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Efficacy and Safety of Intraoperative Radiotherapy for High-Grade Gliomas: A Systematic Review and Meta-Analysis

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Abstract

Background and objectives: High-grade gliomas (HGGs) are aggressive tumors of the central nervous system that cause significant morbidity and mortality. Despite advances in surgery and radiation therapy (RT), HGG still has a high incidence of recurrence and treatment failure. Intraoperative radiotherapy (IORT) has emerged as a promising therapeutic approach to achieve local tumor control while sparing normal brain tissue from radiation-induced damage.

Methods: A systematic review and meta-analysis were conducted following PRISMA guidelines to evaluate the use of IORT for HGG. Eligible studies were included based on specific criteria, and data were independently extracted. Outcomes of interest included complications, IORT failure, survival rates at 12 and 24 months, and mortality.

Results: Sixteen studies comprising 436 patients were included. The overall complication rate after IORT was 17%, with significant heterogeneity observed. The IORT failure rate was 77%, while the survival rates at 12 and 24 months were 74% and 24%, respectively. The mortality rate was 62%.

Conclusion: This meta-analysis suggests that IORT may be a promising adjuvant treatment for selected patients with HGG. Despite the high rate of complications and treatment failures, the survival outcomes were comparable or even superior to conventional methods. However, the limitations of the study, such as the lack of a control group and small sample sizes, warrant further investigation through prospective randomized controlled trials to better understand the specific patient populations that may benefit most from IORT. However, the limitations of the study, such as the lack of a control group and small sample sizes, warrant further investigation through prospective randomized controlled trials to better understand the specific patient populations that may benefit most from IORT. However, the limitations of the study, such as the lack of a control group and small sample sizes, warrant further investigation. Notably, the ongoing RP3 trial (NCT02685605) is currently underway, with the aim of providing a more comprehensive understanding of IORT. Moreover, future research should focus on managing complications associated with IORT to improve its safety and efficacy in treating HGG.

Keywords: Glioblastoma; Glioma; High-grade glioma; IORT; Intraoperative radiotherapy; Radiosurgery; Radiotherapy.

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