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Laser interstitial thermal therapy for first-line treatment of insular glioma

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Abstract

Objective: Insular gliomas pose a significant surgical challenge due to the complex surrounding functional and vascular anatomy. The authors report their experience using a novel framework for the treatment of insular gliomas with laser interstitial thermal therapy (LITT) and provide representative case examples emphasizing indications, rationale, and technical pearls.

Methods: A prospectively gathered institutional database was used to identify patients with newly diagnosed insular gliomas who underwent LITT between 2015 and 2023. The proposed framework of insular glioma management is guided by tumor size and extent of extra-insular tumor involvement. Patients with tumors localized to the insula (insula-only) were treated with single-session or staged LITT. Patients with insular tumors with frontotemporal involvement (insular+) were treated with insular LITT and standard frontotemporal resection of extra-insular tumor. Clinical and volumetric lesional characteristics were analyzed, with particular emphasis on extent of cytoreductive treatment and safety.

Results: Of the 261 patients treated at the authors' institution with LITT between 2015 and 2023, 33 LITT procedures were identified involving 22 unique patients with treatment-naive insular gliomas. Of the 22 patients, 12 had insular-only tumors and were treated with LITT alone, while 10 patients had insular+ lesions and were treated with LITT and resection. The median tumor volume for insular-only tumors was 13.4 cm3 (IQR 10.6, 26.3 cm3), with a median extent of treatment of 100% (IQR 92.1%, 100%). Insular+ lesions were significantly larger, with a median volume of 81.2 cm3 (IQR 51.9, 97 cm3) and median extent of treatment of 96.6% (IQR 93.7%, 100%). All patients with insular-only tumors were discharged the day after ablation, while insular+ patients had significantly longer hospital stays, with 50% staying more than 3 days. Overall, 8% of insular-only patients had permanent neurological deficits compared with 33% of insular+ patients. Two patients' tumors progressed during follow-up: one patient with WHO grade 4 astrocytoma and the other with diffuse glioma not otherwise specified. Patients with grade 4 tumors had the highest rate of permanent neurological deficit (43%) and a larger decline in postoperative Karnofsky Performance Status score ($p = 0.046$).

Conclusions: The authors present their experience using a novel insular glioma treatment paradigm that incorporates LITT into the broader framework of insular glioma surgery. Their findings suggest that insular LITT is feasible and may allow for high rates of cytoreduction while potentially ameliorating the risks of conventional insular glioma surgery.

Keywords: LITT; ablation; glioma; insula; tumor.