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**Introduction**

Mild cognitive impairment (MCI) can manifest in the early stages of Parkinson’s disease. It is under recognised, under treated, and is associated with poorer quality of life and an increased risk of developing Parkinson’s disease associated dementia\(^1,2\). MCI in Parkinson’s disease can involve deficits in single or multiple cognitive domains including memory, visuospatial, language, executive function and attention. Previous resting state functional magnetic resonance imaging (rs-fMRI) has shown disruption to brain networks important for normal cognitive function in subjects with Parkinson’s disease\(^3\). This study aims to identify if rs-fMRI is able to identify early brain network changes associated with MCI and its utility as an early biomarker of MCI.

**Methods**

As part of the ICICLE-PD longitudinal observational study\(^1\), the rs-fMRI data of 121 patients with a new diagnosis of Parkinson’s disease was analysed. Forty-seven patients were classified as having MCI, defined as 1.5 SD below control mean scores on at least two neuropsychological tests as per the MDS task force level two criteria\(^4\). These were compared to 32 healthy age matched controls. Resting state brain networks common to all subjects were initially identified by independent component analysis (ICA) using the FMRIB’s Software library (FSL)\(^5\). Differences in functional connectivity between the resting state networks and the whole brain were assessed using dual regression (see Beckman et al. 2009)\(^6\). Non-parametric permutation testing was performed to test the relationship between fMRI voxel clusters identified with significant differences between groups and neuropsychiatric test scores.

![Figure 1. The Default Mode Network (DMN) as identified with ICA in FSL.](image)

**Results**

Significant differences in functional connectivity were found in subjects with MCI within the DMN and Executive control network when compared to controls. Differences were also found between Parkinson’s patients without MCI and controls in the Fronto-parietal resting state network. The clusters of altered functional connectivity correlated with impaired performance on neuropsychiatric tests.

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- The resting state networks identified are known to play important roles in cognitive processing including attentional shifting and executive function. The increased connectivity in MCI subjects may suggest an inability to switch network configurations appropriately for the environmental/task specific context.
- Future work should focus on better defining how brain wide networks are reconfigured dynamically, the important role certain brain regions with high connectivity (hubs) play in this process and how they are affected in Parkinson’s disease associated MCI and dementia.

**Conclusions**

- Significant differences in functional connectivity were found in subjects with MCI within the DMN and Executive control networks when compared to controls. Differences were also found between Parkinson’s patients without MCI and controls in the Fronto-parietal resting state network. The clusters of altered functional connectivity correlated with impaired performance on neuropsychiatric tests.
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**References**