

Initial vs. Repeat Epilepsy Surgery Evaluation for Children in the US: Findings from the PERC (Pediatric Epilepsy Research Consortium) Epilepsy Surgery Subgroup

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Introduction

Epilepsy surgery can result in seizure freedom for children with drug resistant epilepsy (DRE) and should be considered in appropriate candidates.

A proportion of patients will have inadequate seizure control after surgery and undergo additional surgical evaluation and treatment.

We sought to characterize children undergoing repeat surgical evaluations and compare their epilepsy characteristics, evaluations, and surgical treatment to those undergoing initial evaluations.

Methods

- This is a multicenter prospective cross-sectional study enrolling patients 0-18 years of age undergoing epilepsy surgery evaluation at 19 pediatric epilepsy centers from the PERC (Pediatric Epilepsy Research Consortium) Epilepsy Surgery Database.
- Predefined variables collected included demographics, epilepsy characteristics, presurgical treatment, evaluation, surgical therapy, and outcome of epilepsy surgery.
- Data was analyzed from project inception (1/1/18) to 6/15/20. Patients were grouped by 1) initial or 2) repeat surgical evaluation after failed procedure. Independent t test and Fischer's exact test were used to compare continuous and categorical variables, respectively.

Table 1. Characteristics of children being considered for surgery

EPILEPSY CHARACTERISTICS	INITIAL SURGERY N=399	REPEAT SURGERY N=74	p value*
Age at onset (years) Mean (SD)	5.193 (4.652)	4.220 (4.032)	0.066
Age at referral (years) Mean (SD)	9.838 (5.267)	10.370 (4.811)	0.419
Age at intractability (years) Mean (SD)	7.548 (5.005)	7.147 (5.161)	0.643
# of failed ASMs ^o Mean (SD)	3.14 (2.097)	4.63 (3.341)	<0.001
# of current ASMs ^o Mean (SD)	2.30 (0.964)	2.48 (1.082)	0.164
Duration of vEEG (hours) Mean (SD)	86.9 (69.587)	72.77 (52.162)	0.104

^oASMs- anti-seizure medications; *Independent t test

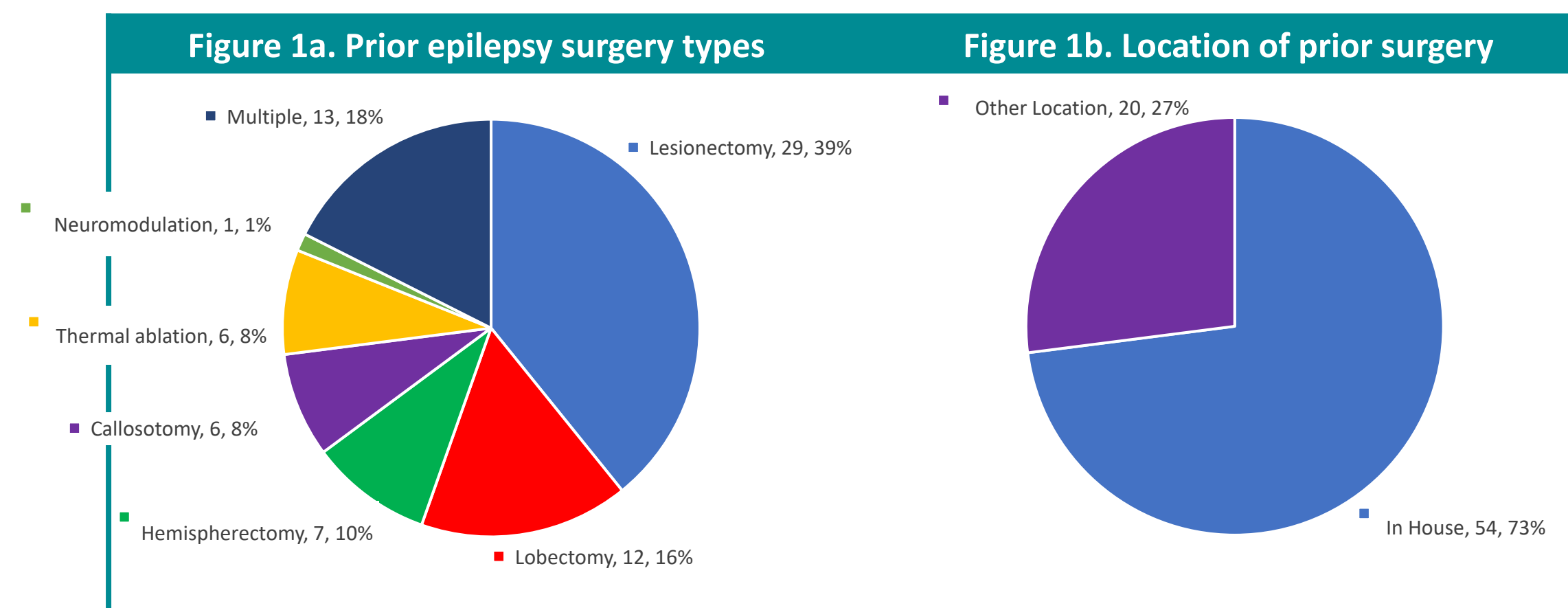
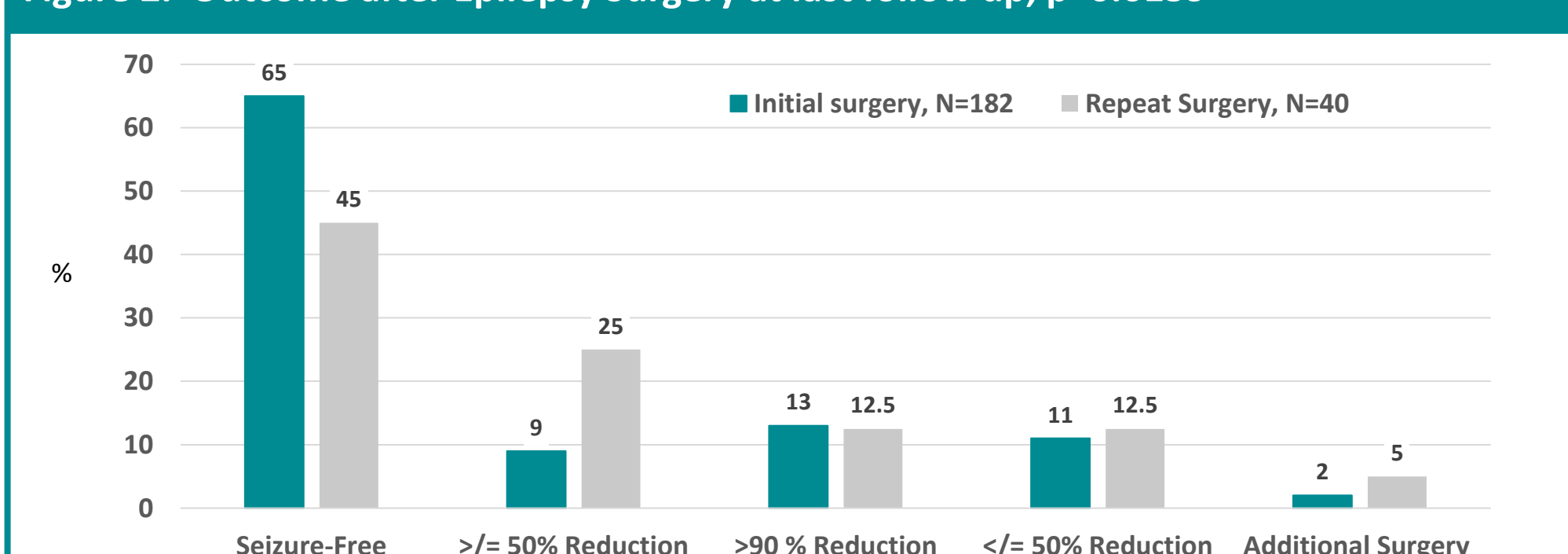


