

# FUTURISTIC TRENDS IN BRAIN TUMOR REHABILITATION: UNLEASHING THE MULTIDISCIPLINARY APPROACHES OF PHYSIOTHERAPY

## Abstract

Brain tumors prevalence is roughly 2% of all malignancy cases worldwide. An intracranial tumor is an anomalous proliferation of cells of the brain. Brain tumors, whether primary or metastatic, benign or malignant, have significant implications for patients, relatives, & the health-care system. They can cause a range of physical, sensory, intellectual, psychological, and social issues, which can severely affect a person's quality of life. Adaptability and regular evaluation are essential to dealing with patients' fluctuating functional alterations in neuro-oncological diagnoses. Therefore, the physical therapist should give thought to various factors while delivering rehabilitation therapy to an elderly patient with a neuro-oncological diagnosis. Evidence-based physiotherapy interventions for managing symptoms and improving the quality of life of brain tumor patients, highlights the role of exercise programs in preserving cardiovascular endurance, muscular strength, and function. Physical activity effectively addresses fatigue in cancer patients. The use of aerobic and resistance training is recommended, although specific instructions regarding timing, dose, and intensity are not provided. The management of gait impairments, cognitive impairments, depression and anxiety, social isolation, and the role of occupational therapy in brain tumor rehabilitation must be addressed for the patients with brain tumor. A multidisciplinary approach, including occupational therapy techniques, neuro-developmental therapy, proprioceptive

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neuromuscular facilitation techniques, and conventional therapy programs is the key. Additionally, the use of vibration therapy for patients with gliomas in the acute phase of rehabilitation. It suggests that vibration therapy, specifically applied to the cervical region, can improve functional outcomes, daily living activities, mobility, and cognition. A multidisciplinary approach and evidence-based physiotherapy interventions in the rehabilitation of brain tumor patients is of immense importance. Thorough assessment, individualized treatment plans, and regular evaluation to address the specific needs and challenges faced by these patients.

**Keywords:** Brain Tumors, Physiotherapy, Muscular strength

## I. INTRODUCTION

An intracranial tumor, or brain tumor, indicates an abnormal growth of cells in the brain. These cells proliferate and reproduce in an uncontrolled manner, often disregarding the normal mechanisms that regulate growth of cell in the body. The two main categories of brain tumors are primary and metastatic tumors (1).

Primary brain tumors are developed by the tissues that already exist in the brain or its immediate environment. The two types of tumors are glial tumors and non-glial tumors. Glial tumors arise from glial cells, which are supportive cells in the brain. Non-glial tumors, on the other hand, form above or within structures of brain such as nerves, blood vessels, or glands. Primary brain tumors can either be benign (non-cancerous) or be malignant (cancerous) (1).

When malignant cells from other regions of the body, including breast or lungs, migrate through the circulation to the brain, it results in metastatic brain tumors, sometimes referred to as secondary brain tumors. Even though these tumors develop in the brain, they are still considered cancers originating from the primary site (1).

Brain tumors, whether primary or metastatic, benign or malignant, have significant implications for patients, their families, and the healthcare system. Early diagnosis, personalized treatment plans, and comprehensive rehabilitation services are essential for improving outcomes and fostering hope for individuals facing these conditions. Continued research, awareness, and access to quality care are crucial in advancing the management and understanding of brain tumors to ultimately improve the lives of those affected.

**1. Global Prevalence and Impact:** Primary brain tumors are relatively uncommon globally. The estimated incidence rate is 7.1 per 100,000 people for malignant tumors and 13.8 per 100,000 people for benign tumors. Brain tumors are been reported for about 2% of all cancer cases worldwide. Despite, their prevalence is increasing, particularly among individuals over the age of 60 (2)(3).

Brain tumors can have a significant impact on patients, caregivers, and families due to the high symptom burden and mortality rate associated with these conditions. They can cause a range of physical, sensory, intellectual, psychological, and social issues, which can severely affect a person's quality of life (4)(5).

