Impact of STN-DBS on Life and Health Satisfaction in Patients with Parkinson Disease

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Introduction

In order to better assess the adequacy of current Parkinson disease (PD) treatments, healthcare providers have increasingly utilized various patient-based outcome measures, such as health status (HS) and health-related quality of life (HRQoL). HS questionnaires focus on the presence of symptoms (e.g. motor dysfunction, fatigue, pain embarrassment or loneliness) and their impact on one's ability to perform various life activities (e.g. housework, bathing, communicating or leisure activities), while HRQoL instruments measure a patient's subjective experience of symptoms and satisfaction with health conditions. HRQoL differs from HS in that it gauges not only the presence and severity of functional limitations, but to what extent such restrictions actually disturb the individual.[1,2]

Multiple previous publications have aimed to assess the effect of DBS on HRQoL in patients with PD; however, all have employed questionnaires (such as the PDQ-39 and PDQL) that evaluate HS, thus providing only an approximation of HRQoL.[1,2,4,5] In the present study, we analyze the impact of high frequency subthalamic nucleus (STN) deep brain stimulation (DBS) on HRQoL, using a recently validated instrument, the Questions on Life Satisfaction (QLS^M) modular questionnaire, which was specifically designed for DBS patient population.[6]

Methods

Participants:
We enrolled 23 consecutive patients with PD, defined according to the UK Parkinson Disease Brain Bank criteria,[7] who underwent DBS at the Baylor College of Medicine Movement Disorders Clinic in Houston, Texas. All had an excellent response to levodopa but developed motor complications refractory to medical management and met inclusion criteria for STN DBS, as per the recommendations of the CAPSIT-PD panel.[8] Exclusion criteria were as follows: age <30 or >75 years, Mini-Mental Status Examination (MMSE) score <24 or other evidence of dementia on a comprehensive neuropsychological evaluation, medically uncontrolled psychiatric co-morbidity and medical contraindications to surgery. The final decision for implantation was made in a multidisciplinary meeting attended by a neurosurgeon, movement disorder specialists, clinical nurses, and a neuropsychologist. One hundred percent of eligible patients consented to participate in the study, but two were lost to follow-up after their baseline (pre-operative) assessment due to geographical constraints and were not included in our analysis. An additional two patients completed their first but not second follow-up assessment. All patients signed an informed consent before entering the study, and the study protocol was approved by the Baylor College of Medicine Internal Review Board for Human Research.

Evaluation Procedures:
HRQoL was prospectively assessed via an expanded version of the Questions on Life Satisfaction (QLS^M).[6] The QLS^M is a validated instrument that contains modules which address general life satisfaction (QLS^M-A), general health satisfaction (QLS^M-G), movement disorder-specific health satisfaction (QLS^M-MD) and satisfaction with DBS (QLS^M-DBS). Each QLSM module is divided into two sections: one section rating the importance of various items and the other rating the satisfaction associated with each item. The QLS^M-MD is comprised of 12 items, the QLSM-DBS is comprised of five items, and the QLSM-A and QLSM-G each have eight items. Importance and satisfaction scores for each item are combined to provide information about weighted satisfaction; accordingly, scores reflect one's satisfaction with items that one considers to be important. Weighted satisfaction scores may range between -12 and +20 for each item, with higher scores indicating an increase in quality of life. Weighted satisfaction is calculated by the following formula: Weighted satisfaction = [importance rating – 1] x [(2 x satisfaction rating) – 5]. Patient scores indicate HRQoL over the preceding 4 weeks. Supplemental assessments included the Geriatric Depression Scale (GDS),[9] Unified Parkinson Disease Rating Scale (UPDRS),[10] Lang-Fahn activities of daily living dyskinesia scale (LFADLDS),[11] Modified Hoehn and Yahr score,[12] Folstein Mini-mental status examination,[13] and EQ-5D.[14] The EQ-5D is a standardized instrument for valuing HS across five domains (mobility, self-care, usual activity, pain/discomfort and anxiety/depression). Data were collected and scored as per the published guidelines for each instrument. Prospective clinical assessments were performed at baseline (within 30 days prior to surgery), and at approximately 6 (7.4 ± 1.5) and 12 (16.6 ± 6.8) months postoperatively.

Data Analysis:
The primary outcome measure was the change from baseline in the QLS^M-MD summary weighted score following DBS. Change from baseline was analyzed by repeated-measures analysis of variance (ANOVA). Pearson's product-moment correlation (rho) was used to identify associations between HRQoL (change in QLS^M-MD summary score from assessment 1 to 3) and clinical variables.

Results

■ Sociodemographic and baseline clinical characteristics are listed in Tables 1 and 2.

■ STN DBS produced significant improvements in LFADLDS and UPDRS part II, III and IV scores as well as general health (QLS^M-G) and movement disorder health (QLS^M-MD) satisfaction (Table 2). No items on the general life satisfaction module (QLS^M-A) changed significantly following surgery. Weighted scores on the DBS module of the QLS^M showed high satisfaction (Table 2), which remained stable between the two post-operative assessments (student's t-test, P=0.45).

