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Surgical Management and Clinical Outcomes in Recurrent Glioma

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ABSTRACT

Background: *Recurrent gliomas, particularly glioblastomas, present significant treatment challenges due to high recurrence rates, aggressive behavior, and limited standardized management options. Repeat surgical resection is a potential therapeutic approach but carries risks of neurological complications. To evaluate the clinical characteristics, surgical management, postoperative outcomes, and complications in patients undergoing reoperation for recurrent brain gliomas.* ***Methods & Materials:*** *This prospective observational study included 30 patients who underwent reoperation for recurrent gliomas at Dhaka Medical College and Green Life Hospital from January 2021 to December 2023. Data on demographics, comorbidities, tumor histology, extent of resection, tumor location, time to recurrence, pre- and postoperative Karnofsky Performance Scale (KPS), and postoperative complications were collected and analyzed using SPSS-26.* ***Results:*** *The mean age was 48.7 years, with 63.3% males. Glioblastoma multiforme was the most frequent initial histology (53.3%), followed by diffuse astrocytoma (20%) and anaplastic astrocytoma (13.3%). Gross total resection was achieved in 53.3% of primary surgeries. At recurrence, hemiparesis (43.3%) and convulsions (36.7%) were most common; 66.7% had KPS ≥70. Early recurrence (<6 months) occurred exclusively in GBM patients, while low-grade gliomas recurred later. Postoperative KPS improvement was observed in 75% of patients with preoperative KPS ≥70, compared to only 20% of those with KPS <70.****Conclusion:*** *Reoperation for recurrent gliomas is feasible and can improve functional outcomes, particularly in patients with higher preoperative KPS. Glioblastoma recurs earlier than low-grade gliomas. While complications are common, careful patient selection based on functional status, tumor characteristics, and comorbidities can optimize surgical outcomes.*

Keywords: *Recurrent glioma, Glioblastoma, Reoperation, Karnofsky Performance Scale, Postoperative complications, Tumor recurrence*

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INTRODUCTION

Gliomas are among the most common primary tumors of the central nervous system, with high-grade gliomas (HGGs), particularly glioblastoma (GBM), representing the majority of aggressive adult cases [1]. Despite maximal safe resection followed by radiochemotherapy, recurrence is almost inevitable, typically occurring within 6–10 months, and is associated with poor prognosis and limited standardized treatment options [2,3].

Management of recurrent gliomas remains controversial. Treatment options for recurrent glioblastoma include repeat surgery, re-irradiation, systemic therapies such as nitrosoureas or bevacizumab, tumor-treating fields, and experimental immunotherapies, although no uniform standard of care has been established. [3,4]. The decision to reoperate must carefully consider benefits in symptom relief and survival against the potential for neurological and systemic complications, alongside patient performance status [2,5].

Evidence from retrospective analyses indicates that repeat resection may confer survival advantages in appropriately selected patients. In one study of 131 patients undergoing up to four surgeries, median survival decreased progressively from 76 months after the first surgery to 24–26 months after subsequent surgeries [5]. Another study focusing on high-grade gliomas reported 1-year overall survival at 100%, with progression-free survival at 6 months reaching over 50%—all achieved with very low rates of major complications after multiple surgical interventions [6]. Nevertheless, perioperative morbidity remains an important concern. In a series of 41 reoperations, neurological worsening occurred in 22.2% of cases (12.2% major), while 44% experienced improvement; overall mortality was low at 2.4% [7]. Literature reviews suggest combined morbidity and mortality rates ranging from 12% to 30%, generally considered acceptable given the potential to prolong survival with preserved quality of life [8].

Patient selection is crucial for optimizing outcomes. Factors such as preoperative Karnofsky Performance Status (KPS), tumor location relative to eloquent areas, extent of resection, time since previous surgery, and availability of adjuvant therapies significantly influence prognosis [2,9,10]. Recurrent glioblastoma further presents challenges due to molecular heterogeneity and treatment resistance [11]. While multiple therapeutic approaches have been explored, no universally standardized strategy has yet emerged [12]. The aim of this study was to evaluate the clinical characteristics, surgical management, and outcomes of patients undergoing reoperation for recurrent brain gliomas. Specifically, the study sought to assess patterns of tumor recurrence, perioperative complications, and postoperative functional outcomes, as well as to identify factors such as preoperative functional status and tumor histology that influence patient prognosis following reoperation.

