The functional neuroanatomy of perisylvian language networks in schizophrenia

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Objective: It has been proposed that schizophrenia symptoms may result from an altered connectivity of distant cortical regions (1). We combined diffusion tensor imaging (DTI) tractography and functional magnetic resonance imaging (fMRI) to study the anatomical and functional integrity of perisylvian language connections in schizophrenia (2).

Methods: We recruited 79 male subjects: 30 controls and 49 subjects with schizophrenia diagnosed according to the ICD-10 criteria (3). A subgroup of 28 subjects with schizophrenia (mean age 34.8±8.4) and 20 age- and gender-matched controls (mean age 29.8±9) was investigated with DTI. Tract-specific measurements of fractional anisotropy (FA) (a potential indirect index of microstructural integrity of fibres) were acquired for the arcuate fasiculus of both hemispheres and for each of its segments. Another 21 subjects with schizophrenia (34.9±9.5) and 10 controls (mean age 28.5±4.3) underwent fMRI. These subjects listened to single words in the presence or absence of acoustic distortion and were asked to judge the source of the speech (4). fMRI data were analysed using SPM2. Dynamic Causal Modelling (DCM) was used to study group differences in effective connectivity (5).

Results: The schizophrenia group showed reduced FA in the left (0.422±0.021) and right (0.423±0.023) arcuate fasciculus compared to controls (left 0.444±0.023; right 0.442±0.021) (*p*=0.001; *p*=0.003, respectively). Analysis of the single segments (Fig.1A) revealed a significant reduction of the FA in the left (0.464±0.028) and right (0.445±0.029) long segment in the schizophrenia group compared to controls (left 0.481±0.023; right 0.471±0.028) (*p*=0.017; *p*=0.015, respectively). During the fMRI task a similar pattern of activation was found between groups. DCM analysis (Fig.1B) revealed between groups differences in effective connectivity between posterior temporal and inferior parietal regions (left p=0.049; right *p*=0.022) and left inferior parietal and frontal regions (*p*=0.022 feedforward; *p*= 0.043 feedback).

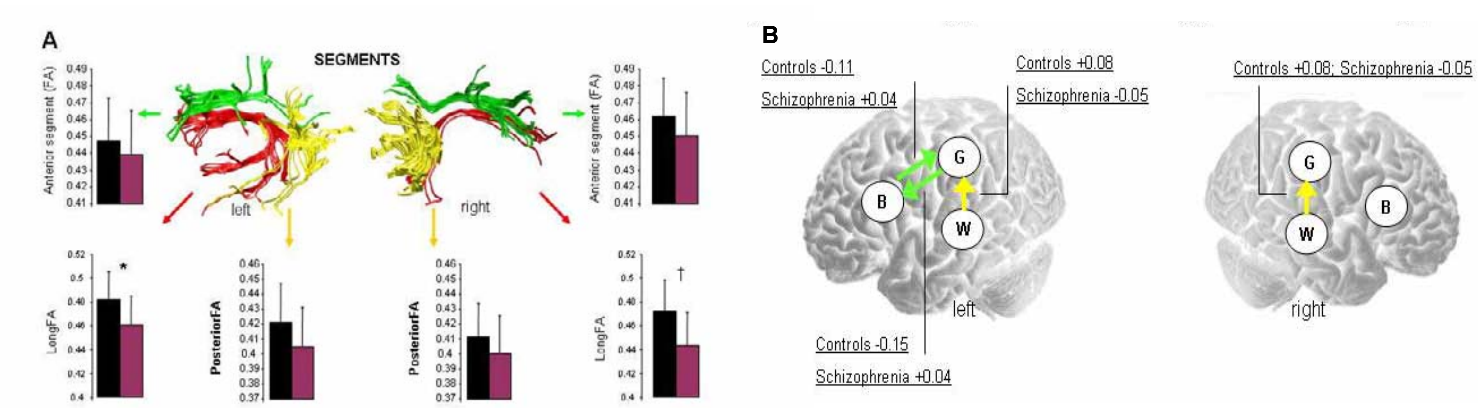

Fig.1 A Tractography dissections of the anterior (green), posterior (yellow) and long (red) segments of the arcuate fasciculus. Tracts specific measurements of FA for each segment in the control (black) and schizophrenia (purple) group. **B** Dynamic Causal Modelling analysis of the effective connectivity between Broca's (B), Geschwind (G), and Wernicke's (W) territories. The differences in connectivity between schizophrenia and control groups are indicated with coloured arrows corresponding to their respective segments in figure 1A.

Discussion: Anatomical differences between patients with schizophrenia and controls were particularly evident in the direct connections between temporal and frontal language areas, whereas functional differences were found in the indirect pathways connecting temporal and frontal regions through the inferior parietal lobe. These findings are consistent with an anatomical abnormality in the direct association language tract and functional reorganisation in less affected indirect tracts**.**

References:

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