Amplitude spectrum of spontaneous fluctuations in idiopathic generalized epilepsy

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Purpose: Resting-state fMRI has increasingly emerged as a powerful tool for describing the functional organization of the brain. The amplitude information of low-frequency oscillations was found meaningful in investigating the regional spontaneous neuronal activity. The amplitude of spectral component in different frequency bands exhibited distinct spatial features. We used fractional amplitude of low-frequency fluctuation (fALFF) to investigate the oscillation abnormality in idiopathic generalized epilepsy, and furthermore extend the analysis to the fALFF in different frequency bands.

Methods: Thirty-four generalized tonic-clonic seizure (GTCS) patients and 34 age- and sex-matched healthy controls were recruited in the present study. For each scan and each participant, we performed fALFF (0.01-0.08Hz) analysis, and then group analysis was carried out using two-sample t test. The full-frequency (0-0.25Hz filtered) was divided into 120 bands, and amplitude of spectral component in frequency oscillation for each band was calculated. Group analyses were performed to find the abnormal amplitude in each band.

Results: Compared with healthy controls in 0.01-0.08 Hz, the patients with GTCS showed significantly increased fALFF in anterior cingulate cortex, bilateral thalamus, putamen and cerebellum; while decreased fALFF in MPFC, bilateral orbit frontal cortex, and dorsolateral frontal cortex. For full frequency, the mesial prefrontal cortex showed group difference in 0.01-0.027 Hz band, and the thalamus in 0.027-0.073 Hz band. Furthermore, both the mesial prefrontal cortex and thalamus showed significant difference in 0.198-0.25 Hz band, which is contrary with 0.01-0.08 Hz band. (Figure 1)

Conclusions: We demonstrated thalamocortical circuit fALFF abnormalities in GTCS patients, including the bilateral thalamus, putamen, cerebellum and frontal cortex. The amplitude of full frequency bands may potentially provide more information of brain oscillations and can be used for epilepsy research.

Figure 1. The amplitude spectrum changes (0-0.25 Hz) in mesial prefrontal cortex and thalamus.