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METHODS & MATERIALS

This prospective observational study was conducted at Dhaka Medical College (DMC) and Green Life Hospital between January 2021 and December 2023. The study included 30 patients who underwent reoperation for recurrent brain glioma. Patients of any age and gender who had previously undergone surgery for glioma and subsequently developed clinical and radiological evidence of tumor recurrence, and were scheduled for reoperation, were included in the study, with all histopathological subtypes of gliomas considered eligible. Patients with de novo brain gliomas, multicentric or inoperable recurrent gliomas, or those deemed unfit for neurosurgical intervention were excluded. For all included patients, detailed information was collected on demographic characteristics (age, sex, comorbidities), initial tumor histopathology, extent of resection during the primary surgery, Karnofsky Performance Scale (KPS) at recurrence, time interval between the primary surgery and recurrence, extent of resection at reoperation, histopathology of reoperated lesions, and postoperative KPS. Data were analyzed in SPSS-26. Ethical approval was obtained from the institutional review boards of both hospitals, and patient confidentiality was maintained throughout the study.

RESULTS

Table I shows total of 30 patients fulfilled the inclusion criteria. Patients' ages ranged from 24 to 72 years, with a mean of 48.7 years. Of them, 19 (63.3%) were male and 11 (36.7%) were female. Regarding comorbidities, 4 (13.3%) were diabetic, 5 (16.7%) hypertensive, 3 (10%) ischemic heart disease, and 1 (3.3%) chronic renal disease on dialysis. Thirteen patients (43.3%) had no comorbidities.

Table I Baseline characteristics of the patients (*n*=30)

Variable	Frequency (n)	Percentage (%)
Age (years)	Range 24–72, Mean 48.7	–
Sex		
Male	19	63.3
Female	11	36.7
Comorbidities		
Diabetes mellitus	4	13.3
Hypertension	5	16.7
Ischemic heart disease	3	10.0
Chronic renal disease	1	3.3
None	13	43.3

Table II shows the characteristics of glioma among the patients, the most frequent histological type at initial surgery was glioblastoma multiforme (GBM, 53.3%), followed by diffuse astrocytoma (20%) and anaplastic astrocytoma (13.3%). Less common subtypes included diffuse oligodendroglioma (6.7%), pilocytic astrocytoma (3.3%), and anaplastic ependymoma (3.3%). Regarding the extent of primary resection, gross total resection was achieved in 53.3% of patients, while the remaining underwent subtotal or partial resection.

Table II Characteristics of glioma after initial surgery (*n*=30)

Variable	Frequency (n)	Percentage (%)
Initial WHO histological type		
Pilocytic astrocytoma	1	3.3
Diffuse astrocytoma	6	20.0
Diffuse oligodendroglioma	2	6.7
Anaplastic astrocytoma	4	13.3
Anaplastic ependymoma	1	3.3
GBM	16	53.3
Extent of resection (Primary surgery)		
Gross total resection	16	53.3
Subtotal resection	8	26.7
Partial resection	6	20.0

At the time of recurrence, the most common clinical presentation was hemiparesis (43.3%), followed by convulsions (36.7%). Other manifestations included disturbed consciousness (20%), visual affection (16.7%), dysphasia (13.3%), and ataxia (10%). With respect to functional status, the majority of patients (66.7%) had a Karnofsky Performance Scale (KPS) ≥70, indicating preserved functional capacity and independence at recurrence. However, one-third (33.3%) had KPS <70, reflecting severe functional impairment and increased dependency (*Table III*).

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Table III Clinical characteristics at recurrence (*n*=30)

Clinical presentation	Frequency (n)	Percentage (%)
Convulsions	11	36.7
Hemiparesis	13	43.3
Dysphasia	4	13.3
Disturbed consciousness	6	20.0
Visual affection	5	16.7
Ataxia	3	10.0
KPS at recurrence		
<70	10	33.3
≥70	20	66.7

Table IV presents the site of the tumors at recurrence, the most common tumor location was the frontal lobe (33.3%), followed by temporal (23.3%) and parietal lobes (23.3%). Less frequent locations included the occipital lobe (10%) and cerebellum (10%).

