Letters to the Editor

NEUROSURGICAL FORUM

Stereotactic laser ablation of high-grade gliomas

TO THE EDITOR: We read with great interest the paper on laser-induced thermal therapy for high-grade gliomas by Hawasli et al.¹ (Hawasli AH, Kim AH, Dunn GP, et al: Stereotactic laser ablation of high-grade gliomas. *Neurosurg Focus* 37(6):E1, December 2014). The authors review a very exciting minimally invasive treatment for intracranial tumors: laser ablation or laser interstitial thermal therapy (LITT). On review of the LITT literature, 18 articles and 174 patients with high-grade gliomas were identified. An algorithm was suggested that incorporates LITT into the treatment options of primary and recurrent high-grade gliomas. Furthermore, this therapy proves promising; LITT has been associated with an overall survival ranging from 6.9 to 30 months for high-grade gliomas.^{1,2}

LITT is viewed as a cytoreductive technique because the effects of therapy are immediate, as opposed to radiosurgery, in which the effects may take several weeks to occur.¹ High temperature (> 70°C) induces cellular necrosis and apoptosis with peritumoral blood-brain barrier (BBB) disruption (> 40°C).^{1,2} Radiologically, LITT shows immediate disruption of the BBB and subsequent neovascularization (47 of 174 patients in Hawasli et al.'s review). The first change noted is central coagulation, manifested by hyperintensity on MRI T1 sequences within days of treatment. Additional findings include restricted diffusion and peripheral enhancement several centimeters from the tumor's edge, suggestive of BBB opening. In these authors' review, 4 (2%) patients encountered cerebral edema, which improved following administration of steroids and the passage of time. Current studies in animal models estimate that opening of the BBB ranges from days to several weeks.

The opening of the BBB has exciting possible benefits, including the potentiation of adjuvant therapies following ablation. This process has been demonstrated in animal models by increased locoregional passage of Evans blue dye and chemotherapy with agents such as paclitaxel.²⁻⁶ However, at least anecdotally in several patients, we have noted the impact of cerebral edema following intervention with laser-induced thermal therapy for tumors (Neuroblate, Monteris Medical).

The cerebral edema seems to be surprisingly long-lasting in duration compared to open resection and, in a few cases, is rather severe. We have noted in 2 patients the return to hospitalization with altered mental status, and found cerebral edema responsive to steroids and hyperosmolar therapy. We have not found studies thoroughly documenting the degree and duration of BBB opening following intracranial ablation in humans. Given the sequelae of necrosis and apoptotic cell death with concomitant BBB opening, it would be interesting to quantify the edema and to differentiate the degree of edema from cytotoxic and vasogenic etiologies, if radiologically possible. LITT is evolving as a new, exciting, and potentially effective treatment in the arsenal of cranial neurosurgery, but more investigation and results of clinical trials remain to be completed.

Kyle A. Smith, MD

Michael Salacz, MD

Paul J. Camarata, MD

University of Kansas Medical Center, Kansas City, KS

DISCLOSURE

The authors report no conflict of interest.

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Response

We thank Smith et al. for their interesting and reasonable comments regarding laser ablation therapy for brain tumors. With regard to cerebral edema, Smith et al. highlighted that their anecdotal experiences with cerebral edema do not match the findings in the literature review. In our own experience, cerebral edema with laser ablation has been a transient and manageable response to the laser procedure.^{1–3} Indeed, laser ablation does lead to a period of cerebral edema associated with the ablation itself. Although some patients respond differently from others, we have found that this edema typically resolves over the course of weeks to a month in the majority of patients. Although this edema is greater in patients who undergo laser ablation when compared to those treated with traditional tumor excision, the edema is manageable and is usually tolerated by the patients, and it is responsive to steroid therapy. It is also worth noting that in the setting of radiation necrosis following Gamma Knife surgery where edema is clinically symptomatic, laser ablation has been shown to have a demonstrable impact in limiting the duration of edema and its associated symptomatology.⁴ In the context of gliomas, the particularly low rates of edema reported in the review article may highlight the variety of laser intensities used by various authors and the reporting bias in the articles reviewed.

Indeed, whereas the effect of laser ablation on the BBB and drug delivery has been studied in animals, further research will be necessary to ascertain if this is replicated in humans. We anticipate that ongoing research trials studying the clinical and radiographic effects of laser ablation therapy and its effects on drug delivery ([\[trials.gov/show/NCT01851733\]\(http://trials.gov/show/NCT01851733\)\) will offer new insight into human laser ablation therapy.](http://clinical</p>
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Ammar H. Hawasli, MD, PhD
Eric C. Leuthardt, MD
 Washington University, St. Louis, MO

DISCLOSURE

Dr. Leuthardt is a consultant for Monteris Medical, and he owns stock in NeuroLutions, Osteovantage, and General Sensing.

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