Case Report

Deep brain stimulation surgery early term results of gait characteristics on Parkinson's Disease

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ABSTRACT

We report a case of 67 year-old man with Parkinson's disease who has gait disturbance for eight years. The Pedunculopontine Nucleus Deep Brain Stimulation (PPN-DBS) surgery was performed and gait parameters were evaluated by using foot print method. After opening the battery step length and stride length increased, the patient has been walking the same distance with less number of steps. When the battery closed, the step length was 34.5 cm, following the battery opening it increased to 45.5 cm suggesting that PPN-DBS surgery was an effective treatment to improve gait ability. (Rawal Med J 2014;39: 464-466).

Key words: Parkinson's Disease, Deep Brain Stimulation Surgery, Gait Analyses.

INTRODUCTION

Parkinson's disease (PD) is a progressive neurodegenerative disorder characterized by bradykinesia, resting tremor, rigidity and postural instability.[1,2] It affects 1-2% of the population above 60 years old.[3] The primary cause is progressive loss of dopamine producing cells in the substantia nigra of basal ganglia.[4] The persons with PD develop a typical gait and is generally a late manifestation of the disease but can be present at onset and at one side of the body.[5] Within 3 years of diagnosis, more than 85% develop gait problems.[6] This leads to increased disability, increased risk for falls, and reduced quality of life.[7] The gait disorders are characterized by the spatiotemporal regulation difficulty (shortened stride length), stride velocity, longer double support, cadence and movement strategies.[8,9]

The management is mainly pharmacological. Levodopa and dopamine agonists are able to provide adequate symptomatic control in the first 510 years of therapy.[10-11] Deep Brain Stimulation is a preferred surgical treatment for advanced PD, as it reduces the symptoms of tremor, speech disorders, bradykinesia or akinesia. The Pedunculopontine Nucleus Deep Brain Stimulation (PPN-DBS) was proposed as a new stereotactic target for the neurosurgical treatment of PD.

CASE REPORT

The patient was a 67-year-old, right-handed Turkish man with an 8 years history of PD. His complaints were difficulty in walking, bradykinesia (slowness of movement), and tremor. His antiparkinsonian medication was started eight years ago consisted of Amantadine 200 mg per day, and Bornaprin HCl 2 mg per day. The patient didn't benefit from treatment despite the regular use of medication and gait got worse. His neurological examination revealed postural instability, bradykinesia, axial rigidity, right hand pronounced bilateral minimal rigidity, and no pathological reflexes. PPN-DBS surgery was performed.

The gait parameters were evaluated by using foot print method. Step length, stride length and stride width in first, fourth and seventh steps were recorded. Also walking velocity and cadence were recorded. Six Meter Walking Test was used to evaluate walking speed rate. All assessments were made after surgery when the battery is turned off, and the battery is turned on after 12 hours of surgery.

Table 1. Changes in gait parameters when the battery is off and on.

	First Step		Fourth Step		Last Step	
	Battery off	Battery Opened (after 12 hours)	Battery off	Battery Opened (after 12 hours)	Battery off	Battery Opened (after 12 hours)
Step length (cm)	34.5	45.5	33.5	46	30	34
Stride length (cm)	66.5	87	66.5	75	64.5	62.5
Step width (cm)	10	11	6	11	4	11.5

After opening the battery step length and stride length increased, the patient has been walking the same distance with less number of steps. When the battery closed, the step length was 34.5 cm, following the battery opening it increased to 45.5 cm. The step width didn't change unlike the first assessment (Table 1). The number of steps per minute, cadence, reduced. While 6-m walking speed test was 5.95 seconds before opening the battery, 7.63 seconds was recorded after opening (Table 2).

Table 2. Changes in speed, cadence and 6 m Walk Speed Test when the battery is off and on.

Variables	Battery Off	Battery Opened (after 12 hours)
Walking velocity (m/s)	0.99 $m.s^{-1}$	1.27 $m.s^{-1}$
Cadence (steps/second)	1.12 $s.s^{-1}$(7/6.26)	0.91 $s.s^{-1}$(6/6.62)
6 m walking speed test (s)	5.95	7.63

DISCUSSION

All assessments were made after surgery and battery is turned off, and the battery is turned on after 12 hours of surgery. After opening the battery step length and stride length increased, the patient has been walking the same distance with less number of steps. The stride width didn't change unlike the first assessment.

Bakker et al. performed a systematic review of early studies examining the effect of STN and GPi DBS on postural instability and gait disturbances (PIGD) symptoms in PD. Most of the studies included in this review reported results 6 months after surgery, but there were some studies with follow up of up to 12 months. Overall, PIGD symptoms significantly improved with both STN and GPi stimulation in the medication "off" phase and "on" phase, but more so in the medication "off" phase.[12] In a study performed by Thevathasan et al. five consecutive patients with PD complicated by severe gait freezing, postural instability and frequent falls while the patient was on medication, received bilateral stimulation of the mid-lower PPN without costimulation of other brain targets. Outcomes were assessed prospectively over 2 years with gait-specific questionnaires and the Unified Parkinson Disease Rating Scale (part III). The primary outcome, the Gait and Falls Questionnaire score, improved significantly with stimulation. Benefits were maintained over 2 years.[13] Consequently, our results are consistent with the literature.

Altug et al. investigated the effects of bilateral subthalamic nucleus stimulation on gait and balance performance in PD. Their results, all the patients' mobility and balance ability (Timed Up and Go Test, 12 m Walking Test, Chair Stand Test and BBS) improved at the 6th month after surgery significantly ($p<0.05$).[14] Our results are similar to these. In summary, PPN-DBS surgery was an effective method in PD patients to improve motor function and to provide functional walking.

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Analysis and interpretation of the data: Filiz ALTUĞ
Drafting of the article: Filiz ALTUĞ
Critical revision of the article for important intellectual content: Uğur CAVLAK
Statistical expertise: Erdoğan KAVLAK
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