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Evaluating efficacy and safety of laser interstitial thermal therapy in patients with newly diagnosed and recurrent glioblastoma: a systematic review and meta-analysis

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Abstract

Glioblastoma (GB), the most common malignant brain tumour, has a poor prognosis despite advances in treatment. Standard management involves surgery followed by chemoradiotherapy. MRI-guided laser interstitial thermal therapy (LITT) is a minimally invasive technique that may offer an option for select patients with specific clinical profiles. While preclinical studies suggest that LITT could disrupt the blood-brain barrier (BBB) to enhance drug delivery, this has yet to be definitively demonstrated in clinical settings. Adhering to the PRISMA guidelines, various databases were searched until March 2024. Eligible studies focused on LITT for supratentorial GB in adults and evaluated its safety and efficacy. Data extraction covered various study characteristics, and statistical analysis was performed using the OpenMeta Analyst software. Quality assessment was performed using the Newcastle-Ottawa Scale. Fifteen studies were analyzed, mainly employing the Neuroblate-Monteris system in the US, as retrospective single-centre trials. Treatment involved LITT in 239 patients with tumours typically in deep-seated areas. Median OS ranged from 4.9 to 32.3 months, and PFS from two to 5.9 months. Most patients received adjuvant therapy, primarily radiation and temozolomide. While LITT showed efficacy in improving OS (10.21, 95% CI 9.05-11.37), PFS (3.94, 95% CI 3.20-4.69), and tumor volume reduction (18.23, 95% CI 14.591-21.860), complications odd-ration(OR) = 0.336 (95% CI, 0.188-0.484) and mortality rates OR = 0.033 (95% CI, 0.009-0.058 were notable. LITT shows promise for treating both newly diagnosed and recurrent GB cases in non-surgical candidates, linked to improved OS, PFS, reduced tumor volume, and shorter hospital stays. However, higher complication and mortality rates were noted, emphasising the need for additional well-designed prospective multicentre trials.

Keywords: Glioblastoma; Laser interstitial thermal therapy; Safety outcomes; Survival outcomes.