**2. Symptoms and Survival Rates:** Depending on the location the symptoms of brain tumors can vary in size, and type of tumor. Headaches, seizures, changes in vision, cognitive impairments, motor deficits, and mood changes are some of the common symptoms. Survival rates depend on the size of the tumor and its stage upon diagnosis. Survival rates can range from a few weeks in aggressive cases to several years in less aggressive cases, with appropriate treatment and management (6).

**3. Treatment Alternatives:** Brain tumour management usually entails a blend of therapeutic modalities. Surgery, radiation treatment, and chemotherapy are the main therapeutic options. The selection of a course of treatment is largely affected by number of variables,

which includes the kind, location, size, and grade of the tumour and also the preferences and general health of the patient(1).

The goal of surgery is to remove the tumour in its entirety with the least amount of harm to healthy brain tissue. Radiation therapy uses high-energy beams to kill cancer cells. Chemotherapy involves administering medications that which results in either killing or slowing the growth of cancer cells. Depending on the particulars of each situation, one or more of these therapeutic methods may be used (1).

- 4. Importance of a "Culture of Hope" and Rehabilitation:** Creating a "culture of hope" is a crucial aspect of managing brain tumors due to the high incidence of debilitating consequences associated with these conditions. Up to 80% of individuals having cancer of central nervous system (CNS) need rehabilitation services to address physical or cognitive impairments resulting from the tumor or its treatment(6).

With the aim of assisting patients, restoring function, enhancing their quality of life, and reintegrating them into society, rehabilitation is essential. The interdisciplinary aspect of rehabilitation comprises a group of medical specialists who collaborate to meet the individual needs of each patient, including psychologists, physiotherapists, occupational therapists, speech and language therapists, and social workers(8)(9).

However, rehabilitation rates for brain tumor patients are generally considered low, and access to comprehensive rehabilitation services may be limited (11)(12). It is important to increase awareness and improve access to rehabilitation to ensure that individuals affected by brain tumors receive the necessary support to optimize their recovery and overall well-being.

## II. EVIDENCE BASED PHYSIOTHERAPY FOR BRAIN TUMOR

- 1. Comprehensive Assessment is the Key:** To treat brain tumours conservatively, whether they are primary or metastatic, benign or malignant, surgery, radiation, and/or chemotherapy may be employed with combinations or individually. Although it is validated that chemotherapy and radiation are most widely used to treatment alternative for malignant, chronic, or recurrent tumours, the optimum treatment course is determined by individual that depends on a number of factors. Some risks and negative side effects are associated with every form of treatment.(1)

Neuro-oncological illness patients have increased risk of medical illness or negative impact due to regular medical therapy that could impede their performance. Therefore, in order to collaboratively develop an efficient treatment plan and establish achievable goals, it is crucial for the physiotherapists to be knowledgeable of the patient's history and current therapies.(13) Adaptability and regular evaluation are essential to dealing with patients' fluctuating functional performances who have neuro-oncological diagnoses. Therefore, the physiotherapists should keep a track of various factors when delivering rehabilitation therapy to an elderly patient with a neuro-oncological diagnosis:

