

One-year Outcome of Magnetic Resonance-guided Stereotactic Laser Amygdalohippocampotomy for  
Mesial Temporal Lobe Epilepsy

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Introduction

Stereotactic magnetic resonance imaging-guided laser amygdalohippocampotomy (SLAH) is a minimally invasive approach to surgical treatment of medically intractable mesial temporal lobe epilepsy (MTLE). Here a highly controlled thermocoagulative lesion that conforms to anatomical boundaries is produced via laser interstitial thermal therapy under real time MRI anatomical and thermal monitoring of both the target and surrounding tissue. Although short term outcomes in two small series have been reported [1,2] one year outcomes represent the gold standard by which to compare SLAH to standard open temporal surgery. A recent meta-analysis comparing the two most common open temporal resective surgeries, anterior temporal lobectomy (ATL) and selective amygdalohippocampectomy (SAH), demonstrated one-year seizure freedom rates of 75% and 67%, respectively[3]. The subset with mesial temporal sclerosis (MTS) yielded higher rates (78% versus 71%, respectively). Here we present the largest single center experience to date, a consecutive series of 41 patients with MTLE that underwent SLAH via the Visualase® system and compare outcomes against those seen with these open temporal resective methods.

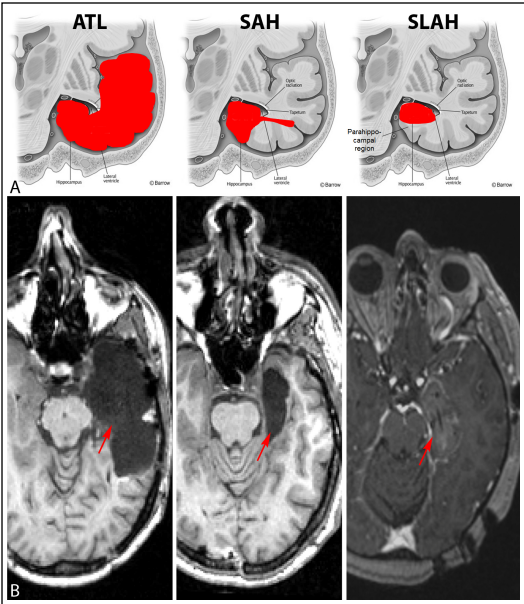


Figure 1: Comparisons of open resective methods to SLAH. A) cartoon[2] B) MRI

Methodology

All patients underwent SLAH for treatment of MTLE between July 2011 and March 2015  
A standard diagnostic epilepsy surgery work-up was performed; more extensive evaluation when indicated  
Pre-op MRI scans were re-evaluated by 2 neuroradiologists and 1 neurosurgeon (REG) for presence or absence of mesial temporal sclerosis (MTS)  
Surgical outcome (via clinic visit or phone interview) was stratified by Engel's classification.  
Seizure freedom results were retrospectively analyzed as a non-inferiority trial.

- Seizure Freedom Rate: Engel Class 1 proportion of sample population
- Objective performance criterion (OPC): 67% (equivalent to SAH)
- Non-inferiority margin (f): 8% (equivalent to the absolute risk reduction between ATLAH and SAH)
- The subgroup with MTS was similarly analyzed (OPC=71%, f=7%)

Epilepsy Workup	
Standard	Supplementary
<ul style="list-style-type: none"><li>Scalp long-term videoEEG monitoring</li><li>3T (unless contraindicated) MR imaging</li><li>Fluorodeoxyglucose positron emission tomography (FDG-PET)</li><li>Neuropsychological testing</li></ul>	<ul style="list-style-type: none"><li>fMRI for speech (+/- memory localization)</li><li>Sodium amobarbital (Wada) test</li><li>Invasive EEG monitoring (depth, strip, grid and/or foramen ovale electrodes)</li></ul>
Engel Classification [3]	MTS Diagnostic Criteria
Class 1: "Free of disabling seizures"	Hippocampal atrophy (qualitative)
Class 2: "Rare disabling seizures"	Increased signal on T2 and T2 FLAIR sequences
Class 3: "Worthwhile improvement"	Loss of internal architecture of the hippocampus
Class 4: "No worthwhile improvement"	
Patient Demographics	
Total	41
MTS, no dual pathology, no prior epilepsy surgery	25
Repeat SLAH with ≥12 mo. follow-up	9
Subsequent ATL	6
Lost to Follow-up	3
	1