■ The difference in preoperative Hoehn and Yahr scores between the medically "off" and "on" states correlated with improvement in the QLSM-MD summary score (r = 0.72, P = 0.0005). No other baseline variable predicted long-term improvement in HRQoL. We also assessed the relationship between HRQoL and changes in clinical parameters following surgery. HRQoL benefits correlated with the postoperative improvements in the UPDRS part II (r = -0.59, P = 0.046) and the GDS (r = -0.47, P = 0.007).

Table 1: Baseline Demographic & Clinical Characteristics

Sex, M : F		11 : 10
Age, mean yrs ± SD		61.5 ± 8.6
Age at onset, mean yrs ±SD		47.7 ± 8.9
Level of education, mean yrs ± SD		13.8 ± 2.6
Employment status, number (%)	employed	5 (24)
	retired	2 (10)
	disabled	14 (67)
Marital status, number (%)	married	18 (86)
	divorced	2 (10)
	single	1 (5)
Family history of Parkinson disease, N (%)		4 (19)
L-dopa equivalent units (LEU) dosage, mean mg/day ± SD*		1259 ± 677
Patients on dopamine agonist, N (%)		17 (81)
Hoehn & Yahr score, mean ± SD	on-state	2.3 ± 0.5
	off-state	3.2 ± 0.6

LEU was based on the following formula: regular levodopa dose + controlled-release levodopa × 0.75 + levodopa × 0.25 if on entacapone + pramipexole × 67 + ropinirole × 16.7 + apomorphine × 8 (all dosages in mg).

Table 2: Clinical Outcome Following STN DBS

Instrument		Assessment 1 (Baseline)	Assessment 2 (7.4 ± 1.5 m)	Assessment 3 (16.6 ± 6.8 m)	Significance (p-value)
LFADLDS		12.4 ± 5.9	3.7 ± 4.7	4.1 ± 6.0	< 0.001
UPDRS	Part I	2.6 ± 1.7	1.8 ± 1.4	2.0 ± 2.4	0.25
	Part II off-state (on-state)	20.7 ± 7.4 (11.7 ± 5.9)	14.0 ± 7.6	15.3 ± 6.3	0.03
	Part III off-state (on-state)	36.9 ± 19.4 (27.3 ± 16.4)	25.1 ± 11.9	23.2 ± 11.9	0.03
	Part IV	8.5 ± 3.5	3.6 ± 3.6	4.7 ± 3.4	0.004
EQ-5D Index Score		0.954 ± 0.07	0.983 ± 0.05	0.962 ± 0.08	0.3
QLS^M	general life (A)	58.2 ± 32.6	56.1± 39.5	53.6 ± 32.0	0.9
	general health (G)	11.6 ± 50.3	37.5 ± 43.6	28.4 ± 48.4	0.03
	movement disorders (MD)	10.5 ± 73.4	89.1 ± 54.0	49.0 ± 65.3	0.007
	deep brain stimulation (DBS)	not applicable	59.9 ± 19.0	54.6 ± 20.2	-

All results are listed as mean +/- SD. Scores for the QLSM-A and QLSM-G modules may range between -96 and 160; scores for the QLSM-MD and QLSM-DBS modules may range -144 to 240 and -60 to 100, respectively.

Discussion

■ Several prior studies have demonstrated improvements in HS following DBS.[2,4,5] Following Den Oudsten and colleagues,[1,2] we advocate distinguishing HS and HRQoL in keeping with the WHO definition of quality of life. The distinction between HS and HRQoL is of consequence because differences in life style, social support, coping mechanisms and personality traits may influence how HS variables affect HRQoL,[15,16] and available data indicate that patients themselves view HS and HRQoL as distinct constructs.[1,2,17,18]

■ The primary finding of our study was that various aspects of HRQoL improved following STN DBS, particularly satisfaction with motor function and independence. Improvements, however, did not extend to the QLSM-A, which addresses general life issues, such as occupational function, interpersonal relationships, leisure activities, and living conditions. Importantly, no QLS^M domains significantly worsened following DBS.

■ We found a moderate association between HRQoL and improvements in the GDS. This finding is congruent with prior work which has shown that depression is an important indicator of HS.[17,19-21] HRQoL was also associated with UPDRS part II scores, a measure of activities of daily living, as might be expected based upon shared content between these measures.

■ Among baseline characteristics, HRQoL correlated best with the reduction in Hoehn and Yahr score between the medically "off" and "on" states. Because the Hoehn and Yahr score is heavily influenced by balance, we hypothesize that postural instability influences movement disorder-related quality of life to a greater extent than other motor features, such as tremor. Worsening Hoehn and Yahr scores have previously been shown to negatively impact HS.[15,20] Our work shows that among DBS candidates, those who have the most robust reduction in Hoehn and Yahr score with dopaminergic therapy are the most likely to experience better HRQoL following surgery.

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