Is Schizophrenia a Disorder of Brain Network or Brain Hubs? A Functional Brain Connectome Analysis Using Functional Magnetic Resonance Imaging

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Background:

1. Schizophrenia (SCZ) is a disabling mental disorder characterized by distortions in thoughts, perception, mood, language, and behavior [1].
2. Pathophysiological cause of the disorder remains unclear due to the heterogeneous nature of its biological and clinical manifestations [2].
3. Identification of endophenotypes may assist reliable subgroup classification of schizophrenia patients and clarification of disorder mechanisms.
4. Dysfunctional communication among large-scale brain networks and hub nodes in schizophrenia have been reported [3].
5. An exploratory approach was adopted to evaluate the brain dysconnectivity in schizophrenia.

Methods:

1. One group of adult patients with schizophrenia (n=200) and one group of healthy controls (n=200) were recruited.
2. All subjects received functional magnetic resonance imaging (fMRI) scanning at National Yang Ming Chiao Tung University.
3. Functional connectivity (FC) between parcellated brain regions were obtained.
4. Pair-wise brain regions with significantly different FCs among the two groups were identified and further analyzed for their concurrent ratio of connectomic differences with another solitary brain region (single-FC dysfunction) or dynamically interconnected brain network (network-FC dysfunction).

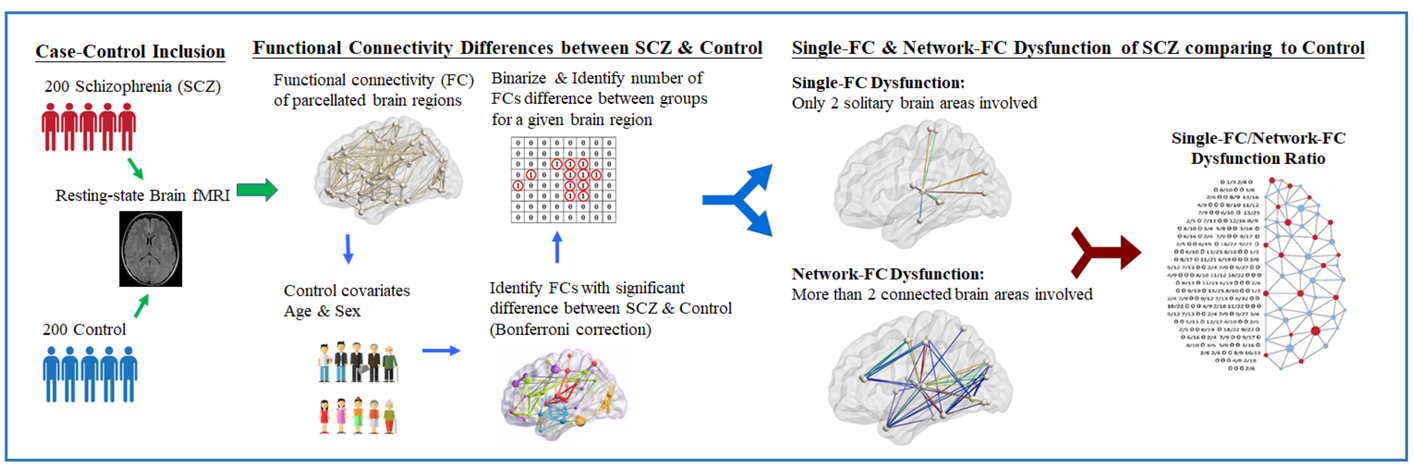

Figure 1. Study design flowchart.

