Mild Cognitive Impairment in Early Parkinson Disease is Associated with Posterior Cingulate Atrophy. A Voxel Based Morphometry Study

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Aim. We investigated whether mild cognitive impairment (MCI) in early Parkinson Disease (PD) is predicted by extent of regional gray matter (GM) atrophy.

Background. Cognitive impairment is common in PD(1). Clinical studies have also revealed MCI in non-demented patients, especially in the domains of visuospatial functions and working memory. It has been shown that such MCI is associated with a higher risk of developing dementia(2).

Methods. Our study sample consisted of forty-three (43) non-demented, newly diagnosed PD patients and thirty-one (31) cognitively unimpaired sex-matched normal controls (NC) with mean age 62.5±9.3 years. In the PD sample, 21 patients (age 68.6±9.1 years, disease duration 26.2±16.5 months) were classified as MCI and 22 patients were not (age 60.6±8.3, disease duration 36.1±26.4 months). MCI classification was based upon performance on an extensive and well recognized test battery consisting of seven neuropsychological tests in domains known to be affected in PD: verbal memory, psychomotor speed, visuospatial functioning and executive functioning. Optimized voxel-based morphometry(3) (VBM) was applied to high resolution 3D-T1 weighted MRI scans. Analyses were corrected for white matter hyperintensities using FLAIR lesion mask in order to avoid misclassification of white matter lesions as GM (figure 1). Statistical analysis was performed on modulated GM images and included covariates for appropriate differences in demographic and clinical characteristics between the groups.

Results. MCI patients showed a strong trend towards reduced GM matter volume in the posterior cingulate region of the right limbic lobe (figure 2) when compared to cognitively intact patients (p= 0.054 corrected for family wise errors, FWE). There were no other significant areas of regional atrophy when comparing the PD patients with NC.

Conclusion. This study shows that the MCI in early PD is associated with region-specific GM atrophy. The cingulate is known to be a part of the anatomical circuits that are involved in cognitive performance such as visuospatial functions(4). Our study shows that cingulate atrophy is associated with early cognitive deficit in PD, and that this region might serve as a possible biomarker for increased risk of developing dementia in PD.

References:

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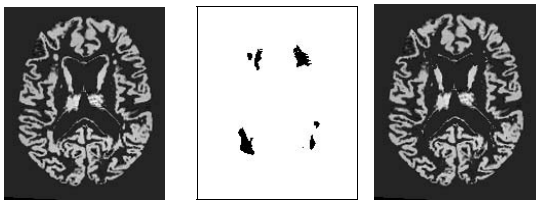

Figure 1.
Modulated gray matter segmented image without lesion correction (left) where white matter lesions are misclassified as gray matter. Middle image shows the lesion mask applied to get the corrected gray matter segmentation to the right.

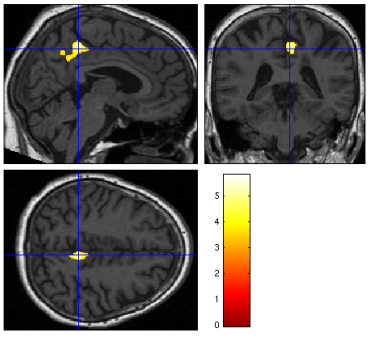

Figure 2.
VBM output shown on normalized T1W image with gray matter atrophy in posterior cingulate in PD patients with MCI compared to cognitively unimpaired PD patients.