Longitudinal Study of Parietal Gray Matter Volume in First-Episode Schizophrenia

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Abstract

Which regions of the brain play a critical role in schizophrenia? The prefrontal lobe and temporal lobe are often considered as the principal candidates for the pathology. Meanwhile, the parietal lobe is relatively ignored despite its important role in perception and cognition. We were thus motivated to examine the parietal lobe gray matter volume. We found that bilateral inferior parietal lobules (IPL) progressively decreased after the onset of schizophrenia. Moreover, the reduction correlated with thought disturbance scores. This suggests that the IPL contributes to the pathology of schizophrenia. We hypothesize this parietal-based pathology reflects more than just one brain region dysfunction since IPL is a part of the default mode network thought to be critical in schizophrenia symptomatology.

Introduction

Many schizophrenia studies have focused on prefrontal lobe or temporal lobe and found progressive pathology such as volume reduction in those regions. However, few studies have paid attention to parietal lobe despite its important roles in thought, attention and cognition which are abnormal in schizophrenia.

We examined parietal lobe of schizophrenia patients and considered the mechanism of the disease in conjunction with abnormalities of other brain regions. We performed a longitudinal study to determine if the parietal lobe shows structural changes in patients with first-episode schizophrenia (FESZ) compared to first-episode affective psychosis (FEAFF) and healthy controls (HC).

Method

21 FESZ patients (mean age: 26.2 ± 8.05), 24 FEAFF patients (23.9 ± 5.02) and 23 HC (23.7 ± 3.63) matched for age, gender, handedness, and parental socioeconomic status. Mean duration of illness (FESZ) was 11.6 ± 10.6 months.

Data Acquisition: MR images by 1.5-T GE scanner with follow-up scans 1.5 years later.

Region of Interest: We segmented parietal lobe into postcentral gyrus (PCG), inferior parietal lobule (IPL), superior parietal lobule (SPL) and precuneus and performed gyni-based manual drawing to measure gray matter (GM) volumes. We examined longitudinal volume changes and analyzed the correlations with clinical symptom measures.

Result

Longitudinally, bilateral IPL volumes of FESZ patients showed significantly greater reduction compared to HC and FEAFF groups (figure 2).

Furthermore, cross-sectionally, FESZ patients showed significantly smaller bilateral IPL and precuneus volumes compared to those of HC and FEAFF at initial scans at first hospitalization. This result suggests that IPL volume decreases progressively as well as it was significantly smaller at the onset of the disease.

Discussion

FESZ patients showed progressive GM volume reduction of IPL. Smaller IPL volumes were correlated with more severe thought disturbance and emotional withdrawal. This result suggests that IPL is involved in both thought disorder and emotional abnormalities, both major components of schizophrenia symptomatology.

What then is the brain role of the parietal lobe in schizophrenia? We offer the following hypothesis. We found the IPL had significantly greater volume reduction over time. Also, the precuneus volume was significantly smaller at the onset of the disease. We note these regions belong to the default mode network (DMN). The DMN also includes the medial prefrontal cortex, medial temporal lobe and posterior cingulate (figure 4). The DMN is a system of brain regions shown to activate in the absence of goal-directed activity and deactivate during the performance of cognitive tasks. We suggest the volume decreases of the parietal component of DMN is a neural substrate of the failure of DMN to deactivate during cognitive tasks such as language as well as emotion recognition. These findings thus furnish empirical support for the hypothesis of DMN dysfunction as a critical component of schizophrenia pathology and the role of structural brain deficits in this dysfunction.

References