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Early and Late Rehabilitation After Stroke in Review: Definition, Classification, Methods and Effectiveness

Wczesna i późna rehabilitacja po udarze – definicja, klasyfikacja, metody i skuteczność: analiza danych literaturowych

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SUMMARY

Aim: We aimed to provide a complete narrative review of the definition, modern classification, methods, and effectiveness of early and late rehabilitation in stroke patients.

Materials and Methods: A comprehensive electronic literature search was performed on Scopus, Web of Science, MEDLINE, ScieLo, PubMed, The Cochrane Library, EMBASE, Global Health, CyberLeninka, RINC databases, and databases of government scientific libraries of Ukraine, European Union, United Kingdom, and the USA for the period 2014-2021. It was done to identify scientific publications that discussed the definition, modern classification, principles, methods, and effectiveness of early and late rehabilitation in stroke patients.

Conclusions: We provided a comprehensive narrative review of the definition, modern classification, methods, and effectiveness of early and late rehabilitation in stroke patients.

Key words: rehabilitation, stroke, classification, methods, effectiveness, review

Słowa kluczowe: rehabilitacja, udar mózgu, klasyfikacja, metody, skuteczność, praca poglądowa

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INTRODUCTION

Worldwide, stroke is a leading cause of death and long-term disability, being also a leading cause of dementia and depression [1-3]. According to the World Health Organization, 15 million people worldwide suffer a stroke each year [4]. Of these, 5 million dies, and another 5 million are permanently disabled [5-7]. Every two seconds, someone in the world has a stroke [8]. In the United States stroke affects someone every 40 seconds [9]. Every 4 minutes, someone dies of stroke [9-11].

Globally, one in four people over age 25 will have a stroke in their lifetime. [1, 12] There are over 80 million people currently living who have experienced a stroke [13]. Over 116 million years of healthy life are lost each year due to stroke-related disabilities and death [4] In addition, up to 15 percent of strokes occur in young adults and adolescents [14, 15]. On average, stroke occurs 15 years earlier in – and causes more deaths of – people living in low- and middle-income countries, when compared to those in high-income countries [16-19]. Compared with stroke in older

adults, stroke in the young has a disproportionately large economic impact by leaving victims disabled before their most productive years [4, 20].

Unlike some progress in acute stroke prevention and treatment, comprehensive rehabilitation of stroke patients is progressing more slowly and is not applied timely and widely. However, efficient stroke rehab improves psychosomatic status and functional recovery, prevents recurrent cerebrovascular events, improves the quality of life of the patient, and reduces disability and mortality [21-25]. Medical rehabilitation even helps patients with severe stroke and is economically justified [26].

AIM

We aimed to provide a review of the definition, modern classification, methods, and effectiveness of early and late rehabilitation after stroke.

MATERIALS AND METHODS

A comprehensive electronic literature search conducted on Scopus, Web of Science, MEDLINE, ScieLo, PubMed, The Cochrane Library, EMBASE, Global Health, CyberLeninka,

RINC databases, and databases of government scientific libraries of Ukraine, European Union, United Kingdom, and the USA for the period 2014-2021. It was performed to identify scientific publications that discussed the definition, modern classification, conditions, components, types, forms, stages, principals, methods, and effectiveness of early and late rehabilitation in stroke patients. The applicable articles are cited and referenced. No limit is placed on publication time or the language of the article. All relevant articles were identified and screened by three authors (MP, OF, and VM), and disagreements were resolved by consensus. The results are summarized narratively.

REVIEW AND DISCUSSION

The severity of stroke complications and each person's ability to recover vary widely. However, stroke rehabilitation helps the patient regain independence and improve quality of life.

According to the recommendations of the European Stroke Organization, all stroke patients should be referred to the stroke department for coordinated multidisciplinary rehabilitation (level of evidence A); early onset of rehabilitation is recommended (level of evidence C) [27]. In the case of a mild or moderate stroke, early discharge of a patient from the stroke department is possible with stable medical indicators, provided further rehabilitation by a multidisciplinary team in an outpatient setting (level of evidence A) [27].

