



Staged versus Simultaneous Bilateral Deep Brain Stimulation Surgery for Parkinson’s Disease: Impact on Health Outcomes.

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Introduction

- Deep Brain Stimulation (DBS) has been shown to be effective in treating medically refractory Parkinson’s Disease (PD), with long-term improvement in quality of life.
- Bilateral DBS can be performed simultaneously or staged based on symptom severity.
- The goal of this study was to evaluate the impact of staging on health outcomes following DBS for PD.

Methods

- A large, retrospective cohort study was performed using the Thomson Reuter’s MarketScan® national database, examining patient who underwent bilateral DBS between 2000 and 2009.
- Patients were separated into cohorts based on simultaneous-bilateral or staged-bilateral DBS.
- Multivariate regression analysis was used to evaluate complications, lead revision, generator reprogramming and annual healthcare cost.

Results

A total of 689 patients were included in the analysis (Simultaneous: 563(81.7%) vs. Staged: 126(18.3%)). The mean±SD age was 61.1±9.9years (Simultaneous: 60.6±9.8years vs. Staged: 63.1±10.1years). Overall, 29.8% of patients were female (Simultaneous: 30.9% vs. Staged: 24.6%) and 39.5% had a Charlson score of 1+ (Simultaneous: 39.3% vs. Staged: 40.5%), Table 1. Post-operative complication rates, lead revision rates and generator reprogramming time are illustrated in Table 2. After adjusting for age, gender, Charlson index, insurance, employment status and year of procedure, staged-bilateral DBS was associated with increased postoperative reprogramming time within one year (RR 1.24; 95% CI 1.15, 1.33; p<0.001) and increased risk of lead revision (HR 2.96; 95% CI 1.76, 4.96; p<0.001), Tables 3. There was no significant difference in annual healthcare cost between both cohorts (RR: 0.07; 95% CI -0.12, 0.26; p=0.485).

Demographics by Procedure Type

Table 1. Demographics by Procedure Type			
	Overall	Bilateral	Staged
Total, no.	689	563	126
Age			
mean (SD)	61.1 (9.9)	60.6 (9.8)	63.1 (10.1)
median (Q1, Q3)	61.0 (55.0, 68.0)	61.0 (55.0, 67.0)	62.0 (56.0, 71.0)
Age Group, no. (%)			
18-34	7 (1.0)	6 (1.1)	1 (0.8)
35-44	26 (3.8)	23 (4.1)	3 (2.4)
45-54	130 (18.9)	106 (18.8)	24 (19.0)
55-64	296 (43.0)	252 (44.8)	44 (34.9)
65+	230 (33.4)	176 (31.3)	54 (42.9)
Female, no. (%)	205 (29.8)	174 (30.9)	31 (24.6)
Charlson Score, no. (%)			
0	417 (60.5)	342 (60.7)	75 (59.5)
1+	272 (39.5)	221 (39.3)	51 (40.5)
Insurance Type, no. (%)			
Commercial	387 (56.2)	325 (57.7)	62 (49.2)
Government	302 (43.8)	238 (42.3)	64 (50.8)
Employment Status, no. (%)			
Employed	76 (11.0)	62 (11.0)	14 (11.1)
Retiree	249 (36.1)	196 (34.8)	53 (42.1)
Other, Missing	364 (52.8)	305 (54.2)	59 (46.8)
Follow-up Months			
mean (SD)	23.4 (16.9)	23.4 (16.9)	23.5 (16.9)
median (Q1, Q3)	18.8 (9.6, 33.9)	19.0 (9.4, 33.9)	18.7 (9.9, 32.5)

Outcomes by Procedure Type

Table 2. Outcomes by Procedure Type			
	Overall	Bilateral	Staged
Total, no.	689	563	126
Hemorrhage within 90 days, no. (%)	19 (2.8)	16 (2.8)	3 (2.4)
Infection within 90 days, no. (%)	36 (5.2)	28 (5.0)	8 (6.3)
PE within 90 days, no. (%)	5 (0.7)	3 (0.5)	2 (1.6)
Pneumonia within 90 days, no. (%)	23 (3.3)	17 (3.0)	6 (4.8)
Device Complication (ICD-9 996.4) within 90 Days, no. (%)	3 (0.4)	3 (0.5)	0 (0.0)
Lead revision within 90 Days, no. (%)	41 (6.0)	21 (3.7)	20 (15.9)
Generator revision within 90 Days, no. (%)	26 (3.8)	20 (3.6)	6 (4.8)
Revision, no. (%)	63 (9.1)	40 (7.1)	23 (18.3)
Reprogramming Hours within One Year Annualized			
mean (SD)	5.5 (6.5)	5.2 (6.3)	6.7 (7.1)
median (Q1, Q3)	3.4 (1.4, 7.1)	3.3 (1.2, 6.8)	4.2 (2.2, 9.1)
Days to Revision, among those with Revision			
mean (SD)	188.1 (288.2)	241.9 (333.4)	94.7 (150.6)
median (Q1, Q3)	86.0 (20.0, 225.0)	107.0 (60.0, 269.0)	21.0 (14.0, 110.0)
Days to reprog, among those with reprog			
mean (SD)	288.1 (410.4)	290.7 (410.0)	277.6 (413.6)
median (Q1, Q3)	71.0 (19.0, 450.0)	78.0 (20.0, 470.5)	56.0 (6.0, 359.0)
Total Payments to Provider annualized in 1000's (2012 dollars)			
mean (SD)	89.6 (102.9)	86.9 (96.3)	101.6 (127.7)
median (Q1, Q3)	51.3 (30.1, 107.4)	49.8 (29.8, 106.9)	54.1 (31.5, 129.0)

Learning Objectives

Staged-bilateral DBS was associated with increased device-related complications but decreased incidence of lead revision, compared to simultaneous-bilateral DBS

Conclusions

In this retrospective analysis, staged-bilateral DBS was associated with increased device-related complications but decreased incidence of lead revision, compared to simultaneous-bilateral DBS. These results may be valuable to physicians and patients in the decision algorithm when planning bilateral DBS for PD.

STAGING status regressed on Outcomes

Table 3. STAGING status regressed on Outcomes

Outcome	Regression	Level	Estimate* (95% CI)	P-value
Log(Payments to Provider, in 1000's + 1)	Linear	Staged	0.07 (-0.12, 0.26)	0.485
		Bilateral	reference	.
Reprogramming Hours within One Year	Zero-inflated Poisson	Staged	1.24 (1.15, 1.33)	<.001
		Bilateral	reference	.
Reprogramming Hours within One Year	Zero-inflated Poisson (Certain Zero)**	Staged	0.51 (0.26, 1.00)	0.048
		Bilateral	reference	.
Revision	Cox PHM	Staged	2.96 (1.76, 4.96)	<.001
		Bilateral	reference	.

*Adjusted for age, sex, charlson score, and insurance type. **Modelled using staging status only.