RESEARCH PAPER

Association Between Cognitive Impairment and Functional Independence in Patients with Brain Tumors: An Occupational Therapy Perspective

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ABSTRACT

OBJECTIVE: Aim of this study is to examine the relationship between cognitive screening scores and functional independence in individuals with primary brain tumors.

METHOD: This study adopted a quantitative, non-experimental, correlational research design. This design was chosen to examine the relationship between cognitive function and functional independence in individuals with primary brain tumors using standardized assessment tools. A total of 30 participants were included in the study. The sample size was determined through purposive sampling based on feasibility and availability of eligible participants during the data collection period. Patients who were diagnosed with Primary brain tumors who had come to the Occupational Therapy Outpatient Department at a Tertiary Care Centre were chosen as the study population.

RESULT: There was a weak positive correlation between MoCA and FIM-FAM scores ($\rho = 0.31$). However, this correlation was not statistically significant ($p = 0.09$). This indicates that higher cognitive scores tended to be associated with higher levels of functional independence, although the relationship did not reach statistical significance.

CONCLUSION: The findings reinforce the importance of comprehensive assessment that includes both cognitive screening and functional evaluation. While MoCA provides a quick overview of cognitive status, the FIM-FAM offers a broader understanding of how cognitive and motor impairments translate into everyday functional challenges.

The results highlight the need for cognitively informed rehabilitation approaches, including task- specific training, compensatory strategies, environmental modifications, and caregiver education. Occupational therapists should consider addressing cognitive deficits alongside physical impairments to optimize functional independence and participation.

Key Words: Primary Brain Tumors, Neoplasm, Malignancy, Cognition, Functional Independence, MoCA, FIM-FAM
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Introduction

Brain tumors are defined as abnormal growths of cells occurring within or surrounding the brain. The term encompasses a heterogeneous group of neoplasms that vary widely in their biological behavior, ranging from benign lesions to highly aggressive malignant tumors. Brain and central nervous system (CNS) tumors include those arising from the brain parenchyma, cranial nerves, spinal nerves, spinal cord, and meninges. These tumors can be broadly classified as malignant and non-malignant (benign) and exhibit diverse morphological and histopathological characteristics (3).

Brain tumors account for approximately **1.35% of all malignant neoplasms** but contribute to nearly **29.5% of cancer-related deaths**, highlighting their significant clinical burden (1). Although relatively less common, their impact on morbidity and mortality is substantial due to their critical anatomical location and effects on neurological functioning (2). Brain tumors are complex neurological conditions often associated with significant physical, cognitive, and psychosocial impairments. Standard medical management typically involves a multimodal approach, including surgical resection, radiotherapy, chemotherapy, and, in some cases, targeted therapy or immunotherapy depending on tumor type, location, and grade (2,4).

Advances in neurosurgical and oncological treatments have improved survival outcomes in patients with brain tumors. However, a substantial proportion of survivors continue to experience long-term functional limitations, including cognitive, emotional, linguistic, and sensorimotor deficits, which significantly affect independence in activities of daily living (ADLs) and social participation (4,8).

Cognitive impairment is a major concern in this population and may arise due to the tumor itself or as a consequence of treatment modalities. Surgical resection may improve cognitive function by reducing tumor

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burden; however, it can also lead to deficits depending on the extent of resection and involvement of eloquent brain regions (6). Radiotherapy has been associated with delayed cognitive decline, particularly affecting memory, attention, and executive functioning (7). Similarly, chemotherapy-related cognitive impairment has been linked to neurotoxicity, inflammatory mechanisms, and white matter changes (8). These findings highlight the complex interaction between disease pathology and treatment effects on cognition.

From an occupational therapy perspective, an individual's ability to engage in meaningful activities and daily occupations depends not only on physical functioning but also on cognitive abilities such as attention, memory, and executive functioning. Cognitive deficits can therefore significantly limit functional independence and reduce the effectiveness of rehabilitation interventions (20,21).

The Montreal Cognitive Assessment (MoCA) is a brief and widely used cognitive screening tool developed to detect mild cognitive impairment (11). It assesses multiple cognitive domains including visuospatial/executive functions, attention, memory, language, abstraction, and orientation. Its brevity, ease of administration, and multidomain structure make it particularly suitable for use in heterogeneous clinical populations (12,14).

