

Speech Therapy as a Component of Comprehensive Rehabilitation of Patients with Acute Impairment of Cerebral Circulation

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Abstract: *The article reveals the essence of speech and speech therapy as a component of the rehabilitation process in restoring the health of patients who have suffered acute impairment of cerebral circulation. The concept of cerebral vascular insufficiency was analyzed, which refers to cerebral physiological changes in old age and associated conditions of speech impairment. Vascular diseases of the brain are not only a medical problem, but also a social one: they cause enormous damage to the economy, considering the costs of treatment, medical rehabilitation, and losses in production. The effectiveness of motor recovery after an ischemic stroke in the early recovery period depends largely on timely rehabilitation. Physical exercises have a positive effect on the recovery of the body systems of people who have had an ischemic stroke.*

The most frequent consequences of stroke in about 40-50% of the total number of patients are disorders of speech function, manifested in the form of aphasia and dysarthria, which are often combined with pathology of other higher mental functions (various types of agnosia and apraxia).

Today, speech therapy is practiced by specialists both as a separate method and in combination with other techniques, and is used in individual and group work, including work with patients who have had an acute impairment of cerebral circulation.

Keywords: *Stroke; speech disorders; physical therapy; speech therapy.*

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Introduction

Acute impairment of cerebral circulation leads to stroke, which is the third leading cause of death worldwide and the main cause of formation of permanent primary disability. On average, no more than 55% of patients survive for 5 years after acute stroke. One of the main concerns of a stroke patient is to return to an active life and physical rehabilitation, which makes up the general post-stroke rehabilitation, helps to restore independence and improve the patient's quality of life.

Post-stroke rehabilitation should begin as early as possible after a vascular accident, usually in the acute period after the patient's general condition has stabilized (mostly within 24-48 hours after the stroke). The earlier the patient receives rehabilitative interventions, the greater the chances of restoring impaired or lost abilities and skills.

The goal of rehabilitation is to help stroke patients regain the skills they have lost as a result of damage to part of the brain through retraining. It is also important to develop, maintain, and restore as much as possible the patient's motor and functional abilities when they are impaired or lost due to aging, trauma, disease, or negative environmental influences.

The duration of the rehabilitation process is individual for each individual and depends on the severity of the stroke, comorbidities, and the timing of rehabilitation care from the onset of the disease. Although some patients recover fairly quickly, most patients require long-term rehabilitation that may last for months or even years (Behas et al., 2019; Kim et al., 2021; Kimble & Ellor, 2001; Nenko et al., 2022; Sarancha et al., 2021; Taran et al., 2020).

Rehabilitation is an important part of recovery for many stroke survivors. The aftermath of a stroke can mean that the patient must change, rethink their philosophy, and learn how to live. And it is physical rehabilitation after a stroke that can help return to independent living. This requires offering the patient an individual rehabilitation program, competently and reasonably designed by rehabilitation specialists (kinesitherapists, occupational therapists, language therapists).

Cerebral circulation impairment as a neurological problem

Hemodynamic vascular insufficiency develops in the tissues when the perfusion pressure changes and decreases relative to the vascular resistance. Thereafter, a decrease in blood flow may occur, causing ischemic

hypoxia. Cerebrovascular insufficiency is analogous to coronary insufficiency. In turn, it may cause episodic focal neurological states in cases with no apparent vascular occlusion. Cerebrovascular insufficiency may contribute little to episodic neurological disorders, but it may be crucial in age-related changes in mental function. One can imagine that subacute, prolonged or intermittent ischemia (with the consequence of hypoxia) can lead to diffuse degenerative changes in the brain, leading to behavioral and intellectual disorders. Acute hemostasis and tissue infarction are not the only consequence of cerebrovascular insufficiency. Ischemic hypoxia occurs involving histological, ultrastructural and cytochemical changes. Impairment of higher integrative functions depends on the wide cerebral spread of such effects and their accumulation over time. The concomitant onset of anemia or pulmonary insufficiency, common in the elderly, can easily exacerbate the underlying hypoxia.

Obrist W. D. (1972) notes that the role of cerebrovascular insufficiency in the development of intellectual impairment in old age is important enough and emphasizes the need to assess circulatory states of the brain. Cerebrovascular disease is directly related to aging intellectual changes.

