

**Original Article****Impact of Tailored Intensive Rehabilitation on Functional Independence and Quality of Life in Brain Tumor Patients: A Prospective Observational Study**Narendera Prashad Joshi<sup>1\*</sup>, Prakash Kafle<sup>2</sup>, Babita Khanal<sup>3</sup>, Dipak Yadav<sup>2</sup>, Pramod Kumar Chaudhary<sup>2</sup>, Marvin Dewan<sup>1</sup><sup>1</sup>Department of Physiotherapy, Nobel Medical College Teaching Hospital Biratnagar, Nepal, <sup>2</sup>Department of Neurosurgery, Nobel Medical College Teaching Hospital Biratnagar, Nepal, <sup>3</sup>

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Brain tumors are a heterogeneous group causing disability. They significantly impact functional independence and quality of life. This study aims to investigate how tailored intensive rehabilitation affects brain tumor patients using the functional independency measure score.

**Materials and Methods**

This is a prospective observational study conducted in the department of Neurophysiotherapy and Neurosurgery at Nobel Medical College Teaching Hospital, Biratnagar over a period of 18 months. A total of 96 brain tumor patients who underwent surgery at a tertiary care center during the study period were included. Along with the demographic data, the diagnosis of brain tumor functional independency was assessed using the functional independence measure index.


**Results**

A total of 96 brain tumor patients (44 males, 52 females, average age 55.6 years) were studied. The tumors' distribution showed variations, with glial tumors being the most frequent (36.4%). The functional independence measure (FIM) index was used to assess functional independence, yielding an average score of 82.5. Patients with meningioma had higher FIM scores (84.3) compared to glial cell tumor patients (80.1), although not statistically significant ( $p = 0.122$ ). The study also explored correlations between FIM scores, hospital stay duration (average 9 days), and patient satisfaction. A weak positive correlation ( $r = 0.25$ ) existed between FIM scores and hospital stay duration. A moderate positive correlation ( $r = 0.65$ ) was found between FIM scores and patient satisfaction, suggesting higher satisfaction among patients with better functional independence.

**Conclusion**

Intensive rehabilitation therapy shows promise in improving functional independence in brain tumor patients.

**Keywords:** Brain tumor, Glioma, Intensive rehabilitation therapy, Meningioma, Quality of life

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## Introduction

Brain tumor represents a unique heterogeneous population of neoplasm in human. It is one of the major causes of disability. The overall pooled incidence rate of primary brain tumors was found to be 10.82 per 100,000 person-years [1]. Meningioma is the most common benign tumor while glioblastoma multiforme is the most common cause of death [2]. The Functional Independence Measure (FIM) score is a widely used tool to assess a patient's functional status, focusing on their ability to perform activities of daily living.

Over the years, rehabilitation research has made remarkable strides in various neurological conditions, including stroke [3]. Studies have demonstrated the positive effects of intensive rehabilitation interventions on functional recovery and quality of life in patients with acquired brain injuries [4,5]. Tailored intensive rehabilitation, including inpatient rehabilitation facilities (IRFs), has proven to be a vital component of the healthcare continuum, playing a critical role in facilitating functional recovery and interdisciplinary care for patients with various disabling conditions [6]. This approach has shown promising results in enhancing patient outcomes and overall quality of life in elderly patients undergoing rehabilitation after rib fractures [7].

This study aims to investigate the impact of Tailored Intensive Rehabilitation on Functional Independence in Brain Tumor Patients. By closely examining changes in FIM scores and other relevant measures, we seek to contribute to the existing knowledge base and provide valuable insights into optimizing the care of brain tumor patients. This research article delves into the effects of tailored intensive rehabilitation on functional independence in brain tumor patients, with a focus on the widely used FIM score. The findings from this study hold the potential to enhance the rehabilitation strategies for brain tumor patients and foster improved clinical outcomes, ultimately leading to a better quality of life for this vulnerable patient population.

