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Original Investigation

Preoperative Nomogram-Based Assessment to Identify GBM Patients Who Do not Derive Survival Benefit From GTR Compared to STR

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Rationale and Objectives

Glioblastoma, IDH-wildtype (GBM), the most common primary malignant brain tumor in adults, has a median overall survival of 11–15 months. While gross total resection (GTR) generally improves survival compared to subtotal resection (STR), certain patient subgroups may not benefit from more extensive resection.

Methods

This study developed a nomogram-based predictive model using preoperative clinical and imaging data to identify GBM patients who may or may not benefit from GTR compared to STR. Data from the UCSF-PDGM dataset (N=371) were used to construct the model, with external validation performed using the UPENN-GBM dataset (N=457).

Results

Multivariate Cox regression identified age, extent of resection (EOR), and volume all (necrotic, enhancing, and peritumoral regions of tumor) as independent prognostic factors. The nomogram stratified patients into low-, medium-, and high-score groups based on age and tumor volume. Results showed that GTR significantly improved survival in patients with scores between 55 and 95, but not in those with scores below 55 or above 95. Younger patients with smaller tumors (usually with score <55) and older patients with larger tumors (usually with score >95) derived limited additional survival benefit from GTR compared to STR. The nomogram-based

classification outperformed methods relying solely on age or tumor volume.

Conclusion

These findings suggest that preoperative assessment using the nomogram can guide individualized surgical strategies, optimizing the extent of resection for GBM patients. However, prospective studies are warranted to further validate the reliability of the findings in this research.

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INTRODUCTION

Glioblastoma, IDH-wildtype (GBM) represents the most prevalent primary malignant brain tumor in adults, comprising 50.1% of all malignant brain tumors and demonstrating a median overall survival (OS) of 11–15 months 1, 2. The initial treatment for GBM remains surgical resection, with the extent of resection (EOR) categorized progressively as biopsy, subtotal resection (STR), gross total resection (GTR), and supratotal resection (SpTR) (3). While the increased extent of resection generally …

MATERIALS AND METHODS

All data for this study were publicly available in The Cancer Imaging Archive (TCIA) (https:// www.cancerimagingarchive.net ↗). Therefore, this study did not require Institutional Review Board Approvals from an individual institution. …

Patients

In the UCSF-PDGM dataset (N = 501), we identified 371 GBM cases that met the study criteria, which were subsequently divided into a training set (N = 259) and a testing set (N = 112) (Figure 1). The median age of patients was 63 years and 61 years, with males comprising 58.69% and 61.61% in the training set and the testing set, respectively. Baseline analysis revealed no significant differences in any characteristics between the training and testing sets (Supplementary Table 1). Additionally, …

DISCUSSION

This study aims to investigate the relationship between the extent of resection (EOR) and patient prognosis in GBM, which holds significant implications for neurosurgical decision-making. By developing a nomogram scoring system, we can accurately assess whether the survival benefits of gross total resection (GTR) significantly outweigh those of subtotal resection (STR) based on preoperative characteristics. This approach provides a scientific foundation for the formulation of individualized ...

CONCLUSION

Using our established nomogram prediction model, we calculated scores based on patient age and volume all (necrotic, enhancing, and peritumoral regions volume of tumor). Our analysis revealed that, compared to STR, GTR did not appear to prolong survival in GBM patients with scores < 55 or > 95. However, GTR significantly improved survival outcomes in patients with scores between 55 and 95. These findings may provide valuable insights for determining the optimal extent of resection in GBM ...

Ethical Approval

All data for this study were obtained from publicly available data from the Cancer Imaging Archive (TCIA). Therefore, this study did not require Institutional Review Board Approvals from an individual institution. ...

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Assistance with the Study

None. ...

CRediT Authorship Contribution Statement

Lei He: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Mingfang Luo**: Methodology, Formal analysis, Data curation. **Longlin Yin**: Methodology, Formal analysis. **Jinzhou Feng**: Writing – review & editing, Validation, Methodology, Investigation, Formal analysis. **Ruxiang Xu**: Writing – review & editing, Investigation, Conceptualization. **Fan Fei**: Writing – review & editing, ...

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. ...

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