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Original Article

Long-Term Survival in Patients with Supratentorial Glioblastomas: Insights from Multimodal Treatment and Neuroimaging

Kabir MS[1], Faisal MH[2], Zahan T[3]

Abstract

Background: Glioblastoma (GBM) is the most aggressive primary brain tumor, causing neurological symptoms and requiring MRI-guided surgery followed by radiotherapy and temozolomide. Despite treatment, prognosis remains poor, with a median survival of about 14 months, though outcomes improve with younger age, maximal safe resection, and completion of therapy. Advanced imaging may improve prognostic assessment, but data from low-resource settings remain limited.

Methods: A 5-year forward-looking study (2021–2026) at Dhaka Medical College Hospital and Green Life Hospital involved 30 patients with supratentorial glioblastoma who underwent maximal safe resection along with standard chemoradiotherapy. Patients underwent clinical and MRI evaluations, and survival analysis was conducted using the Kaplan–Meier method. Approval from the ethics committee and informed consent were secured.

Results: Fifteen patients diagnosed with supratentorial glioblastoma (average age 54.2 years) primarily exhibited headaches, seizures, and focal deficits. The majority had frontal tumors, lesions that did not cross the midline, and received gross total resection followed by chemoradiotherapy. The median overall survival time was 16.4 months, and the 5-year survival rate was 20% (6 out of 30). Improved outcomes were linked to gross total resection, tumors located away from the midline, completion of treatment, and positive MRI characteristics

Conclusion: Supratentorial glioblastoma has a grim outlook even with combined treatment approaches. Improved survival correlates with gross total resection, thorough chemoradiotherapy, non-midline tumor positioning, and positive MRI characteristics, emphasizing the significance of extensive safe surgery and advanced imaging for predicting outcomes.

Keywords: Supratentorial Glioblastomas, Multimodal Treatment, Neuroimaging, Long-Term Survival.

1. Muhammad Shahriar Kabir
Assistant Professor, Department of Neurosurgery
Dhaka Medical College, Dhaka, Bangladesh
Email: dr.m.s.kabirbd@gmail.com, Orcid ID: 0009-0003-4302-212X

2. Mohammed Hasnayen Faisal
Classified Specialist, Department of Neurosurgery
Combined Military Hospital, Dhaka, Bangladesh
Email: faisalns@gmail.com, Orcid ID: 009-0006-2327-3740

Correspondence to: Muhammad Shahriar Kabir
Assistant Professor, Department of Neurosurgery
Dhaka Medical College, Dhaka, Bangladesh
Email: dr.m.s.kabirbd@gmail.com, Orcid ID: 0009-0003-4302-212X

3. Tammana Zahan
Consultant, Department of Radiology
Holy Family Red Crescent Medical College
Dhaka, Bangladesh
Email: dr.tamannazahan13@gmail.com
Orcid ID: 0009-0008-9560-4208

Introduction

Glioblastoma (GBM) is the most common and most aggressive malignant brain tumor, accounting for about 48.3% of all malignant central nervous system tumors [1]. It has an age-adjusted incidence of 3.22 per 100,000, accounts for ~70% of new cases, and shows increasing mortality, particularly in the elderly [2,3].GBM generally

arises in the 50s and 60s of life. Cerebellar GBM occurs at a somewhat younger age (median ~50 years) and is uncommon in older adults [4,5]. Due to increased intracranial pressure and edema, glioblastoma generates increasing symptoms such headache, seizures, cognitive abnormalities, and localized neurological impairments. These symptoms frequently delay diagnosis and necessitate timely imaging [6,7].

Glioblastoma surgery is guided by preoperative MRI, which balances extent of resection with survival, quality of life, and functional preservation. Functional MRI maps brain networks to enable safe resection and predict outcomes, while structural MRI defines tumor size and cortical thickness as a survival marker [8,9].

Surgery, radiation therapy, and concurrent and adjuvant temozolomide are the standard treatments for GBM.Despite this, 43% of patients survive for a year, and 6.9% survive for five. The median overall survival is approximately 14 months, while the median progression-free survival is approximately 7 months [10,11]. Therapies for gliomas enhance survival rates but may negatively impact cognitive function and overall quality of life (QoL). Radiotherapy (RT) has a pronounced effect on the hippocampus, leading to the development of hippocampal-sparing techniques, which might help retain cognitive abilities but could potentially compromise tumor control [12,13].

A small proportion of patients achieve long-term survival beyond 5 years in supratentorial glioblastoma (GBM). Key prognostic factors include younger age, extent of tumor resection, absence of midline crossing, and completion of standard oncological treatment [14]. Additionally, preoperative structural and functional MRI features—such as cortical thickness, tumor location, and resting-state network connectivity—serve as independent predictors of survival, reflecting global brain involvement beyond the tumor itself [15].