DEFINITION

Neurological rehabilitation (re – again, habilitation – ability), commonly known as rehab, is a specialty that requires neurological knowledge and experience, as well as the acquisition of additional skills in rehabilitation medicine [28]. The goal of rehabilitation is to reduce the number of complications of acute cerebrovascular events/stroke, to achieve full or partial recovery of lost neurological functions, and achieve the maximum ability of the patient to lead a normal life [29].

Following conditions are necessary for the organization of effective rehabilitation work, namely [30]: the patient should not have severe somatic diseases; it is necessary to preserve the psyche, the activity of the patient because in the absence of contact, passivity – rehabilitation remedies are ineffective; active rehabilitation cannot be performed while the disease is progressing.

FORMS OF THE REHABILITATION AFTER STROKE

Acute rehabilitation is an intensive form of medical rehabilitation in which patients receive three or more hours of core therapies per day (physical therapy, occupational therapy, and speech therapy). In acute rehabilitation settings, patients are cared for by a team of clinicians from a wide variety of medical fields [31].

Subacute rehab is a less intense version of medical rehabilitation where three hours of rehab therapy a day are not required. Care is typically limited to the three core therapies – physical therapy, occupational therapy, and/or speech therapy, robot-assisted therapy [32].

TIME WINDOW FOR THE REHABILITATION AFTER STROKE

Early rehabilitation begins in the first hours after a stroke. It is carried out in the acute period of the disease and during the first 3-6 months after the acute cerebrovascular incident [28, 33]. At the *first stage*, it involves pharmacological correction of the dysfunction of the respiratory and cardiovascular systems, normalization of water-electrolyte and acid-base balance s, and psycho-emotional state of the patient, physical therapy (1st and 2nd modes), position treatment, breathing exercises, passive movements of the extremities, as well as early verticalization of the patient, taking into account his condition. At the *second stage*, the complex of rehabilitation measures that started during the first stage of rehabilitation is carried out in the rehabilitation department and includes therapeutic exercise (3rd and 4th modes), physiotherapy, massage, rehabilitation of motor and sensory deficits, occupational therapy (self-care skills training, work on training stands), psychotherapy, speech therapy classes, and social assistance. Infusion therapy at this stage takes a back seat. Important in this period is the work of nurses, physiotherapists, psychologists, and speech therapists.

Late rehabilitation is carried out 6 months after the stroke and provides an optimal adaptation of the patient to social life in order to reduce the severity of a neurological deficit and a disability. It lasts for 2-3 years or more. Basically, this rehabilitation is carried out at the patient's place of residence. It is important that late rehabilitation stays continuous. According to the European Stroke Organization recommendations, it is advisable to continue rehabilitation during the first year after discharge from the hospital (level of evidence A), increasing the duration and intensity of rehabilitation measures (level of evidence B) [27].

ASPECTS OF THE REHABILITATION AFTER STROKE

The most important components of medical and social rehabilitation include medical, physical, psychological, professional, and social aspects [34].

The *medical aspect* of rehabilitation includes medical, medical-diagnostic, treatment, and preventive actions [35]. It starts with an early diagnosis and timely hospitalization of the patient, early use of pathogenetic therapy, and secondary stroke preventive medicine [36]. Prevention of complications associated with an acute cerebral event is also crucial in the effectiveness of rehabilitation measures.

The *physical aspect* of rehabilitation is a restorative treatment, which includes all actions related to the use of physical factors, physical therapy (exercise in the ward, exercise room, gym, and pool; various types of mechanotherapy, gymnastics, yoga, Pilates, etc.), manual and reflexotherapy, chiropractic, psychotherapy, as well as research methods that reflect the body's response to the applied rehabilitation measures [37]. The main goals of physical rehabilitation are acceleration of recovery processes and prevention or reduction of the risk of disability. It is impossible to provide functional recovery without taking into account the body's natural desire to move (kinesophilia). Therefore, therapeutic exercise, various types of massage, and hardware physiotherapy should be the main link in the rehabilitation of these patients [38].

