CASE REPORT

Case Report: Impact of gross total resection on survival in glioblastoma [version 1; peer review: awaiting peer review]

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v1 **First published:** 17 May 2024, **13**:487
https://doi.org/10.12688/f1000research.150065.1
Latest published: 17 May 2024, **13**:487
https://doi.org/10.12688/f1000research.150065.1

Abstract

Glioblastoma (GBM), known for its aggressive behavior and dismal prognosis. Traditional therapeutic methods, including adjuvant chemotherapy and radiotherapy in conjunction with maximally safe surgical resection, are designed to prolong survival and alleviate symptoms. This case report investigates the relationship between survival outcomes in glioblastoma patients and gross total resection (GTR). A recurring seizure disorder manifested in a 58-year-old female patient presented with left-sided lower limbs weakness and occurred twice weekly for a maximum duration of 20 seconds; this condition necessitated hospitalisation and subsequent surgical intervention. A gross total resection was executed with success, resulting in the accomplishment of complete tumor excision. The patient received radiotherapy after a six-week regimen of temozolomide chemotherapy that followed the surgical removal of tumor. Notably, following treatment, the patient reported a substantial amelioration of symptoms and has maintained a 24-month survival rate thus far, with continuous follow-up. This case highlights the potential for enhanced survival outcomes in the treatment of glioblastoma when gross total resection (GTR) is followed by adjuvant chemo-radiotherapy.

Keywords

Glioblastoma, Extent of Resection, Survival outcome, Gross total resection

Open Peer Review

Approval Status *AWAITING PEER REVIEW*

Any reports and responses or comments on the article can be found at the end of the article.

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Author roles: Chaulagain D: Conceptualization, Data Curation, Formal Analysis, Software, Validation, Writing – Original Draft Preparation; **Smolanka V**: Supervision, Validation, Writing – Review & Editing; **Smolanka A**: Supervision, Validation, Writing – Review & Editing; **Havryliv T**: Investigation, Methodology, Validation

Competing interests: No competing interests were disclosed.

Grant information: The author(s) declared that no grants were involved in supporting this work.

How to cite this article: Chaulagain D, Smolanka V, Smolanka A and Havryliv T. **Case Report: Impact of gross total resection on survival in glioblastoma [version 1; peer review: awaiting peer review]** F1000Research 2024, **13**:487 https://doi.org/10.12688/f1000research.150065.1

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Introduction

Glioblastoma multiforme (GBM) is a prevalent and highly aggressive type of glial tumor primarily affecting the central nervous system in adults. Although intensive treatment measures such as surgical resection, radiation, and chemotherapy have been implemented, the prognosis remains significantly restricted.[1]

Glioblastoma, which accounts for around 15% of all brain tumors, mostly impacts persons who are 50 years old or older which is more common in males than in females.[2,3] Surgical tumor excision is vital in multimodal glioblastoma therapy. Extensive research indicates that achieving gross total resection (GTR) is strongly associated with improved outcomes in GBM patients, as determined by objective extent of resection (EOR) assessments.[4,5]

An EOR that is greater than 98% of the tumor mass has been shown to correspond with a more favourable prognosis, as demonstrated by research conducted by Lacroix et al. and following studies.[6–9] Surgical tumor removal, radiation, and chemotherapy with Temozolomide-based adjuvant treatment are routine.

Stupp et al.[10] published the findings of a randomized trial conducted by the National Cancer Institute of Canada (NCIC) and the European Organisation for Research and Treatment of Cancer (EORTC) in 2005. The data showed that the combination treatment increased survival from 12.1 to 14.6 months. In addition, combination treatment (26.5%) had a higher 2-year survival rate than radiation alone (10.4%).[10] However, radiotherapy-only patients had 11.2%, 4.3%, and 3.8% survival rates. These data confirm that combination treatment improves GBM survival.[11]

This interesting case report involves a patient who had gross total resection of glioblastoma and had six weeks of temozolomide and concomitant radiotherapy. The patient has survived 24 months and continues to get follow-ups. Symptoms have improved, and there are no signs of tumor recurrence. This example shows the promise of multimodal therapy for glioblastoma and the significance of long-term surveillance for recurrence.

Case report

A housewife with a smoking history who was 58 years old and married; she was a mother of one child. She had presented to the Neurosurgery Department of the Regional Clinical Centre of Neurology and Neurosurgery in Uzhhorod, Ukraine. The individual disclosed enduring paralysis in her left arm and limb for a duration of one month, in addition to a minimum of two episodes of seizures per week that lasted for a maximum of twenty seconds, during the previous two months. No evidence of prior trauma or familial medical predispositions was present. The utilisation of Magnetic Resonance Imaging (MRI) unveiled the existence of a heterogeneous lesion characterised by necrotic regions and irregular borders. Peri-tumoral edema and mass effect were apparent subsequent to the administration of contrast, which were accompanied by substantial enhancement. The results obtained align with the diagnostic parameters for glioblastoma, which is distinguished by its aggressive and infiltrative nature. The volumetric analysis of the tumour yielded a value of 21.8 cm^3 (Figure 1).

