Case-control comparison of cortical thickness maps in schizophrenia: An anatomical MRI study

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Background: Focal gray matter changes have been reported in several brain regions in schizophrenia. Recently, it became possible to measure cortical thickness maps for large magnetic resonance imaging (MRI) data-sets in an automated manner. This study compares cortical thickness maps of subjects with schizophrenia with those of normal controls.

Method: T1-weighted structural MRI scans of the whole brain were collected from 159 patients (mean age: 35.6 yr (SD 12.4); 112 men, 47 women) with schizophrenia or schizophreniform disorder and 158 healthy comparison subjects (mean age: 37.7 yr (SD 14.0); 106 men, 52 women). One rater blind to age, gender, and diagnoses performed both the automated image processing and statistical analysis. Each scan was registered to Talairach space, corrected for intensity non-uniformity, classified, and fit with an inner and outer surface. Cortical thickness was determined at each vertex, then blurred using a 20mm surface-based kernel. Cortical thickness maps were then generated, regressed against group at every vertex, and t-statistical maps were plotted.

Results: With significance calculated based on a false discovery rate alpha=0.01, preliminary analysis showed that in schizophrenia, significant bilateral cortical thinning was present in the lateral prefrontal cortex, the orbitofrontal cortex, the poles of the temporal lobes and the superior temporal gyrus, and the visual association cortex. In addition, the cortex of the right middle temporal lobe and the left medial temporal cortex were thinner in schizophrenic subjects. Areas of significantly increased cortical thickness in schizophrenic subjects included the right insula and the left parietal association cortex.

Conclusions: These results demonstrate the ability of this automated, whole-brain method to detect changes in cortical thickness in schizophrenia, and that some of the anatomical changes in gray matter in schizophrenia can now be described in terms of cortical thickness changes in vivo. The regional distribution of changes found was consistent with independent findings on the distribution of neuropathological alterations in schizophrenia. Further research is needed to correlate these findings to behavioral observations, and to explore longitudinal changes of cortical thickness over the course of the illness.