Several studies have demonstrated the sensitivity of the MoCA in detecting cognitive impairment in patients with primary brain tumors. Robinson et al. reported that the MoCA identified a significant proportion of patients with cognitive deficits when compared with domain-specific neuropsychological assessments, particularly in memory and verbal fluency domains (13).

However, despite its advantages, the MoCA has limitations, including limited domain-specific detail and susceptibility to confounding factors such as education, language, aphasia, and motor deficits (15).

Functional independence in neurological populations is commonly assessed using the Functional Independence Measure–Functional Assessment Measure (FIM-FAM), which evaluates motor, cognitive, and psychosocial aspects of disability (16). The FIM-FAM has demonstrated strong reliability, validity, and responsiveness in neurological and brain injury populations and is widely used in both clinical and research settings (17–19).

Evidence suggests that cognitive impairment plays a significant role in determining functional outcomes and rehabilitation potential. Deficits in attention, memory, executive functioning, and visuospatial abilities are commonly reported in individuals with primary brain tumors and can significantly impact independence in daily activities (9,24).

Cognitive rehabilitation has been shown to improve functional outcomes in neurological populations; however, its effectiveness in brain tumor populations remains variable (20–22). Furthermore, the strength and nature of the relationship between cognitive function and functional independence remain inconsistent across studies.

Importantly, limited research has directly examined this relationship using standardized tools such as MoCA and FIM-FAM in individuals with primary brain tumors. This represents a significant gap in the literature, particularly from an occupational therapy perspective.

Rationale and Need for the Study

The existing literature emphasizes the importance of integrating cognitive and functional assessments in neuro-oncology rehabilitation. However, there is limited evidence examining the direct association between cognitive functioning and functional independence using standardized tools such as MoCA and FIM-FAM.

Study Objective

Therefore, the present study aims to examine the relationship between cognitive function (MoCA scores) and functional independence (FIM-FAM scores) in individuals with primary brain tumors, thereby contributing clinically relevant evidence to guide occupational therapy assessment and intervention planning.

METHODOLOGY

Study Design:

This study adopted a quantitative, non-experimental, correlational research design. This design was chosen to examine the relationship between cognitive function and functional independence in individuals with primary brain tumors using standardized assessment tools.

Sample Size:

A total of 30 participants were included in the study. The sample size was determined based on feasibility and availability of eligible participants during the data collection period.

Sampling Method:

A purposive sampling technique was used to select participants who met the inclusion criteria. Source of Data

Patients who were diagnosed with Primary brain tumors who had come to the Occupational Therapy Outpatient Department at a Tertiary Care Centre were chosen as the study population.

Selection Criteria Inclusion Criteria

This study included Patient Participants who meet the following inclusion criteria

- Diagnosed with primary Brain tumor
- Age of 18 years or above
- Medically stable at the time of assessment with ECOG of 0,1,2
- Able to understand and follow simple verbal instructions Exclusion Criteria

This study excluded Patient participants if they had

- Severe Aphasia or communication deficits interfering with the assessment.
- Severe visual or hearing impairments not corrected with aids.
- Altered sensorium or reduced level of consciousness
- Known pre-existing psychiatric illness or neurodegenerative disorder.
- ECOG of 3 or 4 Outcome Measures:
- The Montreal Cognitive Assessment (MoCA)
- Functional Independence Measure- Functional Assessment Measure (FIM-FAM)

Data Collection Procedure

Eligible participants were identified based on Inclusion and Exclusion Criteria. Written Informed consent was obtained from all participants. Demographic and clinical details were collected using a structured data sheet. Cognitive function was assessed using the MoCA and Functional Independence was assessed using the FIM-FAM.

Statistical Analysis

Data was entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version. Descriptive Statistics were used to summarize demographic and clinical variables. Spearman's rank correlation coefficient was chosen due to the ordinal nature of the functional data and non- normal distribution of scores. The level of statistical significance was set at $p<0.05$.