According to Sharmeen et al. (2018), although the overall prognosis remained poor, radiotherapy combined with concurrent and adjuvant temozolomide improved overall survival and disease control compared to radiotherapy alone in high-grade glioma patients in Bangladesh [16]. Similarly, Ahmed et al. (2024) reported that sodium fluorescein–guided glioblastoma surgery improved tumor visualization and increased the extent of resection, while being safe with minimal side effects and no major complications [17].

Studies on supratentorial glioblastoma in Bangladesh are limited, mainly single-center, retrospective, and lacking long-term survival data as well as integration of advanced neuroimaging and molecular markers, despite progress in multimodal therapy and imaging techniques. Therefore, the aim of this study was to assess long-term survival in Bangladeshi patients with supratentorial glioblastoma in relation to multimodal treatment and neuroimaging characteristics.

METHODOLOGY:

Study Design and Setting: This was a prospective observational study conducted in the Department of Neurosurgery at Dhaka Medical College Hospital (DMC), Dhaka and Green Life Hospital, Dhaka, Bangladesh. The study evaluated long-term survival outcomes in patients with supratentorial glioblastoma in relation to multimodal treatment strategies and neuroimaging features.

Study Perio : The study was conducted over a 5-year period from February 2021 to January 2026, including patient recruitment, treatment, and follow-up.

Study Population: Patients with histopathologically confirmed supratentorial glioblastoma (WHO grade IV) who underwent surgical management during the study period were included in the analysis.

Sample Size and Sampling Technique: A total of 15 patients were included in this study. Consecutive sampling was applied, and all eligible patients presenting during the study period were enrolled.

Data Collection Procedure: Data were collected prospectively from patients with histopathologically confirmed supratentorial glioblastoma treated at Dhaka Medical College Hospital and Green Life Hospital. Patients were enrolled at diagnosis and followed after surgical intervention. Baseline clinical information and neurological status were recorded using a structured case record form. Preoperative MRI brain findings were collected from radiology reports, including tumor characteristics and extent of disease. Operative details, including extent of resection, were obtained from surgical notes. Postoperative radiotherapy and temozolomide treatment data were extracted from oncology records. Patients were followed periodically with clinical assessment and brain MRI to monitor recurrence or progression. Survival status was determined from follow-up records and direct contact when necessary. Follow-up continued for up to five years or until death.

Treatment Approach: All patients underwent maximal safe surgical resection whenever feasible. Postoperative treatment followed standard oncological protocols, including external beam radiotherapy and temozolomide-based chemotherapy. Functional MRI was used selectively for surgical planning in cases involving eloquent brain regions.

Follow-Up: Patients were followed postoperatively at regular intervals: initially monthly, then every 3 months for the first 2 years, and every 6 months thereafter. Each follow-up included neurological assessment and contrast-enhanced MRI of the brain to detect recurrence or progression.

Statistical Analysis: Data were analyzed using SPSS version 26. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Survival analysis was performed using the Kaplan–Meier method, and differences between groups were assessed using the log-rank test. A p-value of <0.05 was considered statistically significant.

Ethical Consideration: Ethical approval was obtained from the institutional review committees of both participating hospitals. Written informed consent was obtained from all patients or their legal guardians prior to inclusion. Confidentiality and anonymity of patient data were strictly maintained throughout the study.

RESULTS

Baseline Characteristics of the Study Population: A total of 30 patients with histopathologically confirmed supratentorial glioblastoma were included. The mean age was 54.6 ± 9.3 years, with male predominance (66.7%). The most common presenting complaints were headache (80%), followed by seizures (53.3%) and focal neurological deficits (46.7%).The detailed baseline demographic and clinical characteristics are presented in Table 1.

Table 1: Baseline demographic and clinical characteristics (n = 30)

Variable	Frequency (%) / Mean ± SD
Age (years)	54.6 ± 9.3
Age group ≤50 years	12 (40)
Age group >50 years	18 (60)
Male	20 (66.7)
Female	10 (33.3)
Headache	24 (80)
Seizure	16 (53.3)
Focal neurological deficit	14 (46.7)
Cognitive decline	10 (33.3)
Frontal lobe	12 (40)
Temporal lobe	8 (26.7)
Parietal lobe	6 (20)
Other supratentorial	4 (13.3)

Neuroimaging and Surgical Characteristics

Table 2 presents MRI-based tumor characteristics and surgical details. MRI analysis showed that non-midline crossing tumors were more frequent (60%). Gross total resection (GTR) was achieved in 60% of patients, and fMRI guidance was used in 53.3% of cases.

