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63 A Literature Review of Cortical Mapping, fMRI, and Standards of Care in Pediatric Epilepsy Surgical Workup

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Objective: Epilepsy includes recurrent, unprovoked seizures and affects 470,000 children in the US, of which 7% have drug-resistant epilepsy due to failing two or more antiseizure medication trials. For some patients with drug-resistant epilepsy, surgery has been successful in reducing seizure burden. Functional MRI (fMRI) and intracranial mapping of neurocognitive functions, especially language, are increasingly done to assess potential functional loss from epilepsy surgery. However, these procedures vary by medical institute. The purpose of this review was to examine published literature on fMRI and intracranial mapping procedures for pediatric epilepsy surgery workup toward development of a standardized protocol that can be used across institutes as a guide to standard-of-care best practices for predicting loss of function associated with epilepsy surgery.
Participants and Methods: Our literature review includes information from 8 electronic databases for peer-reviewed, English language studies of evaluation for pediatric epilepsy surgery candidacy. Thirty-one studies were selected based on inclusion criteria. Only studies including fMRI and intracranial mapping conducted with pediatric patients being worked up for epilepsy surgery were selected.
Results: Our review revealed that the most common task used in fMRI and intracranial mapping procedures is visual-object naming, but type of naming tasks and the way they are administered varies widely across medical institutes and includes published measures and those created on site. Variability makes examining findings across studies and designing best practice for these procedures challenging.
Conclusions: Creating gold-standard procedures for fMRI and intracranial mapping administration for epilepsy surgery evaluations is critical in optimizing treatment and functional outcomes for our pediatric patients. Our review is an initial step in this process.

Categories: Neurophysiology/EEG/ERP/fMRI
Keyword 1: epilepsy / seizure disorders
Keyword 2: neuroimaging: functional
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64 Effects of Age and Task Difficulty on the Presence of EEG Midline-Frontal Theta Power During Administration of the Repeatable Battery for the Assessment of Neuropsychological Status-Update (RBANS)

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Objective: Concurrent electroencephalography (EEG) during neuropsychological assessment offers a promising method to understand real-time neural and cognitive processes during task performance. For example, previous studies using experimental tasks suggest that midline-frontal theta power (MFT) could serve as a measure of mental exertion and subjective difficulty. The RBANS provides an opportunity to examine this issue in neuropsychological assessment, as a widely-used screening battery that was explicitly developed with subtests that vary according to difficulty within its five domains. This study investigated the effects of task difficulty, cognitive domain, and age on elicitation of MFT during rest and RBANS administration.
Participants and Methods: EEG was recorded during eyes-closed and eyes-open resting periods and RBANS administration in a sample of 45 healthy younger adults (n = 21; mean age = 23.29, SD = 3.27, range = 19-33; 48% female) and older adults (n = 24; mean age = 70.58, SD = 5.77, range = 59-83; 83% female). MFT was defined as the highest peak above the overall

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power spectrum within 4-8Hz from electrode Fz, and operationalized as a binary variable (present/absent). A multilevel generalized logistic regression model was run to assess the main effects of Age (Younger, Older), Difficulty (Easy, Hard), Domain (Rest, Immediate Memory, Visuospatial/Constructional, Language, Attention, Delayed Memory), and their potential interactions, on the presence of MFT.
Results: In the full sample, the Coding, Figure Recall, and Picture Naming subtests were numerically most likely to elicit MFT (71.1%, 66.7%, and 62.2%, respectively), whereas Semantic Fluency, Eyes-Closed Rest, and List Recall had the lowest likelihoods (37.7%, 31%, 28.9%). Older adults were also numerically less likely to exhibit MFT (37.50% present) compared to younger adults (62.24% present). An analysis of deviance revealed a significant effect of Age ($F(1,43) = 7.22$, $p = .01$) and a significant interaction between Difficulty and Domain ($F(5,220) = 4.78$, $p < .001$). Specifically, Hard subtests in the Visuospatial/Constructional (Figure Copy; $b = -2.63$, $p < .05$) and Language (Semantic Fluency; $b = -2.92$, $p < .01$) Domains were less likely to elicit MFT than the Easy subtests (i.e., Line Orientation and Picture Naming, respectively).
Conclusions: Results indicated that MFT can be reliably measured during neuropsychological assessment, and varies in relation to both age and task-related factors. Consistent with previous studies, older adults exhibited less MFT than younger adults in general, possibly suggesting a failure to recruit the relevant networks. Further, present findings suggest that the presence of MFT varies not only by the type of task but also by the level of difficulty. Future research with larger samples can clarify whether and how the amount of MFT elicited during specific subtests relates to objective and subjective difficulty. Overall, MFT can reliably be elicited by cognitive tasks and bears further study as a measure of real-time neural expenditure.

Categories: Neurophysiology/EEG/ERP/fMRI
Keyword 1: neuropsychological assessment
Keyword 2: electroencephalography
Keyword 3: aging (normal)
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65 Neuroscience in the Everyday World: Lateralization of Brain Activity During Dual-Task Walking

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Objective: Functional near-infrared spectroscopy (fNIRS) is a non-invasive functional neuroimaging method that takes advantage of the optical properties of hemoglobin to provide an indirect measure of brain activation via task-related relative changes in oxygenated hemoglobin (HbO). Its advantage over fMRI is that fNIRS is portable and can be used while walking and talking. In this study, we used fNIRS to measure brain activity in prefrontal and motor region of interests (ROIs) during single- and dual-task walking, with the goal of identifying neural correlates.
Participants and Methods: Nineteen healthy young adults [mean age=25.4 (SD=4.6) years; 14 female] engaged in five tasks: standing single-task cognition (serial-3 subtraction); single-task walking at a self-selected comfortable speed on a 24.5m oval-shaped course (overground walking) and on a treadmill; and dual-task cognition+walking on the same overground course and treadmill (8 trials/condition: 20 seconds standing rest, 30 seconds task). Performance on the cognitive task was quantified as the number of correct subtractions, number of incorrect subtractions, number of self-corrected errors, and percent accuracy over the 8 trials. Walking speed (m/sec) was recorded for all walking conditions. fNIRS data were collected on a system consisting of 16 sources, 15 detectors, and 8 short-separation detectors in the following ROIs: right and left lateral frontal (RLF, LLF), right and left medial frontal (RMF, LMF), right and left medial superior frontal (RMSF, LMSF), and right and left motor (RM, LM). Lateral and medial refer to ROIs' relative positions on lateral prefrontal cortex. fNIRS data were analyzed in Homer3 using a spline motion correction and the iterative weighted least squares method in the general linear model. Correlations between the

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