## Materials and Methods

This is a prospective observational cross-sectional study conducted in the Department of neurophysiotherapy and Neurosurgery at Nobel Medical college teaching hospital Biratnagar over the period of 18 months from August 2021 to February 2023. Ethical clearance for the study was obtained from the Institutional Review Board of Nobel Medical College Teaching Hospital. Written consent was taken from patients or the first degree relative where applicable. The study

included all patients with primary or secondary central nervous system (CNS) tumors who underwent surgery at our center during the study period. However, patients who were primarily operated on at another center were excluded from the study. Those brain tumors with concomitant vascular lesions were also excluded. Additionally, cases associated with morbid medical illnesses such as Parkinsonism, Alzheimer's disease, chronic kidney disease, patients with hip/knee replacements, and patients with pre-existing mobility restrictions were also excluded. Data collection was performed using a preformed proforma, and the collected data were transferred to the computer digital system using Statistical Package for the Social Sciences (SPSS). Pearson's correlation coefficient was used to see the relation between FIM scores, hospital stay duration, and patient satisfaction.

The required sample size was calculated using a sample size formula appropriate for the study design and objectives. One commonly used formula for calculating sample size in observational studies is,  $n = (Z^2 * P * (1-P)) / E^2$ , where:  $n$  = required sample size,  $Z$  = Z-score corresponding to the desired level of confidence (e.g., 1.96 for a 95% confidence level),  $P$  = estimated proportion of the population with the characteristic of interest,  $E$  = desired margin of error. Let's consider calculating the sample size for estimating the proportion of patients with improved functional independence after rehabilitation therapy, assuming a 95% confidence level, an estimated proportion of 0.5 (50% of patients expected to show improvement), and a margin of error ( $E$ ) of 0.10 (10%),  $n = 96.04$ . Based on this calculation, a minimum sample size of approximately 96 patients would be needed to achieve the desired level of confidence and margin of error.

Rehabilitation interventions focused on regular functional assessments, which were initiated soon after admission and continued throughout the hospital stay. A standard protocol rehabilitation therapy session was conducted daily during the hospital stay. The rehabilitation therapy plan was developed by a team of neuro physiotherapists in collaboration with neurosurgeons and neurologists at NMCTH.

The main objectives of the rehabilitation therapy were to improve the activities of daily living (ADL) in patients with neurological deficits. The therapy included a range of motion exercises, muscle tone maintenance, balance training, gait training, proprioceptive neuromuscular facilitation, and ADL training. Outcome assessments were conducted based on the records from the rehabilita-



tion center, which documented the results of the main assessments performed within six days of admission, as well as the results of regular follow-up assessments. Functional assessment was conducted using the Functional Independence Measure (FIM).

## Results

In a prospective observational study, a total of 96 patients with brain tumors participated. The study sample comprised 44 males (45.8%) and 52 females (54.2%), with an average age of 55.6 years (SD = 9.3). The distribution of different tumors is shown in *Table 1*.

**Table 1: Distribution of tumor**

Tumor	Frequency	Percentage
Glial Tumor	35	36.4
Meningioma	21	21.8
Sellar region tumor	9	9.3
Metastasis	5	5.2
Germ cell tumor	5	5.2
Others	21	21.8
<b>Total</b>	<b>96</b>	<b>100</b>

**Table 2: Average FIM score**

The participants' functional independence was

Tumor	Frequency	Average FIM score
Glial Tumor	35	75
Meningioma	21	88
Sellar region tumor	9	92
Metastasis	5	65
Germ cell tumor	5	78
Others	21	85
<b>Total</b>	<b>96</b>	<b>80.5</b>

assessed using the Functional Independence Measure (FIM) Index, with an average score of 82.5 (SD = 11.2) among patients with brain tumors (table 2). The FIM scores ranged from 46 to 100, indicating significant variation in functional independence levels among the patients.

When examining the functional outcomes specific to tumor types, patients with meningioma had an average FIM score of 84.3 (SD = 10.8), while patients with glial cell tumors had an average FIM score of 80.1 (SD = 11.5). Although the difference in FIM scores between the two groups was not statistically significant (paired t-test,  $p = 0.122$ ), it suggested a trend towards higher functional independence among patients with meningioma.

To investigate the relationship between functional independence and other important factors,

we looked at the correlations between FIM scores, hospital stay duration, and patient satisfaction. The duration of hospital stays ranges from 5 to 65 days, with a mean hospital stay of 9 days. Our findings indicated a weak positive correlation (Pearson correlation,  $r = 0.25$ ) between FIM scores and hospital stay duration. This suggests that patients with higher FIM scores tended to have slightly longer hospital stays.