RESULTS

Variable	Value
Total Sample Size (n)	30
Mean Age (years)	38.9
Age Range	19–58
Male (n, %)	17 (58.6%)
Female (n, %)	12 (41.4%)

Table 1: Participant Characteristics

Variable	Mean ± SD	Median	Range
MoCA Score (/30)	24.1 ± 4.2	25	14–30
FIM Score (/210)	188.2 ± 18.6	194	130–210

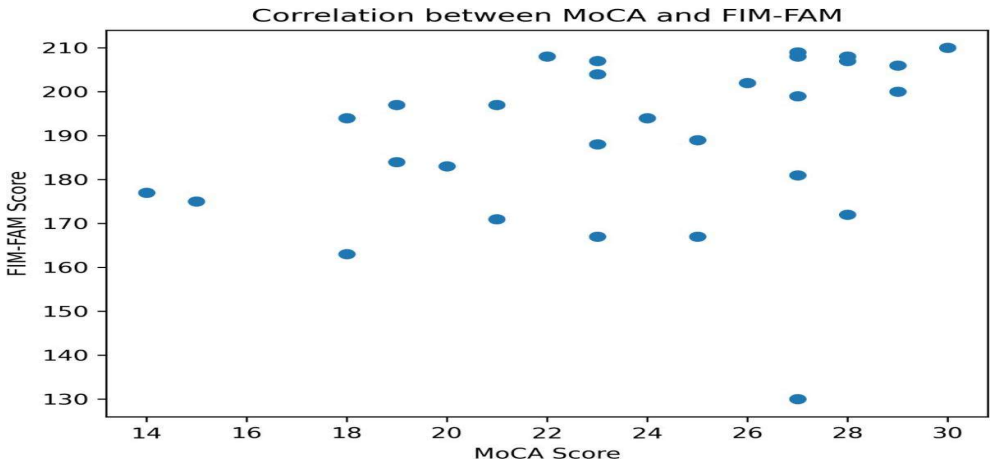
Table 2: Cognitive and Functional Scores

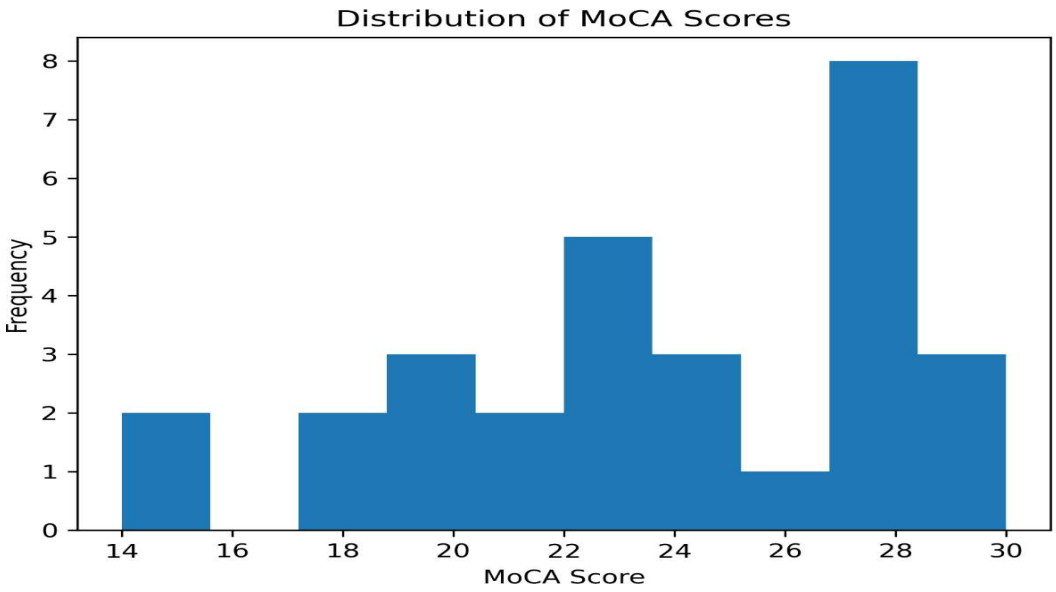
Variable	Male (Mean ± SD)	Female (Mean ± SD)
MoCA	24.7 ± 3.6	23.3 ± 4.9
FIM	189.6 ± 19.5	186.1 ± 17.8

