Deep Brain Stimulation of the Subthalamic Nucleus on Parkinson's Disease Effects on Quality of Life

Alan Diamond, D.O., Kevin Dat Vuong and Joseph Jankovic, M.D.

Parkinson's Disease Center and Movement Disorders Clinic, Department of Neurology, Baylor College of Medicine, Houston, Texas, USA

ABSTRACT

Introduction: Advanced Parkinson disease (PD) is associated with deterioration in health related quality of life (HRQol). Deep brain stimulation of the subthalamic nucleus (STN-DBS) is associated with improvements in motor symptoms of PD.

Methods: A retrospective analysis of the impact of STN-DBS on HRQol was performed in 40 consecutive patients utilizing the PD Quality of Life scale (PDQUALIF). Primary outcome was improvement in PDQUALIF total score. Multiple regression model and Spearman correlation analysis were used to determine the impact of pre-DBS UPDRS items on HRQol outcomes. Wilcoxin signed rank test was used to determine the change in HRQol and UPDRS scores.

Results: There were significant improvements in UPDRS III, UPDRS subscales and dyskinesias. There were non significant improvements in total PDQUALIF score. Only improvement in PDQUALIF sleep subscale reached significance. More severe tremor, dyskinesias, akinesia and gait/postural instability items of the UPDRS at baseline strongly predicted HRQol in PD patients.

Conclusion: Although STN-DBS significantly improved motor function the effects on HRQol did not reach statistical significance, partly because of retrospective nature. Our findings suggest that many measures of baseline impairment are predictive of HRQol outcome.

INTRODUCTION

Parkinson's disease (PD) is a progressive neurological disorder resulting in a detrimental burden on society.[1] In PD, there is a strong association with advancing stages of the disease and motor complications with deterioration in health related quality of life (HRQol).[2] High-frequency deep brain stimulation (DBS) of the subthalamic nucleus (STN) for PD is a viable alternative for those with severe motor fluctuations, dyskinesias or medication refractory tremor. Bilateral STN DBS has been associated with improvements in HRQol.[3] We performed a retrospective analysis of the impact of STN-DBS on HRQol in patients with PD. In addition, we sought to determine what aspects of PD influence HRQol measures.

Table 1: UPDRS

	Preoperative (Off)	Postoperative (On/Off)	P Value
UPDRS III	50.4 (9.8)	33.8 (16.3)	0.001
Dyskinesias	3.9 (2.1)	0.9 (2.1)	0.001
Tremor	6.9 (4.8)	2.3 (3.9)	0.001
Rigidity	10.9 (3.3)	6 (3.9)	0.001
Akinesia	17.1 (3.9)	12.6 (5.6)	0.001
Gait	4.5 (1.8)	3.5 (2.1)	0.005

Table 2: Weighted PDQUALIF scores

	Preoperative (Off)	Postoperative (On/Off)	P Value
Social	62.4 (16.3)	57.7 (21.2)	0.21
Image	51.2 (17.8)	53.4 (21.9)	0.69
Sleep	54.4 (22.1)	43 (24.3)	0.03
Outlook	57.9 (19.1)	52.5 (22.9)	0.22
Function	45.1 (18.1)	40.3 (18)	0.1
Independence	29.3 (33.8)	25.7 (33.3)	0.53
Urinary	50 (24.1)	50.7 (24.1)	0.92
Total	50 (13.8)	46.2 (15.5)	0.18

METHODS

We conducted structured interviews with 40 consecutive patients with PD treated with unilateral or bilateral STN-DBS at Baylor College of Medicine during their follow-up visits. The surgical technique used at our center has been previously described.[4] Subjects were eligible if they were between the ages of 30 and 80 years, had idiopathic PD, Minimental State Exam score of >24, and had unilateral or bilateral STN-DBS. They were administered the Parkinson's disease quality of life scale (PDQUALIF) and unified Parkinson disease rating scale (UPDRS).[5] The PDQUALIF is a 33-item PD disease specific scale, consisting of seven domains: social function, self-image and sexuality, sleep, outlook, physical function, independence and urinary function.[6] A lower score indicated better quality of life. Unified Parkinson's Disease Rating Scale (UPDRS) tremor (items 20,21), rigidity (items 22), akinesia (items 23-26), gait/postural instability (items 29,30) and dyskinesias (item 32-35) were calculated.

