Background

The uncinate fasciculus (UF) is the major white matter tract that connects the frontal and temporal lobes (see Figure 1) and has been demonstrated to be abnormal in patients with chronic schizophrenia (Kubicki, 2007).

Using Diffusion Tensor MRI (DTI), a neuroimaging technique that measures the diffusion of water throughout the brain (Figure 2), the tissue structure and connectivity of different regions of the brain may be examined. This study utilizes DTI to explore the changes between first episode and chronic schizophrenia in the uncinate fasciculus.

Methods

18 patients with first episode schizophrenia, 20 patients with chronic schizophrenia and 20 controls for each patient group, totaling 78 subjects, received diffusion imaging on a GE 3T MRI scanner at a resolution of 1.7 mm x 1.7 mm x 1.7 mm (51 diffusion directions, b=000, TR 17000 ms, TE 78 ms, FOV 24 cm, 144x144 matrix). Two sets of regions of interest, the temporal pole and temporal stem white matter of each hemisphere, were placed on color-by-orientation maps for each subject (Figure 3). Each of these two regions of interest were then seeded for streamlined tractography (Figure 4) and filtered through a midline exclusion region. Fractional anisotropy (FA), mode, trace, axial and radial diffusivity (Figures 5-8) were then calculated for the tracts resulting from the streamlined tractography.

Results

CSZ – Chronic Schizophrenia

FE – First Episode Schizophrenia

FENC – Normal Controls Matched to FE

CSZNC – Normal Controls Matched to CSZ

• In overall diffusivity, FE patients showed increased Trace compared to their matched controls on the right hemisphere. This trend was also present on the left, but did not reach statistical significance (p=0.06). This suggests that FA is already decreased in FE patients.

• The lack of significant differences in Mode show that the geometry of the white matter diffusion tensors in terms of their prolato to oblate shape does not differ between patients and controls, nor over time in either group.

• The bilateral decrease in FA between FENC and CSZNC reflects a normal decrease in anisotropy with age which reflects previously reported aging effects in white matter.

• FE patients showed significantly decreased FA compared to controls on the left. This decrease was also present on the right, but did not reach statistical significance (p=0.06). This suggests that FA is already decreased in FE patients.

• The lack of significant differences in Mode show that the geometry of the white matter diffusion tensors in terms of their prolato to oblate shape does not differ between patients and controls, nor over time in either group.

Conclusion

• The bilateral decrease in FA between FENC and CSZNC reflects a normal decrease in anisotropy with age which reflects previously reported aging effects in white matter.

• FE patients showed significantly decreased FA compared to controls on the left. This decrease was also present on the right, but did not reach statistical significance (p=0.06). This suggests that FA is already decreased in FE patients.

• The lack of significant differences in Mode show that the geometry of the white matter diffusion tensors in terms of their prolato to oblate shape does not differ between patients and controls, nor over time in either group.

• In overall diffusivity, FE patients showed increased Trace compared to their matched controls on the right hemisphere. This trend was also present on the left, but did not reach statistical significance (p=0.115). This increase in Trace was primarily driven by an increase in Radial Diffusivity between FE patients and their controls, which was significant in the right hemisphere, and showed a non-statistically significant trend in the left hemisphere (p=0.057). This type of change in Radial Diffusivity has been associated with myelin abnormalities, and may suggest that myelin abnormalities are present at the time of first episode.

• Trace was also significantly increased bilaterally in FE patients relative to CSZ Patients. This was primarily driven by a significant bilateral increase in Axial Diffusivity in FE patients, which has previously been associated with abnormalities in axon integrity.