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Spontaneous neural activity in the right superior temporal gyrus and left middle temporal gyrus is associated with insight level in obsessive-compulsive disorder

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ABSTRACT

Background: Insight into illness is an important issue for psychiatry disorder. Although the existence of a poor insight subtype of obsessive-compulsive disorder (OCD) was recognized in the DSM-IV, and the insight level in OCD was specified further in DSM-V, the neural underpinnings of insight in OCD have been rarely explored. The present study was designed to bridge this research gap by using resting-state functional magnetic resonance imaging (fMRI).
Methods: Spontaneous neural activity were examined in 19 OCD patients with good insight (OCD-GI), 18 OCD patients with poor insight (OCD-PI), and 25 healthy controls (HC) by analyzing the amplitude of low-frequency fluctuation (ALFF) in the resting state. Pearson correlation analysis was performed between regional ALFFs and insight levels among OCD patients.
Results: OCD-GI and OCD-PI demonstrated overlapping and distinct brain alterations. Notably, compared with OCD-GI, tOCD-PI had reduced ALFF in left middle temporal gyrus (MTG) and right superior temporal gyrus (STG), as well as increased ALFF in right middle occipital gyrus. Further analysis revealed that ALFF values for the left MTG and right STG were correlated negatively with insight level in patients with OCD.
Limitations: Relatively small sample size and not all patients were un-medicated are our major limitations.
Conclusions: Spontaneous brain activity in left MTG and right STG may be neural underpinnings of insight in OCD. Our results suggest the great role of human temporal brain regions in understanding insight, and further underscore the importance of considering insight presentation in understanding the clinical heterogeneity of OCD.

1. Introduction

Poor insight has long been regarded as a hallmark of psychosis, and has been one of the hot spots in the studies of schizophrenia. Interestingly, a growing number of researchers have reported that patients with obsessive-compulsive disorder (OCD), who have traditionally been described as having preserved insight into their symptoms, also present varying degree of insight (Solyom et al., 1985; Insel and Akiskal, 1986; Kozak and Foa, 1994). Insight in OCD can be defined as a patient's ability to recognize the excessiveness or unreasonableness of his or her obsessive-compulsive (OC) symptoms. DSM-IV (APA, 1994) has introduced a subtype of ‘poor insight’ in OCD, and recently, as a reflection of the awareness that insight may be a more dimensional construct, the DSM-V (APA, 2013) has further specified ‘good or fair insight’, ‘poor insight’, and ‘absent insight/delusional beliefs’ in patients with OCD.

According to previous investigations, patients with poor insight form 15–36% of the OCD population (Matsunaga et al., 2002; Kishore et al., 2004; Catapano et al., 2010). Poor insight in OCD has been reported to be associated with many clinical characteristics, such as greater severity of symptoms (Storch et al., 2008; Catapano et al., 2010), earlier age of onset (Catapano et al., 2010), higher rates of psychiatric co-morbidity with schizotypal personality disorder and body dysmorphic disorder (Catapano et al., 2010; Costa et al., 2012),

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less favorable responses to both behavioral and pharmacological interventions (Erzegovesi et al., 2001; Himle et al., 2006), and worse prognosis (Matsunaga et al., 2002; Catapano et al., 2010). Furthermore, the neuropsychology studies have also revealed that OCD patients with poor insight exhibited more severe neuropsychological deficits especially in conflict resolution/response inhibition, and verbal memory (Tumkaya et al., 2009; Kashyap et al., 2012). These results of distinct clinical and neuropsychological characteristics of poor insight in OCD patients may indicate the important role of insight in coping with and treating OCD.

Despite all these previous reports, however, the neural underpinnings of insight in OCD have rarely been studied. To our knowledge, only one neuroimaging study that has explored the specific pattern of structural brain abnormalities related to poor insight in OCD; the authors found higher rates of abnormalities in ventricle system, interhemispheral commissural systems, temporal lobe, brainstem, and left hippocampus in OCD patients with poor insight (Aigner et al., 2005). However, these results should be treated with caution as neither a healthy control group nor volumetric measurements (In their research, magnetic resonance imaging (MRI) findings in selected locations were rated qualitatively as abnormal or normal) were included in this research. Thus, further neuroimaging studies are needed to elucidate the neurobiological basis of insight in OCD.

In recent years, resting-state fMRI has gained increasingly application. It has been shown that spontaneous low frequency (0.01–0.08 Hz) fluctuations (LFF) in the BOLD fMRI signal at rest are physiologically meaningful, related to brain spontaneous neural activity (Biswal et al., 1995; Zang et al., 2007). Further, an approach named amplitude of LFF (ALFF), was developed to reflect the regional spontaneous neuronal fluctuations in the BOLD time course (Zang et al., 2007). Recently, the ALFF approach has been applied more and more widely to psychiatric researches, such as in studies of schizophrenia (Tang et al., 2015), major depression disorder (Liu et al., 2012), as well as OCD (Hou et al., 2012). All of these studies have indicated that ALFF is a reliable and sensitive approach that aids the location of impaired brain regions and detection of related cerebral dysfunction mechanisms in mental disorders.

