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EVALUATION OF THE EFFECT OF STN-DBS ON THE GASTROINTESTINAL SYMPTOMS IN PATIENTS WITH PARKINSON'S DISEASE VIA GIQLI

Neurosurgery

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ABSTRACT

Aims: Our aim is to evaluate the effects of Deep Brain Stimulation (DBS) on the quality of life in Parkinson's disease (PD) patients by using the Gastrointestinal Quality of Life Index (GIQLI).

Materials and methods: 26 patients with idiopathic PD who underwent STN-DBS were evaluated by the GIQLI test before and 3 months after STN-DBS. Also the medications used by the patients and The Unified Parkinson's Disease Rating Scale scores were compared.

Results: Mean GIQLI score was improved from 84.48±6.19 to122.89±3.34 at postoperative period and the difference was statistically significance. Also the number of patients who needs medications for the gastrointestinal symptoms decreased significantly in the postoperative period.

Conclusion: STN-DBS leads to improved quality of life by reducing the gastrointestinal symptoms in PD patients. We consider that STN-DBS exerts this effect by regulating both the parasympathetic and sympathetic systems and by reducing the need for dopamine agonists that have gastrointestinal side effects.

KEYWORDS

Deep Brain Stimulation; Subthalamic Nucleus; Gastrointestinal; Quality of life; Nonmotor symptoms; Parkinson's disease.

INTRODUCTION

Parkinson's disease (PD) is a progressive degenerative disorder of the central and peripheral nervous system. PD leads to motor and nonmotor symptoms. Motor symptoms often include tremor, bradykinesia, rigidity, and posture, balance, and gait disturbances[1, 2], whereas nonmotor symptoms include a wide range of manifestations affecting numerous systems such as gastrointestinal, genitourinary, cardiovascular and respiratory systems [3]. The gastrointestinal symptoms, mostly including dyspeptic compl9aints, constipation, and abdominal pain, often have negative effects on the quality of life of the patients [4, 5]. These effects are commonly assessed by using the Gastrointestinal Quality of Life Index (GIQLI), which is a disease-specific quality of life instrument[6].

Literature indicates that more than 95% of PD patients have at least one nonmotor symptom. In addition, recent reports suggest that the nonmotor symptoms have a greater impact on the quality of life compared to the motor symptoms[7-9].

Deep Brain Stimulation (DBS) has recently emerged as a useful method for the symptomatic treatment of PD, which has been shown to have favorable effects on both motor and nonmotor symptoms[9, 11-13]. In this study, we aimed to evaluate the effects of Subthalamic Nucleus (STN)-DBS on the quality of life in PD patients by using GIQLI.

MATERIALS AND METHODS

The study included 35 patients diagnosed with idiopathic PD who underwent STN-DBS due to inadequate response to medical treatment or the side effects of medication. The research protocol was approved by Ethics Committee. A written informed consent was obtained from each patient prior to study participation.

Of the 35 patients, 9 patients with a history of organic gastrointestinal system disease or gastrointestinal system surgery were excluded from the study. The remaining 26 patients were evaluated by the GIQLI test both before and 3 months after STN-DBS through face-to-face interviews. A total of 36 parameters were evaluated and each parameter was scored using a Likert-type scale ranging from 0 (worst) to 4 (best). At the end of the interviews, an overall score was calculated and compared for each parameter. In addition, the medications used by the patients and The Unified Parkinson's Disease Rating Scale (UPDRS) scores before and 3 months after STN-DBS surgery were compared to.

Surgical Procedure

After the Magnetic Resonance Images (MRI) were obtained (T1 and T2 weighted) with a 1.5 Tesla MRI scanner (Philips, Ingenia), the stereotactic frame (Radionics® CRW™) was installed under local anesthesia, then the patient was sent to the Computerized Tomography (CT). The CT and MRI images was fused by the aim of the stereotactic planning software (NeuroSight™ Arc). After the Anterior and Posterior Commissure identification, the dorsolateral part of the STN was targeted. After the x, y, z coordinates of the dorsolateral part of the STN were obtained the patient was underwent to the operating theatre. The surgery was made in two parts; firstly; two leads (Vercise™ Boston Scientific) were putted bilateral to the targeted area under local anesthesia. Before lead placement, Micro Electro Recording (NeuroNav™ Alpha-Omega) was made to select the best effective area in all patients. After being decided on the most effective target, the lead was implanted, and the macrostimulation was made to evaluate the probable adverse effects. Following the lead implantation the wound was closed and the second part of the operation was proceeded. The second part was made under general anesthesia and the pulse generator (Vercise™ Boston Scientific) was putted in the subclavicular region and connected to the leads by extension cables.

