Title: Stereotactic laser ablation of symptomatic cavernous malformations: imaging and clinical outcomes at one year

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ABSTRACT

BACKGROUND: Surgical resection is indicated for cerebral cavernous malformations (CCMs) causing medically refractory epilepsy. Magnetic resonance-guided laser interstitial therapy is a minimally invasive thermal-ablative approach to treating focal brain lesions.
OBJECTIVE: To describe the use of stereotactic laser ablation for treating symptomatic cavernous malformations with respect to feasibility, safety, imaging, and clinical outcomes in series of patients.
METHODS: Nineteen consecutive patients were prospectively enrolled who had medically-refractory epilepsy or intractable headaches with corresponding CCMs. To confirm concordance between symptoms and location of pathology, each patient underwent a combination of anatomic and functional MRI, encephalography, PET, and neuropsychometric testing. Intraoperatively, each patient underwent twist-drill craniotomy and placement of a saline-cooled cannula through which was passed an optical fiber to deliver 980-nm diode laser energy (Visualase, Medtronic). MR imaging provided confirmation of cannula placement and near-real-time feedback on extent of thermocoagulation. Patients were followed for symptom recurrence and imaging to estimate CCM involution.
RESULTS: Out of 12 epileptic patients with 12-month follow-up, 11 are seizure free (92% Engel class 1 outcome). One patient continued to have seizures and went on to resection at 9 months after which she has been seizure free. Two of two headache patients with 12-month follow-up have reduced symptoms. The five remaining patients with less than 12-month follow-up were included for perioperative complications and are seizure free at last followup. The most common lesion location was temporal lobe followed by frontal and parietal, with one case in the basal ganglia and one case in the thalamus. There was no incidence of hemorrhage upon cannula insertion into CCM; however, the one large basal ganglia lesion (4.2 cm^3) showed evidence of hemorrhage during ablation at which time the procedure was aborted. This patient had transient

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hemiparesis in the immediate post-operative period but only trace spasticity at last follow-up. No other patients had lasting perioperative complications.
CONCLUSION: Minimally invasive MR-guided ablation of symptomatic CCMs is a potentially safe and effective alternative to open resection. Additional experience and longer follow-up are needed.

KEYWORDS: Cavernous malformation; epilepsy; headaches; magnetic resonance imaging; stereotactic laser ablation; laser interstitial thermal therapy

LEARNING POINTS:

- Cerebral cavernous malformations (CCMs) are ideal candidates for stereotactic laser ablation due to their minimal blood flow, lobular shape, and susceptibility to thermocoagulation
- Nineteen consecutive patients with medication-refractory epilepsy or intractable seizures confirmed to be concordant with CCM location underwent laser ablation
- Out of 12 epileptic patients with one year follow-up, 11 are seizure free (92% Engel class 1). One went on to resection.
- No significant lasting perioperative complications.