Altered brain functional connectivity in juvenile myoclonic epilepsy patients

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Background: Structural MRI in JME patients are generally normal and there is no well established biomarker for the disease other than clinical observation. There are few literature which presented the difference in functional connectivity of JME patients. In this study we tried to establish an imaging biomarker tool to monitor the disease by understanding the difference in functional connectivity in 8 JME patients in comparison to 10 healthy subjects.

Methods: We performed resting state fMRI for 8 JME patients in eyes closed position in a Philips Achieva 3T scanner with 8 channel SENSE head coil with TR/TE 3s/33ms. 45 slices were acquired in each dynamic in a single shot echo planar multi-slice Fast Field Echo scan mode. The number of dynamics acquired was 250 in 12 min 30 sec. T1W structural imaging was acquired in 3D Turbo Field Echo mode (3D-TFE). Phase and magnitude images were also acquired in a dual echo acquisition for fieldmap. Ten healthy subjects T1W preprocessed structural and resting state fMRI data were obtained from HCP Connectome DB.

T1W images were spatially normalized with MNI152 template. B0 fieldmap correction, head motion correction, high pass filtering with cutoff frequency of 0.01 Hz (100s) and ICA-FIX cleaning were performed on the resting state fMRI data of each patient using HCP MR pipelines. Additionally temporal confounding factors were regressed out by anatomical component based method using CONN toolbox. Functional connectivity (FC) from 116 ROIs of AAL atlas were calculated for each patient in both groups using DPARSFA. Group mean and standard deviation FC matrices were calculated. T-score matrix was calculated from group mean ad standard deviation matrices. p-value matrix was calculated from t-score matrix and a threshold of p<0.0001 was used to identify the high connectivity regions from the p-value matrix.

Results: High connectivity was observed in cerebellum crus-1 to vermis_7, cerebellum crus_2 to cerebellum crus_7b, cerebellum 4_5 to vermis_4_5. High connectivity was also observed in left frontal superior orbital to left frontal mid orbital, left frontal mid orbital to left frontal medial orbital, right frontal mid orbital to right frontal inferior orbit, left frontal medial orbital to right frontal medial orbital, left olfactory to left rectus, left anterior cingulam to right anterior cingulam and left hippocampus to left parahippocampus.

Conclusions: Altered functional connectivity was observed in 8 JME patients group in comparison to the 10 healthy subjects group. Methodology used in this study could be used as an imaging biomarker tool after understanding the functional role of these high