Gender difference in schizophrenia revealed by resting-state functional MRI

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Introduction

Regional Homogeneity (ReHo) hypothesized that the time series of fMRI signals within a functional cluster are similar to each other, and it utilized KCC (Kendall's coefficient concordance) to measure this similarity in a voxel-wise way [1]. The present study aims to study the gender difference in schizophrenia using the ReHo method.

Method

Sixteen first episode schizophrenia patients (8 males and 8 females) and sixteen age and gender matched normal controls were recruited for the present study. All subjects were right-handed and had no contraindication for MRI scanning or other disorders that may affect the central nervous system. MRI data was acquired on a 3T MR imaging system (EXCITE, General Electric, Milwaukee, USA) with an 8 channel phase array head coil. MR images sensitized to changes in BOLD signal were obtained by a gradient-echo echo planar imaging (EPI) sequence (TR/TE = 2,000/30 ms; flip angle = 90 degrees; slice thickness = 5 mm; 30 slices with no gap) in a resting state when participants were instructed to simply remain motionless, keep eyes closed and think of nothing during scanning. Each functional run contained 200 image volumes.

The ReHo map was produced by calculating the KCC with a free Software ReHofMRI (available on request: yonghe@bic.mni.mcgill.ca, or zangyf@263.net) with 27-voxel cluster attributing to the center voxel. The individual ReHo map was spatially smoothed (FWHM = 6 mm) and standardized by dividing with global mean KCC, and then taken into group analysis with two way (diagnosis × gender) analysis of variance in a voxel-by-voxel manner. The resulting statistical map was set at a combined threshold of $t > 2.763$ and cluster size > 864 mm^3 ($p < 0.05$ after correction for multiple comparison). The second stage post hoc analysis was performed on these significant areas by calculating the peak voxel using Tukey's test focusing on the differences within same gender subgroups.

Result

Main effect of diagnosis showed reduced ReHo in left inferior frontal gyrus, left insula, right thalamus, right precuneus and medial prefrontal gyrus (Fig 1). No area with significantly increased ReHo in the schizophrenia patients or interactive effect was found. Turkey's post hoc test shown that in left inferior frontal gyrus, right thalamus and medial prefrontal gyrus, schizophrenia males differ significantly with normal males (p=0.002, 0.044 and 0.01 respectively) while no difference was found between schizophrenia females and healthy females. In left insula and right precuneus significant differences were found between female schizophrenia patients and female controls (p=0.017, and 0.003 respectively). No difference was found between male patients and male controls in these areas (Fig 2).

Conclusion

Sex difference in schizophrenia has been studied with both structural [2] and functional MR imaging [3]. Abnormal ReHo is possibly related to the changes of temporal aspects of neural activity in regional brain, and it may help to detect the brain regions with impaired function in psychiatric diseases such as schizophrenia[4]. Using ReHo approach, the present study demonstrated the gender difference in brain activity at resting state in schizophrenia which gave further evidence of gender effect on this illness from a functional perspective.

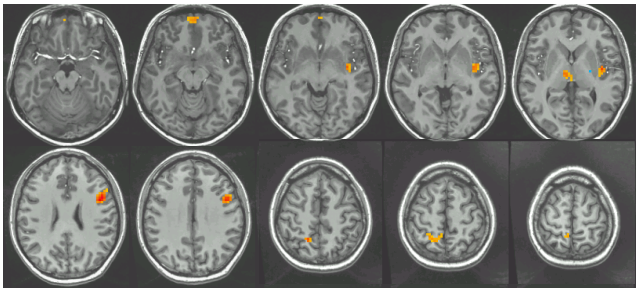

Fig 1. Schizophrenia patients exhibit ReHo reductions involving left inferior frontal gyrus, left insula, right thalamus, right precuneus and medial prefrontal gyrus.

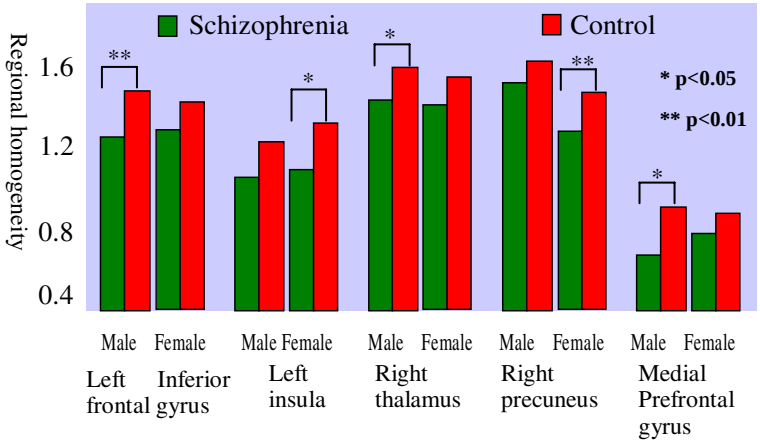

Fig 2. Post hoc test of decreased ReHo areas between genders showed that in left inferior frontal gyrus, right thalamus and medial prefrontal gyrus, schizophrenia males differ significantly with normal males, while in left insula and right precuneus, female schizophrenia patients differ significantly from their normal counterparts.

Reference

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