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CLINICAL ASPECTS OF THE REHABILITATION OF A PATIENT WITH AN ISCHEMIC STROKE AFTER A BILATERAL COVID-19 PNEUMONIA. A CASE REPORT

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ABSTRACT

THE PURPOSE - to present a clinical case of a patient undergoing hospital rehabilitation for ischemic stroke post COVID-19 pneumonia.

MATERIALS AND METHODS: The rehabilitation program was administered to a 77-year man with a severe motor deficiency (group-I) after stroke, 4 weeks post SARS-CoV-2 infection. The individual program includes positional therapy, breathing gymnastics, active and passive exercises, neuromuscular reeducation, verticalization, daily activity living-training. On the second day of rehabilitation, the patient received acute bleeding from the urinary tract, which necessitated one-day interruption of the rehabilitation until overcoming the hemorrhage. The clinical symptoms were assessed before and after the therapy.

RESULTS: An improvement in the functional tests (Brunnstrom scale, coordination tests and locomotion, Barthel Index, Borg Scale) was observed. The patient was discharged on day 8-th with a second II-group of motor deficit, with mild paresis for upper and severe paresis for lower left limbs, verticalized in a walker.

CONCLUSION: The rehabilitation program for patients with a post-COVID stroke requires an exact assessment of the general condition and the degree of the functional impairment of the respiratory system and motor activity. An adequate combination of physiotherapeutic methods aimed at improving the lung function and motor recovery based on the involvement of the nervous system led to a reduction of the motor deficit and improved daily activity.

Key words: Post-Covid stroke, Multidisciplinary rehabilitation team, Functional recovery, Activity daily living, Locomotion, Brunnstrom scale, Barthel Index, Borg CR10 Scale.

INTRODUCTION

The emergence of the new and highly pathogenic coronavirus (SARS-CoV-2) in 2019 and its rapid spread worldwide caused a subsequent pandemic that affected millions of people worldwide.

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Although COVID-19 primarily affects the respiratory system, there is currently much evidence of multisystem involvement of the body, which can be severe and can lead to death from the disease. The long-term effects of COVID-19 are unknown, but evidence of previous coronavirus infections indicates impaired lung and physical function, reduced quality of life, and emotional distress. Many patients who survive COVID-19 require long-term medical care due to psychological, physical, and cognitive impairment (1).

In order to improve medical care, to reduce length of stay in wards for treatment of acute COVID-19 infection and to prevent long-term adverse effects on the physical and mental health of patients, it is necessary to develop and implement COVID-specific rehabilitation guidelines and criteria for post-acute care (2, 3). Currently, there is evidence that the coronavirus infection occurs not only with lung but also with cardiovascular, neurological, musculoskeletal, liver, kidney, dermatological, psychosocial, and cognitive disorders (1, 4-8).

The association between COVID-19 and the nervous system involvement has been described by several authors. Mao L. et al. find a relationship between the severity of the infection and the severity of neurological manifestations. Some patients have headache, dizziness, impaired consciousness, while others have acute cerebrovascular accidents, epilepsy, encephalitis, encephalopathy, acute myelopathy, peripheral nervous system disorders: hypogeusia, hyposmia, neuralgia, musculoskeletal symptoms (9-13). According to a meta-analysis from 2021, cerebrovascular diseases after COVID-19 are 9.9% (6.8-13.4) (13). Often, the neurological manifestations occur 2-3 weeks after an acute respiratory infection (14).

PURPOSE OF THE STUDY

The aim of this paper is to present a clinical case of a patient undergoing hospital rehabilitation for ischemic stroke post COVID-19 pneumonia.

MATERIALS AND METHODS

This paper presents a clinical case of a 77-year-old man with a severe motor deficiency (group I) who is undergoing rehabilitation after an acute ischemic stroke, 4 weeks after bilateral viral COVID-19 pneumonia. Due to the severe SARS-CoV-2 infection, the patient undergoes a four-week hospital treatment from 15th of December 2020 till 16th of January 2021. Due to deterioration of the vital signs and acute respiratory failure, mechanical ventilation was performed in the anesthesiology and intensive care unit. He was discharged from the hospital in stable general condition with improved laboratory indicators and initial resorption of interstitial changes in the lung. Three weeks after the end of the treatment, the patient was hospitalized in a neurological ward with severe disorientation, weakness, and lack of active movements in the left limbs, difficulty breathing and dependence on oxygen treatment. Two days before the hospitalization in the Neurology department, the patient was consulted about weakness, dizziness, and general malaise. The medical records show a negative polymerase chain reaction test for COVID-19, the laboratory tests show evidence of increased D-dimer (twice normal), platelets, prothrombin time, urea, creatinine, direct bilirubin, LDH, INR. Computed tomography was performed without evidence of acute vascular accident, with degenerative changes in the brain structures. Home treatment is prescribed.