The *psychological aspect* involves overcoming the negative reactions of the psycho-emotional status of the patient, which arose in connection with the disease. It has a significant positive effect on the restoration of functions and recovery of the patient [39, 40]. The most important tasks of psychological rehabilitation are: accelerating the normal process of adaptation to a new, disease-induced life situation and prevention of development and treatment of pathological mental changes. The main methods of optimizing the mental status of a patient include psychotherapy and pharmacotherapy [41].

The *professional aspect* of rehabilitation involves the successful restoration and maintenance of ability to work, which is derived from many factors such as a proper medical examination of working capacity, rational employment, systematic differentiated medical treatment of the underlying disease, as well as the implementation of the program aimed to increase the physical and mental tolerance of the patient [42, 43]. Achieving the state of recovery depends on rehabilitation measures, and is the most striking criterion for the effectiveness of rehabilitation [44].

The *social aspect* of rehabilitation states that the purpose of recovery is not only the desire to return the patients to their former state but also to develop their physical and mental functions to optimal levels [45]. This means restoring the patients' independence in everyday life; returning them to their former job or, if possible, preparing them for another full-time job appropriate to their physical capabilities.

It is important to notice, that the solution of the issue of employment of the patients to the appropriate type of work in their specialty or to perform other work gives them the opportunity of material self-sufficiency. Thus, this aspect of rehabilitation refers to the area related to working capacity, employment, the relationship between the patient and society, the patient and his family members, and so on.

PRINCIPLES OF THE REHABILITATION AFTER STROKE

In the guide to the rehabilitation of patients who have suffered a stroke, the basic principles of rehabilitation are formulated, as follows [28, 46]:

- The *principle of partnership* provides for the cooperation of the patient and the medical doctor in the leading and guiding role of the medical doctor, which allows targeting psychological preparation for rehabilitation, the success of which depends on the activity of the patient.
- The *principle of the versatility of efforts*, the basis of which is the implementation of medical-pedagogical and therapeutic-restorative tasks under the condition of restructuring the patient's personality in the direction necessary for rehabilitation tasks.
- The *principle of unity of psychosocial and biological methods of action* (complexity of the application of medical and restorative measures).
- The *principle of gradation of influences* is based on the step-by-step prescription of restorative measures taking into account dynamics of a functional condition of the patient, his age, sex, and tolerance to increasing physical activity.

TYPES OF THE REHABILITATION AFTER STROKE

The three main types of rehabilitation therapy are *occupational, physical, and speech* [28, 47]. Each form of rehabilitation serves a unique purpose in helping a person reach full recovery, but all share the ultimate goal of helping the patient return to a healthy and active lifestyle.

METHODS OF THE REHABILITATION AFTER STROKE

The main methods of rehabilitation after a stroke are, as follows:

- *For patients with a motor dysfunction*: kinesiotherapy, including gait training; home rehabilitation, training in self-care skills (can be included in the course of kinesiotherapy) [48]; electrical stimulation of the neuromuscular system [49]; combating spasticity, including taking muscle relaxants, thermal treatments (paraffin, ozokerite applications), selective or acupressure [50]; prevention of contractures arising due to the post-stroke trophic changes of joints (arthropathy), including heat treatment (paraffin applications, ozokerite), analgesic electrophysiotherapy (exposure to sinusoidal modulated currents, diadynamic currents), phonophoresis of drugs; orthopedic measures with the use of splints, special devices for walking, orthopedic shoes.
- *In case of speech disorders*: classes with a speech therapist-aphasiologist on language restoration, reading, writing, arithmetic.
- *For patients with central post-stroke pain syndrome*: administration of antidepressants, carbamazepine in individual dosage; psychotherapy, the elements of which are included in kinesiotherapy, the work of a speech therapist, aphasiologist, neurologist-rehabilitation specialist.
- *For additional methods of rehabilitation* it is recommended to include: biocontrol with feedback on electrochemograms for hemiparesis; biocontrol with feedback on the stabilogram in case of imbalance and gait; acupuncture and/or electroacupuncture for muscle spasticity and pain; occupational therapy in specially equipped workshops; psychotherapy conducted by a psychotherapist.

