

## **Abnormal spontaneous brain activity in Early Parkinson's Disease revealed by ALFF analysis**

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### **Introduction:**

Resting state brain activity in Parkinson's disease (PD) can help us to understand the pathophysiology of the disorder (1, 2), but it has never been reported to reveal the resting state brain function in early PD using fMRI. Using a new biomarker, the amplitude of the low frequency fluctuation (ALFF) (3), the aim of current study is to explore the abnormal spontaneous neural activity of resting state in early PD patients and demonstrate the potential of these changes for monitor the progression of PD in early stage.

### **Material and Method:**

The study was approved by the local ethical committee and written informed consent was obtained from all subjects. Ten early PD patients (aged  $64.1 \pm 1.7$  years; range 47-80 years), diagnosed based on UPDRS, the Hoehn and Yahr disability scale and MMSE, were compared with eleven gender- and age-matched controls (aged  $63.3 \pm 1.67$  years; range 45-79 years). All subjects are right handed. Twenty-two axial slices covering whole brain were acquired using a 1.5T GE Signa Excite MR scanner (General Electric Health Care, Milwaukee, USA) with an 8 channel phase array head coil (TR/TE 2000/45 ms, flip angle  $90^\circ$ , matrix  $64 \times 64$ , FOV 24 cm, thickness/gap 5/1mm, total 200 volumes). Data processing was performed using (DPARS) (data processing assistant for resting-state fMRI) software. Data preprocessing included slice timing, head-motion correction and spatial normalization. Further analyses included band-pass filtering (0.01 - 0.08 Hz), linear-trend removing, power spectrum calculation, mean square root (0.01 - 0.08 Hz), spatial smoothing (FWHM = 4 mm), and standardization by dividing global mean ALFF. Two sample t-test was used to compare the ALFF differences between the two groups.

### **Results:**

The significant increased ALFF ( $p < 0.05$ , corrected) was showed in bilateral cerebellum, bilateral temporal lobe, right frontal lobe, right anterior insula and left parietal lobe in patients compared with normal controls. Meanwhile, significant decreased ALFF ( $p < 0.05$ , corrected) was showed in left globus pallidus and left amygdale, left cuneus lobe and left occipital lobe in patients compared with normal controls.

### **Conclusion:**

In this study, abnormal ALFF demonstrate that spontaneous neural activity in the resting state is changed in patients with early PD. The increased ALFF in bilateral cerebellum correlated with abnormal motor function in the early PD (1). The decreased ALFF in globus pallidus is consistent with the dopamine uptake reduced in the striatum in PD (4). In conclusion, the abnormal neuronal activity in resting state should be considered in explaining findings in behavior deficits in early PD. The simplicity and noninvasiveness of this method make it as a potential tool to monitor the progression of PD.

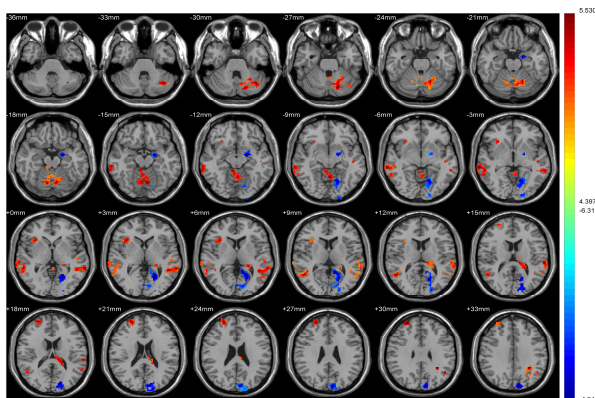


Fig.1 ALFF differences between PD and control groups. Blue indicates that PD subjects had decreased ALFF compared with the controls and the yellow indicates the opposite. T score bars are shown on the left. Left in the figure indicates the right side of the brain.

### **Reference:**

1. Tao Wu, Xiangyu Long, Yufeng Zang, et al. Human Brain Mapping 30:1502–1510 (2009)
2. Tao Wu, Liang Wang, Yi Chen, et al. Neuroscience Letters 460 (2009) 6–10
3. Yang H, Long XY, Yang Y, et al. Neuroimage. 2007 May 15;36(1):144-52
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