van Lieshout et al. conducted a retrospective study of nine low-grade glioma patients. Language sites were identified by intraoperative direct electrocortical stimulation (DES). They compared resting-state connectivity (RSC) values between and within groups of DES-positive and DES-negative region of interest (ROIs). Both close-negative sites (i.e., DES-negative sites <1 cm apart from and on the same gyrus as DES-positive sites) and far-negative sites (i.e., purely randomly chosen sites not in the vicinity of the tumor or of the DES-positive sites but on the same lobe) were included. Receiver operating characteristics were used to quantify comparisons.

Functional connectivity between all positive language sites was on average significantly higher than between all close-negative sites and between all far-negative sites. The functional connectivity between the positive language ROIs and their respective close-negative control sites was not smaller than between all positive language sites.

Resting-state functional magnetic resonance imaging likely reflects similar neural information as detected with intraoperative direct electrocortical stimulation (DES), but in its current form does not reach the spatial resolution of DES. [1].

Twenty-one pediatric patients with epilepsy or temporal lobe pathology underwent ECS mapping using visual (n = 21) and auditory (n = 14) tasks. Fisher's exact test was used to determine whether the frequency of errors in the stimulated trials was greater than the patient's baseline error rate for each tested modality and subregion.

While the medial superior temporal gyrus was a common language site for both visual and auditory language (43.8% and 46.2% of patients, respectively), other subregions showed significant differences between modalities, and there was significant variability between patients. Visual language was more likely to be located in the anterior temporal lobe than was auditory language. The pediatric patients exhibited fewer parietal language sites and a larger range of sites overall than did adult patients in previously published studies.

There was no single area critical for language in more than 50% of patients tested in either modality for which more than 1 patient was tested (n > 1), affirming that language function is plastic in the setting of dominant-hemisphere pathology. The high rates of language function throughout the left frontal, temporal, and anterior parietal regions with few areas of overlap between modalities suggest that ECS mapping with both visual and auditory testing is necessary to obtain a comprehensive language map prior to epileptic focus or tumor resection [2].

2017

Electrocorticograph recordings were reviewed to determine incidence of ECS-induced ADs and seizures. Multivariable analyses for predictors of AD/seizure occurrence and their thresholds were performed. RESULTS: In 122 patients, the incidence of ADs and seizures was 77% (94/122) and 35% (43/122) respectively. Males (odds ratio [OR] 2.92, 95% CI 1.21-7.38, p=0.02) and MRI-negative patients (OR 3.69, 95% CI 1.24-13.7, p=0.03) were found to have higher odds of ECS-induced ADs. A significant trend for decreasing AD thresholds with age was seen (regression co-efficient -0.151, 95% CI -0.267 to -0.035, p=0.011). ECS-induced seizures were more likely in patients with lateralized functional imaging (OR 6.62, 95% CI 1.36-55.56, p=0.036, for positron emission tomography) and presence of ADs (OR 3.50, 95% CI 1.12-13.36, p=0.043).

ECS is associated with a high incidence of ADs and seizures. With age, current thresholds decrease

and the probability for AD/seizure occurrence increases.

ADs and seizures during ECS brain mapping are potentially hazardous and affect its functional validity. Thus, safer method(s) for brain mapping with improved neurophysiologic validity are desirable [3].

2016

Corley et al, retrospectively analyzed data from 92 patients with medically intractable epilepsy who had extra-operative cortical Electrostimulation. Mapping records were evaluated and information gathered about demographic data, as well as the thresholds of stimulation for motor, sensory, speech, and other responses; typical seizure behavior; and the induction of afterdischarges.

Ninety-two patient cortical stimulation mapping reports were analyzed. The average of the minimum thresholds for motor response was 4.15mA±2.67. The average of the minimum thresholds for sensory response was 3.50mA±2.15. The average of the minimum thresholds for speech response was 4.48mA±2.42. The average of the minimum thresholds for afterdischarge was 4.33mA±2.37. Most striking were the degree of variability and wide range of thresholds seen between patients and within the different regions of the same patient [4].

1)
van Lieshout J, Debaene W, Rapp M, Noordmans HJ, Rutten GJ. fMRI Resting-State Connectivity between Language and Nonlanguage Areas as Defined by Intraoperative Electrocortical Stimulation in Low-Grade Glioma Patients. J Neurol Surg A Cent Eur Neurosurg. 2021 Feb 22. doi: 10.1055/s-0040-1721757. Epub ahead of print. PMID: 33618418.
2)
Muh CR, Chou ND, Rahimpour S, Komisarow JM, Spears TG, Fuchs HE, Serafini S, Grant GA. Cortical stimulation mapping for localization of visual and auditory language in pediatric epilepsy patients. J Neurosurg Pediatr. 2019 Nov 8:1-10. doi: 10.3171/2019.8.PEDS1922. [Epub ahead of print] PubMed PMID: 31703207.
3)
Aungaroon G, Zea Vera A, Horn PS, Byars AW, Greiner HM, Tenney JR, Arthur TM, Crone NE, Holland KD, Mangano FT, Arya R. After-discharges and seizures during pediatric extra-operative electrical cortical stimulation functional brain mapping: Incidence, thresholds, and determinants. Clin Neurophysiol. 2017 Jul 18. pii: S1388-2457(17)30493-5. doi: 10.1016/j.clinph.2017.06.259. [Epub ahead of print] PubMed PMID: 28778475.
4)
Corley JA, Nazari P, Rossi VJ, Kim NC, Fogg LF, Hoeppner TJ, Stoub TR, Byrne RW. Cortical stimulation parameters for functional mapping. Seizure. 2016 Nov 23;45:36-41. doi: 10.1016/j.seizure.2016.11.015. [Epub ahead of print] PubMed PMID: 27914225.