- **Complications Due to Surgery:** Ataxia is a common impairment seen after posterior fossa surgery. Infection, hemorrhage, brain edema, increased intracranial pressure from hydrocephalus, and the onset of convulsions are some additional risks associated with surgery.(14)
  - **Side Effects of Radiation:** Along with developing neurological symptoms, the patient may also experience headaches, which can be temporary and be managed with corticosteroids. Usually, during the second or third week, fatigue sets in. Short-term memory loss, apathy, somnolence, and cognitive deterioration are some possible symptoms. In elderly people with moderate dementia or temporal lobe lesions, the level of cognitive decline could be highly pronounced. Early-delayed myelopathy is usually shows Lhermitte's sign can be characterized as electrical sensation moving down the spine and can be increased by forward bending of neck, radiation moving to the upper neck or chest. It is characterised by Lhermitte's sign, an electrical sensation that travels down the spine and can be brought on by bending the neck forward. This condition is self resolving. After radiation therapy for extraspinal tumors, a condition known as late-delayed myelopathy, which might manifest as Brown-Sequard syndrome, may arise.
  - **Side Effects of Chemotherapy:** Physical therapy patient participation may be negatively impacted by the side effects of chemotherapy and biologic drugs, including nausea, vomiting, exhaustion, neuropathy, and thrombocytopenia (depression of the bone marrow). In people with thrombocytopenia, straining or strenuous activity may cause a hemorrhage (affecting, for example, the skin, muscles, eyes, or brain). Compression clothing and blood pressure cuffs should only be worn under strict supervision. Anaemia may have an impact on a patient's capacity to engage in exercise programmes due to its effects on cardiopulmonary capacity and muscle performance. Less than 8 to 10 g/dL of hemoglobin are commonly regarded as a threshold where activity should be avoided. The advice varies.
2. **Corticosteroids:** They frequently have both advantageous and harmful effects. Reduced inflammation, increased appetite, adjunctive pain management, and nausea control are just a few advantages. Extended use of corticosteroids have various side effects which include increased susceptibility to infections, adrenal insufficiency, myopathy, hyperglycemia/diabetes, cushing syndrome, and hyperglycemia/diabetes.(15) Behaviour abnormalities may also be brought on by steroid use. The most severe of these is steroid psychosis. Confusion, delusions, agitation, and even hallucinations are some of the early indicators of toxic-organic symptoms. Medication for seizures slows cognitive function, affects reaction time, causes disorientation, and potentially worsens movement abnormalities like ataxia or dysarthria.
  3. **Additional Comorbidities:** While designing a physiotherapy programme for elderly neuro-oncological disordered patients, bone wellness is required to be taken into account to prevent bone fracture. Bony metastases of the long bones lead to difficulty in moving heavy loads. Using a hard-shelled thoraco-lumbo-sacral orthosis (TLSO) during upright activity and checking body mechanics, which includes avoiding rotations or forward- or backward-bending to extremes, may be necessary in cases of bony metastases of the spine

39 Additionally, osteopenia or osteoporosis are more likely to be present in older patients. Some factors to be considered while creating a plan of treatment for cancer patients include limitations brought on by metastasis or other illnesses, suppression of immune system or neutropenia, thrombocytopenia, fever, anaemia, or current infections.(13)

### III.EVIDENCE BASED TREATMENT FOR MANAGEMENT OF SYMPTOMS

- 1. Strengthening and Managing Fatigue:** In general, the earlier strength returns, the higher the recovery rate. According to the American College of Sports Medicine (ACSM), the goal of exercise regimens for cancer patients is designed in such a way which maintains cardiovascular endurance, muscular strength, and function. This includes the following benefits, a reduction in motion sickness, a rise in stamina, and an improved quality of life is usually observed.(16) Along with energy-saving strategies, distraction, and psychosocial interventions, regular exercise is one of the few therapies that has been shown to effectively address the fatigue issue in cancer patients.(13) For improving muscle strength and endurance, Australian Cancer Network advises trainings such as aerobic and resistance training for almost every benign tumor patient. However, no precise instructions are given on the timing, dose, or intensity. ACN supports resistance training for persons with ataxia and cerebellar dysfunction to make up for their lack of coordination.(3)
- 2. Physical Activity and Quality of Life:** After the completing 17 months of their acute medical care, 38 patients with brain tumours were enrolled in a 4-week inpatient rehabilitation intervention. The intervention included both group and individual components, such as physiotherapy exercises that included both firm surface-based and water-based activities as well as hippotherapy. A 4-week rehabilitation intervention is helpful for enhancing psychological well-being, as shown by immediate and sustained increases in HRQoL, and the enormous increase in PA levels may also be related to overall recovery. (17)
- 3. Gait Impairments:** BT patients with gait impairment require specific orthoses (usually AFO), walking aids such canes, walkers, and wheelchairs for improving gait impairments.(3) Concrete guidelines or evidence-based advice is still limited in literature.
- 4. Cognitive Impairment:** People who need cognitive rehabilitation can help them restore the majority of their mental, physical, and emotional abilities. This includes compensatory techniques, which are strategies to learn new skills to supplement lost ones, like activities involving sight, speech, and movement.(18)

