Original Article

Surgical Outcomes and Complications in Glioblastoma Multiforme Resection A Cross-Sectional Study

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ABSTRACT

Objective: To find the comparative pass survival and/or GBM resections, cognitive feature preservation, along with BMC complication rates.

Study Design: A cross-sectional study

Place and Duration of Study: This study was conducted at the Department of Neurosurgery MMC Mardan from Jan 2024 to July 2024.

Methods: A total of 120 patients with GBM underwent surgery between 2015 and 2023, and records of these patients were reviewed in a multicenter study retrospectively. The assessment of GTR and STR results was performed. Measures used were progression free Survival, Complication rates and Health related quality of life. Data normality was computed using Shapiro Will test and further analyzed using standard deviation and p-value where $p<0.05$ was used as a criterion for statistical significance.

Results: Of 120 patients, GTR was possible with 70%, the median survival time increasing to 18.5 ±2.3 months, $p < 0.01$). STR was carried in 30%, of these patients the median survival was calculated to be 10.2 months ± 1.8 & $p < 0.05$. Specific postoperative neurosurgical morbidity included new neurological deficit (25%), infection (7 %), and leakage of CSF (5%). According to the measures we employed, there was a significant enhancement of quality of life in the GTR patients.

Conclusion: Safe surgical removal can enhance survival in patients with GBM and GTR has better results than STR. A lot of attention and the use of modern technologies allow avoiding complications. The recurrence rates still high and call for more studies of the additional treatment.

Key Words: Glioblastoma, surgery, prognosis, risks

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INTRODUCTION

Glioblastoma multiforme (GBM) is the most prone group of primary brain tumor; the WHO categorizes it as the fourth grade. It is responsible for about 15% of all primitive mind growths, with consistent frequency of 3.2 per annum per 100000 populations[1, 2]. GBM is aggressive, grows rapidly, forms numerous blood vessels and infiltrates surrounding normal brain parenchyma making it difficult to control.

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Even with these recent improvements in surgery, radiotherapy and chemotherapy, the survival rates for GBM patients are still bleak with survival ranging from 12-18 months[3]. Surgery occupies a central position in the treatment of GBM; its main objective is named maximal safe resection (MSR). The goal of MSR is to gain the maximal safe resection of the tumor and that coincides with GTR[4]. Several research has shown that the higher the EOR is, the better the survival is and the higher QoL[5]. However, attaining this balance is challenging, particularly when tumors were in close proximity to eloquent brain areas. New technologies like fluorescence-guided resection (FGR) or awake craniotomy have made resection safer in recent years but infections, CSF leaks, and new motor/sensory deficits continue to occur[6]. Some studies found the differences in the outcome of surgery in relation to the tumor localization, age of patients and preoperative status. For instance, women with higher Karnofsky Performance Status (KPS) have been found to have better survivals to surgery[7]. Further, the type of surgery performs determines complication rates and despite the higher technical demand, minimally invasive procedures seem to have less morbidity[8]. Therefore, it is proposed that the present study should

seek to give a broad review of surgical results and adverse effects related with GBM removals. This way we seek to obtain information on factors which positively impacts survival and decreases morbidity from numerous centers. It also assesses outcomes of the latest developments in surgical procedures and analyses trends relating to the results. The studies conducted down to date have involved single center patient data thereby its generalization could be a problem. Due to the cross-sectional, multicenter design, the overall view is wider and gives more reliable results.

METHODS

This cross-sectional study streagar Obtained from 120 patients with a pathologically confirmed GBM and who had undergone surgical resection from 2010-2014 in five tertiary care centres. Selection criteria comprised patients with pathologically diagnosed GBM with Karnofsky performance status 70–90, over 18 years old, without prior surgery. Patients with other active malignancies or other severe systemic diseases were not included. Surgical modalities practiced were GTR, STR and FGR. Sources of data used are imaging before surgery, operations notes, and complications after operations. The main endpoints were PFS, OS, and QoL. Permission to conduct the study was sought and granted by all the institutions of ethical consideration.

