

## Disrupted effective connectivity in first-episode patients with major depressive disorder

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### Purpose:

Major Depressive Disorder (MDD) patients' Prefrontal-Limbic Network (PLN) has a number of anomalies in brain structure and function. In PLN, Some researches explained the MDD pathogenesis from the bottom-up emotion processing; while others owed the real pathogeny to top-down lack of cognitive control<sup>[1]</sup>. So we selected the important node rostral anterior cingulate cortex (rACC) between PLN regulating emotion and cognition as the seed point. In addition, we used the method of model-free Granger causality analysis (GCA) to probe into the variation of effective connectivity in first-episode treatment-naive MDD patients<sup>[2]</sup>.

### Methods:

22 MDD patients participated in this study, the control group used 20 normal volunteers with matched gender and age. REST-GCA software package was used. The results of anterior cingulate cortex (ACC) in the Meta analysis of MDD were used as the MNI coordinates of the seed point for GCA based on coefficient<sup>[3]</sup>. Finally two-sample T test was used for analysis of the differences of effective connectivity between the two groups.

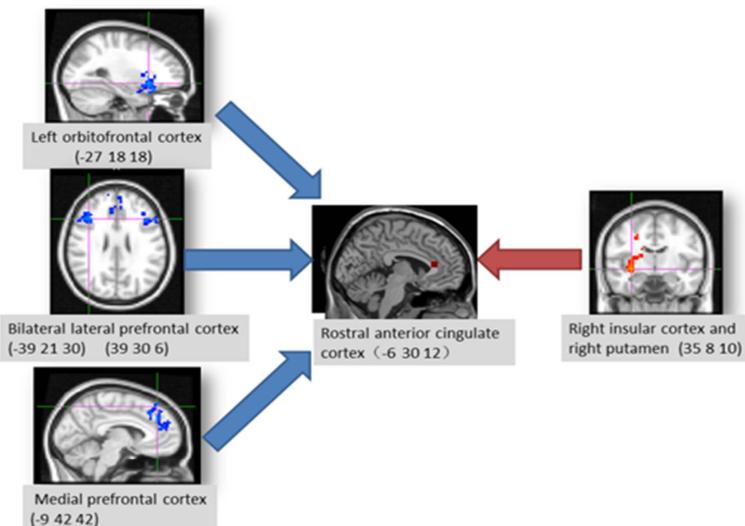


Fig1 The blue suggested the effective connectivity reduced, and red vice versa

abnormality of effective connectivity from right insular cortex to rACC showed that there was something wrong with the SN switching function between central-executive network and default-mode networks under the resting state, plus the change of effective connectivity from the striatum to rACC, it was further verified that the loop of limbic cortex–striatum–globus– pallidus–thalamic lost balance.

### Conclusion:

These specific abnormal connectivities reflected the abnormal change of baseline of neural activities under non-task state.

### Reference:

- [1] Siegle G J, Thompson W, Carter C S, et al. Increased amygdala and decreased dorsolateral prefrontal BOLD responses in unipolar depression: related and independent features . *Biological psychiatry*, 2007, 61(2): 198-209.
- [2] Bennett M. The prefrontal - limbic network in depression: Modulation by hypothalamus, basal ganglia and midbrain. *Progress in neurobiology*, 2011, 93(4): 468-487.
- [3] Fitzgerald P B, Oxley T J, Laird A R, et al. An analysis of functional neuroimaging studies of dorsolateral prefrontal cortical activity in depression . *Psychiatry research*, 2006, 148(1): 33-45.

### Results:

In the analysis results of resting-state fMRI, compared to the normal control group, the regions of MDD patients where the effective connectivity from the whole brain to rACC increased were mainly right insular cortex and right putamen, while brain regions where effective connectivity decreased were mainly bilateral lateral prefrontal cortex, medial prefrontal cortex and left orbitofrontal cortex. The effective connectivity from rACC to the whole brain did not show significant statistical difference.

### Discussion:

The change of effective connectivity of prefrontal cortex proved that top-down cognitive control function reduction existed in MDD and revealed potential executive function and attention function impairment of MDD patients. The