



Abnormalities in White Matter Integrity in First Episode Schizophrenia Using Atlas-Based Segmentation



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INTRODUCTION

Atlas-based segmentation can be useful in detecting and localizing white matter abnormalities in patients with schizophrenia. This study examines white matter abnormalities in first episode schizophrenia compared with healthy controls. We used white matter atlas-based segmentation to identify structures, then calculated Fractional Anisotropy (FA) and Trace, and lastly correlated our findings with symptom severity. Symptom severity was assessed with the Brief Psychiatric Rating Scale (BPRS).

METHODS

•Seventeen first-episode patients with schizophrenia and seventeen age and gender matched healthy controls were scanned and received neuropsychological evaluation.

•The Montreal Neurological Institute (MNI-152) White Matter Atlas, and the ICBM DTI-81 Atlas were used to define regions of interest (Mori et al., 2005).

•Fractional Anisotropy (FA) and trace were compared between the two groups.

•DTI Image Acquisition: Diffusion data were acquired on a 3 Tesla GE Echospeed system (General Electric Medical Systems, Milwaukee, WI). Diffusion-weighted images were acquired using an echo planar imaging sequence, 51 diffusion directions, and 1.7 × 1.7 × 1.7 mm resolution.

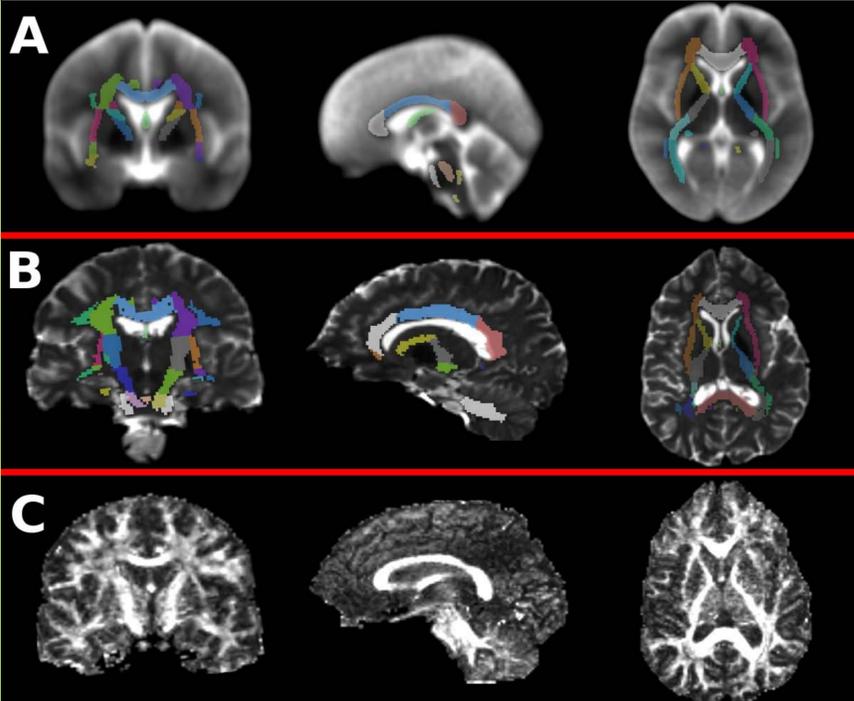


Figure 1: (A) White matter parcellation over-layed onto MNI T2 probabilistic atlas. (B) Co-registered White Matter Parcellation overlaid onto subject baseline. (C) The subject's Fractional Anisotropy map.

RESULTS

•Patients with first-episode schizophrenia showed lower FA values in the genu and splenium of corpus callosum, the internal capsule, the fornix, bilateral uncinate fasciculi and the left inferior fronto-occipital fasciculus compared with healthy volunteers (see Figure 2 and Table 1 below).

•Spearman correlation analysis demonstrated that only FA values in the right inferior fronto-occipital fasciculus were significantly correlated with the BPRS scores, and, more specifically, to negative symptom scores in first episode schizophrenia (see Figure 3).

•In terms of trace, increased diffusivity was shown in almost all white matter regions (see Figure 4). Spearman correlation analysis showed that only trace values in the left cingulum were significantly correlated with BPRS total scores in first episode schizophrenia (see Figure 3).

