



**MODERN VIEW OF PHYSICAL THERAPY IN PEOPLE WITH  
INTRACRANIAL BRAIN TUMORS IN THE POSTOPERATIVE PERIOD  
СУЧАСНИЙ ПОГЛЯД НА ФІЗИЧНУ ТЕРАПІЮ У ЛЮДЕЙ З  
ВНУТРІШНЬОЧЕРЕПНИМИ ПУХЛИНАМИ МОЗКУ В ПІСЛЯОПЕРАЦІЙНОМУ  
ПЕРІОДІ**

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**Abstract.** *Background: Combating malignant brain neoplasms is among the major health care challenges in Ukraine, with high relevance of this issue stemming from its constantly increasing incidence rate, difficulties with timely diagnosis, high costs and complexity of treatment, and increased rates of patient disability and mortality. Introduction of up-to-date surgical intervention methods contributes to a significantly improved prognosis of treatment and encourages the development of comprehensive rehabilitation methods for patients with this nosology, among which a certain role is to be played by physical therapy measures.*

*Objective: To identify the challenging issues of physical therapy in persons with brain tumors in the postoperative period.*

*Sample: Online information resources, specialized periodicals of Ukraine and foreign specialized publications, Medline, PubMed, Medscape, Cochrane Library databases were analyzed.*

*Methods: theoretical analysis, synthesis and generalization of data from research and methodological literature on the use of physical therapy measures in patients after brain neoplasm removal.*

*Results: The analysis of available literature found no specific methodological recommendations for programming of physical therapy measures in persons with intracranial brain tumors in the postoperative period.*

*Conclusions: Research and methodological literature addresses the use of physical therapy measures in the postoperative rehabilitation of brain tumor patients in a highly restricted manner, and this highlights the need for further scientific research in this area.*

**Key words:** *Brain Tumor, Physical Therapy, Postoperative Period*

## **INTRODUCTION**

The world is experiencing an increase in the incidence of brain tumors. Neuroepithelial tumors - gliomas diagnosed in 55% of patients (Polishchuk, 2019) account for a significant proportion of tumors which are commonly known as primary brain tumors. According to the Central Brain Tumor Registry of the United States (CBTRUS), the incidence rate of primary central nervous system tumors in the U.S. ranges from 2.3 to 23.41 (age-specific) cases per 100,000 inhabitants, and the mortality rate - from 0.5% to 20.2% cases per 100,000 inhabitants (Ostrom et al., 2019). Epidemiological study data available from the Western European countries



regarding the glial brain tumor incidence rates show about 12.8 cases per 100,000 inhabitants in males and 5.8 - 9.3 cases in females with an annual increase of 0.6 - 0.9% (Hansen et al., 2020 ). According to data for 2019 available from the Public Health Center of the Healthcare Ministry of Ukraine, the rates of primary brain tumors ranged from 4.8 to 6.1 cases per 100,000 inhabitants. At the same time, the incidence rate of metastatic (secondary) brain tumors is significantly higher and, according to various estimates, exceeds the incidence rate of primary brain tumors by 4-5 times (Pedachenko, 2019). Surgery is the basic method of treating brain tumors. Over the past decade, competencies and skills with which neurosurgical interventions are performed have been significantly enhanced and now under modern conditions it is possible to remove brain tumors which were earlier regarded as inoperable (Pedachenko, 2019). And owing to the current advancements in neuroresuscitation, early postoperative rehabilitation of patients can be started as soon as possible and thus patients may recover their motor functions and quality of life at a faster pace. However, it should be taken into account that surgical removal of tumors, in its turn, is associated with the risk that neurological deficits may occur or further develop (Berger et al., 2019). Incomplete reversibility of motor, speech and cognitive disorders lead to a long-term and often manifested disability of patients.

### **OBJECTIVE**

Based on the data obtained through an analysis of reference literature, to identify challenging issues of physical therapy in persons with brain tumors in the postoperative period.

### **SAMPLE**

Online information resources, specialized periodicals of Ukraine and foreign specialized publications, and Medline, PubMed, Medscape, Cochrane Library databases were analyzed. In addition to electronic search, reference lists of all retrieved review articles and primary studies were manually checked to identify other studies which were not found by electronic keyword search.