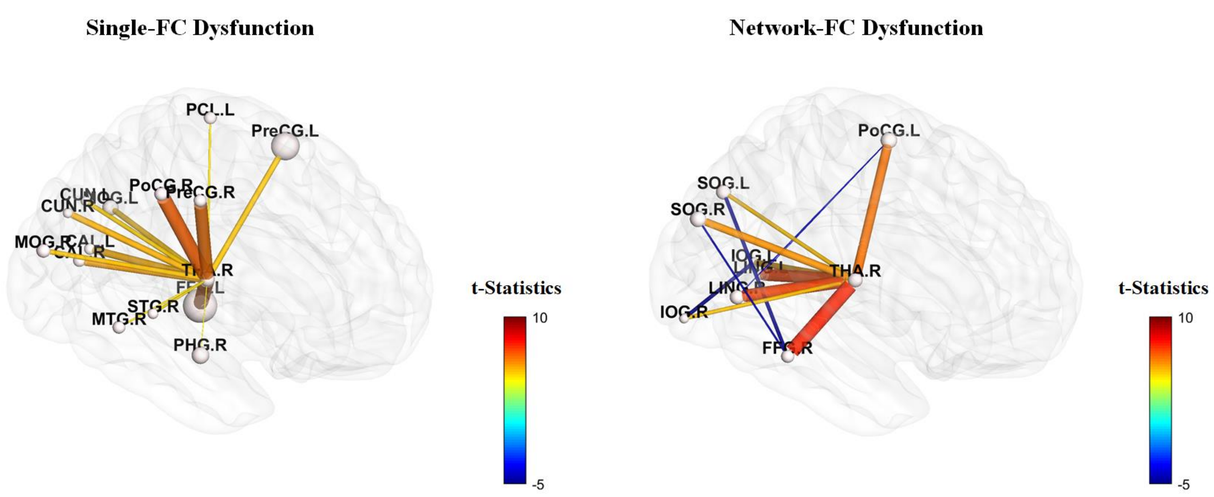

Figure 2. Single-FC dysfunction and network-FC dysfunction within the right-thalamus network.

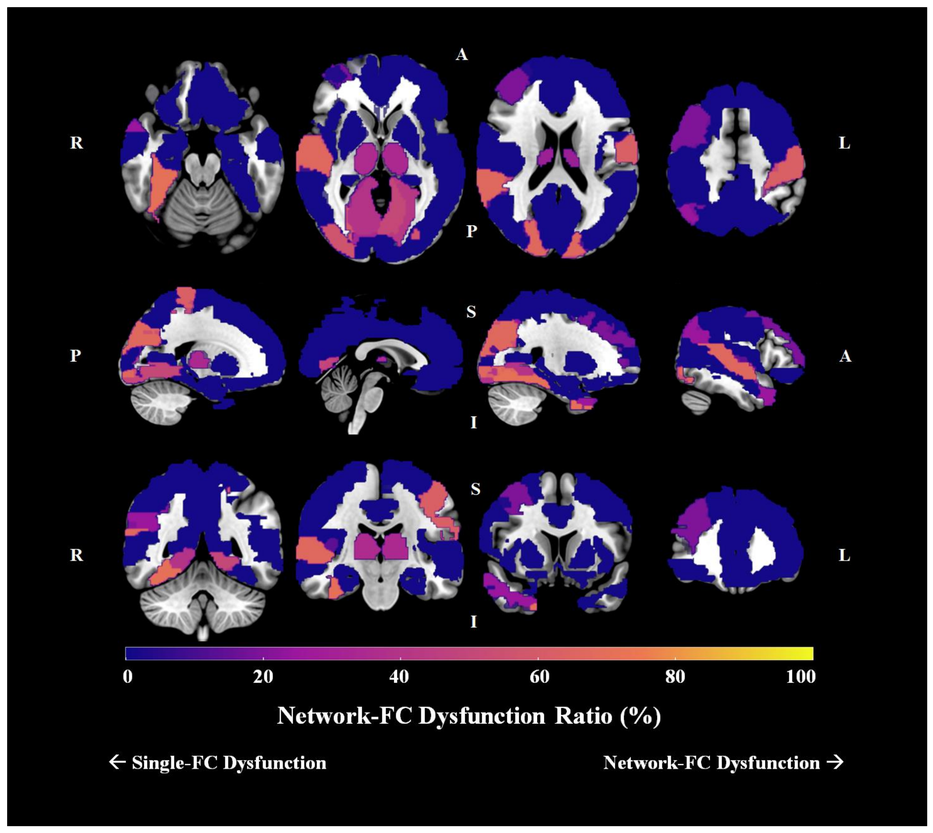

Figure 3. Network dysfunction ratio across AAL90.

Results:

1. The right thalamus had the highest number of significantly different pair-wise functional connectivity between schizophrenia and control groups, followed by the left thalamus.
2. Among the automated anatomical labeling atlas (AAL-90), 55.6% and 7.8% of the brain regions showed ratio favoring single-FC dysfunction and network-FC dysfunction respectively.
3. Brain nodes connected to dysfunctional single-FC were highly overlapped, which could be further classified into a dysfunctional module with bilateral thalamus being the key dysfunctional hub.

Conclusions:

1. Dysconnectivity between the thalamus and its connected brain regions may play a crucial role in schizophrenia pathophysiology.
2. Interconnections between dysfunctional FCs for individual brain regions can be investigated for their roles as endophenotypes of schizophrenia. Current study results also provide insight for the establishment of network-based treatment strategies.

References:

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