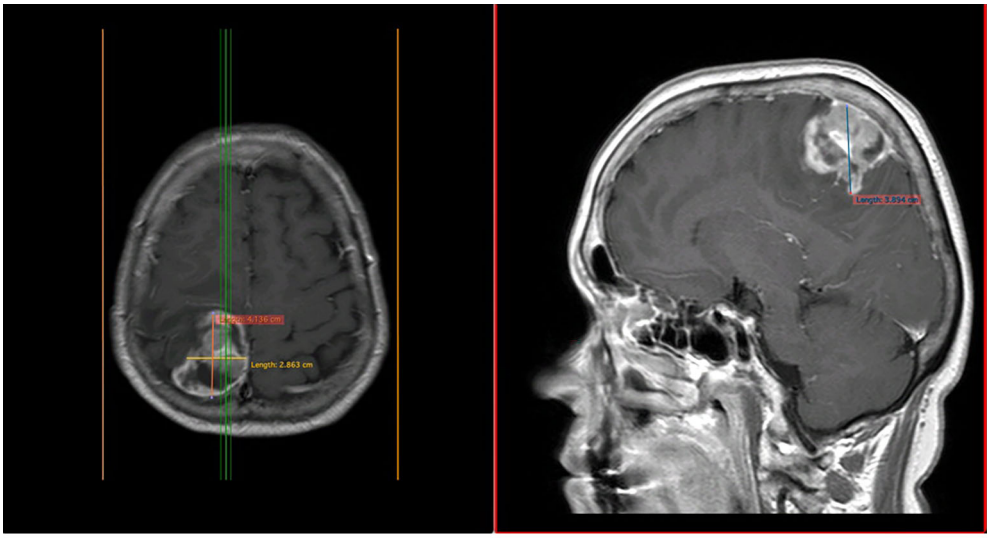

Figure 1. The volumetric analysis of tumor volume pre-operatively.

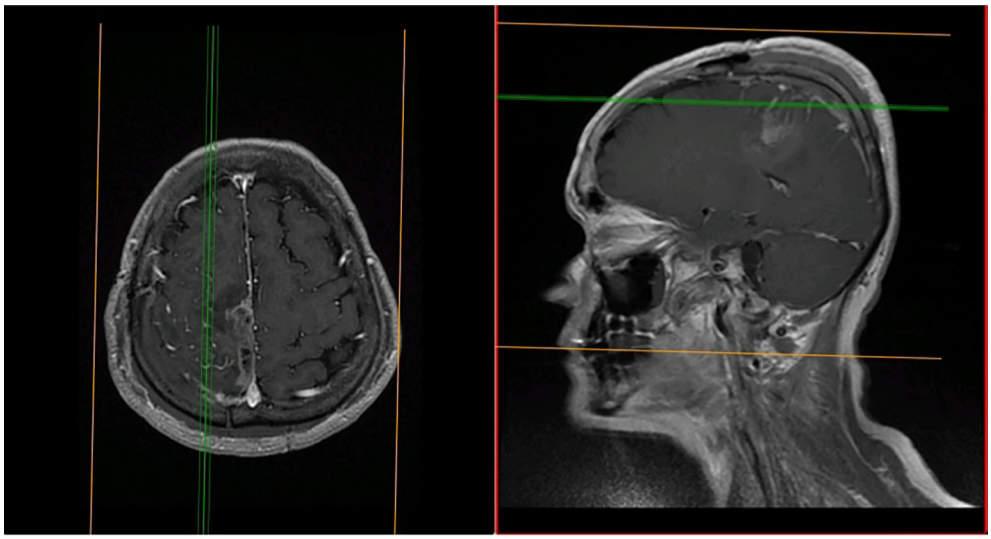

Figure 2. Volumetric analysis of residue volume of tumor post-operatively.

The patient was administered steroid and anti-epileptic medications on the second day after admission in order to control inflammation, edema, and seizure activity. Following that, the patient was subjected to surgical intervention, specifically a gross total resection of the tumor. On the second day following the operation, a follow-up MRI was conducted employing volumetric analysis to reveal that the tumour had been entirely eliminated. The residual volume was determined to be 0 cm^3 (Figure 2).

It was determined that the patient did not encounter any issues after the operation. Following that, she was given the recommendation to participate in adjuvant chemotherapy and radiotherapy. During the course of her treatment, she decided to undergo radiotherapy after undergoing chemotherapy with temozolomide, which was given to her at a daily dose of 75 mg/m^2 for a duration of six weeks. Over the course of the follow-up period that lasted for twenty-four months, the patient reported a reduction in the severity of symptoms and continues to be monitored to this day.

