Altered gamma power oscillations in patients with comorbid temporal lobe epilepsy and psychiatric disorders: a novel MEG spectral analysis.

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Introduction: Temporal lobe epilepsy (TLE) shares a well-established and significant connection with psychiatric disorders (PD). PD in TLE is correlated with reduced response to pharmacological and surgical treatments and a decline in quality of life. Hence, recognizing and addressing it is imperative. We performed a novel MEG spectral analysis in TLE patients to investigate the relationship between gamma oscillations and PD. **Methods:** Resting-state MEG data from 25 drug-resistant TLE patients, 17 with comorbid anxiety or depression, were used. Time-frequency decomposition in source space and a permutation t-test were performed between TLE patients with and without PD (Figure 1). Low gamma power maps were exported and compared between groups in Graph Pad, assuming significance $\alpha = 0.05$ (Figure 2). **Results:** Low gamma power was significantly increased in the frontal and cingulate regions and decreased in the occipital regions of patients with PD compared to the control group. Analyzing ROIs implicated in the default mode network (DMN), there was an increase in gamma in the PD group's medial prefrontal cortex, posterior cingulate, and precuneus compared to the control. Low gamma power was not associated with epilepsy duration or age (Pearson test, $p = 0.76$ and $p = 0.80$, respectively). **Conclusions:** Previous EEG studies have demonstrated the role of gamma oscillations in PD. Nevertheless, this is the first study demonstrating that gamma oscillations are also altered in patients with PD and comorbid epilepsy, including regions associated with the default mode network. While further evaluation is necessary, our findings corroborate the role of gamma oscillations as a potential neuroimaging biomarker for PD.

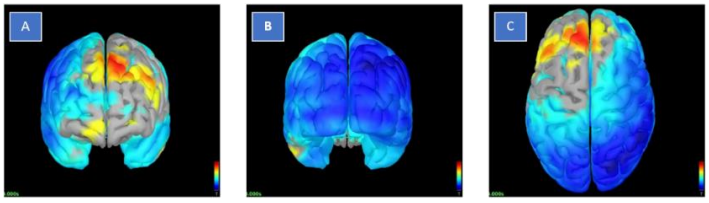

Figure 1. A, B, and C. 3D brain image of a template brain in anterior (A), posterior (B), and superior views (C) evidencing the results of the permutation t-test with false-discovery rate correction of low gamma band in TLE patients with PD compared with TLE without PD, performed in Brainstorm software. The areas in yellow and red (higher) evidence significantly increased gamma power, and the areas in light and profound (lower) blue evidence a significant decrease in gamma power. A. Anterior view, B) Posterior view, C) Superior view.

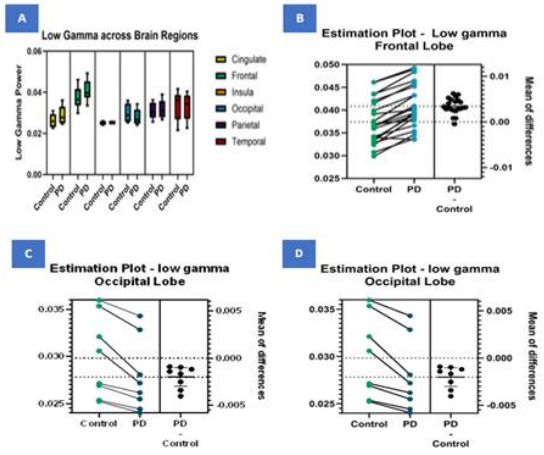

Figure 2. Graphs: A. Boxplot evidencing the mean low gamma power across regions in TLE patients with and without PD. B, C, D. Estimation plots evidencing the results of the unpaired t-test between TLE patients with and without PD in the frontal (A), cingulate (B), and occipital (D) regions of interest.