Subjects were asked to base their PDQUALIF answers on their status prior to STN-DBS surgery and their current status. In addition, they underwent examinations with the UPDRS Part III on stimulator, off medications for >12 hours. The charts were reviewed for the preoperative demographic information. After obtaining consent 2 subjects did not complete the questionnaires. The study was approved by the Baylor College of Medicine institutional review board. Multiple Regression model and Spearman correlation analysis were used to determine the relationship between UPDRS items and HRQol. Wilcoxin signed rank test was used to determine the change in HRQol and UPDRS scores. A p value of <0.05 was considered significant.

Table 3: Multiple regression of UPDRS scales on improvement in PDQUALIF

PDQUALIF	Predictive Factor	Unstandardized coefficient	95% CI	P Value
Social	Tremor	2.8	1.5-4.1	0.0001
Image	Tremor	2.0	0.8-3.3	0.002
Sleep	Rigidity	3.4	1.3-5.6	0.003
	Tremor	1.4	-0.2-2.9	0.08
Outlook	Dyskinesia	3.3	2.1-6.4	0.04
	Gait	3.3	-0.9-7.4	0.12
Independence	Tremor	2.7	1.5-4.1	0.0001
Total	Tremor	1.7	0.8-2.6	0.0001

Table 4: Spearman correlative analysis between QOL and UPDRS

	Social	Image	Sleep	Outlook	Function	Independence	Urinary	Total
Dyskinesia	0.22	0.23	0.04	0.5*	0.22	-0.06	-0.01	0.3
Tremor	0.56*	0.53*	0.4*	0.42*	0.33*	0.41*	-0.09	0.53*
Rigidity	0.21	0.10	0.41*	0.12	0.26	0.27	0.11	0.27
Akinesia	0.33*	0.25	0.12	0.29	0.42*	-0.01	0.00	0.28
Giat	0.26	0.18	-0.03	-0.36*	0.43*	0..07	-0.12	0.23

RESULTS

There were 21 male and 17 females with mean age at onset of 46.7 ± 11.3, disease duration at implantation of 14.8 ± 5.7, age at implantation of 61.5 ± 11.8 had adequate follow up of 1.6 ± 1.3 years. Thirty-three had bilateral STN-DBS and 5 had unilateral implantation. The pre-DBS levodopa equivalents was 1079.1 ± 555.6 mg and post-DBS equivalents was 737.7 ± 628.1 mg. There were significant improvements in UPDRS III, UPDRS subscales and dyskinesias (Table 1).

STN-DBS effect on HRQol

There were non significant improvements in total PDQUALIF score (Table 2). Only improvement in PDQUALIF sleep subscale reached significance. Several UPDRS items predicted PDQUALIF total and subscale scores (Tables 3 and 4). Higher pre-DBS UPDRS tremor scores predicted worse PDQUALIF total and social, function, outlook, independence, image and sleep subscale scores. The presence of pre-DBS dyskinesia was a predictor for worse outlook scores whereas higher pre-DBS rigidity scores predicted worse sleep scores. In addition, higher pre-DBS akinesia score predicted poor social and function scores and worse pre-DBS gait score predicted poor outlook and function subscales. Age at implantation and duration of disease had no influence on HRQol measures.

DISCUSSION

Our findings of marked improvement in PD related and levodopa related related impairment after STN DBS is consistent with other studies. Although the total PDQUALIF improved after STN DBS, it did not reach statistical significance when compared to baseline values. The worse baseline scores in several domains predicted worse outcome after surgery. One of the chief limitations of our study is potential recall bias. PD patients treated with STN-DBS have been shown to underestimate their presurgical disability by up to 16% .[7] This underestimation of presurgical disability may be why we showed lack of significant improvement in total PDQUALIF in spite of significant improvement in UPDRS part III and dyskinesias. Furthermore, we were unable to assess the impact of depression and anxiety on our outcomes which are known to influence HRQol in patients with PD.[8] We found that the more severe tremor, dyskinesias, akinesia and gait/postural instability items of the UPDRS at baseline strongly predicted adverse effect on HRQol in PD patients as measured by the PDQUALIF and subscales. Tremor, in particular, adversely impacted most domains of the PDQUALIF. This is probably due in large part to the fact that the presence of tremor not only results in a negative self image and poor social function.

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