

The clinical and EEG spectrum of periodic discharges – diagnosis, association with seizures, approach to care and prognosis

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The family of periodic EEG discharges first delineated by Chatrian included lateralized types and more recently generalized, bilateral independent, multiple lateralized, and stimulus-induced varieties. Each of these subtypes has been defined, and reported. A review of the aggregate of reports on each of these types has been reviewed as they investigated the most frequent causes, the relative association with seizures, morbidity and mortality. Severity increases from lateralized varieties to generalized synchronous types. These features along with a schema of the spectrum of periodic discharges along axes of morbidity and ictal tendencies, as well as approaches to investigation and respective treatment will be discussed.

Isolated Epileptic Discharges in Panic Disorder

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Isolated Epileptic Discharges (IEDs) are not uncommon in patients with panic attacks, repeated violent acts, dissociative episodes, and rapid cycling mood disorders. The value of detecting IEDs in a non-epileptic psychiatric patient in predicting favorable responses to anti-epileptic drugs (AEDs) remains undetermined. A number of reports have been published suggesting that in some treatment-refractory PD patients AEDs may be useful. Comparing AEDs use in PD patient with and without IEDs showed significant differences. Ten reports were identified for use of AEDs in PD patients with abnormal EEGs with a total of 20 patients (17 responders). None of the ten reports were controlled studies. Eighteen reports (3 controlled) were identified for use of AEDs in panic patients with either normal EEGs or unselected groups (no EEG work-up). Included in the 18 studies were 253 patients (137 responders). The response was significantly higher in patients with abnormal EEGs. These data suggest that an abnormal EEG may be indicative of a higher likelihood of a positive response to an AED. Behavioral effects of IEDs appear to be region-dependent. IEDs emanating from the amygdalar region would be expected to correlate with fear manifestations (like in panic attacks). We have also shown that experimentally induced IEDs in the somatosensory region induce hyperactive behaviors in rats. That is the same region where epileptic discharges may be found in individuals with ADHD. It should be stated here that the optimal number or duration of recordings for the maximal yield has not been established for any psychiatric condition.

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New Advances in Electrical NeuroImaging to Evaluate the Sources of Non-Ictal Proximal Discharges

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The 3-dimensional evaluation of the sources of non-ictal discharges and focal gross pathologies has recently been enhanced using advanced technology called swLORETA (weighted sLORETA (Palmero-Soler et al, 2007). swLORETA uses Single-Value-Decomposition (SVD) to weight the lead field in order to increase lead field homogeneity and hence improved localization of deep sources. This allows for estimates of EEG sources in different layers of the cortex. Also, swLORETA uses a real MRI and not an average MRI with 12,270 voxels and a Boundary-Element-Method (BEM) of source localization (Wroel and Aliahadi, 2002). Non-ictal events and gross pathologies are localized inside of 3-dimensional volumes with the aid of slice and volume cutting tools to allow one to navigate through the brain and identify dysregulated brain network hubs (Brodmann areas) and connections. Computations include Functional Connectivity (Coherence, Lagged Coherence and Phase Difference) and Effective Connectivity (Phase Slope Index) of the magnitude and direction of information flow between network hubs as well as integration with

Diffusion Tensor Imaging (DTI). A useful method is to also view the EEG potentials on a transparent scalp while simultaneously viewing the deeper sources of the EEG from inside the brain. Both raw scores and Z scores are used as well as the Laplacian transform of the scalp EEG. Examples of source localization in patients with gross pathologies such as epileptic foci and stroke will be presented as well.

Electrical networks connectivity is modulated by personality traits and significantly altered during non-ictal (NID) and ictal discharges in psychiatric patients

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Epilepsy and mental disorder links have been debated for centuries. Current epidemiological studies show a direct relationship with anxiety disorders, and a polarized one with psychoses: ictal-related psychoses on one side, forced normalization and electroconvulsive therapy on the other. Links with affective, impulse control, attention deficit and neurodevelopmental disorders have had partial support. From the historical term “psychomotor variant” to plenary sessions in this meeting, the EEG keeps facing the challenge. Against common mechanisms is the incongruousness of time-limited discharges causing long-lasting pleomorphic symptoms. Yet, network analysis has shown enduring changes caused by non-ictal discharges (NID). To address the impact of NID we studied a set of networks presumably involved in psychiatric symptoms, first by looking at network behavior in “normal-at-visual-inspection” (NL) EEGs of healthy volunteers. Networks’ z-scores (Nz) were within normal and correlated with neuropsychological scores. Multiple correlation analysis was also performed in psychiatric patients, comparing the NL epochs against NID epochs for each subject. NID introduced significant alterations, the affected networks correlated with predominant symptoms. The next step was conducting the analysis retrospectively on a comprehensively studied sample of attention-deficit-disorder (ADD) with treatment response follow-up. Methylphenidate response was correlated to attention network alterations in NL epochs, antiepileptic response to alterations in NID epochs. Lastly, the impact of NID was compared to that of ictal discharges in 10 psychiatric patients who developed an electroclinical partial seizure during EEG recording. Results will be discussed focusing on the impact of NID on complex network behavior and their potential relevance for therapeutic interventions.