450.3 (severe limitations in the ability to move on a flat plane). Climbing stairs – d469.4 (complete limitation in the ability to climb stairs).

Clinical tools	Rehabilitation diagnosis before the application of an individual program of physical therapy
Gait velocity (GV) (up to 4 min. walking with a cane on 4 supports)	The ability to move on a flat plane – d450.3 (severe restrictions on the ability to move on a flat plane
Berg Balance scale (11 points – uses a wheelchair)	Standing up from a sitting position – d429.4 (complete limitation of the ability to stand up from a sitting position). Standing without support – d415.4 (total limitation of the ability to stand without support). Sitting without back support, but with fixed legs on floor or chair – d415.4 (total limitation of ability to stand without support). Sitting down from a standing position – d429.3 (severe limitations in the ability to sit down from a standing position). Movement – d4600.3 (severe movement restrictions).
Montreal Scale of Cognitive Assessment (MoCA) (20 points – moderate cognitive impairment)	Use of vision – d110.1 (mild impairment of the use of vision). Names – d135.2 (moderate repetition disorders). Memory – d179.2 (moderate memory impairment). Attention – d160.2 (moderate disturbances of concentration of attention). Repetition of sentences – d135.2 (moderate repetition disorders). Verbal speed – d175.2 (moderate problem-solving impairments). Abstraction – d163.2 (moderate thinking disorders).
"Get up and go" test (7 min. (walking with a cane on 4 supports)	Mobility with the use of technical means – d465.3 (severe limitations in movement with the use of technical means)
Body control test (severe limitations in changing and maintaining body position)	Trunk control – d429.3 (severe limitations in changing and maintaining body position)
FIM (functional independence measure) 75 points	*Self care* Eating – d550.2 (moderate limitations in the ability to eat). Hygienic procedures – d520.3 (severe restrictions in personal hygiene procedures). Taking a bath – d510.4 (total limitations in the ability to take a bath). Dressing the upper part of the body – d540.3 (severe limitations in the ability to dress the upper part of the body). Dressing the lower part of the body – d540.4 (severe limitations in the ability to dress the lower part of the body). Toileting – d598.3 (severe limitations in toileting ability). *Control of bowel movements* Control of defecation – b525.2 (moderate limitation in control of defecation). Control of urination – b620.2 (moderate limitation in control of urination). *Moving* Bed/chair/wheelchair – d460.3 (severe mobility restrictions). Toilet – d450.3 (severe mobility restrictions). Bath/shower – d450.4 (full mobility restrictions). *Ability to move* Walking – d450.3 (severe limitations in the ability to move on a flat plane). Walking upstairs – d469.4 (complete limitation in the ability to climb stairs). *Communication* Speech – d330.3 (severe impairment in the ability to speak). Comprehension – d350.1 (slight impairment in the ability to speak). Expression – d355.3 (severe impairment in the ability to express). *Social cognition* Social relations – d710.2 (moderate impairment of basic interpersonal interactions). Problem solving – d998.3 (severe limitations in ability to solve social problems). Memory – d135.2 (moderate memory impairment).

Table 2. Individual program of physical therapy for hemorrhagic stroke in the recovery period

No.	Initial position	Description of exercises	Number of repetitions	Methodical instructions
Preparatory part. Passive movements in the joints				
1	Lying on your back Lying on the healthy side	*Shoulder joint:* flexion abduction lead rotation (external, internal), extension	 10-12 times 10-12 times 10-12 times 10-12 times	The pace is slow

