Convergent and Divergent Dynamic Functional Connectivity Patterns between Patients with Refractory and Nonrefractory Major Depressive Disorders

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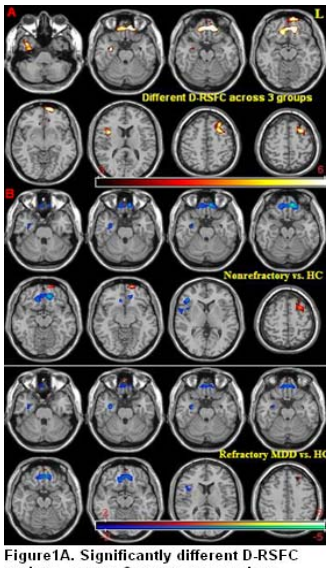

Figure1A. Significantly different D-RSFC regions among 3-groups comparison. 1B.Refractory/nonrefractory MDD vs. HC with D-RSFC

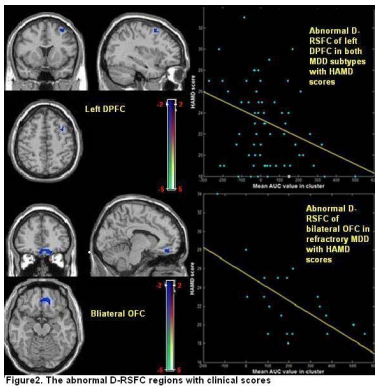

Figure2. The abnormal D-RSFC regions with clinical scores

Target audience: Neuroradiologist, psychiatrist and other scientists interested in the mental disorders.

Purpose : fMRI studies have revealed MDD mainly involving deficits in the cortical-limbic circuit1. However, few studies reported the differed neuronal circuits between refractory and nonrefractory MDD and the results were inconsistent. And these studies based on the assumption that the inter-regional correlations remain temporally stationary during an entire scan. However, dynamic interactions between different brain regions3 have been identified as the intrinsic properties of the brain. Previous study had reported dynamic fluctuations between and within multiple functional brain networks in healthy participants and confirmed the method combining the variable parameter regression (VPR) analysis and the Kalman filtering model is sensitivity and validity4 in the rs-fMRI. But, little is known about the difference of the alternation of the functional interactions between the healthy people and mental disorder such as MDD. Thus we chose the left subgenual ACC (sgACC) as the seed region and proposed to explore the differed dynamic functional connectivity patterns in MDD subtypes in resting-state (D-RSFC) fMRI with the VPR combined with Kalman filtering approach.

Methods: Refractory major depression patients (n=25), Nonrefractory major depression patients (n=40), and age and gender matched healthy comparison (HC) participants underwent the rs-fMRI scan. The left subgenual ACC (sgACC, cg25) was taken as the seed region. Then, a variable parameter regression (VPR) model combined with the Kalman filtering method[5], was employed to detect the dynamic interactions between seed region and other voxels of the brain. The correlation analysis was performed between the clinical characters and the abnormal functional connectivity regions from between groups' comparisons. All the statistical threshold were set at p <0.05 (AlphaSim -corrected) with the minim cluster size above 50 voxels.

Results : There were significant differences among 3-groups comparison (Figure1A.). Relative to HC group, both MDD subtypes showed significantly increased D-RSFC within prefrontal-limbic circuit. Reduced D-RSFC was found within temporal-limbic circuit. Even no significant difference in D-RSFC was found between refractory and nonrefractory MDD, the refractory MDD group exhibited more diverse abnormal D-RSFC regions than nonrefractory MDD group. These regions mainly located among distributed prefrontal-limbic areas. Both MDD subtypes showed decreased D-RSFC in the middle and posterior part of bilateral OFC, the nonrefractory MDD showed increased D-RSFC in the frontal part of left OFC (Figure1B). Besides, the increased D-RSFC in left DPFC of both MDD subtypes exhibited negative correlation with HAMD scores, while reduced D-RSFC in bilateral OFC showed negative correlation with HAMD scores in refractory MDD patients (Figure 2).

Discussion and Conclusion : It is the first study to investigate MDD subtypes with D-RSFC. The results confirm our hypothesis that the D-RSFC method can reveal the similar dysfunction brain network as traditional static functional connectivity in both MDD subtypes. The cortical-limbic, especially the prefrontal/temporal–limbic circuit, is the most stable varying and important dysfunction brain network in MDD. The frontal part of left OFC, which shows reversed activity in MDD subtypes respond to treatment, may provide new insight into evaluate the treatment.

Abstract:

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