SETTINGS FOR THE REHABILITATION AFTER STROKE

The rehabilitation system in Middle and Eastern Europe includes three main stages: hospital; outpatient; sanatorium [28]. Worldwide, the following acute and subacute rehab settings are recognized: Acute Care Rehab Setting, Subacute Care Rehab Setting, Long-term Acute Care Rehab Setting, Home Health Care Rehab Setting, Inpatient Care Rehab Setting, Outpatient Care Rehab Setting, School-Based Rehab Setting, Skilled Nursing Facility Rehab Setting [27].

EFFECTIVENESS OF THE REHABILITATION AFTER STROKE

Unfortunately, the effectiveness of early and late rehabilitation has not been sufficiently studied as it is ethically difficult to conduct such a study. However, limited evidence has been obtained that the early versus delayed inpatient stroke rehabilitation directly leads to improved functional outcomes [51]. At the same time, there is strong evidence that interdisciplinary rehabilitation leads to improved functional

outcomes and reduces mortality [52]. Such functional improvements persist for a long time (more than one year). Speech disorders, such as aphasia and dysarthria, improve more effectively after a stroke at the end of the acute period and during the first 6 months after the disease onset.

Rehabilitation is necessary for patients after stroke even in the absence of neurological deficit [26]. The need for comprehensive multidisciplinary rehabilitation is substantial and improves patient's well-being, quality of life, and life expectancy [21, 51, 52].

According to the European Stroke Organization, rehabilitation is indicated for all patients with stroke, and the main elements of it are, as follows: therapeutic exercise; occupational therapy; assessment of the communication defect; providing information to patients and caregivers; assessment of cognitive impairment; observation of patients to detect depression during the hospital stay and after discharge; drug and non-drug therapy to improve mood; drug therapy in case of post-stroke emotional lability and post-stroke spasticity [27].

It's common for stroke rehabilitation to start as soon as 24 to 48 hours after stroke in an acute care facility, if no contradictions. There is convincing evidence that increasing the intensity of rehabilitation leads to the improved functional status of patients in a shorter time, and this effect lasts for 5 years [28, 52]. Two meta-analyses have shown that the more active a patient is, the better the rehabilitation results will be, but there are no specific recommendations for the intensity and duration of treatment today [53].

There are many approaches to stroke rehabilitation that depend on the severity of a stroke and the type of ability affected [27-31, 33, 38, 46, 51]. The main of them might be summarized, as follows:

- *Physical*: motor-skill exercises to improve muscle strength (including strengthening of swallowing) and coordination; mobility training to teach patient to use mobility aids, such as a walker, canes, wheelchair or ankle brace; constraint-induced therapy; range-of-motion therapy to ease spasticity and help regain range of motion.
- *Technology-assisted physical*: functional electrical stimulation; robotic technology to assist impaired limbs with performing repetitive motions, helping to regain strength and function; wireless technology; a virtual reality that involves interacting with a simulated, real-time environment.
- *Cognitive and emotional*: therapy for cognitive disorders, communication disorders, speech therapy; psychological evaluation and treatment and medication.
- *Experimental therapies*: noninvasive brain stimulation; biological therapies, such as stem cells; alternative medicine such as massage, herbal therapy, acupuncture, and oxygen therapy.

The duration of stroke rehabilitation depends on the severity of a stroke and related complications. Some stroke survivors recover quickly but most need long-term stroke rehabilitation, lasting months to years. Stroke rehabilitation plans should be individual, flexible, and vary during the recovery based on patient needs.

At the same time, a healthy psychological climate in the patient's family (the creation of which should be greatly facilitated by explanatory conversations with the patient's relatives) plays a significant role in stroke recovery [26, 27, 30]. The family should, on the one hand, provide psychological support to the patient, help to create an optimistic mood, and on the other, help to form a realistic approach to assessing the existing disease, opportunities, and limits of recovery.

