Integrity of limbic system network in schizophrenia: a tract-specific analysis

A. Kunimatsu[1], N. Kunimatsu[2], S. Aoki[1,3], O. Abe[1], Y. Masutani[1], H. Yamasue[4], K. Kasai[4], H. Mori[1], D. Itoh[2], and K. Ohtomo[1]

[1]Department of Radiology, University of Tokyo, Tokyo, Japan, [2]Graduate School of Medicine, University of Tokyo, Tokyo, Japan, [3]Department of Radiology, Juntendo University, Tokyo, Japan, [4]Department of Neuropsychiatry, University of Tokyo, Tokyo, Japan

Introduction

There is increasing evidence that a disruption in limbic system network integrity has a putative role in pathogenesis of schizophrenia. However, a few pioneering studies using diffusion tensor (DT) imaging have failed to provide constant results on diffusion abnormalities of white matter tracts connected to the limbic structures in schizophrenic patients [1-4], and effects of disintegration of limbic system network, measured by MR, have not yet been determined. Our purpose was to evaluate diffusion abnormalities of three major white matter tracts that constitute limbic system network with a tract-specific analysis: the cingulum bundle (CB), the fornix, and the uncinate fasciculus (UF).

Methods

Patient population

Nineteen male and 20 female patients with schizophrenia and were studied. Age- and gender-matched normal subjects (20 men and 20 women) were respectively recruited. All patients were diagnosed according to DSM-IV criteria (American Psychiatric Association 1994) by experienced psychologists. All patients received antipsychotic drugs during the whole course of the disease. The mean age of the patients and the control subjects were 29.1±6.7 (mean±SD) and 30.0±5.2 years for male subjects, and 29.8 ±7.0 and 29.1±8.1 years for female subjects, respectively.

Methods for DT tractography

We used a 1.5-T imager (GE Signa system, ver. 9) for DT imaging with a single-shot echo-planar sequence (TE/TR = 78/6000 ms, 6 MPG directions, b-values = 0 -1000 s/mm^2, NEX = 4, FOV = 24 cm, 30 contiguous, 5-mm-thick slices, matrix = 128×128). After realignment, DT tractography of CB, the fornix and UF were created using dTV [5] with a streamline method. Tract-specific measurement of fractional anisotropy (FA) was performed after semi-automated segmentation of these tracts [6]. The corticospinal tract (CST) and the corpus callosum (CC) were used as a methodological control.

Analyses

FA values were measured on 6 locations on anterior CB at regular intervals, 5 on middle CB, 5 on the fornix, 5 on UF, 5 on CST, and 5 on CC, similarly. Measurement was respectively performed on each hemispheric side. Comparison was made between the patients and the controls by using unpaired t-test. Statistical significance was set at $P = 0.05$.

Results

Statistically significant decreases in FA ($P < 0.05$) were found in right and left anterior CBs, right and left fornices, right and left uncinate fasciculi in both of the male and the female patients (Figs. 1 and 2). Left middle CB also showed a trend of FA decrease in the male patients ($P = 0.054$)

Conclusion

Our tract-specific analysis suggests that integrity of anterior CB, the fornix or UF might be impaired in schizophrenia.

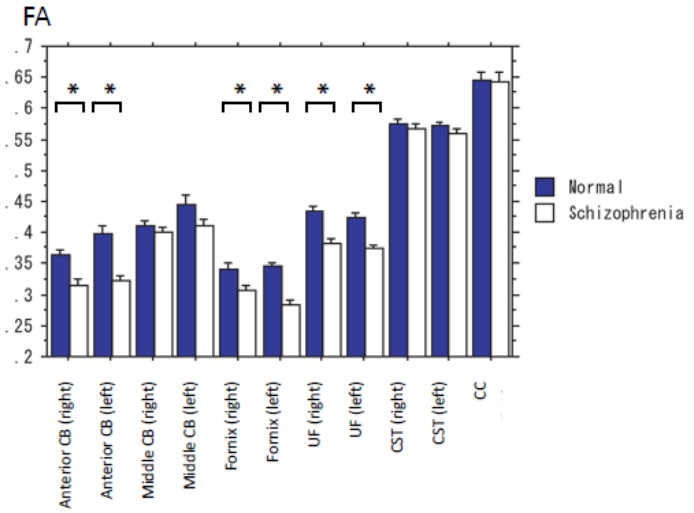

Fig.1 Results of FA analysis in male patients
CB = cingulum bundle, UF = uncinate fasciculus, CST = corticospinal tract, CC = corpus callosum
(*) indicates a statistically significant difference.

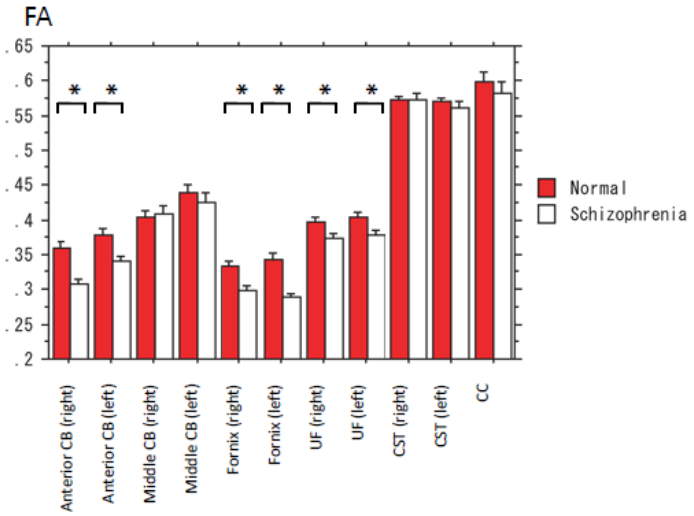

Fig.2 Results of FA analysis in female patients
CB = cingulum bundle, UF = uncinate fasciculus, CST = corticospinal tract, CC = corpus callosum
(*) indicates a statistically significant difference.

References

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