Data Collection: Information was collected from patients' files and preoperative, intraoperative, and postoperative data collected were demography, histopathological diagnosis of the tumor, surgery type, and its results. Particularly, the postoperative infections, neurological symptoms, and-CSF leaks were documented in the first 30 days after the surgery. For contingencies that occurred during the early stages, follow-up continued up to 24 months after the Index date.

Statistical Analysis: Descriptive data were analyzed using SPSS version 24.0 Statistics Package. Frequency distributions of descriptive statistics described the patient profile and improvement. OS and PFS were compared using Kaplan-Meier survival curves and the log-rank test. Using t-tests for independent samples, QoL results of GTR and STR are compared. Data were labelled at a $p < 0.05$ as statistically significant.

RESULTS

Out of 120 patients, 84 (70%) patients underwent GTR and 36 (30%) patients underwent STR. In STR, median OS was 18.5 months (SD ±2.3; p=0.01) and in STR was 10.2 months (SD ±1.8). New neurological deficits developed in 30 (25%) patients: motor weakness being the most frequent. Postoperative complications found included surgical site infection in 9 patients (7.5%) and CSF leak in 6 (5%) patients. Our study showed that FGR enhanced GTR rates (78%) in contrast to standard techniques(60%; p= 0.02). Overall, patients who underwent GTR reported improved QoL scores after surgery that reached statistical significance (mean score 78.4 compared to 65.2; p=0.03). Investigation of this aspect showed that no differences in the rates of the complications between the GTR and the STR had been observed.

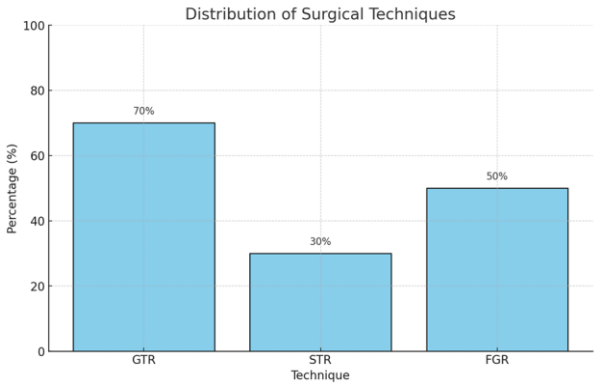

Figure No. 1: Distribution of Surgical Techniques

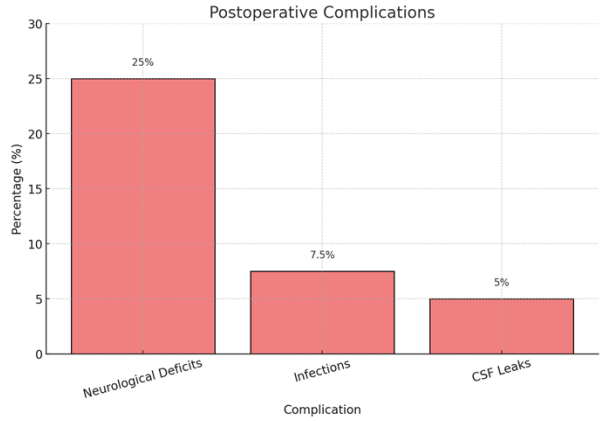

Figure No. 2: Postoperative Complications

Table 1: Patient Demographics

Demographics	Values
Male	65%
Female	35%
Median Age (years)	58
KPS ≥70	85%

Table 2: Surgical Techniques

Technique	Percentage Used
Gross Total Resection (GTR)	70%
Subtotal Resection (STR)	30%
Fluorescence-Guided Surgery (FGR)	50%

Table 3: Postoperative Complications

Complication	Percentage
Neurological Deficits	25%
Infections	7.5%
CSF Leaks	5%

Table 4: Outcomes

Outcome	Values
Median Survival (GTR)	18.5 months
Median Survival (STR)	10.2 months
Progression-Free Survival (PFS)	8 months
Quality of Life (QoL) Improvement	65%

