The Rate of Visual Field Deficits Following Laser-ablation Amygdalo-hippocampectomy in Patients with Mesial Temporal Lobe Epilepsy

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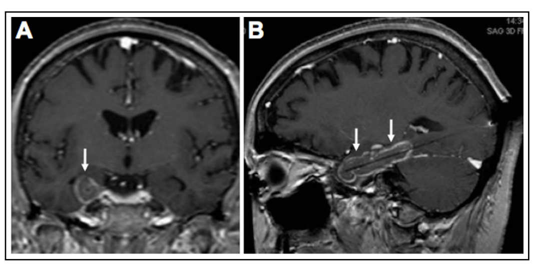
Introduction

As a minimally invasive surgical technique, laser-induced thermal therapy (LITT) for epileptogenic foci has become an alternative to open-resective surgery for patients with refractory mesial temporal lobe epilepsy (MTLE) (1,2). Visual field defects (VFDs) are reported to occur in 52–100% of patients following open surgery for MTLE (3-5). Our purpose was to evaluate the rate of VFD following LITT for amygdalo-hippocampectomy (AHE) in patients with MTLE and correlate it with damage to optic radiation, assessed by diffusion tensor tractography.

Methods

We performed a retrospective analysis of 5 patients (3 males and 2 females; mean age 45 years, range: 28 and 69) who underwent laser ablation AHE for medically refractory MTLE between June and December 2015. Follow-up included assessment of seizure outcome through medical records and patient interview and VF by automated perimetry method. We examined the association between damage to optic radiations and incidence of VFD by qualitative assessment of optic radiation fiber tracts using preoperative diffusion tensor imaging (DTI). We performed three -dimensional reconstruction of optic radiations, preop planning (laser probe trajectory) and postop MRIs (ablation volume).



Results

Preoperative evaluation included magnetic resonance imaging (MRI), functional MRI (fMRI), and DTI. During follow-up ranging from 3 - 9 (median 7) months, all patients achieved significant seizure reduction, and one patient was seizure free. Postoperatively, no patient reported subjective visual changes or had detectable VFDs based on bedside confrontation testing. All patients underwent formal visual field testing at 3–8 months postoperatively. Four patients had normal visual field testing, and one had right superior quadrantanopia (20%). The damage to Meyer's loop was determined and was consistent with the VFD. No other complications or neuropsychological side effects related to laser ablation were noted.

Discussion

1.Laser ablation AHE significantly reduced the frequency and severity of epilepsy of our patients and was associated with a low risk of complications.

2.DTI-tractography allows alignment of preoperative optic radiations onto pre- and post-operative MRI with the potential to reduce the possibility of damage to the optic radiations by altering trajectory of laser catheter to avoid damage to optic radiations, therefore decreasing VFDs after laser ablation AHE.

Figure 1: Post op MRI indicated successful ablation and no overt damage in the region of the laser catheter indicated by arrow(s).

Conclusions

1. Short-term follow-up in our small series suggests that laser ablation AHE is associated with 20% of VFD.
2. DTI tractography can delineate the optic radiations preoperatively and allow through approach planning to minimize risk of VFD following laser ablation AHE.
3. Our results suggest that it is clinically relevant to incorporate optic radiation into preop MRI to guide surgical planning.
4. A larger series with long-term follow-up is necessary to assess the robustness of this finding.

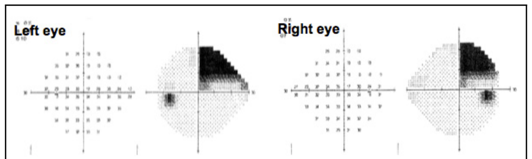


Figure 2: Visual field test showing right superior quadrantanopia in one patient.

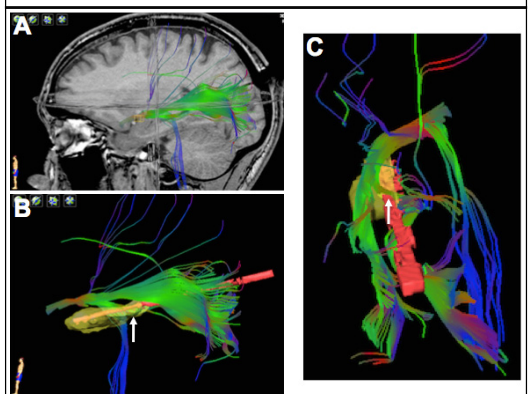


Figure 3: A, DTI tractography of optic radiation. B and C, The 3D reconstruction of optic radiation, laser catheter trajectory and ablation volume showed that Meyer's loop was penetrated by laser catheter as shown by arrow.

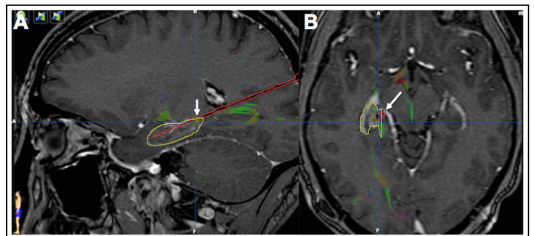


Figure 4: Sagittal (A) and axial (B) T1-weighted, contrast MR images showing the relation among optic radiation, laser catheter trajectory and laser ablation area. Green: Optic radiation; Red: Laser catheter trajectory; and Yellow: Laser ablation area.

References

1. Waseem H, Osborn KE, Schoenberg MR, Kelley V, Bozorg A, Cabello D, Benbadis SR, Vale FL. Laser ablation therapy: An alternative treatment for medically resistant mesial temporal lobe epilepsy after age 50. Epilepsy & Behavior 2015; 51: 152–157.

2.Willie JT, Laxpati NG, Drane DL, Gowda A, Appin C, Hao C, Brat DJ, Helmers SL, Saindane A, Nour SG, Gross RE. Real-time magnetic resonance-guided stereotactic laser amygdalohippocampotomy for mesial temporal lobe epilepsy. Neurosurgery 2014;74: 569–585.

3.Tecoma ES, Laxer KD, Barbaro NM, Plant GT. Frequency and characteristics of visual field deficits after surgery for mesial temporal sclerosis. Neurology 1993; 43:1235–1238.

4. Hughes TS, Abou-Khalil B, Lavin PJ, Fakhoury T, Blumenkopf B, Donahue SP. Visual field defects after temporal lobe resection: a prospective quantitative analysis. Neurology 1999; 53:167–172.

5. Egan RA, Shults WT, So N, Burchiel K, Kellogg JX, Salinsky M. Visual field deficits in conventional anterior temporal lobectomy versus amygdalohippocampectomy. Neurology 2000;55:1818-22.