No.	Initial position	Description of exercises	Number of repetitions	Methodical instructions
2	Lying on your back	*Elbow joint:* bending extension pronation supination	 10-12 times 10-12 times 10-12 times 10-12 times	The pace is slow
3	Lying on your back	*Carpal joint:* flexion extension	 10-12 times 10-12 times	The pace is slow
4	Lying on your back	*Phalanges of the fingers of the upper limb:* bending extension abduction lead	 10-12 times 10-12 times 10-12 times 10-12 times	The pace is slow
5	Lying on your back The starting position is lying on the healthy side	*Hip joint:* flexion abduction lead rotation (internal, external) extension	 10-12 times 10-12 times 10-12 times 10-12 times 10-12 times	The pace is slow
6	Lying on your back	*Knee joint:* bending extension	 10-12 times 10-12 times	The pace is slow
7	Lying on your back	*Ankle joint:* bending extension	 10-12 times 10-12 times	The pace is slow
8	Lying on your back	*Phalanges of the fingers of the lower limbs:* bending extension	 10-12 times 10-12 times	The pace is slow
Main part				
1	Sitting on a chair, fingers intertwined	*Exercise 1.* Raise your hands above your head, put your palms on the back of your head, then slowly lower them down to the sides. The number of repetitions (Figure 1).	10-12 times	The pace is slow. Fixation of the patient's attention on achieving the goal, if necessary, the physical therapist's help in performing the movement.
2	Sitting on a chair, fingers intertwined	*Exercise 2.* Raising straight arms to the level of the shoulders in front of you, moving them to the sides by 90°, external and internal rotation, returning to the starting position, at the end, slowly lower your arms (Figure 2).	10-12 times	The pace is slow. Fixation of the patient's attention on achieving the goal, if necessary, the physical therapist's help in performing the movement

Fig. 1. Exercise 1

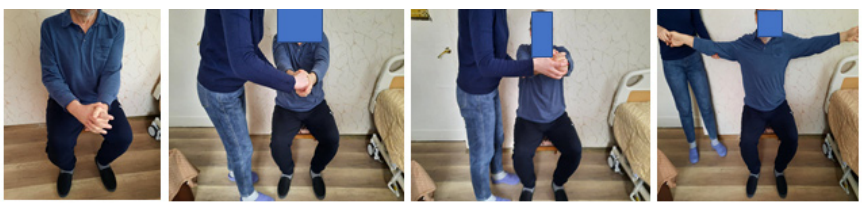

Fig. 2. Exercise 2

No.	Initial position	Description of exercises	Number of repetitions	Methodical instructions
3	Sitting facing the table, the arms are bent at the elbow joints, the forearms lie on the table, the hand is in the middle position between pronation and supination.	*Exercise 3*. Rotation of the forearm inward and outward (Figure 3).	10-12 times	The pace is slow. Fixation of the patient's attention on achieving the goal, if necessary, the physical therapist's help in performing the movement
4	Sitting facing the table, the arms are bent at the elbow joints, the forearms lie on the table, the hand is in the position of supination.	*Exercise 4*. Bringing the forearm to the body and moving it away from the body, sliding on the surface of the table (Figure 4).	10-12 times	The pace is slow. Fixation of the patient's attention on achieving the goal, if necessary, the physical therapist's help in performing the movement
5	Sitting on a chair, the fingers are intertwined in a lock at chest level	*Exercise 5.* Execution: turn the palms outward, pull the arms forward, return to the starting position (Figure 5).	10-12 times	The pace is slow. Fixation of the patient's attention on achieving the goal, if necessary, the physical therapist's help in performing the movement
6	Sitting facing the table, forearm on the table, hand with palm on the table.	*Exercise 6*. Clenching the fingers into a fist followed by straightening all the fingers. Number of repetitions: alternately for each hand (Figure 6).	10-12 times	The pace is slow. Fixation of the patient's attention on achieving the goal, if necessary, the physical therapist's help in performing the movement
7	Sitting on a chair, hands on knees	*Exercise 7.* Roll the foot from the heel to the phalanges of the fingers of the lower limb of the healthy leg, repeat this movement on the affected limb (Figure 7).	10-12 times	The pace is slow. Fixation of the patient's attention on achieving the goal, if necessary, the physical therapist's help in performing the movement
8	Sitting on a chair, hands on knees	*Exercise 8.* Stepping on the spot alternately with each leg, with the knee raised as high as possible (Figure 8).	10-12 times	The pace is slow. Fixation of the patient's attention on achieving the goal, if necessary, the physical therapist's help in performing the movement