Results

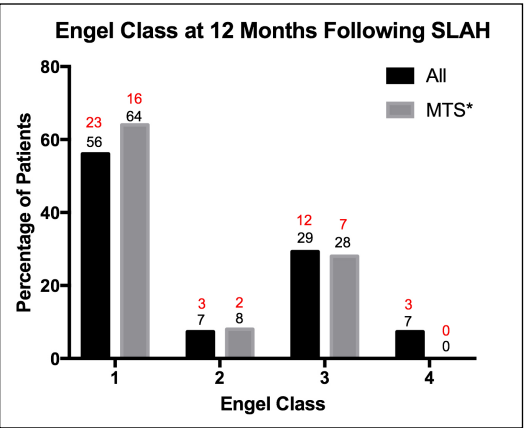


Figure 2: One year seizure freedom outcomes stratified by Engel class. Numbers above bars indicate number of patients (red) and percentage of patients (black).

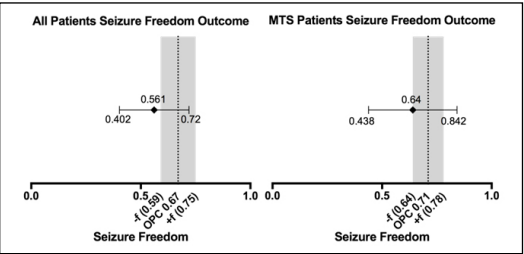
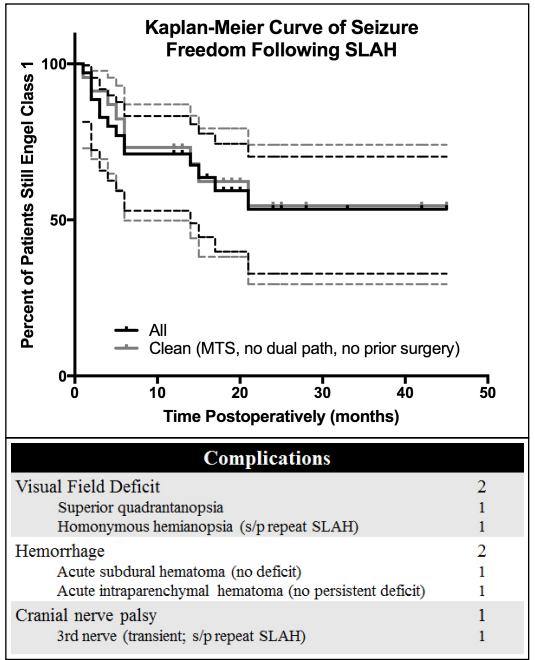


Figure 3. SLAH is non-inferior to SAH at 1 year follow-up. At 12 months following SLAH 56.1% (95% CI ±15.9%) of all MTLE patients and 64.0% (95% CI ±20.2%) of MTS\* patients were free of disabling seizures (Engel 1) suggesting statistical non-inferiority to SAH. The seizure freedom rate (diamond) for each population with 95% CIs is compared with the OPC for SAH shown (dashed line) with the non-inferiority margin boundaries (shading). Fewer (43.8%, CI 95% ±27.3%) of non-MTS patients were seizure-free (no OPC available). \*indicates MTS patients without dual pathology and prior seizure surgery.

Figure 4: Long term seizure freedom outcomes. Dashed lines represent 95% CI



Conclusions

In our cohort, SLAH was non-inferior to SAH at one year, with superior results in patients with MTS. Compared to open temporal lobe surgery, SLAH is an effective minimally invasive alternative with a favorable neurocognitive profile. In the minority of patients that do not achieve seizure freedom, SLAH presents no barrier to additional open surgery.

References

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