Acute cerebral circulation impairments are a major cause of morbidity, mortality, long-term disability, and disability in society. They are also the second most common cause of dementia, the most common cause of epilepsy in adults, and a frequent cause of depression.

Stroke is an acute disorder of the cerebral circulation. There are two varieties of this disease - ischemic and hemorrhagic stroke. Approximately 80% of all stroke cases occur in the ischemic form. The mechanism for the development of this form of stroke is as follows: the blood supply is blocked, resulting in less blood flow to the brain. The remaining 20 cases are hemorrhagic strokes, which occur differently: the vessel wall ruptures and blood pours into brain tissue or nearby tissues.

An ischemic stroke is an acute insufficiency of the cerebral circulation, resulting in impaired neurological function. Among the diseases that lead to the development of cerebral infarction, the first place is occupied by atherosclerosis affecting the main cerebral vessels of the neck or the intracranial vessels or both at the same time.

Risk factors for stroke are over 50 years of age; arterial hypertension; heart disease, especially those accompanied by arrhythmias; diabetes mellitus; smoking, alcohol abuse; obesity. In the case of ischemic stroke, the consequences can range from very severe, with a large ischemic stroke, to

minor, with microstrokes. It all depends on the place of localization and the volume of the focus of the disease.

Every year cerebral stroke develops in 5.5-6 million people, 4.5 million of them die, i.e. the population of an average European country by area. In the structure of cardiovascular pathology, strokes began to prevail over myocardial infarctions in terms of frequency by about 30%. This phenomenon has been called the "stroke paradox". A convincing explanation of this phenomenon is the link between stroke and life expectancy. Scientists at Oxford University found that the mortality rate from all types of stroke during the first week is 12%, in the first month - 19%, in the first year - 31%. The highest mortality rate is observed in large strokes in the carotid basin - up to 60% in the first year.

Several studies, including Johnston S. C., Mendis, S., & Mathers, C. D. (2009) analyzed stroke-related mortality. This analysis presents a proportional relationship between a country's low economic development and the increased medical and social burden of causing strokes in that country. At the same time, the difference between the richer and poorer countries was tenfold. The consequence of stroke is often permanent disability. Of all stroke patients, about 60% become disabled, who are able to serve themselves, 19-35% are completely dependent on others and only 15-20% return to work.

Also cerebral circulation impaired occurs in acute craniocerebral injury and is due to its severity (Safin et al., 2007). In studies of Shcherbatyi A. A., Korkushko O. O., and Chupryna H. M. (2000) showed the effect of low doses of ionizing radiation on the development of various cerebrovascular disorders. The results of examination of 120 patients with initial forms of cerebrovascular insufficiency, who were victims of the Chernobyl accident, with analysis of the most important clinical manifestations in patients are presented. The results of treatment of patients by laser puncture technique are presented, its high efficiency in the complex of therapeutic measures carried out in patients with initial forms of cerebrovascular insufficiency is shown.

If we talk about the causes of stroke, coronavirus infection COVID-19 caused by SARS-CoV-2 is now a serious threat. Pizova, N.V. et al (2020) note in their study that neurological disorders detected in patients with coronavirus infection have a wide range of clinical signs: headaches, dizziness, altered level of consciousness, acute ischemic stroke, intracerebral hemorrhage, venous sinus thrombosis of the brain. In people with vascular

risk factors, COVID-19 was more common, and mortality rates were higher among such people. Various possible and not mutually exclusive mechanisms that may play a role in the development of ischemic stroke in patients with COVID-19, including a hyperinflammatory state ("cytokine storm"), "COVID-19-associated with coagulopathy" and disseminated intravascular clotting syndrome have been described in detail. Risk factors of stroke associated with critical condition in these patients are presented. The results of observation of patients with acute cerebral circulation impairment in specialized vascular centers 2 months before and 15 days after quarantine through COVID-19 are presented.

