Shared and Distinct Functional Network Connectome Abnormality in Deficit and Non-deficit Schizophrenia

Miao Yu[1], Xiangrong Zhang[1,2], Xiaowei Tang[3], Zhengjia Dai[4], Xiang Wang[5], Xiaobin Zhang[3], Weiwei Sha[3], Shuqiao Yao[5], Yong He[4], and Zhijun Zhang[1]

[1]Department of Neuropsychiatry Affiliated ZhongDa Hospital of Southeast University, Nanjing, JiangSu, China, [2]Department of Geriatric Psychiatry, Nanjing Brain Hospital Affiliated to Nanjing Medical University, JiangSu, China, [3]Department of Psychiatry, Wutaishan Hospital of Yangzhou, JiangSu, China, [4]State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University, Beijing, China, [5]Medical Psychological Institute of the Second Xiangya Hospital, Central South University, HuNan, China
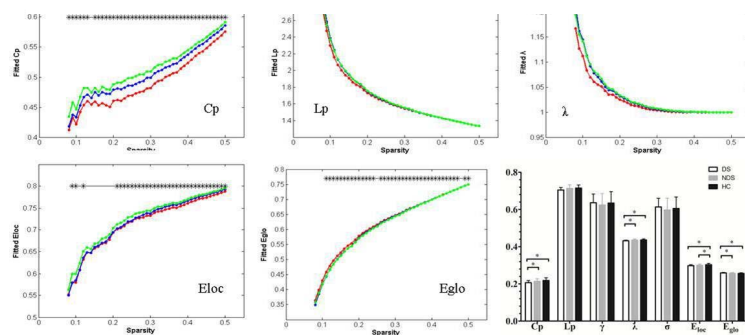
Target audience: Researchers studied on translational medicine in neuroimaging and neuropsychiatric disorders

Purpose Schizophrenia is a highly heterogeneous mental disease. Deficit schizophrenia (DS) was a clinically homogeneous subgroup of patients characterized by primary and enduring negative symptoms. DS patients differ from the patients with non-deficit syndrome of schizophrenia (NDS) in terms of risk factors, gender, treatment response and long-term clinical outcome.[1,2] Numerous studies have demonstrated the the deficit syndrome as a pathophysiologically distinct subgroup within schizophrenia. There is still relatively lack of neuroimaging studies on DS, especially the resting-state functional magnetic resonance imaging (fMRI). Therefore, the present study employed resting-state fMRI to investigate commonalities and distinctions of the topological abnormalities in DS, NDS patients compared with HC.

Fig.1 Small-world properties comparisons of function brain networks among DS, NDS and HC.

Methods 33 DS, 41 NDS and 40 HC underwent cognitive evaluations and resting-state fMRI scans. The functional connectivity networks were constructed by parcellating the brain into 90 ROIs according to AAL atlas and computing the Pearson correlation coefficients of all pairs of brain regions. The topological properties were computed based on the graph theory by using the network analysis toolbox (GRETNA). One-way analysis of covariance (ANCOVA) with age and education as covariates followed by post-hoc, two-sample t-tests, were performed to compare the group differences in global network measures and regional nodal characteristics.

Fig.2 nodal metrics comparisons among DS, NDS and HC.

A. DS vs. HC, B. NDS vs. HC, C. Overlap regions in both patient groups compared with HC, D. DS vs. NDS. Red color means increased nodal metrics and blue means decreased nodal metrics.
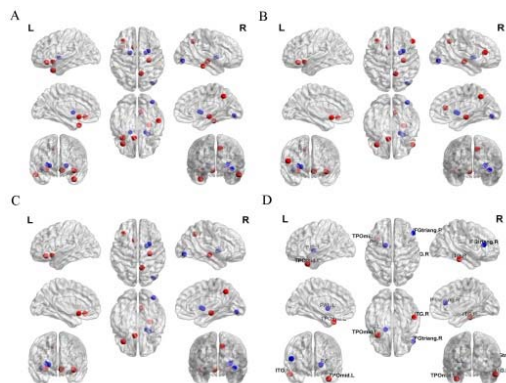
Results Both the patient groups showed decreased local efficiency (Eloc) relative to the HC group (green line). Furthermore, DS group (red line) showed decreased Cp, λ and increased global efficiency (Eglo) compared with the HC and NDS group (blue line) (Fig.1). Additionally, both the patient groups showed overlapping abnormally nodal metrics involving frontal, occipital and precuneus cortices, as well as subcortical nuclei. Different abnormal nodal characteristics ascribable to DS within bilateral temporal areas and left pallidum, as well as abnormalities referable to NDS in right inferior frontal gyrus (triangular part), were observed between DS and NDS (Fig.2). Moreover, the abnormal network metrics correlated with patients' clinical and cognitive performance.

Discussion and Conclusion The present findings provided evidence of shared and distinct areas of connectome dysconnectivity in DS and NDS. The disorder-specific abnormalities emphasize the core neural circuitry of the emotional and social functions abnormality characteristically impaired in DS patients, which may emphasize DS might be a specific subgroup within schizophrenia.

References 1. Kirkpatrick, B., Ross, D.E., Walsh, D., et al. 2000. Family characteristics of deficit and nondeficit schizophrenia in the Roscommon Family Study. Schizophr Res 45(1-2), 57-64. 2.Galderisi, S., Bucci, P., Mucci, A., et al. 2013. Categorical and dimensional approaches to negative symptoms of schizophrenia: Focus on long-term stability and functional outcome. Schizophr Res 147(1), 6.