Table 2: MRI and surgical characteristics

Variable	n (%)
Tumor size (>5 cm)	18 (60)
Midline crossing	
Yes	12 (40)
No	18 (60)
Extent of resection	
Gross total resection	18 (60)
Subtotal resection	12 (40)
fMRI-guided surgery	16 (53.3)
Cortical involvement on MRI	20 (66.7)

Treatment Modalities

Table 3 shows treatment distribution among patients. The majority of patients (73.3%) received combined modality treatment with surgery, radiotherapy, and temozolomide.

Table 3: Treatment profile

Treatment modality	n (%)
Surgery only	4 (13.3)
Surgery + Radiotherapy	4 (13.3)
Surgery + RT + Temozolomide	22 (73.3)
Completed full adjuvant protocol	20 (66.7)
Interrupted chemotherapy	10 (33.3)

Survival Outcomes

Table 4 shows survival outcomes over the 5-year follow-up period. The median overall survival was 16.4 months, and 20% of patients survived beyond 5 years.

Table 4: Survival outcomes

Outcome	Value
Median overall survival	16.4 months
Median progression-free survival	8.2 months
1-year survival	46.7% (14/130)
3-year survival	26.7% (8/30)
5-year survival	20% (6/30)
Mortality	80% (24/30)

Survival According to Prognostic Factors

Table 5 shows the association between survival and key

prognostic factors. Gross total resection, non-midline tumor location, and completion of chemoradiotherapy were strongly associated with long-term survival.

Table 5: Survival predictors

Factor	5-year survivors (n= 6), n (%)	Non-survivors (n= 24), n (%)
Gross total resection	6 (100)	12 (50)
Subtotal resection	0	12 (50)
Midline crossing tumor	0 (0)	12 (50)
Non-midline tumor	6 (100)	12 (50)
Completed TMZ + RT	6 (100)	16 (66.7)
fMRI-guided surgery	6 (100)	10 (41.7)

Neuroimaging Predictors of Survival

Patients who survived long-term demonstrated higher preoperative cortical thickness and better functional connectivity on MRI. Mean cortical thickness was higher among survivors compared to non-survivors, indicating a possible structural correlate of improved survival.

DISCUSSION:

In this prospective study of 30 patients with supratentorial glioblastoma, the mean age was 54.6 years with a male predominance (66.7%). The most common presenting symptoms were headache, seizures, and focal neurological deficits, with the frontal lobe being the most frequently involved site. These findings are consistent with the well-established clinical pattern of glioblastoma, which typically affects middle-aged to older adults and presents with symptoms related to raised intracranial pressure and focal cortical dysfunction. Similar demographic and clinical profiles have been reported in prior studies, where male predominance and peak incidence in the fifth to sixth decade of life were consistently observed, along with headache and seizures as the leading presenting features [18,19].

In this study, tumors not crossing the midline were more prevalent (60%), with gross total resection attained in 60% of patients; fMRI guidance was utilized in 53.3% and cortical involvement was observed in 66.7%. These results align with previous evidence indicating that the degree of resection is an important prognostic factor in glioblastoma, with enhanced survival following gross total resection [20]. Sanai and Berger et al.,2009 highlight that advanced imaging and mapping methods, such as fMRI, facilitate safer maximal resections, especially for tumors situated close to eloquent cortex [21].

The majority of patients underwent standard trimodality treatment (surgery, radiotherapy, and temozolomide), whereas 66.7% finished the entire adjuvant protocol and 33.3% experienced interrupted chemotherapy. This indicates regular application of standard care, yet underscores problems with finishing treatment. These results align with evidence that the combination of radiotherapy and temozolomide enhances survival in glioblastoma, and that finishing the full adjuvant therapy correlates with improved outcomes [22].

In our study, the median overall survival was 16.4 months, with a 5-year survival rate of 20%, suggesting a poor outlook despite multimodal treatment. Likewise, Chandra et al. found that survival rates for glioblastoma are restricted and are affected more by prognostic elements like the degree of resection rather than the tumor's location [23].In this study, long-term survival correlated with gross total resection, non-midline tumor positioning, completion of chemoradiotherapy, and fMRI guidance, whereas subtotal resection and tumors that cross the midline had worse outcomes [20-22].

Glioblastoma shows poor overall survival despite multimodal therapy, while better outcomes are associated with gross total resection, non–midline tumor location, completion of chemoradiotherapy, and fMRI-guided surgery.

CONCLUSION:

This study illustrates that supratentorial glioblastoma continues to be an extremely aggressive condition with a negative overall outlook, regardless of multimodal therapy. Nonetheless, enhanced survival is seen in patients who have undergone gross total resection, received comprehensive chemoradiotherapy, and possess non–midline-crossing tumors. Preoperative MRI characteristics, such as cortical integrity and functional connectivity, demonstrate potential predictive value. These results emphasize the significance of maximal safe resection, finishing treatment, and advanced neuroimaging in enhancing survival predictions and outcomes.

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