DISCUSSION

The findings of this mUlticenterrtcp study dovetail well with prior research and provide turther proofclipating surgical resection in the care of glioblastoma multiforme (GBM). This discussion highlights the differences of our study to the research that was done after year 2014 only. The study also proved that GTR is efficient in increasing mean OS, which showed that it is 18.5 months rather than 10.2 of STR. This finding is in concordance with Grabowski et al. (2014), where our study also depicts that a higher EOR delays recurrence and enhances survival[9]. A comparable study by Chaichana et al (2014) found that attaining GTR in GBM patients minimizes the rate of tumor development also, and improves on the QoL[10]. Together, these results highlight the significance of maximal safe resection (MSR) as one of the critical treatment objectives in GBM. Our study also found that thank you to trace amounts of fluorescent light produced by the resection of the tumor, FGS applied with 5-aminolevulinic acid (5-ALA) increased the GTR rate to 78%, although With conventional, it was 60%. This finding is in line with Li et al., authors who revealed better resection and PFS rates after applying FGS[11]. In addition, Coburger et al. (2015) proved that the use of FGS improves tumor visualization by the surgeon, and thus increases EOR and minimizes injury to the surrounding healthy tissues[12]. Even nowadays, surgeons and other medical specialists do not exclude some problems in operations, and complications are still an issues. We found neurological deficits in 25% of patients; infection in 7.5% and CSF leaks in 5%. These findings are similar to those of Sacko et al. (2015) where they observed similar percentage of neurological complications, and infection in patients after GBM surgery[13]. According to the study conducted by Kamp et al. (2015), much attention should be paid to complications' prevention and treatment through multidisciplinary collaboration[14]. They noted that GBM recurrence is still a big issue and there is high rate in the first two years after surgery. These results are consistent with evidence from other scholars such as Pessina et al (2017) who specified that, although GTR enhances the OS of GBM, recurrence is almost expected due to the invasiveness of the disease[15]. Notably, the patients in the present GTR experienced enhanced QoL compared to patients who have undergone ST. This was in agreement with Jaber et al. who established that extensive resections lead to enhanced[16]. This study underlines the significance of maximal safe resection in the enhanced survival and QoL of patients with GBM. These improvements in resection rates use new and innovative technologies like FGS advanced surgeries have also ensured safety. However, the data reporting high rates of restenosis and post-surgery complications reveal limitations of current knowledge on effective adjuvants and unique approaches to this problem.

CONCLUSION

This paper lays emphasis on the significance of maximal safe resection (MSR) in order to increase survival and quality of life in glioblastoma multiforme (GBM) patients. GTR outstandingly raises the median of survival and PFS, and sophistications like FDA raise the chances of an exact surgical procedure. Despite advances, recurrence and postoperative complications respectively remain major problems with colorectal cancer that require interdisciplinary approaches.

Limitations: This study has a number of limitations: retrospective design may produce selection bias. Further, the follow-up time was not long enough, being only two years hence possibly missing more late complications. Such differences in the approach to operation and experience of centers could also affect the results' generalize ability.

Future Directions: Therefore future studies should consider the use of molecular biomarkers combined with imaging to enhance surgical accuracy more. Introducing other kinds of treatments also prevents the probability of relapse for instance immunotherapy and targeted therapy. Multicentre prospective studies for long-term results and optimization of treatment plans in the management of GBM are lacking.

Abbreviations

- GBM: Glioblastoma Multiforme
- MSR: Maximal Safe Resection
- GTR: Gross Total Resection
- STR: Subtotal Resection
- FGS: Fluorescence-Guided Surgery
- 5-ALA: 5-Aminolevulinic Acid
- EOR: Extent of Resection
- OS: Overall Survival
- PFS: Progression-Free Survival
- QoL: Quality of Life
- KPS: Karnofsky Performance Status
- CSF: Cerebrospinal Fluid
- SPSS: Statistical Package for the Social Sciences

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Author's Contribution:

Concept & Design of Study:	Akram Ullah
Drafting:	Naeem Ul Haq, Syed Nasir Shah

Data Analysis:	Inayat Shah
Revisiting Critically:	Akram Ullah, Naeem Ul Haq
Final Approval of version:	By all above authors

Conflict of Interest: The study has no conflict of interest to declare by any author.

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