Objective

To examine pre- to post-surgical cognitive changes associated with bilateral subthalamic nucleus deep brain stimulation surgery (STN-DBS) with emphasis on frontostriatal functioning.

Few studies have included matched healthy controls or non-surgical Parkinson's disease (PD) patients to help account for test practice effects and disease progression.

Background

While some researchers have found declines in executive functioning, working memory, episodic memory, and visuospatial functioning after STN-DBS, others have reported improvements or no change.

Frontostriatal functioning has not been evaluated specifically following STN-DBS.

Participants

31 advanced PD patients with bilateral STN-DBS
18 healthy elderly controls (HC)
24 medically-managed non-surgical PD patients

Standard Tests

- Mental flexibility (Trails B)
- Fluency (Letter and Animal Fluency)
- Visuospatial (clock copy)
- Attention (WAIS-III Digit Span)
- Cognitive speed (Symbol Digit Modalities Test-Oral)
- Nonverbal memory (Brief Visual-spatial Memory Test-R)
- Verbal memory (Rey Auditory Verbal Learning Test)
- General ability (Mattis Dementia Rating Scale)

Statistics

- The Reliable Change Index was used to determine clinically significant changes in performance while taking into account the tests’ reliability.
- DBS patients were significantly more depressed pre-surgically than either HC or PD patients; thus, Repeated Measures ANCOVA with depression as a covariate was used for the frontostriatal measures.

Results

Reliable Change

<table>
<thead>
<tr>
<th>Declines</th>
<th>Improvements</th>
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<tbody>
<tr>
<td>Semantic fluency</td>
<td>Mental flexibility</td>
</tr>
<tr>
<td>Mental flexibility</td>
<td>Visual-spatial</td>
</tr>
<tr>
<td>Phonemic fluency</td>
<td>Attention/working memory</td>
</tr>
<tr>
<td>Verbal memory</td>
<td>No patients improved in semantic fluency or verbal memory abilities</td>
</tr>
</tbody>
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Frontostriatal Tests

- Alternating Fluency

Statistics

- Phonemic: N and S, D and A
- Semantic: B & Clothing, W & Food, Occupations & Boys Names, Girls Names & Furniture

Summary & Conclusions

- Short-term cognitive morbidity was found in a large percentage of STN-DBS patients after controlling for practice effects, disease progression, and test unreliability.
- On the frontostriatal tasks, DBS patients showed significant decline at 6 months on nonverbal working memory and cued alternating fluency measures compared to the PD and HC groups.
- Depression was not a moderating variable.
- The long-term frontostriatal cognitive outcome of DBS needs to be evaluated.
- Results provide a helpful guide for counseling surgical candidates on the possible short-term cognitive risks associated with surgery.