

Review

Neurosurg Rev. 2025 May 30;48(1):465. doi: 10.1007/s10143-025-03631-w.

Efficacy and safety of intraoperative magnetic resonance imaging for low-grade and high-grade gliomas: an updated systematic review and meta-analysis

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PMID: 40445417 DOI: [10.1007/s10143-025-03631-w](https://doi.org/10.1007/s10143-025-03631-w)

Abstract

Intraoperative magnetic resonance imaging (IMRI) has been increasingly used in glioma surgery, but previous studies did not differentiate low-grade (LGG) and high-grade gliomas (HGG). We conducted a meta-analysis to assess the efficacy and safety of IMRI compared to non-IMRI surgery, without association with fluorophores or multi-modality surgery (IMRI combined with other interventions), following PRISMA guidelines. Primary outcomes included gross total resection (GTR), extent of resection (EOR), and safety. A total of 22 studies (4 RCTs and 18 observational) were included. IMRI was associated with higher GTR rates in RCTs (RR 1.6, 95% CI 1.41-1.83) and observational studies (RR 1.53, 95% CI 1.39-1.68). Stratified analyses showed superior GTR rates for both LGG (RR 1.7, 95% CI 1.41-2.05) and HGG (RR 1.52, 95% CI 1.4-1.66). EOR was higher in observational studies (MD 7.3%, 95% CI 3.96-10.64%), with similar results for both LGG (MD 5.75%, 95% CI 2.66-8.83%) and HGG (MD 6.05%, 95% CI 1.75-10.3%). Regarding safety, IMRI was associated with fewer motor (RR 0.84; 95% CI 0.62-1.14; $p = 0.27$) and language deficits (RR 0.63; 95% CI 0.51-0.78; $p < 0.0001$). The incidence of early and late deficits was also lower in the IMRI group for both motor (early: RR 0.97; late: RR 0.57) and language (early: RR 0.51; late: RR 0.63) deficits. IMRI-assisted glioma surgery was associated with higher GTR and EOR, with better safety outcomes. However, the lack of significant differences in RCTs suggests further high-quality trials are needed to confirm the benefits.

Keywords: Glioma; Intraoperative MRI; Progression-Free survival; Resection.

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