Physical therapy for patients with stroke

To date, the problem of rehabilitation of stroke patients has not been fully studied. Despite all the variety of techniques for restoring the lost functions in patients with brain stroke, today there is no unified system of differentiated use of means and methods of therapeutic physical training, taking into account not only the peculiarities of the development of a brain stroke, but also peculiarities of motor function development in norm during ontogenesis, stages of spontaneous functional recovery after brain stroke, possibilities of rational combination of advantages of different treatment methods (kinesotherapy) during treatment of an individual particular patient.

Neurorehabilitation is a field of neuroscience and practice that requires specialists to have knowledge of neuroanatomy, neurophysiology, psychophysiology, neurology, psychiatry, neuropsychology and neurodefectology, a neurosociological component, and finally an understanding of the laws of neuroeconomics (Behas, 2019; Demchenko et al., 2021; Nenko et al., 2022; Onishchuk et al., 2020; Sarancha et al., 2021).

According to Bowler J.V. (2004), 1 month after the development of stroke only 55% of patients are able to move freely on their own, in 2 months - 79%. 6 months after the development of stroke, there are still impairments that affect activity in daily life: impaired pelvic function is noted in 7-11% of patients, 33% cannot eat independently, 31% cannot dress themselves, 49% cannot take a bath; 19% of patients cannot move from a bed to a chair independently, 15% cannot walk. 15% of patients experience significant difficulties in communication. Stroke affects not only motor and sensory functions, but is also a powerful risk factor for cognitive impairment and dementia. The combination of physical and cognitive impairment

significantly slows or prevents recovery of impaired functions, and also increases the patient's dependence on others.

S. Paolucci et al (2003) believe that women have less effectiveness in post-stroke rehabilitation than men. They suggest that men, regardless of age, have greater muscle strength and tend to be more active than women. The same authors note that the rate of good rehabilitation outcomes gradually decreases with increasing patient age, from 64% in patients younger than 50 years old, to 27% in older people.

In addition, the study of Al-Waili, N.S., Butler, G.J., Beale, J. et al (2005), regarding hyperbaric oxygen therapy (HBO), which is used to treat patients with numerous diseases, including stroke, is quite interesting. This treatment has been shown to reduce cerebral edema, normalize water content in the brain, reduce the severity of infarction, and maintain the integrity of the blood-brain barrier. HBO therapy attenuates motor deficits, reduces risks of consequences and prevents recurrent cerebral circulatory impairments, leading to improved outcomes and survival. Hyperbaric oxygen also accelerates regression of atherosclerotic lesions, promotes antioxidant protection and suppresses proliferation of macrophages and foam cells in atherosclerotic lesions.

In impaired cerebral circulation the use of angiotensives (in atherosclerosis of the great brain artery, arterial hypertension), indirect anticoagulants (in atrial fibrillation), statins (Maksimova et al., 2012) is quite effective. Patients with impaired cerebral circulation reveal an increased frequency of autoantibodies to gamma-synuclein (Roman et al., 2017).

The main consequences of ischemic stroke are: mental disorders; impaired sensitivity in the limbs and face; impaired motor function; impaired speech; impaired coordination. The main motor disorders after cerebral stroke include paralysis and paresis (usually unilateral hemiparesis) with decreased strength and limitation of movements in the limbs, impaired tone and sensitivity. Timely treatment of neurological defects, early use of physical rehabilitation methods such as massage, kinesotherapy, physical therapy, reflexology, biofeedback management and manual therapy are of great importance in the recovery of patients with motor disorders after ischemic stroke of the brain.

Speech therapy after a stroke

Recovery of speech disorders and swallowing disorders is a complex of medical and psychological measures aimed at the full or partial recovery

of impaired and (or) compensation for the lost functions of swallowing, speech and voice during an acutely developed disease, as well as early diagnosis and correction of possible disorders of voice, speech and swallowing functions; reduction of the degree of possible disability, improvement in quality of life, maintaining the ability to work and his social integration into society.

The primary task is to determine the route for recovery of impaired speech functions in patients with acute cerebral circulatory impairments; the content of corrective work is determined by the localization and severity of the brain lesion. Often, along with aphasia and dysarthria, there are movement disorders, inability to orient oneself in space, disorders of memory, thinking, and attention.