Taken together, the present study was conducted to explore the possible neural underpinnings of the varying degrees of insight in patients with OCD using the resting-state ALFF methods. To do so, we first compared whole-brain ALFF findings among OCD patients with good insight, poor insight and healthy controls to locate impaired brain regions that distinguishes the two patient groups, and then we examined correlations between patients' insight levels and ALFF findings from impaired brain regions to identify potential core regions that could account for the degree of insight in OCD. Given the exploratory nature of this preliminary study, we chose an unbiased approach with no *a priori* hypothesis regarding the spontaneous neural correlates of insight in OCD.

2. Methods

2.1. Participants

A total of 40 right-handed individuals with OCD, recruited from the psychology clinic at Second Xiangya Hospital of Central South University, were initially included in this study. Two experienced psychiatrists established diagnoses and comorbidities using the Structured Clinical Interview for the DSM-IV. All patients met the DSM-IV criteria for OCD. We excluded patients who (1) presented with comorbid axis I psychiatric disorders; (2) had histories of major medical or neurological problems, or alcohol or substance dependence. Data from 3 patients were excluded from the further analysis due to the excessive head motion (see Methods). Of the remaining 37 patients, 17 individuals were seeking treatment for the first time and thus were drug naïve, and 20 patients were under treatment with selective serotonin reuptake inhibitors (SSRIs) on the day of MRI scan (see specific demographic and medication information for each patient in Table S1). None of the patients has reported any history of the cognitive behavior therapy in their lives.

Twenty-five right-handed, age- and gender-matched healthy people were recruited as the healthy control group (HC). They were students and staff members at Central South University. Exclusion criteria were (1) history of any psychiatric illnesses; (2) major medical or neurological problems, or any alcohol or substance dependence.

All participants were between 16–35 years of age and had at least 9 years of formal education. Before study participation and after being informed of all procedures involved, they signed consent forms. The Ethics Committee of the Second Xiangya Hospital of Central South University approved this study.

2.2. Clinical assessment and group classification

After being diagnosed, each participant with OCD underwent a semi-structured interview which was completed by a psychiatrist. During the interviews, sociodemographic data (e.g., age, gender, occupation, education level) and information about clinical variables (e.g., age onset, illness duration, medical condition, history of disease) were recorded. The Yale-Brown Obsessive-Compulsive Scale (Y-BOCS) including the checklist (Goodman et al., 1989) was administered to assess OCD severity and to obtain symptom profile. All participants completed the Beck Depression inventory (BDI; Beck et al., 1961) and State Trait Anxiety Inventory (STAI; Spielberger et al., 1983) to determine depression and anxiety levels.

Insight was assessed using the Brown Assessment of Beliefs Scale (BABS; Eisen et al., 1998). BABS is a clinician-administrated 7-item scale developed to assess insight across a variety of psychiatric disorders. Chinese version of BABS has been also tested to have good reliability and validity (Niu et al., 2016). The scale's specific probes include conviction, perception of other's views of beliefs, explanation of differing views, fixity of ideas, attempt to disprove beliefs, insight, and ideas/delusions of reference. In BABS, each item is rated on a scale ranging from 0 (non-delusional or least pathological) to 4 (delusional or most pathological) and scores for the first six items are summed to create a total score (range: 0–24). Patients with total score ≥12 and conviction item score ≥3 (fairly or completely convinced that belief/worry is true) were classified into OCD patients with poor insight group (OCD-PI) (Eisen e al., 2001; Kishore et al., 2004; Catapano et al., 2010). As a result, of the 37 OCD patients enrolled, 18 were classified into OCD-PI and 19 into OCD with good insight group (OCD-GI). Eleven patients in OCD-PI and 9 patients in OCD-GI were under treatment.

2.3. Scan acquisition

Imaging data were acquired on a Siemens Skyra 3T MRI scanner at the Second Xiangya Hospital of Central South University. All participants were instructed to lie supine with closed eyes; to remain still; and to think of nothing in particular, but to avoid falling asleep. Their heads were fixed snugly with foam pads and straps to minimize head movement. Resting-state fMRI images were obtained using an echo-planar imaging sequence with the following parameters: 39 axial slices, 3.5-mm slice thickness, no gap, 2500-ms repetition time (TR), 25-ms echo time (TE), 3.8×3.8×3.5-mm voxel size, 90° flip angle, 240-mm field of view, 64×64 data matrix, and 200 volumes. In addition, three-dimensional T1-weighted magnetization-prepared rapid gradient echo (MPRAGE) sagittal images were acquired using the follow parameters: 176 slices, 1900-ms TR, 2.01-ms TE, 1.00-mm slice thickness, 1.0×1.0×1.0-mm voxel size, 9° flip angle, 900-ms inversion time, 256-mm field of view, and 256×256 matrix.