### **METHODS**

The data from research and methodological literature on the use of physical therapy measures in patients after brain neoplasm removal were subjected to a theoretical analysis, synthesis and generalization.

### **RESULTS**

#### **Risk factors**

A considerably increased incidence rate of brain tumors which has occurred over the past decades is associated, on the one part, with an enhanced availability of methods for early tumor process diagnosis and, on the other part, with an unfavorable demographic situation, high pollution rates and other negative socio-economic factors. Brain tumors grow because of exogenous and endogenous factors, namely: heredity, effects of carcinogens, dysembryogenesis, unfavorable environmental situation, neuropsychological disorders, penetration of viruses, injuries, harmful effects of ultraviolet and gamma rays, population aging, consequences of the Chernobyl disaster, as well as other negative factors (Polishchuk, 2019; Dereka, 2020; Kolesnyk et al., 2020).



## Symptoms

The clinical picture of a primary or metastatic brain lesion is characterized by general brain and focal symptoms, and also by meningeal syndrome which is less common (Hansen, 2020). All brain tumors, including non-malignant ones, lead to long-term disabling consequences both because of the tumor itself and because of the effect of its treatment. They can cause fatigue, pain, lymphedema, neuropathies, balance and mobility disorders, ataxia, convulsions, sensitivity disorders, spasticity, speech disorders, dysphagia, aphasia, impaired muscle strength, impaired attention and memory, visual perception deficit, impaired cardiopulmonary function, bladder and bowel disorders, sexual dysfunction, and cognitive and psychosocial problems. The most common manifestation of brain tumors is progressive neurological deficit (68%) in the form of movement disorders (45%). Headache occurs as a primary symptom in 54% of cases, epileptic seizures - in 26% (Polishchuk, 2019).

## Treatment

Brain tumor treatment methods include surgical removal, radiotherapy, and antitumor medicinal treatment (Barzilai et al., 2019). Modern neurosurgical technologies that significantly improve surgery efficacy and reduce brain trauma include neurosurgical navigation systems, laser and endoscopic technologies, operating microscopes, and ultrasonic aspirators (Pedachenko, 2019). Considerable advancements in technology and continuous improvement of surgical and conservative treatment methods ensure a significant decrease in the fatal case rate and a reduction in the overall proportion of postoperative persistent motor function disorders (about 30%), and create a reserve of time for further radiotherapy and chemotherapy (Yu et al., 2019).

## Physical therapy

It has long been believed that the use of physical factors in patients with brain disorders is absolutely contraindicated, and physical therapy was generally incompatible with treatment of such patients. In recent years, there has been an upsurge of interest in the potential of using physical therapy measures in patients who had their brain tumors removed (Stucki, Bickenbach, 2017).

However, today functional movement disorders, training in movement skills and self-care, adaptation to environmental conditions in patients of this category remain an incompletely explored issue, although relevant literature shows that persons who had brain tumors removed were willing to do physical exercises (Hansen et al., 2020).

The analysis of the findings of a number of recent scientific studies confirms that using therapeutic exercises in patients of this category is safe, and this affords ground for talking about the potential benefit of introducing physical therapy into the neuro-oncology practice. Thus, Marciniak et al. (2001) also demonstrated the efficacy of inpatient rehabilitation in persons with brain tumors. The data provided by these authors show higher FIM-scale scores of the functional independence level not only in persons after removal of low-grade gliomas, but also in persons who had more histologically aggressive types of tumors. Fu et al. (2010) found that patients with high-grade anaplastic astrocytoma demonstrated a higher increase in general functional independence figures but spent a longer time at an inpatient rehabilitation



