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Title

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Background

Electroconvulsive therapy (ECT) efficacy and cognitive side effects remain influenced by several parameters including electrodes position and configuration, the applied current intensity, duration, and polarity. We applied a nonlinear interaction model on multichannel scalp EEG recordings paired with ECT and determined the functional interaction across cortical areas.

Methods

Patients were treated with unidirectional current FEAST using a modified MECTA spECTrum 5000Q device (MECTA Corp, Tualatin, Oregon) and following the same anesthesia protocol. 64 channel EEG recording (Neuroscan, Compumedics) were acquired during 2 cross- randomized treatment sessions at 6 times seizure threshold ($6*ST$) with opposite current polarity involved a simultaneous. We derived the non-linear dynamic interaction models from modified neuronal population activity models whose dynamics can reproduce basic features of ECT-induced seizures within local areas and across distant cortical areas. We applied the Square-Root Cubature Kalman filter in three EEG states: baseline under general anesthesia, ictal and post-ictal. This yielded the functional connectivity between right and left frontal and parietal regions.

Results

To date, we acquired 24 recordings from 12 patients with major depressive disorder (5 females, age $1/4$ 44.5 ± 10 years). These 12 6*ST direct polarity and 8 6*ST reversed polarity with conserved electrodes configurations and 4 6*ST reversed polarity and electrodes configurations (172.8 ± 59.48 mC). Right Frontal-to-Parietal and Right Parietal-to-Frontal ictal parameters showed significant differences in functional connectivity values (4.07 ± 2.98 , -0.46 ± 0.34 , $p < 0.001$) between direct and reversed polarity. This difference was most accentuated between direct and reversed polarity with reversed electrodes configurations.

Conclusion

This innovative research highlights the regional relationships of ictal activity with FEAST. Differences between direct and reversed polarity treatment administration indicated that FEAST is clearly initiating seizure activity in the frontal region (right 4 left). Ongoing analyses are focusing on dynamic regional interactions over time. Future work will focus on comparing FEAST with more classic ECT modalities and relationship to clinical outcomes.

Keywords

ECT, brain stimulation, FEAST, EEG

Disclosures

FEAST machine on loan from MECTA Inc.