Fig. 3. Exercise 3

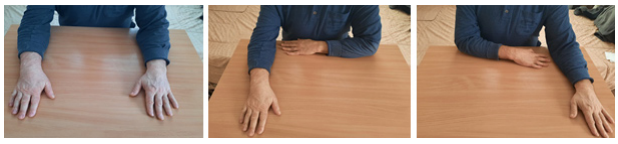

Fig. 4. Exercise 4

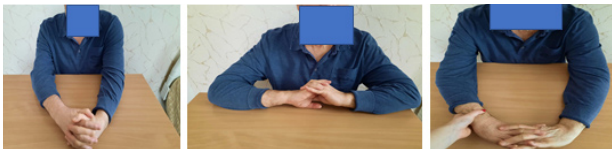

Fig. 5. Exercise 5

Fig. 6. Exercise 6

Fig. 7. Exercise 7

Fig. 8. Exercise 8

No.	Initial position	Description of exercises	Number of repetitions	Methodical instructions
9	Sitting on a chair, hands on knees	*Exercise 9.* Sliding feet on the floor, as on skis (Figure 9).	10 times on each leg	The pace is slow. Fixation of the patient's attention on achieving the goal, if necessary, the physical therapist's help in performing the movement
10	Sitting on a chair, hands on knees	*Exercise 10.* Bend the healthy leg at the knee, pull the phalanges of the fingers of the lower limb towards you, return to the starting position, repeat this exercise on the affected limb (Figure 10).	10 times on each leg	The pace is slow. Fixation of the patient's attention on achieving the goal, if necessary, the physical therapist's help in performing the movement
11	Sitting on a chair, hands on knees, legs fixed in a rehabilitation simulator. Auxiliary equipment: Rehabilitation exerciser for legs OSD-CPS005BC.	*Exercise 11.* Scrolling the pedals of the rehabilitation simulator for legs forward and backward, with two legs at the same time (Figure 11).	20 times in each direction	The pace is slow. Fixation of the patient's attention on achieving the goal, if necessary, the physical therapist's help in performing the movement
Final part				
12	Functional electrical stimulation.	PowerDot 2.0 was used for electrical stimulation, purpose: application in post-stroke subluxation of the shoulder. Electrical stimulation was applied to the deltoid muscle after each session with the patient for 30 minutes (Figure 12).		
13	Speech therapy consultations.	The work of a speech therapist involved the patient mastering the techniques of performing speech therapy gymnastics and articulation exercises, Su-Jok (massage ball and ring) (Rose et al., 2019). Speech therapy exercises (performed daily): *Exercise 1.* Run your tongue 4-5 times over the surface of the upper and lower lip clockwise and counterclockwise; with the lower lip, it is necessary to capture as much space as possible of the upper lip and hold the muscles in this position for 1-2 seconds; after that, you can relax your facial expressions (you need to repeat the exercise 5-10 times, similarly, you need to repeat the exercise with the upper lip); *Exercise 2.* Having turned the tongue, you need to touch it to the hard, and then to the soft palate; at the same time, the mouth must be closed; the head and neck should be stretched forward; from the open mouth, you need to stick out the tongue as much as possible and stay in this position for 2-3 seconds (it is necessary to repeat the exercise 5-10 times). *Exercise 3.* It is allowed to click the tongue an unlimited number of times during the day; the sound should resemble the clicking of hooves. *Exercise 4.* You should try to push the tongue twisted by the tube out of the mouth. *Exercise 5.* You need to smile 5-10 times so that the mouth is closed, and the open lips show the teeth; then 4-5 times the smile should be closed – the lips are closed, the teeth are not visible. *Exercise 6.* The patient needs to stick his tongue out of his mouth and make hissing sounds similar to the hissing of a snake. *Exercise 7.* It is necessary to squeeze the lips with a straw 5-10 times and hold in this position for about 5 seconds; you need to close your lips, while a distance of 2 cm should be maintained between the teeth; between the lips and the teeth, the tongue should make clockwise and counterclockwise circular movements. *Exercise 8.* Perform an air kiss, at the same time, the lips must be spread with a loud sound. Exercise 9. The patient needs to stick out his tongue and try to touch the base of the nose with it, in the process of 1 procedure, you need to repeat the techniques at least 5-10 times.		