Table 2. Diagnostic evaluations of children being considered for surgery

DIAGNOSTIC TESTS	EVALUATION TYPE AND NUMBER OF PATIENTS			p value [#]
	INITIAL SURGERY	REPEAT SURGERY	TOTAL	
MRI RESULTS				
-Abnormal	303	67	370	0.020
-Normal	95	7	102	
PET				
-Performed	226	34	260	0.0982
-Not performed	172	40	212	
MEG				
-Performed	74	22	96	0.0401
-Not performed	316	51	367	
SPECT				
-Performed	85	18	103	0.6455
-Not performed	305	55	360	
fMRI				
-Performed	114	24	138	0.5788
-Not performed	273	49	322	
Neuropsychologic Testing				
-Performed	221	47	379	0.0887
-Not performed	158	27	74	

[#]Fisher's exact test

Figure 2. Outcome after Epilepsy Surgery at last follow up, p=0.0159



Results

- Of 473 patients undergoing presurgical evaluation, 74 (16%) had a previously failed epilepsy surgery. Most had prior surgeries at the same institution (Figure 1).
- Compared to children undergoing a first presurgical evaluation, children undergoing a repeat evaluation had failed more ASMs (anti-seizure medications) [mean 4.6 vs 3.1, p<0.001], had a younger age of epilepsy onset [mean 4.2 vs 5.2 years], were more likely to have a structural etiology (76% vs 60%), were less likely to have an unknown etiology (9% vs 26%), and lived closer to the treating hospital (Table 1).
- There were no differences in sex, race, ethnicity, or insurance type.
- MEG scans were more commonly utilized in repeat evaluations (p=0.0401), though there was no difference in VEEG duration or utilization of PET, SPECT, fMRI or neuropsychological testing between the groups (Table 2).
- 372 (79%) patients were offered surgical therapy and 265 of these (71%) have completed surgery. There was no difference in likelihood to offer surgery or type of surgery offered (1-stage vs 2-stage).
- Outcome data is available for 222 (84%) patients (median follow up 7 months). Favorable outcome (Engel 1 or 2) was more common after initial surgery (p=0.016) (Figure 2).

Conclusions

- While repeat epilepsy surgeries in children are less likely to result in seizure freedom, over 50% will experience meaningful (≥90%) seizure reduction.
- Repeat surgical evaluations are pursued more commonly in children with younger age at seizure onset and structural etiologies, likely related to challenges in completely characterizing the epileptogenic zone in these circumstances.
- Methods of repeat evaluation more often include MEG, possibly due to difficulties interpreting other neuroimaging in the setting of prior resection.
- Children undergoing repeat surgical evaluations live closer to surgical centers, suggesting there may be missed opportunities for subsequent evaluation after surgical failure in children without convenient access to surgical centers.