Statistical Analysis

Data were analyzed using IBM SPSS version 21.0 software (IBM, Armonk, NY, USA). Continuous variable data were reported as mean + Standard deviation (SD), whereas categorical variables were reported as number (n) and percentage (%). Differences were in the groups were assessed by paired-t test.

RESULTS

The patients included 19 (68%) men and 9 (32%) women with a mean age of 57 (range, 38-72) years. Mean GIQLI score was 84.48±6.19 before STN-DBS and increased to 122.89±3.34 at postoperative month 3, and a significant difference was established between the two scores (p<0.001) (Table 1).

Most common medications used by the patients for the treatment of gastrointestinal symptoms included analgesics, proton pump inhibitors (PPI), gastrointestinal motility-regulating agents, and laxatives. The number of patients using these medications decreased significantly in the postoperative period (p<0.005) (Table 2).

The mean preoperative levodopa daily dose was 671 mg. (range 500–1200) and the mean postoperative levodopa daily dose was 375 mg. (range 0–625). The Unified Parkinson's Disease Rating Scale (UPRDS) part III results were;

Preoperative Medication off: 42.7 +- 10.2

Preoperative Medication on: 17.6 +- 9.1
Postoperative STN on Medication off: 14.6 +- 9.2
Postoperative STN on Medication on: 10.7 +- 8.6

DISCUSSION

In the present study, GIQLI was used both pre and post-operatively for evaluating the changes in the nonmotor symptoms and the quality of life in patients that underwent STN-DBS due to PD. To the best of our knowledge, this is the first study in the literature to evaluate the effect of STN-DBS by GIQLI in patients with PD. The results indicated that STN-DBS led to a significant improvement both in the nonmotor symptoms and in the quality of life of the patients.

Previous studies indicated that STN-DBS led to remarkable improvement in the symptoms related to the gastrointestinal, genitourinary, cardiovascular, and respiratory systems[11,14]. The studies also suggested that STN-DBS could be effect on asthma and obstructive apnea since it decreased the blood pressure in hypertensive patients and decreased the frequency of orthostatic hypotension episodes by altering the sympathetic activity and also resulted in positive changes in pulmonary function tests, thereby leading to bronchodilation. In addition, the studies also reported that STN-DBS resulted in remarkable improvement in numerous symptoms such as urinary incontinence, pollakiuria, and nocturia by increasing the bladder capacity and improving the cortical control of urinary bladder [15-18].

Literature also indicates that STN-DBS have significant effects on the gastrointestinal symptoms which mainly include constipation (80-90%) and dysphagia, followed by abdominal pain, dyspepsia, flatal or fecal incontinence, rectal bleeding, bloating, and diarrhea. Constipation is considered to develop as a side effect of antiparkinson agents, whereas dysphagia is considered to occur secondary to basal ganglia dysfunction and to be more associated with motor symptoms [19]. On the other hand, gastrointestinal motility disorders are also commonly seen in PD patients (70-100%) which lead to numerous symptoms including nausea, vomiting, abdominal distention, and abdominal pain[20,21]. It is worth noting that the PD patients need to use additional medications for the treatment of all the symptoms abovementioned. This obligation in turn leads to labor loss and difficulties for performing daily activities in PD patients who also suffer from motor symptoms. Moreover, since most of these patients have a history of psychiatric disorders such as anxiety and depression, the addition of gastrointestinal symptoms further decreases their quality of life[22,23].

Literature reviews indicate that there have been several studies investigating the effect of STN-DBS, on the gastrointestinal symptoms associated with PD. The studies showed that STN-DBS had positive effects on constipation, dyspepsia, and gastrointestinal motility[11,14,17,24-27]. In their recent report, Krygowska-Wajs et al. administered a questionnaire to evaluate the gastrointestinal symptoms and used electrogastrography to evaluate gastrointestinal motility and noted that STN-DBS led to significant improvement in gastrointestinal motility and other gastrointestinal symptoms[28]. Similarly, Arai et al. evaluated gastric emptying by using the (13) C-acetate breath test but did not evaluate the gastrointestinal symptoms and they found that STN-DBS led to significant improvement in gastrointestinal dysfunction [29]. In our study, STN-DBS led to a significant increase in the mean postoperative GIQLI scores. Moreover, a remarkable improvement was seen in the gastrointestinal symptoms and also in fecal incontinence, tolerance, and sexual life of the patients. In addition, STN-DBS led to a significant decrease in the number of the patients using medications for the treatment of PD and gastrointestinal symptoms.