Fig. 9. Exercise 9

Fig. 10. Exercise 10

Fig. 11. Exercise 11

Fig. 12. Exercise 12

No.	Initial position	Description of exercises	Number of repetitions	Methodical instructions
14	Psychological consultations	Psychological research and restoration of cognitive functions, namely: consciousness, attention, orientation, memory, language, gnosis, visual-spatial perception, praxis and executive functions (judgment, ability to predict the consequences of one's actions, problem solving, abstract thinking, planning, the ability to initiate actions and implement ideas). Psychological counseling and support of the patient aimed at the formation of a positive therapeutic and life perspective, restoration of the integrated image of the patient's «I», correction of the self-identification of the individual and self-acceptance, awareness and correction of interpersonal relationships, awareness and acceptance by the individual of a new social role, stabilization of the system of personality relations, formation of a new concept life, mastering techniques for coping with stress. The psychologist's work was also aimed at correcting value orientations, teaching autogenic training skills, meditation, and art therapy. The work of the psychologist was carried out 2 times a week.		

In fact, the task of this complex is to increase blood circulation in the area of large and small joints of the body. An auxiliary tool in the restoration of lost functions, it is used for the prevention of joint contracture, as well as alleviation of pain in them. Passive movements should be performed at a slow pace with as much amplitude as possible. Movements should not be accompanied by pain. During performance, sharp movements at the moment of stretching of spastic shortened muscles are not allowed, they can cause reflex muscle contraction in response. The prescribed physical exercises develop movement capabilities, activate vegetative systems, stimulate and normalize the functions of all body systems, increase the body's resistance to adverse environmental factors. Due to the fact that the main importance in the clinical picture of paresis and paralysis after a stroke belongs to movement disorders, the main task of restorative treatment is the normalization of the patient's motor activity. All exercises are performed slowly; special attention is paid to the principle of correct movement trajectory.

To improve motor functions after a stroke, functional electrical stimulation was used, after which the effectiveness of functional electrical stimulation was confirmed in the form of an increase in muscle strength in patients after a stroke. PowerDot 2.0 was used for electrical stimulation. The purpose is an application in post-stroke subluxation of the shoulder. Electrical stimulation was applied to the deltoid muscle after each session with the patient for 30 minutes.

After carrying out rehabilitation measures, we conducted testing. Table 3 shows the results of the assessment of the patient's functional state and the rehabilitation diagnosis.

Table 3. Assessment of the functional state of the patient after the application of an individual program of physical therapy

Clinical tools	Rehabilitation diagnosis after the use of an individual program of physical therapy
Lovett's scale (2 points – Clear muscle tension and the ability to perform movement without the help of a rehabilitator; 4 points – full amplitude movement with average resistance over the entire amplitude)	Muscle strength of the right upper limb – b7301.2 (moderate restriction of the ability to move the right upper limb). Muscle strength of the right lower limb – b7301.2 (moderate restriction of the ability to move the right lower limb). Muscle strength of the left upper limb – b7301.1 (weak limitation of the ability to move the left upper limb). Muscle strength of the left lower limb – b7301.1 (weak restriction of the ability to move the left lower limb).
Barthel scale (87 minimal limitation of lost neurological functions)	Eating – d550.1 (mild limitations in ability to eat). Taking a bath – d510.2 (moderate limitations in the ability to take a bath). Personal hygiene – d520.2 (moderate limitations in personal hygiene procedures). Dressing – d540.2 (moderate dressing restrictions). Control of defecation – b525.2 (moderate limitation in control of defecation). Control of urination – b620.2 (moderate limitation in control of urination). Toileting – d598.2 (moderate limitation in toileting ability). Transfer (from bed to chair and back) – d4100.2 (moderate limitations in transfer). Ability to move on a flat plane – d450.2 (moderate limitations in the ability to move on a flat plane). Climbing stairs – d469.3 (severe limitations in the ability to climb stairs).
Gait velocity (GV) (3 min. walking with a cane on 4 supports)	Ability to move on a flat plane – d450.2 (moderate limitations to the ability to move on a flat plane).

