Brain Activation Differences in Tremor and Non-Tremor Dominant Parkinson's Disease

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Introduction

The cardinal motor features of Parkinson's disease (PD) are bradykinesia, rigidity, and tremor. Within the general diagnosis of PD, distinct clinical subtypes have been identified based in part on the age of onset, the predominant motor sign (e.g. tremor dominant [TD], non-tremor dominant akinetic-rigid [NTD]), and the clinical course of the disease.[1,2] Previous studies have shown that the TD variant has a slower rate of progression and less deterioration of health related quality of life.[3] We hypothesized that patients with NTD PD would show both cortical and basal ganglia activation deficits compared to patients with TD PD. We further test the hypothesis that areas that show reduced activation in NTD patients relative to TD patients will also be reduced in NTD patients relative to control subjects.

Experimental

The goal was to compare functional brain differences in tremor dominant (TD) and non-tremor dominant (NTD) subtypes of Parkinson's disease (PD) using functional magnetic resonance imaging (fMRI). fMRI activation in TD and NTD patient groups who performed a grip task was compared using voxel-wise analysis. Significantly different brain areas between patient groups were examined with a region of interest (ROI) analysis to compare patients with healthy controls. Voxel-based morphometry was used to determine macroscopic differences in grey and white matter volume between patient groups.

Results and Discussion

Robust findings across both voxel-wise and ROI analyses showed that compared to TD patients, NTD patients had reduced activation in ipsilateral dorsolateral prefrontal cortex (DLPFC), and internal and external globus pallidus (GPi and GPe) (Figure 1). ROI analyses confirmed that NTD patients had reduced activity in ipsilateral DLPFC, GPi, and GPe compared to TD patients and control subjects. TD patients had increased activity in contralateral DLPFC compared to NTD patients and controls. These results could not be explained by differences in grey or white matter volume.

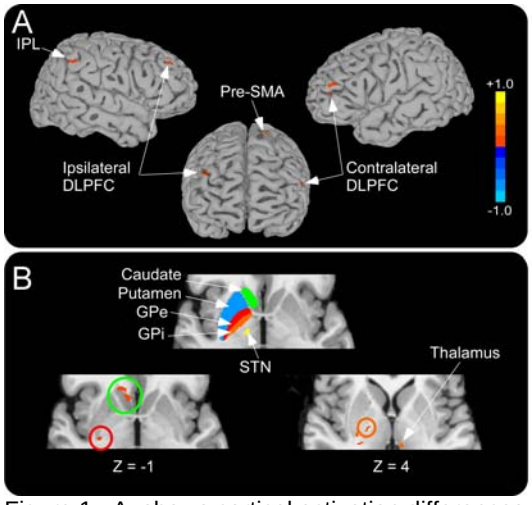

Figure 1. A, shows cortical activation differences between TD > NTD, and B, shows subcortical differences between TD > NTD.

Conclusions

Reduced fMRI BOLD activity occurs in the prefrontal cortex and globus pallidus of NTD PD patients compared to both TD PD patients and controls, suggesting that fMRI is a promising technique to understand activation differences in subtypes of PD. These data match prior studies of post-mortem tissue.

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References

1. Jellinger KA. *Clin Neurol Neurosurg,* 94, Suppl:S86-88 (1992).
2. Jankovic J, et al. *Neurology,* 40, 1529-1534 (1990).
3. Zetusky WJ, et al. *Neurology,* **35**, 522-526 (1985).