

## MR imaging of Parkinson Disease: conventional and advanced techniques

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**Purpose:** Conventional MR imaging of Parkinson disease (PD) is frequently normal or non-specific. However recent advanced MR techniques, such as Diffusion tensor imaging (DTI), Diffusion kurtosis imaging (DKI), Arterial spin labeling (ASL) allow us to evaluate changes related to the pathophysiology of PD. DTI shows changes of FA in the substantia nigra and some white matter tracts. ASL shows reduced CBF in the parieto-occipital lobe. The purpose of this exhibit is to review the conventional and advanced MR imaging of Parkinson disease and its related dementia.

**Outline of Content:** 1. Review of conventional MR imaging of PD. 2. Advanced MR techniques for PD. 3. Review of our results of MR data sets of PD and age matched controls using DTI, DKI, ASL. Analysis of DTI includes ROI, tractography (tract specific analysis), Tract Based Spatial Statistics (TBSS).

**SUMMARY:** We reviewed conventional and advanced MR imaging of Parkinson disease. Using DTI, FA in the substantia nigra and cingulate fiber and some white matter tracts reduced in PD patients compared to normal controls. ASL showed hypoperfusion in the parieto-occipital lobes. Advanced technique such as DTI and ASL may clarify new pathophysiological changes of PD and help early diagnosis and monitoring of PD.

### Our DTI study

**Subjects:** 15 patients with PD without dementia, age matched 15 controls, 10 patients with PD with dementia. **Results:** FA was significantly lower in PDD patients than in normal controls in both the anterior and the posterior cingulate fiber tracts ( $P = 0.003$ ,  $P = 0.015$ ) and significantly lower in PD patients than in normal controls ( $P = 0.003$ ) in the anterior cingulate fiber tract. There were no significant mean diffusivity differences among the groups. Mini-Mental State Examination scores and FA values of the anterior cingulate fiber tracts in PDD patients were significantly correlated ( $r = 0.633$ ,  $P < 0.05$ ).

**Conclusions:** The reduced FA in PD and PDD patients might reflect neuropathological changes such as Lewy body pathology in the cingulate fibers. This abnormality might contribute to the dementing process in PD.

**Subjects:** 20 patients with PD without dementia, age matched 20 controls, 20 patients with PD with dementia..

**Results:** FA values were significantly decreased in the superior longitudinal fasciculus, inferior longitudinal fasciculus, inferior fronto-occipital fasciculus, uncinate fasciculus, and cingulum in patients with PDD compared with control subjects, and in the substantia nigra in patients with PDD compared with control subjects. Mini-Mental State Examination scores and FA values of the genu of corpus callosum fiber tracts in PDD patients were significantly correlated ( $r = 0.392$ ,  $P < 0.05$ ).

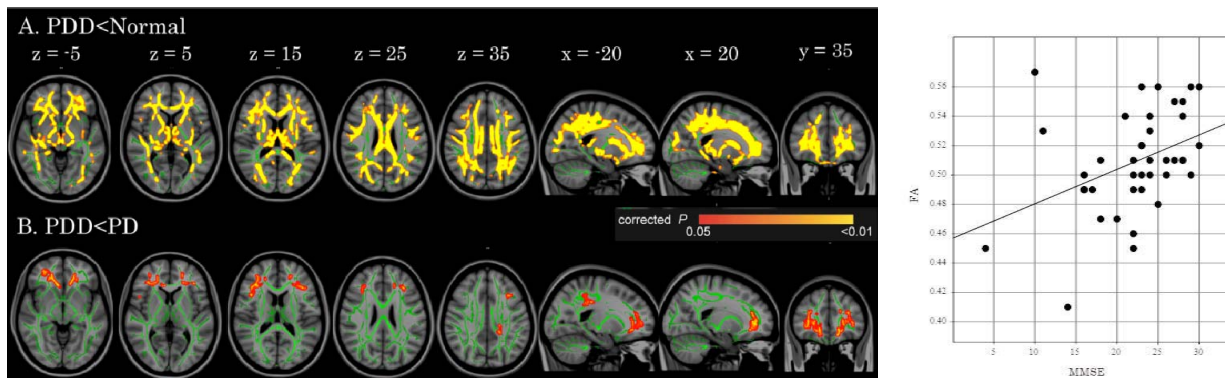


Figure 1. TBSS analysis of FA map. All images are displayed in Montreal Neurological Institute (MNI) space. The mean FA skeleton is shown in green. Areas of significantly decreased FA values in patients with PDD compared with control subjects (A), PDD compared with PD (B). are shown by colors ranging from red to yellow ( $P < 0.05$ , corrected for multiple comparison by using TFCE).