Clinical tools	Rehabilitation diagnosis after the use of an individual program of physical therapy
Berg Balance scale (38 points – walks with assistance)	Standing up from a sitting position – d429.3 (severe limitation of the ability to stand up from a sitting position). Standing without support – d415.3 (severe limitation of ability to stand without support). Sitting without back support, but with fixed legs on floor or chair – d415.3 (severe limitation of ability to stand without support). Sitting down from a standing position – d429.2 (moderate limitations in the ability to sit down from a standing position). Movement – d4600.2 (moderate limitations in movement).
Montreal Scale of Cognitive Assessment (MoCA) (27 points – mild cognitive impairment)	Visual use – d110.1 (mild visual impairment). Names – d135.1 (mild repetition disorders). Memory – d179.1 (mild memory impairment). Attention – d160.1 (mild disorders of concentration of attention). Sentence repetition – d135.1 (mild repetition disorders). Verbal speed – d175.1 (mild problem-solving disorders). Abstraction – d163.1 (mild thinking disorders).
"Get up and go" test (1.5 min. (walking with a cane on 4 supports))	Mobility with the use of technical aids – d465.2 (slight limitations in mobility with the use of technical aids).
Body control test (moderate limitations in changing and maintaining body position) 100 points	Body control – d429.2 (moderate limitations in changing and maintaining body position).
FIM (functional independence measure) 102 points	*Self-care* Eating – d550.1 (slight limitations in the ability to eat). Hygienic procedures – d520.3 (severe restrictions in personal hygiene procedures). Taking a bath – d510.3 (severe limitations in the ability to take a bath). Dressing the upper part of the body – d540.2 (moderate limitations in the ability to dress the upper part of the body). Dressing the lower part of the body – d540.2 (moderate limitations in the ability to dress the lower part of the body). Toileting – d598.2 (moderate limitation in toileting ability). *Control of bowel movements* Control of defecation – b525.2 (moderate limitation in control of defecation). Control of urination – b620.2 (moderate limitation in control of urination). *Moving* Bed/chair/wheelchair – d460.2 (moderate mobility restrictions). Toilet – d450.2 (moderate mobility restrictions). Bath/shower – d450.3 (severe mobility restrictions). *Ability to move* Walking – d450.2 (moderate limitations in the ability to move on a flat plane). Climbing stairs – d469.3 (severe limitations in the ability to climb stairs). *Communication* Speech – d330.1 (slight impairment in the ability to speak). Comprehension – d350.1 (slight impairment in the ability to speak). Expression – d355.1 (mild impairment in the ability to express). *Social cognition* Social relations – d710.1 (mild violations of basic interpersonal interdependent actions). Problem Solving – d998.2 (moderate limitations in ability to solve social problems). Memory – d135.1 (mild memory impairment).

Discussion

Tasks of the early period of physical therapy, occupational therapy in hemorrhagic stroke include is prevention and treatment of complications associated with immobilization; determination of the patient's functional deficit and preserved capabilities; improvement of general physical condition; improvement of motor and sensory functions; restoration of self-care and elementary household skills.

The principle of an individual approach, the formation of individual goals for patients became the main principle when building a physical therapy program. In order to increase the effectiveness of the physical therapy and occupational therapy program and improve the rehabilitation process from the point of view of management, the SMART methodology was taken into account when forming individual goals for patients during the course of the physical therapy and occupational therapy program for hemorrhagic stroke.

The program developed by us is developed in accordance with the current regulatory documentation in the field of occupational health and safety and Australian clinical guidelines and is a comprehensive course of physical therapy, which is carried out in stages and contains the following components: the author's complex of passive-active exercises of therapeutic gymnastics in combination with electrical stimulation of the shoulder and psychological

(psychological counseling, psychological support, developmental classes for the recovery of cognitive impairments) and speech therapy (speech therapy gymnastics, articulation exercises, Su-Jok (massage ball and ring) components. Clinical tools for assessing the functional state of the patient during the scientific study were domains in the form of the ICF tool-core-set (a set of ICF basic categories) (ICF Research Branch, 2022) for complex stroke: Lovett's test, Barthel scale, Gait Velocity (GV) and Berg Balance scale (BBS) tests, Montreal Cognitive Assessment Scale (MoCA), Get Up and Go tests, Trunk Control Test (Torse Control Test), Functional Independence Measure (FIM). The experimental program was developed for a 71-year-old male patient with a diagnosis of "Acute cerebrovascular disorder of the hemorrhagic type: subarachnoid-parenchymal hemorrhage with the formation of a stroke-hematoma of the left temporal-subcortical region of the brain with breakthrough into the ventricular system with right-sided hemiplegia, sensorimotor aphasia" according to the current regulatory documentation in the field of occupational safety and Australian clinical guidelines.

