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Lobectomy versus gross total resection for glioblastoma multiforme: A systematic review and individual-participant data meta-analysis

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Abstract

Overall survival (OS)for glioblastoma multiforme (GBM) has a known association with the extent of tumor resection with gross total resection (GTR) typically considered as the upper limit. In certain regions such as the anterior temporal lobe, more extensive resection by means of a lobectomy may be feasible. In our systematic review and meta-analysis, we aimed to compare the outcomes of lobectomy and GTR for GBM. PubMed and Embase were queriedfor studies that compared the outcomes after lobectomy or GTR for GBM. The primary outcomes were OS, progression-free survival (PFS), and Karnofksy Performance Status (KPS) score at the latest follow-up. The secondary outcomes were seizure control at the latest follow-up and complication rates. Meta-analysis for OS and PFS was performed using individual-participant data reconstructed from published Kaplan-Meier curves. Random-effect meta-analysis was performed for KPS. The secondary outcomes were pooled using descriptive statistics. Of the 795 records screened, 6 were included in our study. Meta-analysis revealed that anterior temporal, frontal, or occipital lobectomy was associated with significantly better OS ($p<0.001$) and PFS ($p<0.001$) than GTR, but not KPS (MD=6.37; 95% CI=(-13.80, 26.54); p=0.536). Anterior temporal lobectomy was associated with significantly better seizure control rates than GTR for temporal GBM (OR=27; 95% CI=(1.4, 515.9); p=0.002). There was no statistically significant difference in complication rates between anterior temporal, frontal, or occipital lobectomy and GTR. In conclusion, lobectomy was associated with significantly better OS, PFS, and seizure control than GTR for GBM.

Introduction

Glioblastoma multiforme (GBM) is the commonest type of malignant primary brain tumor [1],

with recurrence generally occurring within 6 to 8 months after the first resection, and a median overall survival spanning 15 to 17 months [2], [3]. The standard treatment for GBM involves maximal safe resection, followed by adjuvant and concurrent radiotherapy and temozolomide [4].

With regards to surgical resection, it is generally accepted that a greater extent of resection is associated with better local control and survival outcomes [5], with gross total resection (GTR) typically considered the upper limit in clinical practice. Recent emerging data suggest that supramaximal resection is associated with better outcomes than GTR alone [6], [7]. Lobectomy encompassing removal of the tumor in its entirety is also an accepted definition of supramaximal resection [8], and has also been associated with better outcomes than GTR for GBM [9], [10], [11], [12], [13], [14].

However, existing reviews included only a fraction of studies that evaluated the efficacy of lobectomy [6], [7] in the surgical management of GBM.

Hence, we aimed to perform a systematic review and meta-analysis of studies that compared the outcomes after lobectomy and GTR for GBM, to show that supramaximal resection in the form of a lobectomy is also associated with better outcomes than GTR.

Section snippets

Search strategy

This study was done in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [15]. We searched PubMed and Embase for studies published between the inception of the databases and 9 December 2022. The search string used was ("lobectomy" AND "glio*"). No language and field restrictions were imposed in our search. A final search was performed on 30 March 2023, and no additional study that was suitable for inclusion was found....

Study selection

The selection of...

Study characteristics

Of the 795 records screened, 6 reporting a total of 286 patients were included in this study (Fig. 1) [9], [10], [11], [12], [13], [14]. The characteristics of the included studies were reported in Table 1. Briefly, the total sample sizes across the studies ranged from 33 to 83, and the mean age of the patients ranged from 59 to 66 years. The NOS scores ranged from 7 to 9, indicating a low risk of bias [16]....

OS, PFS, and KPS

A total of 3 studies reported the Kaplan-Meier curves for OS and PFS as well as the KPS…

Discussion

In theory, lobectomy allows a greater extent of resection of malignant and pre-malignant cells, which thus translates to a reduced time-to-recurrence and hence prolonged survival. Our results support this proposition, demonstrating that lobectomy was associated with significantly longer OS and PFS than GTR for GBM [9], [10], [12]. The results of this meta-analysis also suggest that lobectomy and GTR have similar safety profiles, as there were no statistically significant differences between…

Conclusions

Results from our meta-analysis suggest that lobectomy was associated with significantly longer OS, PFS, and better seizure control rates than GTR for GBM. However, the decision to perform a lobectomy or GTR should be tailored to the individual patient and tumor location as well as its characteristics.…

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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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