364: Assessment of Functional Connectivity Patterns in Children with Epilepsy with Myoclonic-Atonic Seizures

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INTRODUCTION

- Epilepsy with myoclonic-atonic seizures (EMAtS) (formerly Doose syndrome) is a rare developmental and epileptic encephalopathy (DEE).
- Up to 50% enter a Stormy Phase (SP) of worsening seizures and recurrent non-convulsive status epilepticus.
- Early diagnosis and management of EMAtS are associated with improved seizure and developmental outcomes.
- Lennox Gastaut Syndrome (LGS) is a well-known DEE that is often an EMAtS-SP mimicker.

OBJECTIVES

To distinguish the functional connectivity patterns among electroencephalographs (EEGs) of children diagnosed with a) SP, b) non-SP EMAtS, c) LGS, and d) normal EEGs in children without epilepsy.

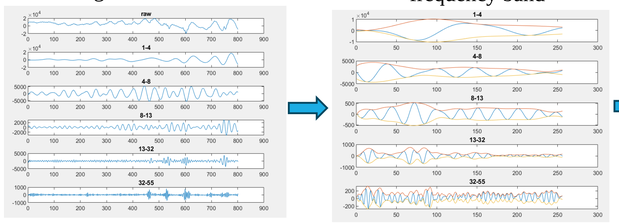
METHODS

- De-identified, non-seizure epochs of scalp EEGs (using 10-20 International system) were obtained from the University of Texas Southwestern, Mayo Clinic Rochester, University of Iowa, and University of Michigan Health.
- EEG cohorts: G1 SP (n=20), G2 control/normal (n=12), G3 non-SP EMAtS (n=5), & G4 LGS (n=15)
- 100 second-epochs were randomly selected from each subject in each group.
- Data samples were filtered into 5 separate band frequencies using the two-way least-squares FIR–Butterworth – filter order.
- Group-level statistics with one-way ANOVA with multiple comparisons
- 10 regions of interest: the right and left prefrontal (FP), frontal (F), center (C), parietal (P), and occipital (O)

METHODS: NETWORK ANALYSIS

Filtering of Raw EEG Data

Envelope of each filtered frequency band

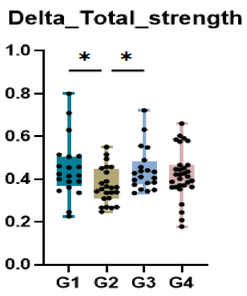


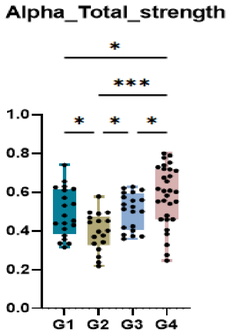
Cross-correlation analysis used to construct adjacency (connection) matrix for each band

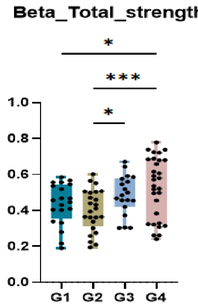
1. Within Network Connectivity Strength (e.g. FP-FP, F-F)
2. Between Network Connectivity Strength (e.g. FP-F, FP-C)
3. Total Connectivity Strength

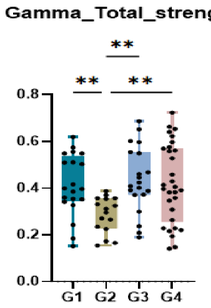
RESULTS

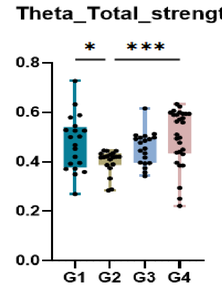
- No significant differences in within-network and between-network connectivity among the four cohorts.
- Total connectivity strength in different band frequencies were greater in the epileptic disorder EEGs (G1, G3, G4) than the connectivity strength in the normal EEGs (G2).











Major observation: In the alpha frequency band, there was a significant mean difference in connectivity strength between the LGS (G4) EEGs and the Stormy Phase (G1) EEGs (0.088, 95% CI 0.016-0.16, $p = 0.017$) and between LGS EEGs (G4) and the non-SP EMAtS (G3) EEGs (0.08, 95 % CI 0.008-0.15, $p = 0.03$).

Key: * $p < 0.05$, *** $p < 0.001$

CONCLUSIONS

- LGS EEGs demonstrated greater connectivity strength, and thus hypersynchronisation and hyperexcitability, than SP and non-SP EMAtS EEGs.
- This first step could help identify future potential EEG biomarkers to distinguish EMAtS from LGS.
- Future studies will further explore the connectivity strength differences in the alpha frequency band.
- A future prospective study can lead to larger sample sizes, which will further clarify connectivity differences.

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DISCLOSURES

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