The program of physical therapy for hemorrhagic stroke during the recovery period developed by us is an author's complex of passive-active exercises of medical gymnastics in combination with electrical stimulation of the shoulder and psychological and speech therapy components.

Conclusion

After applying the author's program of physical therapy, we found qualitatively positive changes in the functional and psychophysical state of the patient, as evidenced by the positive dynamics of the studied indicators: the rehabilitation diagnosis of the patient improved, in particular: b7301.4 to b7301.2; d550.2 on d550.1; d510.3 to d510.2; d520.3 to d520.2; d540.3 to d540.2; d598.3 to d598.2; d4100.3 to d4100.2; d450.3 on d450.2; d469.4 on d469.3; d330.3 on d330.1; d355.3 on d355.3; d998.3 to d998.2. The psychological and speech therapy work carried out contributed to the improvement in the process of restoring the patient's cognitive functions (from moderate to mild impairment), stabilization of his emotional state, acquisition of stress resistance skills, harmonization of the patient's system of relationships with himself, micro- and macro-society, formation of a new concept of life.

Therefore, the experimental program of physical therapy developed by us for a patient with a hemorrhagic stroke during the recovery period was effective. We see the prospects for further research in the improvement of physical therapy of people with hemorrhagic stroke by means of kinesiotherapy.

Author's contribution

Conceptualization, L.K. (Lyudmila Kletsenko) and Ye.V.; methodology, A.L. and L.K. (Lesia Klevaka); check, L.K. (Lyudmila Kletsenko), Ye.V., A.L. and L.K. (Lesia Klevaka); formal analysis, L.K. (Lyudmila Kletsenko); investigation, Ye.V. and L.K. (Lesia Klevaka); resources, L.K. (Lyudmila Kletsenko); data curation, L.K. (Lyudmila Kletsenko); writing – rough preparation, Ye.V. and A.L.; writing – review and editing, L.K. (Lyudmila Kletsenko) and L.K. (Lesia Klevaka); visualization, L.K. (Lesia Klevaka); supervision, A.L.; project administration, L.K. (Lyudmila Kletsenko). All authors have read and agreed with the published version of the manuscript.

Acknowledgements

The team of authors thanks E.V. Skalianskiy, head of the Skalianskiy Clinic Medical Center, for providing the premises and equipment for the experimental study.

Conflicts of Interests

The authors declare no conflict of interest.

Funding

This article didn't receive financial support from the state, public or commercial organizations.

References

Gyryavets, M.V., & Pulyk, O.R (2019). Psycho-emotional and motor dysfunction after hemispheric ischemic stroke. *Ukraina. Zdorovia natsii*, 3, 102-107. https://doi.org/10.24144/2077-6594.3.2019.191644

ICF Research Branch (2022). Creation of an ICF-based Documentation Form. https://www.icf-core-sets.org/en/page1.php

Kelly, P.J., Furie, K.L., Shafqat, S., Rallis, N., Chang, Y., & Stein, J. (2003). Functional recovery following rehabilitation after hemorrhagic and ischemic stroke. *Physical Medicine Rehabilitation*, 84(7), 968-972. https://doi.org/10.1016/S0003-9993(03)00040-6

Khozbei, M.K., Mishchenko, T.S., & Vershyhora, A.V. (2012). Unified clinical protocol of medical care for ischemic stroke (emergency, primary, secondary (specialized) medical care, medical rehabilitation). https://dec.gov.ua/wp-content/uploads/images/dodatki/2012_602/2012_602dod4ykpmd.pdf

