Chronic Subthreshold Cortical Stimulation for Adult Drug Resistant Focal Epilepsy: Safety, Feasibility, and Technique

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CNS 2017 ANNUAL MEETING BOSTON, MASSACHUSETTS OCTOBER 7–11, 2017

Introduction

Epilepsy surgery, while high successful for lesional epilepsy, can be associated with significant morbidity. The objective was to evaluate the safety profile of chronic subthreshold cortical stimulation in patients with seizure foci not amenable to surgical resection.

Methods

Patients underwent intracranial electroencephalography monitoring. Those with seizure foci that were deemed unsafe for resection were offered trial of continuous subthreshold cortical stimulation via intracranial monitoring electrodes. After successful trial, trial electrodes were replaced with permanent stimulation. (Figure 1) Patients with permanent implantation prior to February, 2016, reported their seizure severity and life satisfaction before and after stimulation.

Table 1

Case #	Gender	Age at surgery (years)	Duration of seizure history	Pathology	Duration of monitoring	TLOS (days)	Postoperative Complications	Follow-up length
1	Male	28	16	Cortical dysplasia and bilateral MTS	3	8	None	283
2	Male	25	15	Presumptive linear migrational anomaly	10	12	None	201
3	Male	56	50	Multiple right-sided encephalomalacias	3	9	None	210
4	Male	19	5	Encephalomalacia with gliosis	20	19	None	173
5	Female	19	2	Right precentral deep cortical dysplasia	6	9	None	3
6	Male	26	11	Encephalomalacia	4	6	None	59
7	Female	22	19	Cortical tubers, SEN, SEGA	9	11	None	21
8	Female	27	21	Cortical dysplasia	8	11	None	344

MTS: mesial temporal sclerosis; SEGA: subependymal giant cell astrocytoma; SEN: subependymal nodules; TLOS: total length of stay

Results

Eight patients from 2014 to 2016 were included in this study.(Table 1) Age ranged (19-56 years). Intracranial pathologies included: cortical dysplasia (n = 3), encephalomalacia (n = 3), cortical tubers (n = 1), and linear migrational anomaly (n = 1). The duration of intracranial monitoring ranged (3-20 days). All patients experienced were discharged to home (median length of stay: 10 days). No postoperative surgical complications have developed to date (median length of follow-up: 187 days). Patients (n = 4) reported a improvement in seizure severity (worst = 10) from mean 7.5 (SE 0.29) to 1.25 (SE 0.75) and life satisfaction (best = 10) from mean 4.25 (SE 1.03) to 7 (SE 1.1), mean follow-up 8.8 months

Figure 1

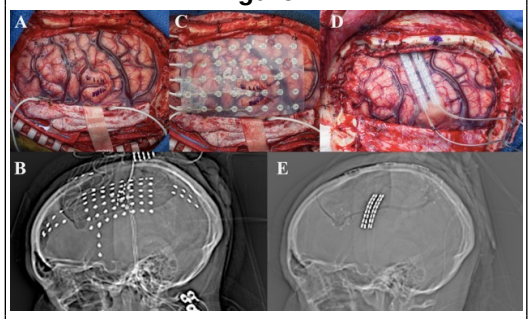

Figure 1: a) Intraoperative view status post right frontoparietal craniotomy with placement of strip electrodes. b) Scout view revealing the placement of grid and multiple strip electrodes. c) Intraoperative view status post right frontoparietal craniotomy with placement of strip electrodes and large grid for coverage of the right hemisphere. d) Intraoperative view showing replacement of recording electrodes with two strip electrodes over the motor cortex utilized for trial stimulation e) Scout view demonstrating two strip electrodes over the motor cortex.

Conclusions

Our institutional experience shows that chronic cortical stimulation can be safely and effectively performed in appropriately selected patients without postoperative complications. Future investigation will hopefully provide further insight to recently published results into the efficacy of this novel and promising intervention.

Learning Objectives

By the conclusion of this sessions, participants should be able to: 1) Appreciate the critical need for therapeutics in patient's with epilepsy in eloquent cortex, 2) Describe the current modalities available to treat medically refractory epilepsy in eloquent regions, 3) Identify the role of continuous subthreshold cortical stimulation in this treatment paradigm