A study was done in two groups which include a VR training group had training for 30-minute in a session three times a week for four weeks and a computer-based cognitive therapy group having 30-minute sessions five days a week. VR training was done by 38 adult brain tumour patients either benign or malignant PBT, or metastatic tumor who were randomly assigned to either the VR training or computer based group. The auditory continuous performance, forward visual span, verbal learning, forward digit span and memory assessments on the K-MMSE and K-MBI were found to have improved in both groups.

5. **Depression and Anxiety:** Psychotherapy, CBT, guided imagery, and relaxation therapy to help with challengeable situations and are important to use in managing depression and anxiety. A person's capacity to choose a course of treatment can be impacted by depression and anxiety.(3) Some of the subjects that have received attention include sexuality, "helping system" also known as models of care for patients and care givers, psychological stress, anxiety, and depression management, care givers needs and wellbeing, palliative care, complementary therapies (homoeopathy, Ayurveda or herbal supplementation, meditation, and massage), and end-of-life care. (20)
6. **Social Isolation:** The experience of having one's life interrupted due to brain tumor causes social trajectory, causes social seclusion adjusting to one's new reality. Therapies that enhance wellbeing through sustaining social bonds may be guided by a greater understanding of the barriers to and facilitators of doing so after a brain tumor.(2)

#### IV. A MULTI-DISCIPLINARY APPROACH

1. **Occupational Therapy:** Patient's performance ability and satisfaction in carrying out COPM-established occupation is impacted by occupation-centered approach, occupation-focused and based intervention, and patients with brain tumours may benefit from occupational therapy techniques developed by shared decision-making and setting goal. Just as with different neurological illnesses, where systematic rehabilitation is well established, patients with brain tumours require systematic rehabilitation.(21)  
Canada's Occupational Performance Measure
2. **NDT and PNF:** Neurodevelopmental therapy (NDT; Brunnstrom and Bobath method) and proprioceptive neuromuscular facilitation approaches have been shown for improvement of the functional levels of individuals having brain tumours.(22) The results show that the Neurodevelopmental Bobath Treatment method was applied in the two instances' rehabilitation regime in order to reduce motor-sensory impairments and enhance the experience of regular movement and functional independence. The key component of the therapy program was trunk control exercises since they were crucial for establishing dynamic stabilization in various body regions and reducing irregularities in other body parts. For two patients, pulmonary rehabilitation played a significant role in their treatment regime. Joint mobilization, pelvic mobilization, and deep friction massage were used to reduce the intensity of sensory input. The rehabilitation curriculum included exercises for weight transfer and functional reaching in both sitting and standing positions.
3. **Conventional Therapy Programs:** Impairments in attention, verbal and visual memory, visuomotor coordination, and frontal executive function are usually seen in patients with brain tumors. At baseline and after a 4-week intervention attention issues in people with brain tumors are particularly detrimental to functional outcomes. (23)

NDT certified Physical therapist delivered physical therapy for one hour each day. There was the usage of aerobic exercise and neuromuscular electrical stimulation therapy. Along with task-oriented therapy for ADL, stretches and exercises to strengthen the upper extremities provided by occupational therapists, patients also got, fine motor training, and

sensory motor recovery. During the four weeks of a conventional rehabilitation program, neither group received computerized or focused cognitive training for neuropsychological deficits. (23)