Discussion

The glioblastoma (GBM), which is considered to be the most common kind of malignant primary brain tumor, is categorised as a high-grade glioma that has been identified.[6]

The high invasiveness of glioblastoma (GBM) poses a substantial obstacle in achieving gross total resection (GTR), mostly because to the persistent character of microscopic tumors. This persistent nature eventually contributes to the unfavourable prognosis associated with this illness. The primary objective is to prioritise the attainment of the maximum possible safe resection, with a special focus on tumor areas that are anatomically accessible. Following this, the administration of adjuvant radiation and chemotherapy with temozolomide is commonly utilised. Despite the progress made in treatment modalities, the median survival duration for patients with glioblastoma multiforme (GBM) continues to be less than 15 months.[1,6,9]

Stupp et al. presented the findings of an NCIC-EORTC randomised experiment in 2005. Temozolomide-radiotherapy was compared to radical radiation alone for glioblastoma treatment in this research. The combination therapy significantly improved median survival from 12.1 to 14.6 months. Additionally, the group receiving combined treatment exhibited a 2-year survival rate of 26.5% compared to 10.4% for those receiving radiation alone. Temozolomide (TMZ) contributed to increased survival rates, elevating them from 10.9% to 27.2% at 2 years and from 1.9% to 9.8% at 5 years. These results highlight the efficacy of combined therapy and TMZ in improving long-term survival outcomes for patients with glioblastoma. Numerous clinical trials after this milestone have not modified the standard-of-care over a decade later.[10,12]

Existing literature suggests that a greater extent of resection, often falling within the range of 80% to 100%, is associated with more favourable results.[13] Therefore, it may be inferred that patients who receive resections over 95% may achieve

more favourable outcomes in comparison to those who get resections below 95%.[5,14] Moreover, previous research has sought to ascertain the upper limit of residual tumour sizes linked to positive results,[14] as shown by the investigation conducted by Chaichana et al.

The optimal surgical strategy is one of maximally safe resection of tumor. In recent years, an increasing body of evidence has provided robust support for the proposition that optimising the extent of resection (EOR) positively affects survival outcomes among individuals who have been diagnosed with glioblastoma.[4,15]

The yearly incidence of grade IV glioblastoma multiforme is estimated to be around 12,000 cases involving persons. Despite this, survival rates continue to be extremely low, with less than forty percent of patients surviving twelve months after receiving a diagnosis and less than nine percent living beyond three years.[16]

The extent of resection was found to be an independent predictor of prolonged survival in a study on 949 patients diagnosed with high-grade gliomas at a single institution, of which more than half underwent initial surgery. In our investigation, we observed distinct median overall survival (OS) rates associated with varying degrees of resection. Specifically, gross total resection (GTR) was linked with a median OS of 11 months, near total resection (NTR) with 9 months, and subtotal resection (STR) with 5 months. These findings highlight the importance of achieving maximal safe resection in optimizing survival outcomes for patients with glioblastoma.[17]

Our case study underscores the potential benefits of complete surgical tumor removal in the treatment of GBM. It highlights the significance of gross total resection in glioblastoma surgical excision, followed by adjuvant chemo-radiotherapy, which has resulted in a notable survival period of 24 months with ongoing follow-up. This suggests that a multimodal approach to glioblastoma therapy may lead to improved prognosis.

Conclusion

This case report describes an exceptional twenty-four-month survival period for a patient with GBM who underwent primary surgical treatment. One significant finding from our case study is the potential advantage of performing radical neurosurgery during the early stages of GBM management. This is supported by the initial complete resection, which created an opportunity for subsequent chemo-radiotherapy and an extended survival period. Placing significant emphasis on the criticality of a customised, patient-centric methodology in the treatment of glioblastoma is unchanged. This requires employing comprehensive therapeutic and diagnostic strategies that are tailored to the specific requirements of each patient. Moreover, the significance of gross total resection in glioblastoma surgical excision, followed by chemo-radiotherapy, which ultimately results in protracted survival outcomes, is highlighted in our single case presentation.

Consent

We are delighted to confirm that we have obtained written consent from the patient for the publication of their clinical details and images in the manuscript. This consent statement is a critical component of our submission, and we are dedicated to upholding the highest ethical standards in medical research. The consent statement, signed by the patient herself, has been furnished. It articulates the patient's clear comprehension and agreement regarding the publication of their clinical information and images for educational and research purposes. We reaffirm our commitment to preserving patient confidentiality and adhering to all ethical guidelines throughout the publication process.

Ethical approval: Not required with this article.

Data availability

No data are associated with this article.

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