Return to work is an attainable goal for patients with stroke [42-44]. However, if the patient is not able to return to work, it is necessary to involve him in household chores, to help him find an interesting hobby, to involve him in various cultural and social events.

CONCLUSIONS

Implementing a rehabilitation program is especially important among the working population, helping such individuals to return to the community as soon as possible and resuming daily activities. Therefore, early mobilization of the patient after stroke is a necessary condition to prevent severe complications in the future.

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Conflict of interest:

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A – Research concept and design, B – Collection and/or assembly of data, C – Data analysis and interpretation, D – Writing the article, E – Critical revision of the article, F – Final approval of article

Informacja prasowa

KOMPLEKSOWE LECZENIE I REHABILITACJA

w 21 Wojskowym Szpitalu Uzdrawiskowo-Rehabilitacyjnym SP ZOZ
w Busku-Zdroju

21 Wojskowy Szpital Uzdrawiskowo-Rehabilitacyjny w Busku-Zdroju (21WSzU-R) jest Samodzielnym Publicznym Zakładem Opieki Zdrowotnej. Kompleks Szpitala położony jest w pięknej, południowej części miasta, tj. części zdrojowej pomiędzy ulicą Feliksa Rzewuskiego i Szymona Starkiewicza. W ciszy, spokoju z dala od miejskiego zgiełku. Świadczymy usługi w zakresie kompleksowej rehabilitacji i leczenia uzdrawiskowego.

Szpital prowadzi działalność profilaktyczną, leczniczą i rehabilitacyjną. Głównym wskazaniem do rehabilitacji są choroby narządu ruchu pochodzenia: reumatoidalnego (choroba zwyrodnieniowa stawów, reumatoidalne zapalenie stawów i inne), neurologicznego (zespoły bólowe kręgosłupa w przebiegu dyskopatii i choroby zwyrodnieniowej, stany po udarach mózgu z zachowaną zdolnością samoobsługi i inne), ortopedycznego (zespoły pourazowe narządu ruchu, choroba zwyrodnieniowa kręgosłupa stawów i inne), choroby skórne (łuszczyca i inne), choroby naczyń obwodowych i układu krążenia (niedokrwienie kończyn dolnych w przebiegu miażdżycy, łagodne nadciśnienie tętnicze i inne), choroby metaboliczne (dna moczowa).

Proces kompleksowej rehabilitacji pacjentów realizowany jest w nowoczesnym Zakładzie Przyrodolecznym.

Łącznie oferujemy ponad 50 rodzajów zabiegów fizjoterapeutycznych.

Naturalnym tworzywem leczniczym stosowanym w 21WSzU-R są buskie wody siarczkowo-siarkowodorowe słone.

Korzystne działanie kąpeli w ww. wodach potwierdzają obiektywne badania naukowe oraz opinie kuracjuszy korzystających z leczenia w Busku-Zdroju. Wśród zabiegów balneologicznych są także zawiązania tj. okłady borowinowe częściowe, kąpiel mineralna jodkowo-bromkowa oraz kąpiel kwasowęglowa sucha.

Kinezyterapia czyli leczenie ruchem jest jednym z najbardziej efektywnych zabiegów pozwalającym odtworzyć lub maksymalnie usprawnić utraconą funkcję ruchową. W indywidualnej pracy z pacjentem stosujemy uznane metody terapeutyczne McKenzie'ego, PNF, S-E-T, techniki terapii manualnej, kinesiologii tapping. Wykorzystywane są również nowoczesne urządzenia diagnostyczno-treningowe z biofeedbackiem, umożliwiające obiektywizację procesu usprawniania. Dużym atutem 21WSzU-R jest personel, zespół lekarzy oraz doświadczonych fizjoterapeutów. Dbając o wysoką jakość świadczonych usług medycznych fizjoterapeuci systematycznie podnoszą swoje kwalifikacje zawodowe i doskonalą się uczestnicząc w konferencjach, szkoleniach i kursach.

(www.szpitalwojskowy.pl)