Mapping the different asymmetry of normal controls and first episode drug naïve schizophrenia patients by Voxel-Based Morphometry

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Objective

Structural and functional asymmetries are now recognized as a fundamental property of brain organization. Brain asymmetry is thought to closely relate with heredity and form in early neurodevelopment(1). Preservation of normal brain asymmetry can provide structure basis for optimal brain function division and specialization(2). The lost of brain asymmetry will cause psychiatric illness (3). Recent studies suggested that schizophrenia patients exhibit abnormal asymmetry in the brain, but a great deal of inconsistencies were reported (4-5). Most studies are ROI based although voxel-based morphology had been used, which failed to explore the overall brain asymmetry patterns both in normal controls and patients. In the present study we used optimized voxel based morphometry (VBM) to probe the overall asymmetry patterns on the level whole brain in normal controls and different genetic load patients: sporadic and familial first episode patients with schizophrenia.

Method

The study was approved by the local ethical committee and written informed consent was obtained from all subjects. 72 treatment naive first-episode schizophrenia patients (FEP) and 72 matched normal controls (NC) were recruited in our study. FEPs were diagnosed according to DSM-IV, and then divided into sporadic patient group (42 patients ) and familiar patient group(42 patients ). Patients and normal controls were all right-handed, age and sex matched. All participants were assessed with neuropsychological tests and scanned by 3.0T MRI to obtain high-resolution T1-weighted images (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 mm3). FEPs were assessed using GAF and PANSS. Laterality Indexes (LI) of grey matter(GM) and white matter(WM) were calculated respectively by using optimized voxel-based morphometry. Color-coded digital maps of GM and WM lateralization distribution within each group were generated from original LI maps at the level of whole brain, by using a voxel-wise one-sample T Test statistical analysis. correlation analysis were conducted to identify the differences among 3 groups.

M Results

On whole brain level, 3 groups showed an overall left dominant lateralization of volume in GM (Fig. 1), but an overall right dominant lateralization of volume in WM (Fig. 2). Leftward lateralization of GM was more prominent than rightward lateralization of WM. Among 3 groups, NC group has the most dominant brain regions. Progressively decreased of normal asymmetry of both GM and WM from sporadic group to familial group was observed. Familial patients showed the most obviously reduced asymmetry and severe lateralization deviation from normal controls.

Conclusion

Our study showed that NC and patients shared the similar asymmetry patterns which exhibited general inverted lateralization of GM and WM, indicating that may be the way gray and white matter are organized to maintain the normal shape and the normal function of brain within a limited volume range. GM showed stronger lateralization than WM, but it can hardly imply that the brain’s asymmetries, both anatomic and functional are decided by that of GM. Familial patients had most severe lateralization deviation from normal controls. With regards to the different genetic loads carried by sporadic and familial patients, the different patterns of asymmetry diminish may reflect the underlying generic information, asymmetry aberrance of brain can be regarded as biologic marker and intermediate phenotype of schizophrenia. Further studies include correlations between lateralization and clinic, cognitive data, as well as DTI based exploration of WM asymmetry shall be needed to gain further insight of our findings.

Reference: