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# Brachytherapy is an effective and safe salvage option for re-irradiation in recurrent glioblastoma (rGBM): a systematic review

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## Abstract

**Purpose:** To evaluate the clinical efficacy and toxicity of brachytherapy as a salvage therapy for patients with recurrent glioblastoma (rGBM).

**Methods and materials:** We searched the PubMed, Embase, and Cochrane libraries from its inception to June 2023, for eligible studies in which patients underwent brachytherapy for recurrent GBM. Outcomes of interest were mOS, mPFS, OS, PFS, and adverse events (AEs). For individual clinical survival outcomes and common AEs, weighted-mean descriptive statistics were calculated as a summary measure using study sample size as the weight. The calculation formula is as follows: weighted-mean =  $\sum wx / \sum w$  (w is the sample size and x is the outcome).

**Results:** This review included 29 studies with a total of 1202 rGBM patients, including 22 retrospective and 7 prospective studies. The results showed that from the time of brachytherapy, the mOS and mPFS were 6.8 to 24.4 months and 3.7 to 11.7 months. The OS of 6 months, 1 year, 18 months, 2 years, and 3 years after brachytherapy were 58.3% to 85.2% (weighted-mean 76.2%), 26% to 66% (weighted-mean 41.9%), 20% to 37% (weighted-mean 27.6%), 11% to 23% (weighted-mean 14.8%), and 8% to 15% (weighted-mean 12.1%), respectively. The PFS of 6 months and 1 year after brachytherapy were 26.7% to 86% (weighted-mean 53.4%) and 14% to 81% (weighted-mean 24.1%). Most patients with rGBM will experience treatment failure again during the follow-up period, mainly local (10.7% to 79.4%) or marginal (3.6% to 22.2%) recurrence, followed by distant failure (6.7% to 57.7%). Although therapeutic adverse events had not been uniformly reported, the overall toxicity rate was considered to be low. The common adverse events reported included progressive neurologic deterioration, seizures, CSF leak, brain necrosis, hemorrhage, and infection/meningitis, with a weighted-mean incidence of 1.9%, 2.4%, 4.1%, 5.4%, 2.1%, and 3.8%, respectively.

**Conclusions:** The evidence summarized above, albeit mostly level III, suggests that brachytherapy has acceptable safety and good post-treatment clinical efficacy for selected patients with rGBM. Well-designed, high-quality, large-sample randomized controlled and prospective studies are needed to further validate these findings.

**Keywords:** Brachytherapy; Glioblastoma; Recurrent; Salvage therapy; Systematic analysis.

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