- 4. Vibration Therapy for Gliomas:** Glioma patients benefit in terms of functional outcomes, daily living activities, mobility, and cognition when they are in the acute phase of rehabilitation. Physiotherapists that specialize in neurological rehabilitation often neglect the cervical region and instead focus on the trunk and limb motions in the physiotherapy regimen. When added to PTR regimens for neurological patients, vibration therapy may be useful because the dense proprioceptors in the neck area will excite the entire vibration tracts.(22) Vibration was applied locally to the paravertebral muscles in addition to the rehabilitation program alone utilizing the portable local vibration equipment (Vibrasens; Techno Concept, France) and a 7 centimeter probe at a frequency range of 60-80 Hz for 60 seconds.
- 5. Telemedicine – Solution in Pandemic:** Rehabilitation doctors (and/or allied health or nursing) should be involved in acute cancer care teams to preserve coordination and care continuity for the effective management of a COVID19 impacted cancer survivor. If at all possible, avoid in-person meetings. The cancer management plan will be supported by an evidence-based strategy taken according to patient's level of risk, care, and prognosis objectives. Including rehabilitation at home services, post-acute care, or other community providers in the integration of rehabilitation teams can assist lessen the demand on hospital capacity. Prior research has shown that telemedicine can effectively support cancer patients in the community with symptom management, survival care, and follow-up for chronic disease management. (24).
- 6. Neurocognitive Behavior Therapy:** By addressing the underlying reasons and deconditioning the hyper arousal response, neuro-cognitive behavior therapy has been shown to alleviate chronic insomnia.(6) Patients with suspected should be swiftly referred from neurosurgery department should refer patients suspected with good prognosis and neuro-cognitive impairment to neuropsychology for evaluation and treatment. When patients have neurological rehabilitation demands that are more serious and extensive, as well as neuro-cognitive difficulties, a transfer to specialized inpatient or outpatient community treatment may be necessary(6).

The research backs up the benefits of neuro-cognitive therapies for patients who can benefit from them, whether they are delivered in-person or online.(6) Finding the important ideas in a paragraph, going over the information in it, and drawing conclusions are a few examples of neuro-cognitive activities that help with thinking and reasoning. List of instructions planned or organized for other exercises are helpful in managing neuro-cognitive functions . There is proof that programs offered to stable patients after treatment and post-operative computerized neuro-cognitive rehabilitation instruction both improve memory and executive function.

- 7. Neurobics:** Neurobics is for the brain what aerobics is for the body. Neurobics are a term used to describe brain training computer program that use repetitive mental activities to improve brain function. These are offered commercially and can be fairly pricey.(25) The



following exercises and assignments are included in NEUROBICS, a revolutionary and effective method of restoring your brain's health.

Few exercises which are used commonly for stimulating our brain cells are mentioned below

Making use of your non-dominant hand for tasks like tooth brushing, writing, or doodling. In this manner, you can perform the same task while using different parts of your brain. Further indulging two or more senses at once is also a great way for practicing neurobics; for instance, inhale the aroma of lavender while listening to music. These opposing actions promote the growth of additional grey matter. Trying to pronounce words while listening to foreign sounds like podcasts or music in the target language. This promotes the development of new neurons. Another way to relax is to sit quietly for at least 5 minutes each day, solely paying attention to your breathing. Your brain may relax and recharge like never before with its aid. Mental stimulation can be intensified by closing your eyes and practicing identifying smells to improve your sense of smell. Closing your eyes will help strengthen your sense of smell because it strongly depends on what you see. Also, altering our routine pathways can further help train our brain for new activities. For example, when we drive or walk the same path again, our brains essentially operate on autopilot. To keep your head active, switch up your routes frequently. One of the easiest exercises to keep our brains healthy is to observe the clock's reflection in the mirror and attempt to draw one. Secondly, pick a tongue twister at random each day, then practice it until you can master it.

