Different deficits of cerebral function between schizophrenia and bipolar disorder: a resting-state functional MRI study

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Target audience:

The target audiences for this study are psychiatrists, neurologists, psychologists and radiologist.

Purpose:

Although the schizophrenia and bipolar disorder share a number of overlap in clinical features, risk genetic factors, as well as co-occurrence within relatives (1), they are conceptualized as separate disease, and it is still uncertainty about the common and distinct neural substrates of each. Studying the cerebral function in schizophrenia and bipolar disorder can enhance understanding of the neuro-pathophysiology of the two severe psychiatric diseases. The purpose of this study was to assess the cerebral function in schizophrenia and bipolar disorder using resting-state functional magnetic resonance imaging (rfMRI).

Methods:

This study was approved by the local ethical committee, and written informed consent was obtained from all participants. The diagnosis of schizophrenia and bipolar disorder was made with the Structured Clinical Interview for DSM-IV Axis I Disorders. All participants completed the Brief Assessment of Cognition in Schizophrenia (BACS) test and patients were evaluated using the Global Assessment of Functioning Scale (GAF) and Positive and Negative Syndrome Scale (PANSS). Finally, 53 schizophrenia and 67 bipolar patients and 59 controls were recruited and scanned. The examinations were performed with a GE 3-T MR system with an 8-channel phased array head coil. During scanning, participants were instructed to relax with their eyes closed without falling asleep. The fMRI data processing was then carried out using the DPARSF software (http://www.restmri.net) to calculate the maps of the amplitude of low-frequency fluctuations (ALFF). Head translation movement to all participants was <1.5mm. Voxel-based comparison of the ALFF maps among the three groups was performed using a full factorial model with one-way analysis of variance with age and sex as covariates in SPM8 (http://www.fil.ion.ecl.ac.uk/spm), and the analyses of ALFF maps between each two groups were performed with two-sample *t* tests. A combined threshold of contrast maps was set at P <0.001 for per voxel and a cluster size of 10, which was equal to the corrected threshold of P < 0.05, determined by AlphaSim (http://afni.nimh.nih.gov/pub/dist/doc/manual/AlphaSim.pdf).

Results:

Relative to the healthy control group, the schizophrenia group showed significantly decreased ALFF mainly in bilateral precentral gyrus, bilateral postcentral gyrus, bilateral thalamus, left cingulate gyrus, left paracentral lobule and left orbital frontal lobe, and increased ALFF in bilateral parahippocapal gyrus, while the bipolar disorder group showed decreased ALFF in the left orbital frontal lobe and left anterior cingulate. Direct comparison between the patients groups showed decreased ALFF in the bilateral thalamus ,left medial frontal gyrus and left lingual gyrus in the schizophrenia in relative to the bipolar disorder (P<0.05, Alphasim corrected) (Figure 1). The ALFF of bipolar disorder patients in bilateral thalamus correlated with negative scores of PANSS, the values of left precentral gyrus correlated with GAF and positive scores, the alterations of ALFF of the same group within the left lingual gyrus were correlated with GAF scores, both positive, general and total scores of PANSS. The findings of schizophrenia in right parahippocapal were correlated with PANSS positive scores. Meanwhile, there are correlation between the ALFF values of schizophrenia patients in left parahippocapal gyrus, bipolar patients in left thalamus and their BACS scores respectively (P< 0.05).

Discussion:

Using resting-state fMRI, we evaluated the common and distinct regional cerebral function of schizophrenia and bipolar disorder controlling age and sex as confounders. Relative to controls, we observed differences in schizophrenia and bipolar disorder patients. The schizophrenia patients showed significantly lower regional function in regions mainly within the thalamo-cortical circuits which are consistent with previous study (2) and these regions were found to be related to the short-term effect of antipsychotic treatment (3). Interestingly, the schizophrenia patients also showed increased ALFF of bilateral parahippocapal gyrus which belongs to the emotion circuit, and the alterations showed correlation with clinical symptoms. Unlike the schizophrenia group, the functional deficits in bipolar disorder patients are observed mainly in the regions indentified in cortical-subcortical interactions in emotion processing (4) and these areas are found as the core in the pathogenesis of unipolar depression (5). Part of regions involved in such decrease were correlated with the clinical ratings.

Conclusion:

Though schizophrenia and bipolar disorder patients share a number of overlap in clinical features, the regional functional deficits of the two disease are quite different and involving two different neural network. Further study builds on that aimed at clarify if there are shared and distinct neural network between the two major psychiatric disease.

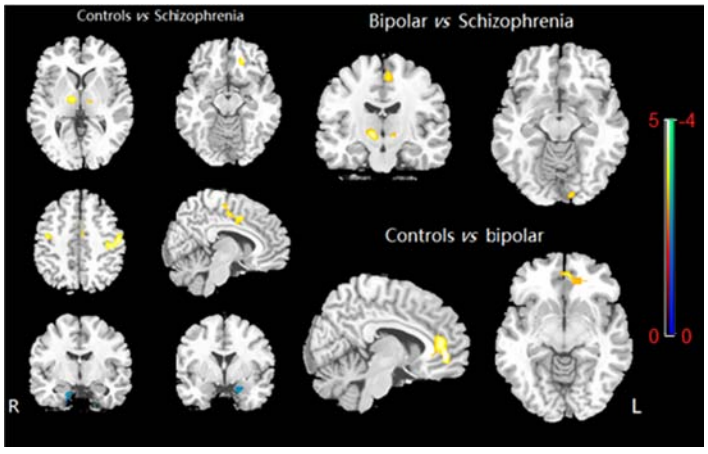

Figure 1.Two-sample *t*-test analyses of ALFF within schizophrenia patients, bipolar and normal controls (P <0.05, Alphasim corrected).The yellow areas indicate lower ALFF in the latter group in relative to the former group, the blue areas indicate higher ALFF.

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