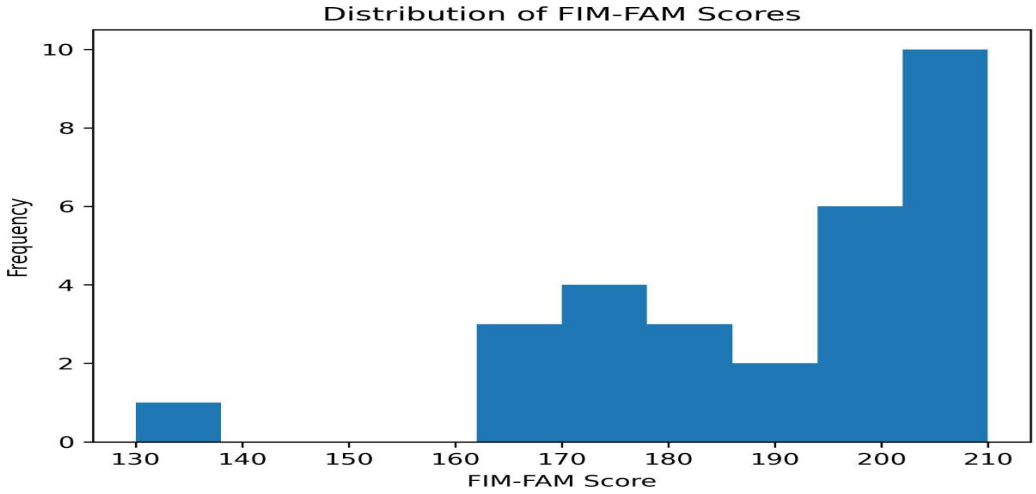
Table 3: Gender-wise Comparison

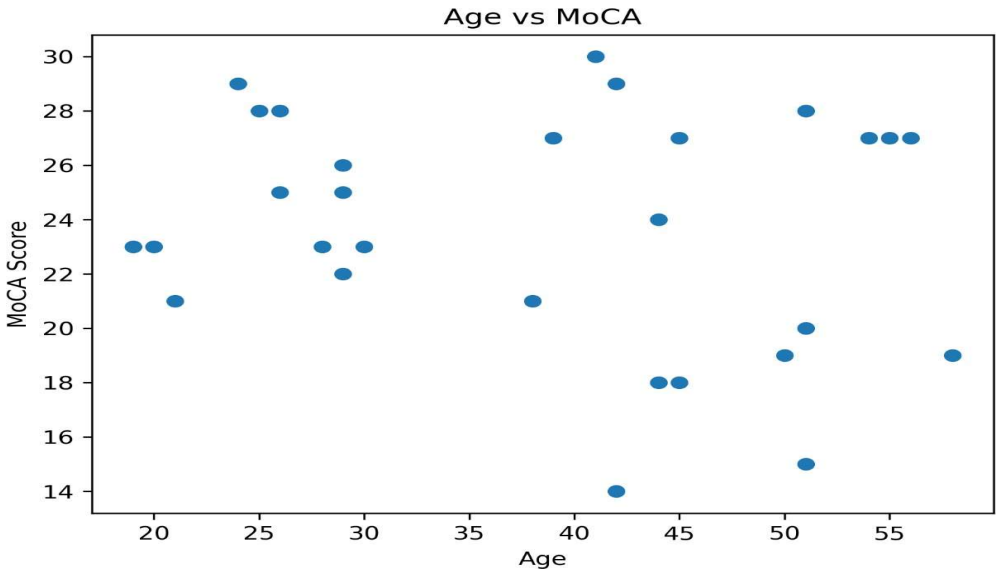
Variable Pair	Correlation Coefficient (ρ)	p- value	Interpretation
MoCA vs FIM- FAM	0.31	0.09	Weak positive correlation (not statistically significant)

Table 4: Correlation Between Cognitive Function and Functional Independence


Correlation between MoCA and FIM-FAM
FIM-FAM Score
MoCA Score
210
200
190
180
170
160
150
140
130
14
16
18
20
22
24
26
28
30


Distribution of MoCA Scores
Frequency
MoCA Score
8
7
6
5
4
3
2
1
0
14
16
18
20
22
24
26
28
30


Distribution of FIM-FAM Scores
Frequency
FIM-FAM Score
10
8
6
4
2
0
130
140
150
160
170
180
190
200
210



A total of 30 patients diagnosed with primary brain tumors were included in the study. Cognitive function was assessed using the Montreal Cognitive Assessment (MoCA), while functional independence was evaluated using the Functional Independence Measure–Functional Assessment Measure.

The MoCA scores ranged from 14 to 30, reflecting a wide variation in cognitive performance among participants. Similarly, FIM-FAM scores ranged from 130 to 210, indicating differing levels of functional independence across the study population.