8. **Electrotherapy:** A device called Novo TTFTM (by Novicure) is applied along with the scalp during electric field treatments to eliminate brain tumor cells. It uses electrodes to deliver a weak electric current that may inhibit the growth of tumor cells without endangering healthy brain cells.(18)

## V. BARRIERS TO TREATMENT

1. **Availability of Rehabilitation for all:** The aim of BT care progression-free survival with minimal morbidity and maximal function should be Long-term. All survivors in this situation should have access to efficient rehabilitation programs, especially the more vulnerable categories. (26)
2. **Inability of Patients to Recognize their Needs:** Brain tumor patients may be unable to identify their requirements or have preconceived notions about how easily their problems may be resolved, which prevents them from seeking assistance. Health practitioners should assess a patient's need for and desire for support.(12,27)
3. **Cost of Rehabilitation:** Even while this may seem daunting (especially if you have health concerns), it's reassuring to know that you have a plan in place to control healthcare expenses.(18)

## VI. CONCLUSION

Brain tumor rehabilitation is challenging because of the rates of mortality are high, complexity of physical, psychological, and cognitive impairments is high, and participation restrictions that demands an integrated interdisciplinary approach(4). Rehabilitation being a group approach requires two or more disciplines, such as nursing, physiotherapy, psychiatry, occupational therapy, social work, and other allied healthcare disciplines, may deliver an intervention. In the BT community, this comprehensive rehabilitation strategy has recently been advocated. Multidisciplinary therapy is patient-centered, time-limited, and functionally focused, with a focus is based on evidences for rehabilitation programs modified according to patients' needs. It seeks to maximize engagement (social integration), participation, and psychological health. Further study is required to comprehend the function of rehabilitation for those with brain tumors.

In addition to improving functional abilities during the acute stage of the disease, rehabilitation interventions should also be focused on enhancing the patient's quality of life, symptom relief, avoiding complications, and mobility and daily activities during the terminal stage. (28)

## VII. SUMMARY

This chapter discusses futuristic trends in brain tumor rehabilitation and the multidisciplinary approaches of physiotherapy. It emphasizes the importance of comprehensive assessment in developing effective treatment plans for patients having brain tumors. It also focuses attention on the evidence-based physiotherapy interventions for managing various symptoms and impairments associated with brain tumors.

The comprehensive assessment of brain tumor patients is crucial for understanding their medical history, past and present treatments, and potential complications. This information helps in developing personalized treatment plans and setting realistic goals. The article discusses the complications of surgery, side effects of radiation and chemotherapy, and the use of corticosteroids in brain tumor patients. It also addresses other comorbidities that need to be considered in the treatment plan, such as bone health, immunosuppression, and infections. Evidence-based physiotherapy interventions for managing symptoms and improving the quality of life of brain tumor patients, highlights the role of exercise programs in preserving cardiovascular endurance, muscular strength, and function. Physical activity has been shown to effectively address fatigue in cancer patients. The use of aerobic and resistance training is recommended, although specific instructions regarding timing, dose, and intensity are not provided.

The chapter also discusses the management of gait impairments, cognitive impairments, depression and anxiety, social isolation, and the role of occupational therapy in brain tumor rehabilitation. It emphasizes the importance of a multidisciplinary approach, including occupational therapy techniques, neuro-developmental therapy, proprioceptive neuromuscular facilitation techniques, and conventional therapy programs. Additionally, the use of vibration therapy for patients with gliomas in the acute phase of rehabilitation. It suggests that vibration therapy, specifically applied to the cervical region, can improve

functional outcomes, daily living activities, mobility, and cognition. Relevance of telemedicine in the rehabilitation of brain tumor patients, particularly during the COVID-19 pandemic is discussed. It suggests that telemedicine can effectively support cancer patients in receiving rehabilitation services and help in managing their care remotely.

Overall, the importance of a multidisciplinary approach and evidence-based physiotherapy interventions in the rehabilitation of patients having brain tumor is discussed. It emphasizes the need for comprehensive assessment, individualized treatment plans, and regular evaluation to address the specific needs and challenges faced by these patients.

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