Table IV Tumor location at recurrence (*n*=30)

Location	Frequency (n)	Percentage (%)
Frontal	10	33.3
Temporal	7	23.3
Parietal	7	23.3
Occipital	3	10.0
Cerebellar	3	10.0

The time interval between primary surgery and tumor recurrence varied widely among patients. Early recurrence within 6 months was observed in 4 patients (13.3%), all with GBM, reflecting the aggressive nature of high-grade gliomas. The majority of recurrences occurred within 6–18 months post-surgery: 6 patients (20%) with GBM, 3 patients (10%) with anaplastic astrocytoma, and 1 patient (3.3%) with anaplastic ependymoma. Late recurrence (>18 months) was primarily observed in low-grade gliomas, including diffuse astrocytoma (16.7%), diffuse oligodendroglioma (6.7%), and pilocytic astrocytoma (3.3%) *Table V*.

Table V Time interval between primary surgery and recurrence (*n*=30)

Interval	Histopathology	Frequency (n)	Percentage (%)
Within 6 months	GBM	4	13.3
6–12 months	GBM	6	20.0
12–18 months	GBM	6	20.0
	Anaplastic astrocytoma	3	10.0
	Anaplastic ependymoma	1	3.3
18–24 months	Diffuse astrocytoma	2	6.7
>24 months	Pilocytic astrocytoma	1	3.3
	Diffuse astrocytoma	5	16.7
	Diffuse oligodendroglioma	2	6.7

Table VI presents the histopathology of lesions after recurrence. Among the reoperated lesions, glioblastoma multiforme (GBM) remained the most frequent histopathology (50%), consistent with its aggressive nature and high recurrence rate. Diffuse astrocytoma (20%) and anaplastic astrocytoma (10%) were the next most common recurrent tumors, reflecting the progression potential of lower-grade gliomas. Less frequent histopathologies included diffuse oligodendroglioma (6.7%), pilocytic astrocytoma (3.3%), and ependymoma (3.3%). Interestingly, radionecrosis was observed in 2 patients (6.7%), highlighting that not all enhancing lesions after primary surgery represent true tumor recurrence and underscoring the importance of histopathological confirmation before reoperation.

Table VI Histopathology of reoperated lesions (*n*=30)

Histopathology	Frequency (n)	Percentage (%)
Pilocytic astrocytoma	1	3.3
Diffuse astrocytoma	6	20.0
Diffuse oligodendroglioma	2	6.7
Anaplastic astrocytoma	3	10.0
Ependymoma	1	3.3
GBM	15	50.0
Radionecrosis	2	6.7

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Postoperative functional outcomes, measured by the Karnofsky Performance Scale (KPS), varied according to patients' preoperative status. Among patients with preoperative KPS <70 (n=10), only 2 patients (20%) improved after reoperation, 3 patients (30%) remained stable, and 5 patients (50%) deteriorated or died. In contrast, patients with preoperative KPS ≥70 (n=20) had significantly better outcomes, with 15 patients (75%) showing improvement, 3 patients (15%) remaining stable, and only 2 patients (10%) deteriorating (*Table VII*).

Table VII Postoperative KPS outcome after recurrence (*n*=30)

Pre-op KPS	Post-op outcome	Frequency (n)	Percentage (%)
<70 (n=10)	Improved	2	20.0
	Stable	3	30.0
	Deteriorated/died	5	50.0
≥70 (n=20)	Improved	15	75.0
	Stable	3	15.0
	Deteriorated	2	10.0

Table VIII shows the postoperative complications following reoperation were observed in 60% of patients, while 40% experienced no complications. The most common complication was disturbed consciousness (20%), followed by new hemiparesis (16.7%) and deterioration of pre-existing hemiparesis (13.3%). Wound infection occurred in 3 patients (10%).

Table VIII Postoperative complications after recurrence (*n*=30)

Complication	Frequency (n)	Percentage (%)
New hemiparesis	5	16.7
Deterioration of previous hemiparesis	4	13.3
Wound infection	3	10.0
Disturbed consciousness	6	20.0
None	12	40.0

These findings indicate that reoperation for recurrent gliomas carries a significant risk of neurological complications, underscores the importance of balancing the potential benefits of reoperation against the risk of neurological deterioration, especially in patients with low preoperative KPS or comorbidities.

DISCUSSION

This study evaluated the clinical characteristics, surgical management, and outcomes of 30 patients undergoing reoperation for recurrent brain gliomas. The cohort predominantly comprised middle-aged adults, with a male preponderance (63.3%). Our study's demographic profiles are consistent with those reported by Li et al., reinforcing the notion that recurrent gliomas predominantly affect middle-aged adults with a significant burden of comorbidities [13]. Regarding comorbidities, our study found a relatively low prevalence, with 43.3% of patients having no comorbid conditions. This is somewhat lower than the 60% reported by Li et al., which may reflect differences in patient populations or healthcare settings [13]. These factors should be considered when evaluating surgical candidacy and predicting postoperative outcomes.

