Objective

To investigate differences in functional brain patterns on a novel event-related attentional set shifting fMRI task in individuals with Parkinson’s disease (PD) and age-matched healthy controls (HC).

Introduction

Cognitive impairment, including executive dysfunction, is a common non-motor symptom of PD and can lead to reductions in quality of life for patients and caregivers. Throughout the course of the disease, approximately 50-80% of PD patients demonstrate cognitive declines, with approximately 30% meeting criteria for dementia. Specific deficits are most often found on executive functioning tasks.

Functional magnetic resonance imaging (fMRI) is a method used to probe brain activity during task performance. We tested PD and Healthy controls on a novel set shifting fMRI task.

Methods

Subjects

14 PD patients and 10 healthy controls (HC)

<table>
<thead>
<tr>
<th>Table 1: Demographics</th>
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<tr>
<td>PD</td>
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<tr>
<td>HC</td>
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<tr>
<td>Gender 67/33</td>
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<td>Age 67.5 (4.3)</td>
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<td>Education 12.8 (2.9)</td>
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<td>H&amp;Y off 2.0 to 3.0</td>
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fMRI Task

In a visual stimulus, large numbers 1-2 composed of small numbers 3-9 were presented and subjects were asked to switch back and forth between sets by responding to the large number or to the small number. The paradigm contained a total of 256 stimuli with 50 switches occurring randomly. Consecutive axial gradient EPI images (256 phases, 64x64,FOV=220mm, slice thickness 3 mm, duration: 12 min 48 sec) were acquired during task performance. Total number of images for this task was in the order of 12,000.

Results

For only the trials with correct switches:

- The PD patients demonstrated lower activation than the HC controls in diffuse areas of the brain.
  - Frontal lobe (left/right superior frontal gyrus, right inferior frontal gyrus, left supplemental motor area)
  - Subcortical/medial structures (right caudate, left/right cingulate gyrus)
  - Parietal lobe (right postcentral gyrus, right superior parietal)
  - Temporal lobe (left middle temporal gyrus, right superior temporal gyrus)
  - Cerebellum (left pyramis, left/right lingual, right cuneus).

Discussion

- The PD patients’ brain activation patterns differed significantly in diffuse brain regions from the HC on a novel executive functioning set shifting task.
- The differences in activation patterns were localized to the frontal, subcortical, parietal, temporal and cerebellar regions.
- These preliminary findings suggest that fMRI is capable of measuring functional differences in PD patients and age-matched controls during the performance of a set-shifting task.

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