facility as compared to patients with low-grade anaplastic astrocytoma. However, the authors emphasize the need for further research. Bartolo et al. (2012) proved the efficacy of rehabilitation in persons who had a brain tumor removed, which efficacy was evidenced by an improved functional status of patients regardless of the tumor type. Khoroshun (2013) describes improved quality of life of persons with brain tumors in the postoperative period which was achieved owing to comprehensive rehabilitation treatment with the use of physiotherapeutic procedures (electrical stimulation and laser therapy), kinesitherapy and massage. A retrospective study by Mix et al. (2017) showed that brain tumor patients who underwent rehabilitation in inpatient medical facilities in the USA improved their motor function; however, the findings of this statistical analysis underline the need for further research in this area. Granata et al. (2018) proved that regular physical exercise can increase the serotonin level thereby raising a person's spirits, alleviating depression and anxiety symptoms in patients with malignant brain tumors, and also helping alleviate chronic pain manifestations. Khosravi et al. (2019) demonstrated the efficacy of strength and combined exercises in patients with cancer diseases. Hansen et al. (2020) noted a slight improvement in social household skills and quality of life which was achieved exclusively through occupational therapy classes in persons with glial brain tumors at the stage of anticancer treatment. Systematic reviews by Morales et al. (2022) performed to summarize the data on the impact of physical therapy on the health of children with malignant brain neoplasms proved that using therapeutic exercises after brain tumor treatment is efficient and safe.

The cognitive disorder progression rate is an essential element in controlling the efficacy of rehabilitation measures (Richard et al., 2019). Studies assessing results of cognitive rehabilitation of persons with brain tumors appeared only recently in research literature (Richard et al., 2019). Improvement of cognitive functions and quality of life in brain tumor patients was noted by Locke et al. (2008) using the Functional Assessment of Cancer Treatment–Brain (FACT-BR) version. Gehring et al. (2009) in their studies evaluated the impact of a multi-domain cognitive rehabilitation program on the objective and subjective assessment of cognitive functions in glioma patients. Improvements in attention, memory and executive functions were noted. Zucchella et al. (2013) found cognitive function improvements in patients with mixed primary brain tumors after early inpatient cognitive rehabilitation. Khan et al. (2015) noted that the use of the multidisciplinary approach resulted in a positive effect of rehabilitation interventions which was manifested in the improved functional abilities and cognitive functions of brain tumor patients. Yu et al. (2019), through Fugl-Meyer functional assessment (FMA), Berg Balance Scale (BBS), the Korean version of the Modified Barthel Index (K-MBI), the Korean version of the Mini-Mental State Examination (K-MMSE) proved the efficacy of physical therapy based on strength training by active-passive exercises, training of balance and general endurance, learning to walk, ergotherapeutic exercises aimed at improving the body's cognitive functions, proprioceptive neuromuscular stimuli of the upper limbs, and daily life training. A study by Dick et al. (2019) emphasized a positive impact of physical therapy measures on cognitive functions (memory, attention, visual-spatial orientation) without medicinal treatment.





## DISCUSSIONS

Data available from literature show that persons who had brain tumors removed are willing to do physical exercises (Hansen et al., 2020). However, the possibility of applying complex rehabilitation care in the context of disability and daily functioning of patients of this category has not been sufficiently explored (Hojan, Gerreth, 2020). There is a lack of reliable information about the structure and organization of rehabilitation care for brain tumor patients in the postoperative period. A certification system with clearly defined criteria for rehabilitation care efficacy has not so far been established. All of the above-mentioned neurological complications and disabilities highlight the need for the use of modern physical therapy approaches based on the International Classification of Functioning, Disability and Health (ICF) (Bornbaum et al., 2013). With certain areas where biopsychosocial care for oncology patients is limited in terms of such aspects as: quality of life, co-morbidities and health status, today ICF remains a universal system and a practical tool for efficient classification and description of patient functioning (Stucki, Bickenbach, 2017). Based on a systematic analysis and assessment of all functioning levels, ICF makes it possible to use the relevant schemes for evaluating changes in the planned therapy results at a specific stage of rehabilitation treatment.

## CONCLUSIONS

1. The analysis of available literature found no specific methodological recommendations for programming of physical therapy measures for the thematic contingent of patients. The sources in place offer nothing more than general mentions of the benefit and safety of therapeutic exercises in patients of this category, and this highlights the need for further scientific research in this area.

2. It is considered appropriate to create and approve differentiated programs of physical therapy for patients who had brain neoplasms removed in the postoperative period based on a modern approach according to the International Classification of Functioning which has a focus on the level of structure and functions of the body.

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