

# Neuropsychological Outcome after Bilateral Deep Brain Stimulation Surgery for Advanced Parkinson's disease: Base Rates Adjusted for Practice Effects, Test Unreliability, and Natural Disease Progression



<sup>1,4</sup>Mario F. Dulay, Ph.D., <sup>2,3</sup>Michele K. York, Ph.D., <sup>2</sup>Joseph Jankovic, M.D., <sup>3</sup>Richard K. Simpson, M.D., Ph.D.

<sup>1</sup>Department of Physical Medicine and Rehabilitation, Baylor College of Medicine, Houston TX

<sup>2</sup>Department of Neurology, Baylor College of Medicine, Houston TX

<sup>3</sup>Michael E. DeBakey VA Medical Center, Houston TX, <sup>4</sup>The Institute for Rehabilitation and Research, Houston TX

## OBJECTIVE

- ✓The purpose of this study was to examine pre- to post-surgical changes associated with bilateral subthalamic nucleus deep brain stimulation surgery (BSTN-DBS) in 25 patients with advanced PD.
- ✓To date, few studies have included matched healthy controls or non-surgical Parkinson's disease (PD) patients for comparative purposes to help account for test practice effects and disease progression.
- ✓Further, most studies have looked at group means, which can mask individual differences.

## BACKGROUND

- ✓The impact of STN-DBS surgery on neuropsychological functioning has been extensively studied.
- ✓The most consistent finding is a reduction in verbal fluency after STN-DBS (Alegret et al., 2001; Ardouin et al., 1999; Daniele et al., 2003; Dujardin et al., 2004; Funkiewiez et al., 2004; Gironell et al., 2003; Saint-Cyr et al., 2000).
- ✓Researchers have also found declines in executive functioning, working memory, episodic memory, interpretation of facial expressions and visuospatial functioning after STN-DBS (Alegret et al., 2001; Dujardin et al., 2000; Hersey et al., 2004; Jahanshahi et al., 2000; Morrison et al., 2000; Pillon et al., 2000; Saint-Cyr et al., 2000; Schroeder et al., 2004; Trepanier et al., 2000; Witt et al., 2004).
- ✓However, other studies demonstrate improvements or no change (Alegret et al., 2001; Ardouin et al., 1999; Dujardin et al., 2001; Jahanshahi et al., 2000; Limousin et al. 1998; Lopiano et al., 2001; McCarter et al., 2000; Perozzo et al. 2001; Pillon et al., 2000; Saint-Cyr et al., 2000).

## PARTICIPANTS

- ✓ 25 patients with advanced PD
- ✓ 18 non-PD controls
- ✓ 27 medically managed PD patients who did not undergo surgery
- ✓ Patients were similar in chronological age.

Research supported by  
Veteran's Affairs &

NIH / NINDS — 5K23NS041254—04

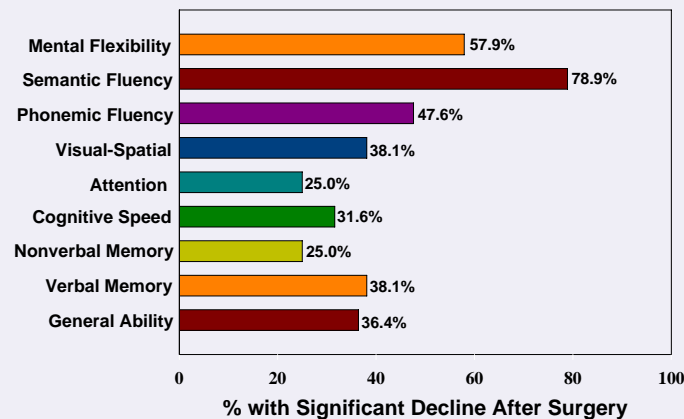
## TESTS ADMINISTERED

General ability (Mattis Dementia Rating Scale), verbal memory (Rey Auditory Verbal Learning Test), nonverbal memory (Brief Visual-spatial Memory Test-R), cognitive speed (Symbol Digit Modalities Test-Oral), attention (WAIS-III Digit Span), visual-spatial (clock copy), fluency (Letter and Animal Fluency), and mental flexibility (Trails B) administered before surgery and 6 months after surgery.

## RESULTS: Declines After Surgery

TABLE 1 shows that the largest declines from pre- to post- BSTN-DBS was on semantic fluency (animal naming) with 79% of patients showing a clinically significant reduction, followed by mental flexibility (Trails B), phonemic fluency (COWA test), and verbal memory (RAVLT). Note that for any cognitive domain, there was significant decline in at least 25% of patients.

TABLE 1



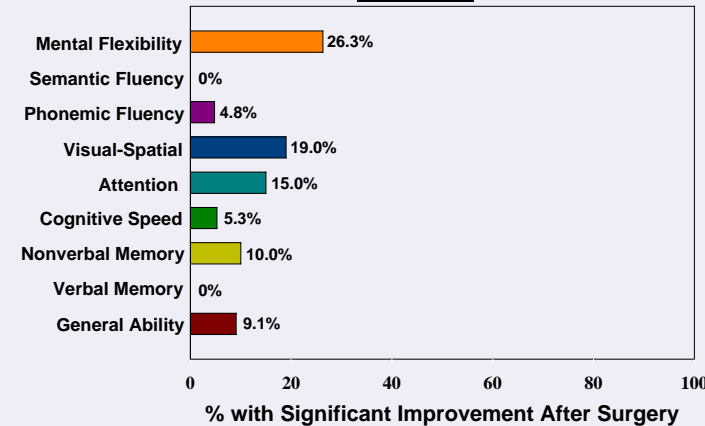
## STATISTICS

- ✓The Reliable Change Index method was used, which allowed for the determination of *clinically significant changes* in performance while taking into account the reliability of the test used.
- ✓Rates of decline and improvement from before surgery to 6 months after surgery were adjusted for practice effects (based on improvements by healthy controls) and disease progression (based on reductions PD controls).

## RESULTS: Improvement After Surgery

TABLE 2 shows the rates of improvement from before to after BSTN-DBS. The largest improvements were found for mental flexibility (Trails B), visual-spatial functioning (clock copy), and attention/working memory (WAIS-III Digit Span). Not one patient had significant improvement in semantic fluency or verbal memory abilities at 6 months post-surgery.

TABLE 2



## SUMMARY & CONCLUSIONS

- ✓Results demonstrate short-term morbidity in a large percentage of patients after BSTN-DBS on measures of neuropsychological functioning after controlling for the influences of practice effects, disease progression, and test unreliability.
- ✓Results provide a helpful guide for counseling surgical candidates on the possible short-term cognitive risks associated with surgery.
- ✓Results highlight a concern with using group means given that individual changes in a specific cognitive domain can include both improvements and impairments following BSTN-DBS.