Speech disorders are one of the main manifestations of brain damage, often developing in patients after a stroke, brain injury, neuroinfection, which is explained by changes in the brain due to the diseases. Many patients have impairments of higher cortical functions, including language, reading, writing, counting, voice, and swallowing, due to lesions in one or another part of the brain. And cognitive, joined emotional disorders further aggravate the picture of the disease, which leads to patients becoming disabled and making it impossible for them to integrate into the social environment.

Various forms of aphasia, dysarthria, dysphagia, and their combined pathology require rapid and competent work of the entire multidisciplinary team. Despite the availability of technical means of examination, the theory and methods of logopedic diagnosis and logotherapy are becoming more and more in demand for all doctors involved in patient treatment and expertise.

Assessment of these disorders in dynamics allows you to determine the rehabilitation potential of patients, make long-term and short-term plans of speech therapy assistance and provide the maximum qualified assistance in the shortest possible time.

McLafferty C. (2016) points out that in the decades since Frankl originally formulated his theory of logotherapy, technological and medical advances have increased the responsibility of caregivers of those diagnosed as "dead brain" or in a persistent vegetative state.

Stroke patients who have been hospitalized are 30-40% depressed. Cognitive therapy and family psychoeducation are recommended for depressed and helpless stroke patients, which increases the ability to change negative thinking (Ramadia et al., 2021).

Eric Pfeifer (2021) notes that in logotherapy and existential analysis, the human will to meaning is considered the primary motivation for human life. This meaning-centered approach in psychotherapy, founded by Viktor Emil Frankl, is often referred to as the Third Vienna School of Psychotherapy. Although the evidence suggests that meaning can be actualized through music, music therapy has so far focused little on the concepts and theory of logotherapy and existential analysis. This contribution fills that gap by introducing a meaning-oriented approach to music therapy and adapting Frankl's model of meaning realization to music therapy.

Speech disorders after a stroke occur due to lesions of the speech cortical areas and their leading pathways. Depending on the localization and size of the affected area, language disorders may manifest as aphasia:

1. Motor aphasia: Afferent - manifests itself in the disintegration of individual articulatory postures, or otherwise, articulations. In the speech of patients, it manifests itself in the search for articulation. Efferent - speech becomes disjointed, accompanied by getting stuck on individual fragments of expression. The patient pronounces individual sounds relatively easily, but has significant difficulty pronouncing words and phrases.

2. Sensory aphasia. Phonemic hearing disorder, which causes severe impairment of impromptu language comprehension. Sounds lose their stable sound and are perceived distorted each time, mixed with each other in one way or another.

3. Dynamic aphasia. The language defect manifests itself in language spontaneity and inactivity. Their language is characterized by poverty, one-syllable answers in dialogue.

4. Amnesic disorders. Patients lose the ability to retain information perceived by ear, narrowing of memory.

5. Semantic aphasia. That is, the inability to perceive complex logical and grammatical patterns of speech.

It takes a very long time to recover speech functions, on average 2-3 years, and in some cases up to 6 years. The effectiveness of treatment depends largely on how quickly the rehabilitation process begins and the methods of treatment. For resumption of speech after a stroke, work with a speech therapist should begin in the first three months after the stroke. As a rule, the form of the disorder and its degree can be determined after a few weeks, and already at this time it is possible to outline a basic program and select a set of exercises.

Speech rehabilitation after a stroke is a necessary part of a comprehensive program of renewal training. It should be remembered that the ability to speak will not return to a person spontaneously - it can only be achieved by daily exercises with specialists in an individual program, depending on the language pathology. The method and duration of the sessions are determined individually.

Speech therapy after a stroke at the rehabilitation center is conducted by qualified speech therapists, aphasiologists, and clinical psychologists. After a preliminary diagnosis and examination of the patient, specialists prepare an individual program for restoring language and other higher mental functions. Consultations are also held with the patient's relatives, including sessions at home.

The task of the speech therapist:

- carry out an initial neuropsychological examination of speech and other higher mental functions of patients, carry out a detailed qualitative assessment of the identified symptomatology in a prescribed form;
- carry out logopedic, neuropsychological, pathopsychological, and express diagnostic examinations;
- determine the strategy and tactics of neurorehabilitation. Together with physicians, a therapeutic exercise specialist, develop programs for the neurorehabilitation of patients, taking into account their individual characteristics and the state of higher mental functions;
- perform dynamic observation with a qualitative assessment of the state of language and other higher mental functions within the course of neurorehabilitation in order to adjust the patient's individual neurorehabilitation program;
- evaluate the effectiveness of treatment and rehabilitation at different stages;
- carry out consultative work with the patient's immediate family for the purpose of specialized psychological and neurologopedic assistance;
- carry out prognostic evaluation of neurorehabilitation.