Kletsenko, L., & Bondarenko, A. (2021). From the experience of physical rehabilitation of a patient with an acute hemorrhagic cerebral circulation disorder. *Scientific Collection «InterConf»: with the Proceedings of the 3 rd International Scientific and Practical Conference «Recent Scientific Investigation»*, 74, 310- 315. https://www.interconf.top/documents/2021.09.16-18.pdf

Knapp, P., Dunn-Roberts, A., Sahib, N., Cook, L., Astin, F., Kontou, E., & Thomas, S.A. (2020). Frequency of anxiety after stroke: An updated systematic review and meta-analysis of observational studies. *International Journal of Stroke*, 15(3), 244-255. https://doi.org/10.1177/1747493019896958

Ministry of Health of Ukraine (2014). Order No. 275 04/17/2014 Unified clinical protocol of emergency, primary, secondary (specialized), tertiary (highly specialized) medical care and medical rehabilitation "Hemorrhagic stroke (intracerebral hematoma, aneurysmal subarachnoid hemorrhage). https://www.dec.gov.ua/wp-content/uploads/2019/11/2014_275_ykpmd_gi.pdf_

Pantielieieva, N., Rogova, N., Kletsenko, L., Braichenko, S., & Dzholos, S. (2020). Legal, organizational and economic aspects of physical rehabilitation and reintegration of combat veterans. *Bulletin the National academy of sciences of the Republic of Kazakhstan,* 4, 242-250. https://doi.org/10.32014/2020.2518-1467.125

Public Health Center of the Ministry of Health of Ukraine (2020). https://phc.org.ua/news/29-zhovtnya-vsesvitniy-den-borotbi-z-insultom

Rose, M.L., Copland, D., & Godecke, E. (2019). Constraint-induced or multi-modal personalized aphasia rehabilitation (compare): A randomized controlled trial for stroke-related chronic aphasia. *International Journal of Stroke,* 14(9). https://doi.org/10.1177/1747493019870401

Sidhartha, J.M., Purma, A.R., Reddy, L.V.P.K., Sagar, N.K., Teja, M.P., Subbaiah, M., & Purushothaman, M. (2015). Risk factors for medical complications of acute hemorrhagic stroke. *Journal of Acute Disease*, 4(3), 222-225. https://doi.org/10.1016/j.joad.2015.07.002

Stroke Foundation (2020). Clinical Guidelines for Stroke Management. https://app.magicapp.org/#/guideline/Kj2R8j/section/LA9N7L

Teasell, R., Salbach, N.M., Foley, N., Mountain, A., & Cameron, J.I. (2020). Canadian Stroke Best Practice Recommendations: Rehabilitation, Recovery, and Community Participation following Stroke. Rehabilitation and Recovery Following Stroke; 6th Edition Update, *International Journal of Stroke,* 15(7), 703-814. https://doi.org/10.1177/1747493019897843

Verkhovna Rada of Ukraine (2021). Law of Ukraine on rehabilitation in the field of health care. https://zakon.rada.gov.ua/laws/show/1053-20#Text

Vyshar, Ye., & Kletsenko, L. (2022a). Features of use health care technologies by professionals in professional activities. *Prospects and innovations of science*, 2(7), 1012-1025. https://doi.org/0.52058/2786-4952-2022-2(7)-1012-1024

Vyshar, Ye., & Kletsenko, L. (2022b). Pedagogical health-preserving technologies in the professional activity of physical therapists, occupational therapists. *Science, practice and theory* [Conference]. http://bit.ly/3hBcjVi

Vyshar, Ye., & Kletsenko, L. (2022c). Modern aspects of application of social-psychological health and conservation technologies in professional activity. *Science and technology today ("Pedagogy" series)*, 6(6), 114-123. http://perspectives.pp.ua/index.php/nts/issue/view/63/93

WHO (2001). International classification of functioning, limitations of vital activities and health. https://physrehab.org.ua/wp-content/uploads/docs/5210-preklad_mkf_dorosla_v_docx.pdf

Yukhymchuk, Kh.V. (2018). Rehabilitation of stroke patients. *Medsestrynstvo,* 3, 23-26. https://doi.org/10.11603/2411-1597.2018.3.9640