

Sub Thalamic Nucleus Deep Brain Stimulation: Iraqi Case Series

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Abstract

- Background** Sub thalamic nucleus (STN) Deep brain stimulation (DBS) electrodes are implanted into STN and programmed by external pulse generator. DBS alleviates the cardinal Parkinson disease symptoms and reduce the need for levodopa and related drugs and eventually reduces levodopa-related motor complications in advanced Parkinson's disease.
- Objective** To evaluate the STN DBS implantation in Parkinson disease patients.
- Methods** A retrospective evaluation of data base of the patients operated on for STN DBS between Jan. 2010 and Jan. 2011. The study involved 11 patients (10 males and 1 female) with an age range between 39 and 65. Surgical implantation was done in the Neurosciences Hospital in Baghdad. Unified Parkinson's disease Rating Scale was reported before surgery and 3 monthly after implantation. Paired t test was used to test the significance of difference between 2 means.
- Results** Highly significant differences ($P < 0.0001$) in the activities of daily living, Tremor, Rigidity, Bradykinesia and Gait parameter. There was no difference in Postural stability before and after. There was 65% of the patients reduced their levodopa medication dosage after STN DBS. One patient out of 11 (9%) developed intracerebral hemorrhage.
- Conclusions** STN DBS is very successful in managing motor clinical manifestations in advanced Parkinson disease and reducing levodopa medication.
- Key words** Parkinson, Deep brain stimulation, subthalamic

Introduction

Deep brain stimulation (DBS) is a Stereotactic surgical treatment in which a device called a neurostimulator delivers tiny electrical signals to the areas of the brain that control movement^(1,2). It was first reported for treatment of Parkinson disease treatment in 1993 from Benabid's clinic and widespread use of DBS began after FDA approval for essential tremor on

1997^(3,4). It has provided remarkable therapeutic benefits for advanced Parkinson disease. It makes pulses of titratable electrical stimulation at the target site in the brain leading to interference with neural activity, creating a reversible lesion in the implanted nucleus .DBS results in improvement of motor features of Parkinson disease (bradykinesia, rigidity and tremor)⁽⁴⁾.

The keys for successful DBS procedure were proper patient selection, proper preparation of the patient, accurate electrode positioning and after implantation care. This multiple steps process involves team of neurologist, neurosurgeon, neurophysiologist, and bio medics engineer⁽⁵⁾.

DBS was admitted first in Iraq on 2007; and all implantations were done in the neurosciences hospital in Baghdad⁽⁶⁾.

The aim of this study is to compare the results of the Unified Parkinson's Disease Rating Scale (UPDRS11 and 111) before and after the sub thalamic DBS (STN DBS) implantation during on period; also to record the side effects and to assess the best Stimulation polarity Settings in Parkinson disease patients in neurosciences hospital in Iraq.

Method

A retrospective evaluation of data base of the patients operated on for STN DBS between October 2007 to June 2009.

We have evaluated the patients and reviewed their past data from the neurosciences hospital file system. The study was conducted between Jan 2010 and Jan 2011 in neurosciences hospital in Baghdad; the study enrolled 11 patients [10 males and 1 female], their age was ranged between 39 and 65.

The patients were considered as Parkinson disease when fulfilling the United Kingdom Parkinson's Disease Society Brain Bank Diagnostic Criteria⁽⁷⁾. The inclusion criteria were failure of all drugs regimen, Good response to Levo Dopa therapy, fairly normal level of function during on period, Normal brain MRI, more than five years disease duration.

The criteria for exclusion were dementia, major psychiatric illness, blood dyscrasias and any history of stroke. Patients' written consent was taken to be enrolled in this study. The study was approved by ethical committee of the directorate of neurosciences hospital.

Operative procedures

The sub thalamic nucleus (STN) was anatomically localized stereotactically using leksel stereotactic frame system of Elekta through a series of brain MRI (0.25 TESLA) scanning axial images in 2 mm volumetric thickness which were integrated using a frame (4 software Medtronic). Physiological localization was done by using microelectrode recording. 5 electrode contact sites were inserted (anterior, posterior, medial, lateral and central); Recording and stimulation of those 5 sites with monitoring for the best response by neurologist was used to determine the permanent electrode for stimulation. Thereafter macro electrode stimulation was done to assess the best response and the least side effects. Surgery was done in 3 stages for each patients; under local anesthesia electrode implantation (Medtronic model 3389, Medtronic, Minneapolis) on one side and within a week implantation of the other side electrode were done; then under general anesthesia implantation of the pulse generator (kinetra7428 Medtronic) on the left subclavicular 1 day from implantation of the electrode.

Each patient was evaluated by using The Unified Parkinson's Disease Rating Scale (UPDRS)⁽⁸⁾ before surgery and 3 monthly after implantation. Electrode contact (four sites), polarity (monopolar or bipolar), frequency, voltage, and pulse width were assessed for the best response 1 week after implantation.

Statistical analysis

Subclasses of (UPDRS) Results were transformed into (means±standard deviation) and comparison was done using graph pad was used for data input and analysis. Paired t test was used to test the significance of difference between 2 means. A p-value less than 0.05 were considered the cutoff point to determine significant findings.

