Early Outcomes of Stereoelectroencephalography followed by MR-guided Laser Interstitial Thermal Therapy: A Paradigm for Minimally Invasive Epilepsy Surgery

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Introduction

Stereotactic electroencephalography (sEEG) and magnetic resonance guided laser interstitial thermal therapy (MRgLITT) have both emerged as minimally invasive alternatives to open surgery for the localization and treatment of medically refractory lesional epilepsy. Data remains limited on the use of these procedures individually and is almost non-existent on their use in conjunction. Our aim is to report early outcomes regarding efficacy and safety of sEEG followed by MRgLITT for localization and ablation of seizure foci in the pediatric population of medically refractory lesional epilepsy.

Patient Characteristics	*n=4*
Age (years)	10.25 (2-21)
Male	2 (50%)
Female	2 (50%)
Number of AEDs	3.75 (2-6)
Prior surgical interventions	2.25 (1-3)
Mean follow-up (months)	5.75 (3-10)
Indication for Ablation	
Tuberous sclerosis	2 (50%)
Cortical dysplasia	2 (50%)

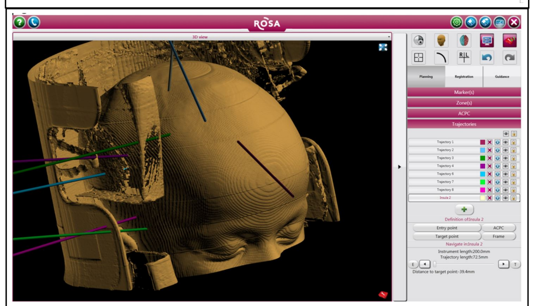

Image capture of stereotactic trajectory planning on the ROSA robot navigation and trajectory software prior to implantation of sEEG electrodes.

Methods

A single-center retrospective review of pediatric patients who underwent sEEG followed by MRgLITT procedures was performed. Demographic, intraoperative, and outcome data were compiled and analyzed.

Results

Four pediatric patients with nine total lesions underwent sEEG followed by MRgLITT procedures between January and September 2017. Mean age at surgery was 10.75 (2-21) years. Surgical substrates included two patients with tuberous sclerosis and two patients with focal cortical dysplasia. Methods of stereotaxis consisted of BrainLab Varioguide and ROSA robotic guidance, with successful localization of seizure foci in all cases. sEEG procedure length averaged 153 (67-235) minutes, with a mean of 6 (4-8) electrodes and 56 (18-84) contacts per patient. MRgLITT procedure length averaged 223 (179-252) minutes. Mean duration of monitoring was 5.75 (4-8) days, and mean total hospital stay was 8 (5-11) days. Over a mean follow-up duration of 5.75 (3-10) months, three patients were seizure free (Engel I, 75%), while one patient saw significant improvement in seizure frequency (Engel II, 25%). There were no complications.

Conclusions

This early data demonstrates that sEEG followed by MRgLITT can safely and effectively localize and ablate epileptogenic foci in a minimally invasive paradigm for treatment of medically refractory lesional epilepsy in pediatric populations. Continued collection of data with extended follow-up is needed.

After the Visualase lasers probes have been positioned according to the planned trajectories, the patient is positioned for MRI with the MRI head coil in place.

sEEG Procedure

Pt	Indication	Laterality	Method of Stereotaxis	Electrodes	Contacts	Length of sEEG procedure (minutes)	LOM (days)
1	TSC	Bilateral	VarioGuide	4	18	235	4
2	CD	Right	ROSA	8	80	201	6
3	TSC	Right	ROSA	8	84	109	5
4	CD	Right	ROSA	4	42	67	8
				6	**56**	**153**	**5.75**

MRgLITT Procedure

Pt	Indication	Laterality	Method of Stereotaxis	Lesions Ablated	Energy of Ablation	Length of Visualase Procedure (minutes)	LOS (days)
1	TSC	Bilateral	BrainLab	2	10.5W x 165s, 10.5W x 150s	179	5
2	CD	Right	ClearPoint	1	10.5W x 178s	251	1
3	TSC	Right	ROSA	3	11.25W x 135s+150s, 11.25W x 150s+135s, 11.25W x 150s+135s	252	1
4	CD	Right	ROSA	3	10.5W x 150s + 10.5W x 120s, 10.5W x 135s, 10.5W x 135s	209	1
				2.25		**222.75**	**2**

Learning Objectives

By the conclusion of this session, participants should be able to: 1) Understand the incidence of and treatment options for pediatric refractory lesional epilepsy; 2) Describe the operative techniques for stereoelectroencephalography and MR-guided laser interstitial thermal therapy; 3) Discuss the advantages of minimally invasive epilepsy surgery; 4) Identify patients who would benefit from minimally invasive epilepsy surgery.

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