Diffusion tensor imaging of white matter abnormalities in patients with writer's cramp

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Introduction. Diffusion tensor imaging (DTI) study of symptomatic and asymptomatic DYT1 carriers showed a reduction in fractional anisotropy within the white matter underlying the sensorimotor cortex (1). It is still unclear whether white matter abnormalities are specifically associated with the DYT1genotype, or if this to other forms of primary dystonia. Moreover, the precise localization of the diffusion abnormalities within white matter pathways remains to be determined. In this study, we investigated white matter abnormalities in patients with focal hand dystonia.

Materiel and methods. We included 26 patients (9 men, 17 women, age range: 21–65 years, mean ± SD: 42.8 ± 13.2 years) with primary focal dystonia of the right hand and 26 age- and gender- matched healthy volunteers. All subjects were studied with DTI at 1.5T (GE) using standard head coil for signal reception. DTI axial slices were obtained using the following parameters: repetition time 10 s, echo time 88 ms, flip angle 90°, matrix 128×128, field of view 380×380 mm^2, slice thickness 3 mm no gap, 4 averages, acquisition time 5:20 min. Diffusion weighting was performed along 6 independent directions, with *b*-value of 900 s/mm^2, and a reference image with no diffusion weighting was also obtained. Axonal integrity was performed using a voxel wise analysis of the fractional anisotropy (FA). Data processing and analysis were performed using statistical parametric mapping software (SPM5, Wellcome Department of Cognitive Neurology, Institute of Neurology, London, UK, http://www.fil.ion.ucl.ac.uk/spm/). Patients were compared to the control group using ANCOVA with age as confounding variable. Clusters were significant at $p<0.05$ corrected for multiple comparisons (height threshold $p < 0.001$). In order to determine which fiber tracts were affected by the FA abnormalities that were evidenced in the voxel-based analysis, fiber tracking was using the FA abnormalities as seeding point. Fiber tracking was performed using a line propagation algorithm implemented in Odysee software (INRIA, Sophia Antipolis).

Results. SPM analysis showed that patients with focal hand dystonia had increased FA values bilaterally in the posterior limb of the internal capsule and the adjacent thalamus and striatum (cluster significant at $p<0.05$ corrected for multiple comparison, Figure 1A and B). Fiber tracking demonstrated that FA abnormalities were located in the fiber tracts connected to the primary motor and sensory areas (Figure 1C).

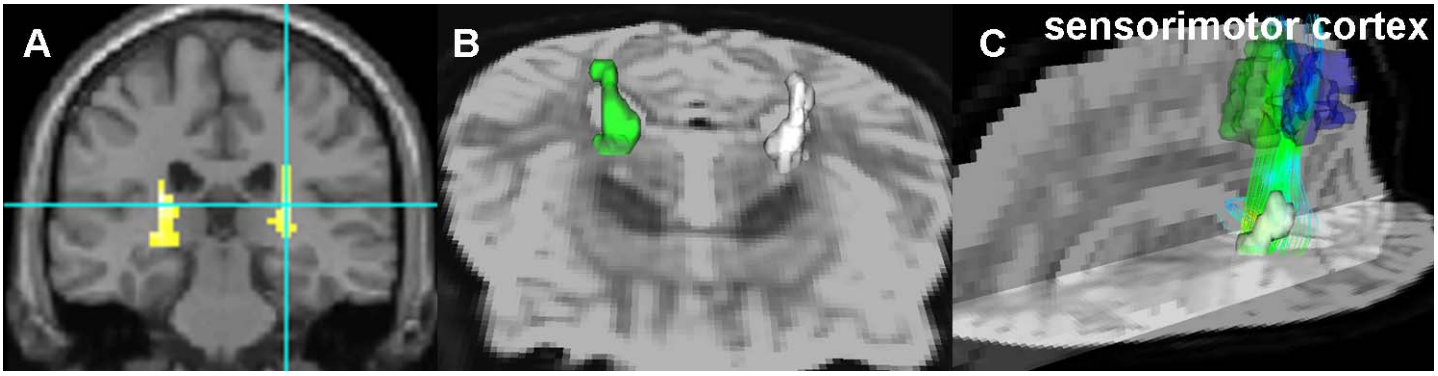

Figure 1. A) SPM analysis showing increased FA values bilaterally in patients with focal hand dystonia had (cluster significant at $p<0.05$ corrected for multiple comparison). B) 3D reconstruction is regions of significant FA increase. C) Fiber tracking using this 3D region as seeding point showing that FA abnormalities were located in the fiber tracts connected to the primary motor and sensory areas.

Conclusion. These data suggest that focal hand dystonia is associated with significant abnormalities of fibers involving fibers connected to the primary sensorimotor pathways. These FA abnormalities were likely to reflect a specific disturbance of the white matter pathways that carry afferents and efferents to the primary sensory motor cortex. These abnormalities are in line with the structural abnormalities that have been reported using voxel-based technique in the primary sensorimotor cortex (2,3)

References. (1) Carbon et al. Ann Neurol 2004, (2) Garraux Ann neurol 2004, (3) Delmaire et al. Neurology 2007

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