Left retrolenticular part of the internal capsule

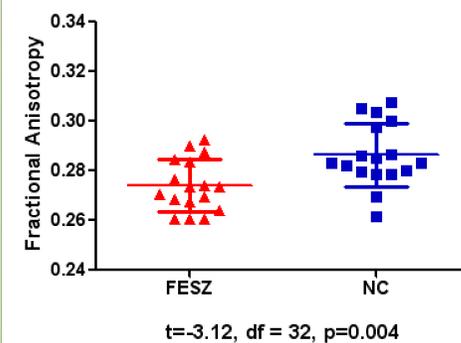


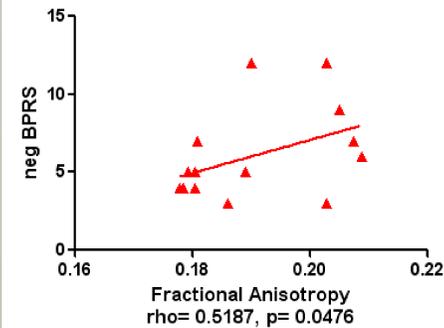
Figure 2: Patients with first episode schizophrenia were shown to have lower FA in the left retrolenticular part of the internal capsule (p=0.004). This example is only one of six regions that were found to have significant differences in FA between groups (see Table 1 below).

SIGNIFICANT MEAN FA RESULTS

	FA Mean in FESZ	FA Mean in NC	t	df	p
Genu of the corpus col.	0.141	0.148	-2.12	32	0.042
Right uncinate fasciculus	0.162	0.175	-2.57	32	0.015
Left uncinate fasciculus	0.169	0.188	-2.07	32	0.047
Left inferior fronto-occipital fasciculus	0.196	0.205	-2.58	32	0.015
Left posterior limb of internal capsule	0.416	0.427	-2.25	32	0.032
Left retrolenticular part of the internal capsule	0.274	0.286	-3.12	32	0.004

Table 1: Mean FA results for both the control group and the experimental group, showing only the regions in which significant differences were found.

Right Fronto-Occipital Fasciculus, FESZ



Left Cingulum, FESZ

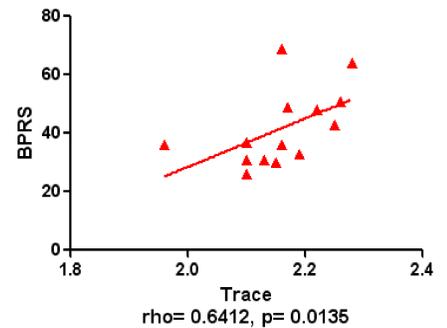


Figure 3: (Left) Scatter plot of negative BPRS scores vs FA values in the right fronto-occipital fasciculus for the first-episode schizophrenia group (n=17, p=0.0476). (Right) Scatter plot of BPRS scores vs trace values in the left cingulum for the first episode schizophrenia group (n=17, p=0.0135).

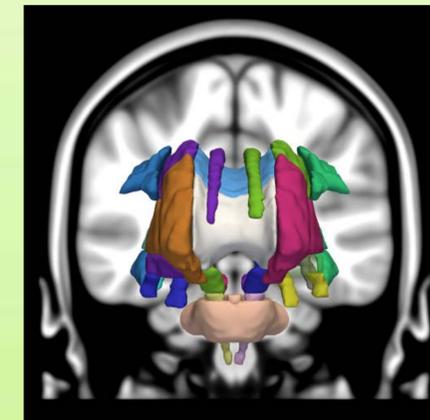


Figure 4: 3-D rendering of the atlas based segmentation. Patients with first episode schizophrenia were shown to have higher trace values in almost all the white matter regions studied.

CONCLUSIONS

These data suggest that first-episode schizophrenia might be associated with disruptions in extensive portions of white matter fiber tracts, especially in the corpus callosum, uncinate fasciculus, inferior fronto-occipital fasciculus and internal capsule, and that negative symptoms are associated with white matter abnormalities related to the right inferior fronto-occipital fasciculus.

REFERENCES

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