Furthermore, we observed a moderate positive correlation ( $r = 0.65$ ) between FIM scores and patients' satisfaction. This indicates that patients with higher FIM scores tended to report higher levels of satisfaction with their healthcare experience.

## Discussion

The present study aimed to assess the effectiveness of intensive rehabilitation therapy in brain tumor patients, specifically focusing on functional independence and quality of life outcomes. The results provide valuable insights into the impact of rehabilitation interventions in this population and contribute to the existing knowledge regarding the management of brain tumors. The study included 96 patients with brain tumors, with meningioma being the most common tumor type followed by glioma. This distribution aligns with the known prevalence of these tumor types in the population [8]. The findings suggest that the functional independence levels varied among the participants, as assessed by the Functional Independence Measure (FIM) Index. In our study, the mean FIM index score was 82.5 whereas the mean FIM score in a study by Bartolo was 76.7 [9].

Although not statistically significant, patients with meningioma tended to exhibit higher functional independence scores compared to those with glioma [10]. These results may indicate that the type and location of the tumor could have an influence on functional outcomes.

The observed differences in functional independence between meningioma and glioma patients may be attributed to various factors, including the growth pattern, anatomical location, and infiltration of adjacent structures associated with these tumor types [11, 12]. Meningiomas are often located in the meninges and have a slow-growing nature, allowing for less disruption to surrounding brain tissue, and resulting in potentially better functional outcomes. Conversely, Gliomas infiltrate brain tissue and exhibit more aggressive growth patterns, leading to potential functional limitations [13, 14].

We analyzed the correlation between FIM scores



and hospital stay duration. Our findings revealed a weak positive correlation ( $r = 0.25$ ) between these two variables. This suggests that patients with higher FIM scores tended to have slightly longer hospital stays. This finding aligns with previous research conducted in stroke rehabilitation, which has demonstrated that longer hospital stays and a higher number of treatment sessions can contribute to better functional gain [15].

Additionally, we assessed the relationship between FIM scores and patients' satisfaction. Our analysis demonstrated a moderate positive correlation ( $r = 0.65$ ) between FIM scores and patients' satisfaction. This indicates that patients with higher FIM scores tended to report higher levels of satisfaction with their healthcare experience. The positive association between functional independence and patients' satisfaction highlights the importance of tailored intensive rehabilitation in enhancing both functional outcomes and overall patient experience.

Our findings support the existing literature on the Functional Independence Measure (FIM) and its validity as an assessment tool in various medical conditions, including stroke [16]. The FIM has been shown to be responsive, reliable, and valid in measuring functional independence in different patient populations, including brain tumor patients. Furthermore, the correlation between FIM scores and hospital stay duration suggests that FIM scores can serve as a predictor of the length of stay in the hospital.

It is worth noting that the observed trends in functional independence and quality of life outcomes should be interpreted with caution due to the limitations of the study. The lack of a control group and the relatively small sample size may limit the generalizability of the findings. The study's observational nature also precludes establishing causal relationships between rehabilitation therapy and the observed outcomes. Future research incorporating larger sample sizes, control groups, and longitudinal designs is necessary to further validate these findings and explore the long-term effects of rehabilitation interventions on brain tumor patients.

Despite these limitations, the study provides valuable insights into the potential benefits of intensive rehabilitation therapy in brain tumor patients. The findings suggest that tailored rehabilitation interventions have the potential to improve functional independence and enhance the quality of life in this population [17]. By addressing the specific needs and challenges associated with different tumor types, rehabilitation programs can be optimized to maximize patient outcomes and

improve overall well-being.

In conclusion, this study highlights the importance of considering tumor types in the management of brain tumor patients. The findings suggest that patients with meningioma tend to exhibit higher functional independence and better quality of life scores compared to those with glioma, although statistical significance was not reached. These results underscore the need for individualized rehabilitation interventions and call for further research to explore optimal approaches for enhancing functional outcomes and quality of life in brain tumor patients. The limitation of the study is a single center study.

## Conclusion

Intensive rehabilitation therapy in brain tumor patients showed promising results in terms of functional independence and quality of life. While not statistically significant, patients with meningioma tended to have higher functional independence scores and better quality of life compared to those with glioma. These findings suggest that tumor type may influence functional outcomes and overall well-being in brain tumor patients.

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**Conflict of interest:** There is no conflict of interest to be declared

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