In conclusion, STN-DBS leads to improved quality of life by reducing the gastrointestinal symptoms in PD patients. We consider that STN-DBS exerts this effect by regulating both the parasympathetic and sympathetic systems and by reducing the need for dopamine agonists that have gastrointestinal side effects.

Our study was limited since it had no control group and had a short follow-up period. Further studies with larger patient series and longer follow-up periods are needed to provide substantial findings.

Table-1. Preoperative and postoperative Gastrointestinal Quality of Life Index (GIQLI) Results. Data was given mean ± SD, Bold p values show statistically significance (p<0.05)" Paired-t test was used.

	Preoperative	Postoperative	P values
Main symptoms			
Pain	2.26 ± 1.06	3.48 ± 0.64	<0.001
Bloating	2.07 ± 1.03	3.37 ± 0.74	<0.001
Epigastric fullness	2.37 ± 1.08	3.33 ± 0.83	0.001
Flatus	2.48 ± 1.05	3.56 ± 0.51	<0.001
Belching	2.11 ± 0.75	3.48 ± 0.58	<0.001
Bowel frequency	1.89 ± 0.64	3.26 ± 0.59	<0.001
Abdominal noises	2.74 ± 0.76	3.67 ± 0.55	<0.001
Restricted eating	2.11 ± 0.85	3.44 ± 0.58	<0.001
Enjoyed eating	2.37 ± 0.88	3.52 ± 0.64	<0.001
Fatigue	1.67 ± 0.96	3.56 ± 0.58	<0.001
Physical items			
Strength	1.74 ± 0.59	3.22 ± 0.58	0.040
Feeling unwell	1.73 ± 0.83	3.15 ± 0.67	<0.001
Feeling unfit	2.11 ± 0.75	3.37 ± 0.63	0.011
Endurance	2.96 ± 0.59	3.41 ± 0.57	0.737
Wake up at night	2.04 ± 0.65	3.63 ± 0.49	0.036
Appearance	1.52 ± 0.80	3.41 ± 0.64	<0.001
Psychological items			
Sadness	2.33 ± 0.62	3.52 ± 0.58	<0.001
Nervousness	2.04 ± 1.19	3.59 ± 0.69	<0.001
Frustration	2.44 ± 0.70	3.56 ± 0.51	<0.001
Happiness	2.41 ± 0.89	3.33 ± 0.55	<0.001
Bothered by treatment	2.59 ± 0.69	3.22 ± 0.64	0.001
Cope with stress	2.41 ± 0.80	3.33 ± 0.62	<0.001
Social items			
Daily activities	1.96 ± 0.65	3.33 ± 0.62	<0.001
Leisure activities	2.89 ± 0.70	3.30 ± 0.47	0.013
Sexual activities	2.74 ± 0.71	2.93 ± 0.55	0.327
Social relations	2.19 ± 0.68	3.48 ± 0.51	<0.001
Disease specific items			
Regurgitation	2.26 ± 0.81	3.48 ± 0.51	<0.001
Dysphagia	2.37 ± 0.74	3.48 ± 0.51	<0.001
Eating speed	2.18 ± 0.68	3.11 ± 0.51	<0.001
Nausea	3.26 ± 0.66	3.56 ± 0.50	0.009
Diarrhea	2.93 ± 0.67	3.44 ± 0.50	0.008
Bowel urgency	3.07 ± 0.67	3.63 ± 0.49	<0.001
Constipation	2.15 ± 0.60	3.41 ± 0.50	<0.001
Blood in stool	2.48 ± 0.80	3.56 ± 0.51	<0.001
Heartburn	2.52 ± 0.51	3.52 ± 0.51	<0.001
Fecal incontinence	3.11 ± 0.58	3.37 ± 0.49	0.070
Total GIQLI score	84.48 ± 6.19	122.89 ± 3.34	<0.001

Table 2: Number of patients using medications for the treatment of gastrointestinal symptoms. PPI: proton pump inhibitors. MRA: motility regulating agents.

Medication	Number of patients		p
	Preoperatively	Postoperative month 3	
Analgesic	25	9	0.001
PPI	24	11	0.03
MRA	22	9	0.002
Laxatives	23	10	0.04

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