The Cingulum Bundle in First Episode Schizophrenia

Background

The cingulum bundle is the major white matter tract connecting the cortex and limbic system, and is involved in memory, reasoning and emotion. It has been observed to be abnormal in patients with chronic schizophrenia (Kubicki, 2007). Using Diffusion Tensor MRI, a method that examines the tissue structure and connectivity of different regions of the brain by measuring the diffusion of water, this study explores the changes between first episode and chronic schizophrenia in the cingulum bundle.

Methods

18 patients with first episode schizophrenia, 20 patients with chronic schizophrenia and 20 controls for each patient group, for a total of 78 subjects, received diffusion imaging on a GE 3T MRI scanner at a resolution of 1.7mm x 1.7mm x 1.7mm (51 diffusion directions, b=900, TR 17000 ms, TE 78 ms, FOV 24 cm, 144x144 matrix). Two sets of regions of interest, anterior and posterior portions of the cingulum bundle, were placed on color-by-orientation maps for each subject. Each of these two regions of interest were then seeded for streamlined tractography and then filtered through a midline exclusion region. Fractional anisotropy (FA), mode, trace, axial and radial diffusivity were then calculated for the tracts resulting from the streamlined tractography.

Results

These results suggest that both axial and radial diffusivity contribute to the change in overall white matter health and organization measured by FA, mode and trace between first episode and chronic schizophrenia. Results further suggest that the underlying pathology in first episode schizophrenia in the cingulum bundle involves abnormalities in both axon integrity and myelination. This is consistent with abnormal myelin development that results in partial degeneration of the underlying axons.