Immediately after overcoming the acute cerebral symptoms, the patient was admitted for rehabilitation to the Department of Physical and Rehabilitation Medicine in a satisfactory general condition, with episodes of disorientation and at times dependent on oxygen treatment, with severe left hemiparesis to plegia, vertical with aid till sitting position in the bed with first group affecting the motor activity with a severe degree of motor deficit of left limbs and impossible independent gait. On the second day of rehabilitation, the patient received acute bleeding from the urinary tract on the background of low molecular heparin administration, which necessitated a day off rehabilitation for overcoming the acute hemorrhage, under the supervision of a nephrologist.

The following functional tests were used to determine the rehabilitation potential: motor function testing; determination of the Brunnstrom functional recovery stage, coordination and locomotion testing, and testing of independence in daily life activities (DLA) according to the Barthel scale.

To determine the stage of functional recovery, the **Brunnstrom scale** was used in six stages (15), modified by Maya Ryazkova (16) (from 0 to 5), where at the stage of recovery - 0, the limbs show 0 degree of movement. They are relaxed and heavy when trying to move passively or lift them by the examiner. Muscle hypotension or initial signs of mild spasticity were found, and in the sixth stage no spasticity during the clinical

examination was observed. Examination. The patient can perform movements in all joints in full volume and good coordination with numerous combinations. Maya Ryazkova's test combines Brunstrom's test in groups and Michels' test of activities that the patient can perform in everyday life. Degree-0 - no movement. Level-1 - beginning of movement. Level-2 - the movement is half done. Level-3 - reaching end point of movement with severe difficulties. Grade-4 - the movement is performed but is different from that of a healthy limb. Grade-5 - there is no difference in the movements of a healthy and affected limb. To determine the daily functional activity and the ability to function independently **Bartel Index** (BI) was used. It is routinely used in medical practice and includes ten indicators: eating, bathing, dressing, using the bathroom, controlling the bladder and sphincters, walking, going down and upstairs. Grades are set from 0 to 5 or 0, 5, 10 or 15 points depending on the activity, with a maximum score of 100 points (17, 18). The higher the final sum, the greater the functional independence of the patient is. Scores between 0 and 20 demonstrate complete dependence, between 21 and 60 - severe dependence, between 61 and 90 - moderate dependence, and between 91 and 99 - slight dependence.

Modified Borg CR10 Scale for assessment of exercise, shortness of breath and dyspnea, chest pain and musculoskeletal pain during physical activity was applied. This scale is used to objectify bodily sensation in a particular area, such as muscle pain or the presence of pulmonary reactions during physical activity (therapeutic exercises) (19,20).

Based on the conducted physical examination and specific tests, an individual rehabilitation program was prepared.

Main goal: Optimal functional recovery of the paretic limbs and improvement of the respiratory function.

Tasks: maintaining the passive joint amplitudes of movement of the affected limbs; stimulating and consolidating the available motor schemes and their subordination to the volitional control; verticalization and training in walking on a flat surface; training in everyday activities of the unaffected limbs.

Intervention: An individual Rehabilitation program was applied, which includes positional therapy - frequent change of position in bed, including positions counteracting the spastic tendencies of the limbs, respiratory gymnastics with control of respiratory rate and oxygen saturation, active and passive exercises for the limbs, including balance and coordination, specialized techniques for neuromuscular reeducation, verticalization and training in walking with a walker, training in the activities of daily living.

The rehabilitation program was carried out along with monitoring of the vital signs, in compliance with all anti-epidemic measures and in accordance with the Helsinki declaration (1964) and after written informed consent of the patient.

RESULTS

The physical activity was assessed through functional tests, which were reported twice - before and after the rehabilitation course. The main vital signs: pulse, blood pressure, respiratory rate, oxygen saturation, orthostatic reactions were routinely monitored before, during and after the rehabilitation activities.

Upon admission to the rehabilitation ward, the patient was in satisfactory general condition, at times disoriented. The patient occupied a passive position in bed. The chest was symmetrical, and both halves of the lungs were taking equal part in breathing. Respiratory rate was 35/min. Rhythmic heart rate, (70/min.), blood pressure - 120/80, lower limbs - without swelling. Neurological status: moderate to mild paresis of the left upper limb and severe paresis to plegia of the left lower limb; Spastic increased muscle tone, pathological Babinski reflexes positive in the left. Pronounced dysmetria when performing finger to nose test, does not perform heel to shin test. Vertical to sitting position in the bed with help. Brunnstrom test result 0 for left lower limb, and 3 for upper limb. Locomotive test does not perform, Barthel index 15 points.

