EEG-power in the motor network as a potential biomarker for disease progression in ALS.

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Background: Most clinical trials in ALS have led to disappointing results raising concerns about the choice of outcome measures. While ALSFRS-R is the most used marker of disease progression, recent studies showed that it fails to satisfy rigorous measurement standards. On the other hand, EEG has proven to be a useful biomarker-candidate in other neurodegenerative disorders as it is a direct measure of neural activity. Additionally, a recent EEG study in ALS showed abnormal pattern in patients that correlated with MRI measures of motor system degeneration.

Aim: To investigate the resting-state EEG β-power in the motor network as a potential biomarker for disease progression in ALS.

Methods: In this pilot study, a 128-channels resting-state EEG was used to estimate _- power in the motor network in 10 ALS patients (5 F, mean age 63.1±12.9 yrs). Data were source-reconstructed using the LCMV beamformer and an atlas-based approach was applied to assess signals from the motor network. Estimated EEG power values were normalized by inverse normal transformation allowing for Pearson's correlation coefficient to be used. Abstracts ENCALS meeting 2019 15-17 May Tours Clinical examination was performed on the recording day: ALSFRS-R, muscular power assessment (deltoid, triceps, biceps, wrist flexors and extensors, fingers flexors and extensors, FDI, APB) and upper motor neuron signs evaluation (biceps, triceps and brachioradialis reflexes, Hoffmann sign). Lower and upper motor neuron score in the upper limbs (LMN and UMN scores) was calculated for each patient.

Results: β-power over in the motor network correlates with: ALSFRS-R ($r = -0.843$, $p = 0.002$), fine motor function sub-score($r = -0.731$, $p=0.016$), LMN score($r = -0.673$, $p=0.033$), UMN score($n=9$, $r = -0.746$, $p=0.021$ removing an outlier with very low beta power and UMN score), delta ALSFRS-R between disease onset and recording time($n=9$, $r = 0.727$, $p=0.027$ removing an outlier with a very slow progression rate).

Discussion: These data suggest that source-reconstructed β-band power may be a useful biomarker for disease progression in ALS. Since β-band activity is present within the sensorimotor cortex and it is mostly generated by pyramidal neurons within the fifth cortical layer and GABA-A receptors, these findings can be attributed to the cortical hyperexcitability observed in ALS, structural degeneration of pyramidal cells and loss of interneurons that entrain them