In our cohort, glioblastoma multiforme (GBM) was the most frequent histological type at initial surgery (53.3%), followed by diffuse astrocytoma (20%) and anaplastic astrocytoma (13.3%). Less common subtypes included diffuse oligodendroglioma, pilocytic astrocytoma, and anaplastic ependymoma. This distribution aligns with epidemiological data reported in population-based studies. Rasmussen et al. (2017) found that high-grade gliomas, particularly GBM, constitute the majority of gliomas in adult patients, while lower-grade gliomas and rarer subtypes are less common, which reflects the predominance of aggressive histologies in recurrent cases [14]. Regarding the extent of primary resection, gross total resection (GTR) was achieved in just over half of the patients (53.3%), while the remainder had subtotal or partial resections. This finding is consistent with previous reports emphasizing that the feasibility of GTR is often limited by tumor location, infiltration into eloquent brain regions, and patient functional status [15]. Lenting et al. (2017) highlighted that experimental model of gliomas often fail to fully capture the infiltrative growth pattern observed in patients, which complicates achieving complete resection surgically [15]. Our findings underscore that histological type and extent of resection at initial surgery remain critical determinants of recurrence patterns.

In our study, the most common clinical presentation at recurrence was hemiparesis (43.3%), followed by convulsions (36.7%), disturbed consciousness (20%), visual disturbances (16.7%), dysphasia (13.3%), and ataxia (10%). These findings are consistent with previous reports on recurrent gliomas, where focal neurological deficits and seizures are predominant manifestations due to tumor mass effect, local infiltration, and peritumoral edema [13,16]. Li et al. (2019) reported similar patterns in recurrent glioma patients, with hemiparesis and seizures being the most frequent presenting symptoms, reflecting the predilection of these tumors for eloquent brain areas and the progressive nature of glioma recurrence [13]. Regarding functional status, two-thirds of our patients (66.7%) maintained a KPS ≥70 at recurrence, indicating preserved independence and ability to tolerate further therapy. Conversely, one-third (33.3%) had KPS <70, reflecting severe functional impairment. Patients with higher KPS are more likely to be candidates for reoperation and adjuvant therapies, while those with lower KPS face increased risks of perioperative morbidity and mortality [13,16].

In our study, early recurrence (≤6 months) occurred only in GBM patients, while most high-grade gliomas recurred within 6–18 months and low-grade gliomas recurred after >18 months. This aligns with established knowledge that high-grade gliomas are more aggressive and recur earlier, whereas

low-grade gliomas progress slowly [17,18]. Li et al. (2023) also reported that histopathology strongly influences recurrence timing, reflecting tumor heterogeneity [18]. These findings highlight the importance of tumor grade in guiding postoperative surveillance and management strategies. Postoperative outcomes were strongly associated with preoperative KPS. Patients with KPS ≥70 showed better improvement (75%), while 50% of those with KPS <70 deteriorated or died. This aligns with Deng et al. (2019), who reported that higher preoperative KPS predicts better recovery and fewer complications in recurrent glioma surgery [19].

In our study, postoperative complications occurred in 60% of patients, with disturbed consciousness (20%) and new or worsened hemiparesis (16.7% and 13.3%, respectively) being the most common, and wound infection in 10%. These findings are consistent with prior literature, where neurological deficits, altered consciousness, and wound-related complications are reported as the primary risks of glioma reoperation [20,21]. Hervey-Jumper and Berger (2014) emphasized that although repeat surgery carries higher complication rates, careful patient selection can minimize morbidity while providing potential survival benefit [21]. Reoperation for recurrent gliomas can improve function and potentially survival, especially in patients with higher preoperative KPS. Outcomes depend on tumor grade and resection extent, while complications are common but manageable with careful patient selection.

CONCLUSION

Reoperation for recurrent brain gliomas is a viable treatment option that can offer functional improvement and potential survival benefits, particularly in patients with higher preoperative KPS and preserved functional status. Glioblastoma remains the most common recurrent histology and tends to recur early, while low-grade gliomas recur later. Although reoperation carries a significant risk of postoperative complications—including neurological deficits and altered consciousness—careful patient selection based on functional status, tumor location, and comorbidities can optimize outcomes. These findings highlight the importance of individualized surgical planning to balance the benefits of tumor control with the risk of morbidity in recurrent glioma management.

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