After rehabilitation, motor function testing proved improvement of motor skills, Brunnstrom

testing (to determine the stage of motor recovery) improvement from 0 to 1 for the lower limb and from 3 to 3+ for the upper limb, improved finger to nose test performance with left hand. Verticalized with a walker, the Barthel scale for everyday life activities from 15 points ("total" dependency) to 40 points ("severe" dependency) and a modified Borg CR10 Scale test to assess shortness of breath and dyspnea, chest pain and muscle skeletal pain from 4 to 2. He was discharged in a good general condition, with stable vitals and second group of motor activity, verticalized in a walker. Continuing home rehabilitation under the supervision of a Physical and Rehabilitation Medicine specialist in collaboration with a personal physician was recommended, and if necessary - consultations with a neurologist, pulmonologist, nephrologist, and cardiologist.

DISCUSSION

With the development of the COVID-19 pandemic, the scientific knowledge about both the acute respiratory syndrome and the strategies for treating the syndrome itself (21) and at the same time for treatment of pathological manifestations caused to other organs and systems of the body increased. There is growing evidence of neurological manifestations in patients with COVID-19. The observed neurological manifestations may be psycho-emotional, depression, neurasthenia, some patients have headache, dizziness, others have cerebrovascular disease, such as stroke: ischemic or hemorrhagic, intracranial hemorrhage, venous sinus thrombosis, demyelinating diseases, encephalitis, seizures, etc. (22).

In patients with cerebrovascular pathology and ischemic stroke, a previous, severe SARS-CoV-2 infection and several concomitant diseases have been identified, which probably makes these patients more susceptible to vascular events (22, 23), but they may also occur in young people and adults without concomitant cardiovascular pathology (24)

Gąsecka A. et al. (2021) reported the collection of increasing evidence showing a link between the severe clinical picture of COVID-19 and the increased risk of thromboembolism. One-third of the patients hospitalized for severe COVID-19 develop macrovascular thrombotic complications, including venous thromboembolism, myocardial infarction, and stroke (25).

Often, these patients have concomitant cardiac CVD and have 1.7 times higher mortality from COVID-19 than patients with chronic respiratory disease, although the respiratory system is the primary target of the virus (25, 26).

Due to the multisystem interference of COVID-19, the medical care requires a multimodal approach to the treatment and rehabilitation of survivors of the infection. The Stanford Hall consensus statement for post-COVID-19 rehabilitation, based on the recommendations of NICE (National Institute for Health and Clinical Excellence (UK)) emphasizes the fact that in some cases the full recovery will require comprehensive and multidisciplinary rehabilitation. It is recommended whenever it is possible to start early rehabilitation, preferably in the first 30 days (after the acute phase) with step-by-step (progressive) rehabilitation procedures (1).

Previous studies have noted that patients undergoing intensive care, including those using mechanical ventilation, are prone to developing muscle weakness and physical impairment (27), with changes in muscle atrophy and loss of muscle mass begins to develop in the first week (1). This should be considered especially in the rehabilitation of stroke patients after COVID-19, because in addition to the motor changes following the stroke, a general muscle weakness and deconditioning are added, which can slow down and complicate the recovery process.

According to literature data, the lower levels of physical function in the recovery period after acute infection are also associated with deteriorating quality of life of patients (28, 29).

The timely and earliest possible start of the rehabilitation consistent with the patient's clinical condition is very important for the success. The adequate assessment of the functional capabilities of the patient allows the gradual inclusion of physiotherapy methods that do not overload the

cardiovascular and respiratory systems, but at the same time are most effective.

Rooney S, et al (2020) share the opinion that special attention should be paid to the type and dose of exercise needed to achieve beneficial effects on the post-infectious condition and that exercise should be modified at different stages of recovery to optimize function recovery. In addition, attention must be paid to the way exercises are performed in order to ensure the safety and effectiveness of the intervention (29).
The early rehabilitation is an essential element of the treatment. Many of the complications after a stroke are related to immobilization, that is why the early rehabilitation is a very important element of the treatment (30).