Results

Table 1 showed the basic demographic features of the patients in the present study; also showed that the duration of the disease was 8.3±1.7 years. The best electrodes were the anterior one in 50 % and medial in 50 %; no lateral or posterior electrodes were present in this study. The starting mode of stimulation was monopolar in 100% of the patients; after 12 months the monopolar stimulation was the mode in only 27% versus 73% bipolar mode (Table 1).

Table 2 showing a highly significant difference (P value < 0.0001) in the activities of daily living, tremor, rigidity, bradykinesia and p value < 0.0004 in gait parameter.

Also table 2 was showing no difference in Postural stability before and after STN DBS (p value = 0.8). Table 3 showing 65% of the patients reduced their levodopa medication dosage after STN DBS (p < 0.004. We have one patient out of 11 (9%) developed intracerebral hemorrhage. We did not report infection or other side effects.

Table 1. Demographic features and stimulation setting of the patients

Variables					
Sex	Male	10			
	Female	1			
Age	Range (39- 65)	57.273±7.4			
Duration of the illness prior to DBS	8.3±1.7				
Electrode chosen	Medial	Anterior	lateral /posterior	Total	
Right side	8/11 (73%)	3/11 (27%)	0/11	11/11	
Left side	3/11 (27%)	8/11 (73%)	0/11	11/11	
Total	11/22 (50%)	11/22 (50%)	0/22	22/22	
Mode of stimulation	Monopolar	Bipolar			
Starting mode	11/11 (100%)	0/11			
3 months	9/11 (81%)	2/11 (19%)			
6 months	8/11 (72%)	3/11 (28%)			
9 months	5/11 (45%)	6/11 (55%)			
12 months	3/11 (27%)	8/11 (73%)			

Table 2. UPDRS motor parameters differences before and after DBS implantation

UPDRS motor parameters	T test	95% CI	SE of Deviation	P value
Activities of daily living (range, 0-52)	6.5	9.63-19.64	2.25	0.0001
Tremor (range, 0-28)	8.4	7.48-12.88	1.20	0.0001
Rigidity (range, 0-20)	8.0	5.77-10.23	1.00	0.0001
Bradykinesia (range, 0-32)	8.9	6.88-11.49	1.03	0.0001
Gait (range, 0-4)	5.2	0.58-1.42	0.19	0.0004
Postural stability (range, 0-4)	1.9	-0.04-0.59	0.14	0.0816

Table 3. Levodopa therapy dosage pre and post DBS

Levodopa medication dose	Post implantation
No change	5 (55%)
Reduce the dose	6 (65%)

P-Value = 0.004

Discussion

The present study was retrospective evaluation of the data base of the operated patients one year ago; the patients were selectively randomized to undertake the operation during the last 3 years.

DBS implanted patients in the present study shows statistically significant improvements of activities of daily living, tremor, rigidity, hypokinesia and gait; the above results were consistent with results of deep brain stimulation groups (9-16).

We have used the UPDRS scale to assess the disease severity and clinical tool to assess the disease clinical manifestation; these tests were more detailed than the Hohen and yaher scale (17).

Regarding the side effects we record only one patient with intracranial hemorrhage approximating other studies (9,12). The above result of intracerebral hemorrhage in the present study [9%] was higher than that was reported by Park et al which was 5% (18); this higher result was related to the difference of surgical method used in both studies as well as the MRI used in our study was 0.25 tesla. Also, the use of multiple microelectrode insertion (MMI) was associated with higher risk of hemorrhage than the circumferential paired microelectrode insertion (CPMI). We did not report other side effects like infection or cognitive deficits or Persisting adverse effects included eyelid opening apraxia, weight gain, psychiatric disorders, depression, dysarthria, dyskinesia, and apathy (19-21).

We did not report suicide attempt in our patients although its rate were very high in other studies

that showed the suicide rate following deep brain stimulation was 13 times higher in the first postoperative year (22,23).

The present study showed significantly lowered dosage of levodopa medication after bilateral STN DBS, this result is in accordance with previously published international findings (19-21). Unipolar stimulation usually had a significantly higher efficacy than bipolar stimulation; however, also with a higher rate of side-effects (19% vs. 0%) (24). In our study the starting mode of stimulation was monopolar in all patients, this is to avoid patients' exposure to a disabling dyskinesia (24); after one year of the DBS implantation 73% of the patients were changed to bipolar mode, this is consistent with Obeso et al study (9).

Our study showed no significant benefit of DBS implantation on postural stability, this in accordance to Indian experience of DBS (14) this may be related to fear of fall after surgery (24), also gait and balance anatomical motor connections in STN involved is more diffusely distributed (25).

The challenges and problems facing our work were many, of them was using 0.2 tesla open MRI; all other studies were used 1.5 tesla MRI. Other was the limited number of patients included in the study because of the limited popular information of this treatment modality

Conclusion

Bilateral STN DBS in Iraqi patients was very successful in managing motor clinical manifestations in advanced Parkinson disease and reducing levodopa medication; we have higher intracerebral hemorrhage than other

international studies, this will be subdued in the future through introducing more advanced generation of MRI like 3 tesla, using more advanced more accurate technique for STN localization and also using newer frameless DBS technique. The mode of stimulation was similar to other studies.

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