Thus, based on the structure of the defect, we can say that the main speech therapy work will be built on the following main areas:

1. Pre-language training.
2. Disinhibition of expressive speech.
3. Development of correct speech breathing.
4. Development of melodic and intonational characteristics of speech.

Pre-language training - training to master the sound side of the native language, directly to speech. This includes the teaching of mosaics, making patterns out of cubes, elements of drawing (shading, connecting by dots, drawing by squares, finishing drawing pictures on a template). Exercises for the development of fine motor skills - molding from plasticine or marzipan, assembling puzzles, weaving from colored (chenille) wire, massage palms and fingers with a special hard mat or a ball. Special devices are also widely used - wooden figures, sorters, laces, work with wooden beads, sorting small objects (buttons, coffee beans, beans, etc.).

In terms of corrective measures, appropriate training also includes articulation exercises and speech therapy massage.

A set of articulation exercises is chosen individually, based on the structure of the defect. The exercises are performed by the patient in front of a mirror, since it is difficult for the patient to coordinate the movements of the lips or tongue without visual control. The articulation exercises, if possible, use the "Mirror" exercise, when the speech therapist asks the patient to repeat his movements, that is, to be his "mirror" - to frown, raise the eyebrows, stretch the lips in a smile or fold them into a tube, etc.

Articulation exercises are performed by the patient himself, the duration of the exercises is about 15 minutes, if possible 2-3 times a day. Pronunciation of the sounds of the tongue is ensured by the coordinated work of the lips, tongue, lower jaw, larynx, pharynx and lungs. All these organs are under the control of the motor zones of speech in the cerebral cortex. Abnormalities in the structure of the articulatory apparatus, such as increased tone of the speech musculature, insufficient or incorrect innervation are the causes of the incorrect formation of pronunciation. With dysarthria, the sound, tempo, expressiveness of speech, its modulation suffer especially. In a complex system of corrective measures, speech therapy massage is ahead of articulation, voice and breathing exercises. The correct selection of a set of massage exercises promotes the normalization of the muscle tone of the articulation organs, which improves their motor skills, which contributes to the recovery of the pronunciation side of speech. The techniques of speech therapy massage vary depending on the pathological symptomatology in the muscular system of speech disorders. It is important to use additional means of massage - speech therapy probes, spatulas, etc. The purpose of a logopedic massage is to eliminate or reduce the pathological symptoms of the speech apparatus. The main objectives of a

logopedic massage for the correction of the pronunciation side of speech in dysarthria are distinguished:

- normalization of muscle tone, overcoming hypo- or hypertonicity in the articulation and mimic muscles;
- elimination or reduction of pathological symptoms;
- improvement in the accuracy, volume, and switching of articulatory movements;
- increase in the strength of muscle contractions;
- activation of subtle differentiated movements of the articulation organs, necessary for correction or recovery of pronunciation.

Massage directly and reflexively affects different systems of the body.

The use of logopedic massage can significantly reduce the time of correctional work, especially on the formation of the pronunciation phase of speech. If the patient has pronounced neurological symptoms, the use of only speech therapy massage, especially at the initial stages of correctional work, can provide a stable positive effect.

A characteristic feature of dysarthria is impaired vocal sound formation due to impaired innervation of the laryngeal muscles. The voice in dysarthria is usually weak with impaired modulation. With weakness of the muscles of the vocal apparatus vibration of the vocal cords is disturbed, because the strength of the voice becomes small.

Pronunciation of words in a whisper and at the top of his voice, singing familiar tunes.

Thus, even with the same forms of dysarthria, the clinical picture of disorders is not the same, so the correction plan in each case will be individual.

Psychological and logopedic work with dysarthria is very time-consuming, diversified and requires systematic sessions with specialists and home exercises, as well as a lot of time and consistent application of a system of special exercises.

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