In patients with stroke, it is necessary to begin rehabilitation measures after the overcoming the acute cerebral symptoms. The rehabilitation needs to be gradual and complex, corresponding to the recovery process. The rehabilitation procedures should take into consideration the established motor deficit, the degree of damage to the central nervous system, and the accompanying diseases of the patient. It is recommended that the rehabilitation is performed when functional recovery is fastest. It is considered that the duration should be at least 18 months following the accident. It is recommended to conduct complex rehabilitation courses several times per year, and after the 6th year - rehabilitation with annual physiotherapy courses (31).

The formation of a multidisciplinary rehabilitation team led by a Physical and rehabilitation Medicine specialist with the participation of various specialists (neurologist, cardiologist, pulmonologist, nephrologist, etc.) depending on the needs of the patient is an important prerequisite for the effectiveness of the rehabilitation process and provides comprehensive medical care to patients with stroke after COVID-19.

A very important participant in the rehabilitation process is the patient him/herself. His/her active participation and assistance is essential for the progress of the functional recovery. Increased levels of anxiety or refusal of assistance or partial assistance in the rehabilitation could adversely affect the result.

Patients diagnosed with COVID-19 can often experience anger, fear, anxiety, depression, insomnia, or aggression during the period of isolation treatment, as well as psychological problems such as loneliness, lack of cooperation, or refusal of treatment due to fear from the disease, all of which adversely affect treatment and rehabilitation (32-34).

The presence of cognitive dysfunction, fatigue, or depression in patients after COVID-19 may affect the outcome and effectiveness of rehabilitation (29).

The rehabilitation process must also consider the fact that the underlying disease may worsen or that unexpected complications from concomitant diseases may occur. Undoubtedly, these events can stop or slow down the rehabilitation process, but it should start as early as possible after the new situation is under control. The rehabilitation measures themselves should not lead to complications.

Early rehabilitation should be performed within the patient's tolerance level, including active/passive joint movements, turning in bed, breathing muscle training, expectoration efficiency training, posture control, standing, ADL training (34-36). It should be noted that in the early stages of severe disease, the aerobic exercise should be avoided as much as possible, as it may cause respiratory failure in patients (32).
It is anticipated that treatment of the consequences of the disease will potentially dominatethe medical practice for years, which predetermines the important role of Rehabilitation Medicine in the care and rehabilitation of post-COVID patients, including patients who have suffered a stroke after coronavirus infection (1).

In the process of rehabilitation, in addition to the clinical manifestations and motor deficits in patients with stroke, it is necessary to consider changes in the physical, mental, and social condition of the patients (31).

In preparing and implementing the rehabilitation program for the studied patient, the principles of

individual approach, gradualness, comprehensiveness were observed, and simultaneously with the active, passive, and specialized methods for neuromuscular reeducation, based on the experience gained in the rehabilitation of post-COVID patients, elements of respiratory rehabilitation were included. During the daily rehabilitation procedures, the general clinical condition of the patient and his connection with the psycho-emotional tone were considered. The acute bleeding from the urinary tract necessitated a change in the medical treatment plan, as well as in the applied rehabilitation measures. This necessitated a flexibility and adaptability of the applied means.

This particular paper which presents a clinical case has the following limitations. First, although cases of acute stroke have been reported in the literature following the COVID-19 infection, there may not be a causal relationship in a particular patient. However, the relationship between the diseases could be assumed based on persistent changes in the laboratory parameters of hemostasis and biochemistry, as well as the presence of more than double increased D-dimer. The clinical assessment is based on determining the rehabilitation potential by applying conventional tests: Brunnstrom scale, coordination, locomotion, Barthel Index, Borg Scale, which largely depend on the subjective assessment of the researcher. Nevertheless, these assessment methods are routinely used in the physiotherapy practice.

FINDINGS AND CONCLUSION

- The rehabilitation program for patients with post COVID-19 infection stroke requires an accurate assessment of the general condition and the degree of impairment of the motor activity.
- The formation of a multidisciplinary rehabilitation team led by a Physical and Rehabilitation Medicine specialist with the participation of various specialists (neurologist, cardiologist, pulmonologist, nephrologist, etc.) depending on the needs of the patient is an important prerequisite for the effectiveness of the rehabilitation process and provides comprehensive medical care to patients with stroke after COVID-19.
- The adequate combination of physiotherapy methods aimed at improving the lung function and respiratory recovery based on involvement of the nervous system leads to a reduction of the motor deficit and improved daily activity.
- Adverse reactions or complications of the existing pathology directly related to the rehabilitation were not observed.
- The applied individual rehabilitation program resulted in reduction in the degree of motor impairment, and improvement in Brunnstrom scale, coordination, locomotion, Barthel Index, and Borg Scale.

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