ABSTRACT

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Laser interstitial thermal therapy for the treatment of primary and metastatic brain tumors: a systematic review and meta-analysis.

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BACKGROUND: Laser interstitial thermal therapy (LITT) is a minimally invasive treatment option for intracranial tumors which are challenging to treat via traditional methods; however, its safety and efficacy are not yet well-validated in the literature.

OBJECTIVE: To assess the available evidence on the indications, adverse events (AEs) of LITT and progression-free (1Y-PFS) and overall survival (1Y-OS) in the treatment of primary and secondary brain tumors.

METHODS: A comprehensive literature search was conducted through the databases PubMed, Embase, and the Cochrane Library through October 2021. Comparative and descriptive studies, except for case reports, were included in the meta-analysis. Separate analyses by tumor type (high-grade gliomas, including WHO grade 4 astrocytomas [which include glioblastomas] as a specific subgroup; low-grade gliomas; and brain metastases) were conducted. Pooled effect sizes and their 95% confidence intervals (CI) were generated via random-effects models.

RESULTS: Forty-five studies met inclusion criteria, yielding 826 patients for meta-analysis. There were 829 lesions total of which 361 lesions were classified as high-grade gliomas, 116 as low-grade gliomas, 337 as metastatic brain tumors, and 15 as non-glial tumors. Indications for offering LITT included: deep/inaccessible tumor (12 studies), salvage therapy post-failed radiosurgery (9), failures of two or more treatment options (3), in pediatrics patients (4), patient preference (1); indications were non-specific in 12 studies. Pooled incidence of all (minor or major) procedure-related AEs was 30% (95% CI: 27-40%) for all tumors. Pooled incidence of neurological deficits (minor or major) was 16% (12-22%); post-procedural edema 14% (8-22%); seizure 6% (4-9%); hematoma 20% (14-29%); deep vein thrombosis 19% (11-30%); hydrocephalus 8% (5-12%); and wound

infection 5% (3-7%). 1Y-PFS was 18.6% (11.3-29.0%) in high-grade gliomas, 16.9% (11.6-24.0%) among the Grade 4 astrocytomas; and 51.2% (36.7-65.5%) in brain metastases. 1Y-OS was 43.0% (36.0-50.0%) among high-grade glioma, 45.9% (95% CI: 37.9-54%) in Grade 4 astrocytomas; 93.0% (42.3-100%) for low-grade gliomas, and 56.3% (47.0-65.3%) in brain metastases.

CONCLUSION: New neurological deficits and post-procedural edema were the most reported adverse events following LITT, albeit mostly transient. This meta-analysis provides the best statistical estimates of progression and survival outcomes based on currently available information. LITT is generally a safe procedure for selected patients, and future well-designed comparative studies on its outcomes versus the current standard-of-care should be performed.

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