MRI study of Cerebral Asymmetry in Patients with First-episode Treatment Naive Schizophrenia

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Introduction

Brain is naturally asymmetrical and the lost of brain asymmetry will often indicate psychiatric illness(1). The brain asymmetry alteration, both functionally and structurally, has been assessed in patients with schizophrenia in earlier studies, but a great deal of inconsistencies was reported (2.3). In the present study we applied voxel based morphometry (VBM) using high resolution T1 weighted MR images to probe the brain asymmetry in first-episode, antipsychotic-naive schizophrenia patients.

Subjects and Methods

The study was approved by the local ethical committee and written informed consent was obtained from all subjects. All subjects studied were right-handed, including 20 (aged 23.6±7.2 years, 10 males, 10 females) first-episode treatment naive schizophrenia patients diagnosed according to DSM-IV; and 21 age and sex matched normal controls (aged 23.2±7.4 years, 10 males, 11 females). High-resolution T1-weighted images were acquired for all participants using 3.0T GE EXCITE system (156 continual axial slices, TR/TE: 8.5/3.4msec, Flip angle: 12 degree, Matrix: 256×256, slice thickness 1mm, voxel size: 0.47×0.47×1.00 mm^3), and were subsequently transferred to workstation for VBM analysis. Data processing was performed using Statistical Parametric Mapping (SPM2) according to the following steps: 1. creation of a symmetric T1-template: all images were resampled into 1×1×1mm^3 and spatially normalized to create a T1 template; 2. creation of enantiomorphous image for each subject; 3. smoothing spatially with the FWHM of 8mm, and 4. paired t-test was used to evaluate the structural difference between all images and their enantiomorphous images, and a P<0.001 corrected for multiple comparison was deemed significant. A color-coded digital map of grey matter asymmetry in three dimensions was subsequently generated.

Results

Table1. Gray matter asymmetry in control and patient groups

	Normal control	Schizophrenia group
SFG	L>R	Reduced area of L>R
MTG	L>R	Reduced area of L>R
Cingulated gyrus	L>R	asymmetry lost
Postcentral gyrus	L>R	Right>Left
OG	L>R	Reduced area of L>R
Head of caudate nuclear	L>R	Reduced area of L>R
Thalamus	L>R	Reduced area of L>R
Hippocampus, parahippocampal gyrus	R>L	Reduced area of R>L
SMG	R>L	Larger area of R>L

Schizophrenia patients showed the decreased left>right (L>R) asymmetry areas in cingulated gyrus (mainly in posterior cingulate cortex), head of caudate nuclear, thalamus, superior frontal gyrus (SFG), orbital gyrus (OG), and middle temporal gyrus (MTG) comparing with normal controls in color-coded digital map. The asymmetry of postcentral gyrus in the patient group reversed. There were right>left (R>L) asymmetry of hippocampus, parahippocampal gyrus and superior temporal gyrus (STG) regions in normal controls. While in patient group, the normal right>left asymmetry in superior temporal gyrus(STG) was lost, while that in hippocampus and parahippocampal gyrus became more evident.

Discussion

A left-hemisphere dominate asymmetry was observed in normal group which is consistent with previous results (5.6), however, an R>L asymmetry of hippocampus, parahippocampal gyrus and superior temporal gyrus were found in our present study. This discrepancy may be due to the difference of cohort recruited, as our study is the first one to investigate the brain asymmetry in Chinese population. Our preliminary results show that normal left-hemisphere dominance asymmetry was lost in patients with schizophrenia, including regions of frontal gyrus and temporo-parietal area; both of which are closely related with human cognitive function. Unfortunately, the underlying mechanism of this asymmetrical alteration of the brain in relation to the psychiatric disorders remains unanswered. Further study on a larger cohort is required to clarify how the brain asymmetry changes for a specific population and how they affect the brain in patients with schizophrenia.

Reference

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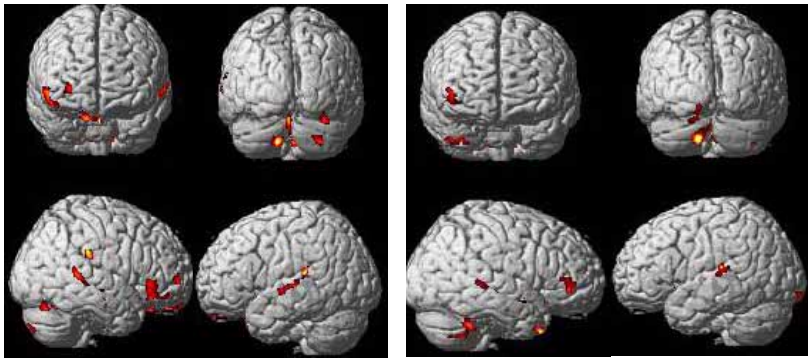

Figure 1. Rendering images of normal group (left panel) and schizophrenia group (right panel) from VBM analysis showed the decreased area of normal brain asymmetry in schizophrenia patients. (In each panel, regions with color on left side of the brains indicated larger regional gray matter in the left hemisphere, regions with color on right side of the brains indicated larger regional gray matter in the right hemisphere).

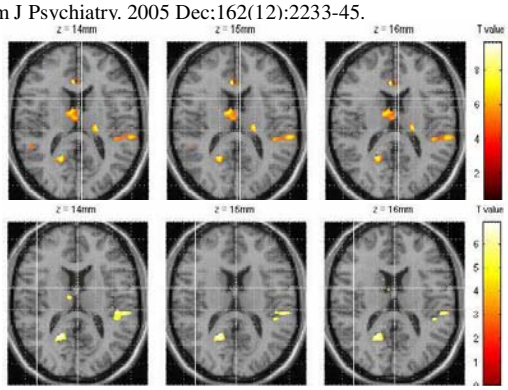

Figure 2. Axial images of normal controls (upper panel) and schizophrenia group (lower panel) from VBM analysis showed the decreased R>L asymmetry of superior temporal gyrus in schizophrenia patients when compared with normal controls.