Further studies with larger sample sizes and more homogeneous patient populations are required to better elucidate the relationship between cognitive function and functional outcomes in individuals with primary brain tumors.

Correlation Between Cognitive Function and Functional Independence

The association between cognitive function and functional independence was analyzed using Spearman's rank correlation coefficient, as the data were not assumed to be normally distributed.

The analysis revealed a weak positive correlation between MoCA and FIM-FAM scores ($\rho = 0.31$, $p = 0.09$). Although higher MoCA scores tended to be associated with better functional independence, this relationship did not reach statistical significance.

Interpretation

These findings suggest that while there is a trend indicating that improved cognitive function may be associated with greater functional independence, the strength of this relationship is limited in the present sample. The lack of statistical significance may be attributable to the relatively small sample size and heterogeneity of tumor types.

DISCUSSION

Relationship Between Cognitive Function and Functional Independence

The present study examined the relationship between cognitive function, assessed using the Montreal Cognitive Assessment (MOCA), and functional independence, measured by the Functional Independence Measure-Functional Assessment Measure (FIM-FAM), in patients with primary brain tumors. The findings revealed a weak positive correlation between MoCA and FIM- FAM scores ($p = 0.31$), indicating that better cognitive performance tended to be associated with higher levels of functional independence. However, this relationship did not reach statistical significance ($p = 0.09$).

Although the correlation was not statistically significant, the positive direction of the association suggests that cognition plays an important role in functional performance. Cognitive abilities such as attention, executive function, memory, and visuospatial skills-domains assessed by the MoCA- are essential for planning, initiating, and executing daily activities, which are reflected in FIM- FAM Scores.

Comparison With Existing Literature

The findings of the present study are consistent with previous research that highlights the contribution of cognitive function to functional outcomes in individuals with neurological conditions, including brain tumors. Studies have shown that cognitive impairments in patients with brain tumors are associated with reduced independence in activities of daily living, decreased participation, and poorer rehabilitation outcomes.

However, the modest strength of the correlation observed in this study aligns with literature suggesting that functional independence is multidimensional. The FIM-FAM assesses not only cognitive aspects but also motor, psychosocial, communication, and adjustment domains. Therefore, functional independence may be

influenced by factors such as motor deficits, fatigue, emotional status, tumour location, treatment effects, and environmental support, which are not fully captured by cognitive screening alone.

Clinical Interpretation of the Non-Significant Finding

The lack of statistical significance may be attributed to several factors. First, the small sample size (n = 30) may have limited the statistical power to detect a significant relationship. Second, the heterogeneity of tumour types and locations could have resulted in variable cognitive and functional profiles, thereby weakening the strength of the association. Third, MoCA is a screening tool, and while it is sensitive to cognitive impairment, it may not capture subtle domain-specific deficits that have a direct impact on functional performance.

Despite these limitations, the observed trend remains clinically meaningful. In occupational therapy practice, even mild cognitive impairments can significantly affect safety, independence, and participation in daily life. Thus, the positive correlation supports the clinical relevance of cognitive assessment in planning rehabilitation for patients with primary brain tumors.

Implications for Occupational Therapy Practice

From an occupational therapy perspective, the findings reinforce the importance of comprehensive assessment that includes both cognitive screening and functional evaluation. While MoCA provides a quick overview of cognitive status, the FIM-FAM offers a broader understanding of how cognitive and motor impairments translate into everyday functional challenges.

The results highlight the need for cognitively informed rehabilitation approaches, including task- specific training, compensatory strategies, environmental modifications, and caregiver education. Occupational therapists should consider addressing cognitive deficits alongside physical impairments to optimize functional independence and participation.

Limitations of the Study

The study has certain limitations. The small sample size and cross-sectional design limit the generalizability of the findings and preclude conclusions about causality. Additionally, the use of a single cognitive screening tool may not adequately capture the complexity of cognitive dysfunction in brain tumour populations. Future studies could benefit from larger samples, longitudinal designs, and the inclusion of detailed neuropsychological assessments.

Recommendations for Future Research

Future research should explore the relationship between specific cognitive domains and functional outcomes using larger and more homogeneous samples. Longitudinal studies examining changes in cognition and function over the course of treatment and rehabilitation would provide valuable insights into recovery patterns and intervention effectiveness.

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