Deep Brain Stimulation of the Subthalamic Nucleus for Peripherally-Induced Parkinsonism

Muhammad M. Nashatizadeh, M.D. and Joseph Jankovic, M.D.

Parkinson's Disease Center and Movement Disorders Clinic

Department of Neurology, Baylor College of Medicine, Houston, Texas

OBJECTIVE

To describe the effects of deep brain stimulation (DBS) of the subthalamic nucleus (STN) on peripherally-induced parkinsonism unresponsive to levodopa.

BACKGROUND

Trauma to the peripheral nervous system can cause various movement disorders including dystonia, tremor and parkinsonism. Most patients with peripherally-induced parkinsonism develop symptoms that extend beyond the original site of injury, suggesting involvement of the central nervous system, possibly through reorganization in response to altered peripheral input. Most patients with peripherally-induced parkinsonism do not respond to levodopa therapy.

DESIGN / METHODS

A 38-year-old man dislocated his right shoulder in April 1989 while playing racquetball and underwent subsequent surgical repair. Within three weeks after surgery, he developed progressive rest tremor in his ipsilateral arm, forearm and hand. He presented in October 1992 with worsening gait, bradykinesia and hypophonia. Left pallidotomy, performed in 1996, resulted in mild, but transient benefit. Although his fluorodopa positon emission tomography (F-DOPA PET) scan showed reduced striatal uptake, he failed to improve with up to 750 mg of levodopa per day. Dopamine agonists and cholinergic medications were also of no benefit. He underwent left STN-DBS in October 2000 and right STN-DBS in May 2006 both without complications. He has been followed for 15 years since the initial evaluation, for seven years since implantation of L STN DBS, and for 22 months since implantation of R STN DBS.

RESULTS

Since he has not been taking dopaminergic drugs for several years, the Unified Parkinson's Disease Rating Scale (UPDRS) Motor Scores (Part III) were recorded during "off medication" time. His condition progressed from a total motor score of 33 in 1992 to 65 in 2000. After implantation of L STN DBS, his six-month follow-up score improved to 56 in the "on DBS" state. After implantation of R STN DBS, his "on DBS" motor score improved further from 55 to 47. Even after 22 months of bilateral STN DBS, his motor score has been maintained at 54 "on DBS" and declines to 64 when DBS is turned off. After undergoing bilateral STN-DBS, his motor scores remain better than they were over seven years ago.

CONCLUSIONS

The improvement in motor signs in this case provides support for the central pathophysiology of peripherally-induced movement disorders. STN-DBS may be a useful option to consider in patients with peripherally-induced parkinsonism who are refractory to levodopa therapy.

TABLE 1: UPDRS Part III Scores

Item	Examination	October 1992 initial presentation	October 2000 preoperative L STN-DBS	April 2001 6 months after L STN-DBS Stim On	April 2001 6 months after L STN-DBS Stim Off	March 2008 22 months after R STN-DBS Stim On	March 2008 22 months after R STN-DBS Stim Off
18	**speech**	1	2	3	3	2	2
19	**facial express**	3	2	2	2	2	2
20	**rest tremor** face/lips/chin	0	0	0	1	0	0
	right hand	3	4	2	4	1	2
	left hand	0	3	3	3	3	4
	right foot	0	2	0	0	0	0
	left foot	0	1	1	0	0	0
21	**action tremor** right hand	1	3	0	0	0	0
	left hand	0	2	2	2	2	3
22	**rigidity** neck	0	3	3	3	3	3
	right arm	2	3	2	2	2	3
	left arm	1	3	3	3	3	3
	right leg	1	2	2	2	2	3
	left leg	0	2	3	3	3	3
23	**finger taps** right	3	4	3	4	3	3
	left	2	3	4	4	4	4
24	**hand grips** right	3	2	3	2	3	3
	left	1	3	3	3	3	3
25	**pronat/supinat** right	3	3	2	2	2	3
	Left	2	3	4	4	3	4
26	**leg agility** right	2	2	2	1	1	2
	left	1	3	3	4	3	3
27	**arise from chair**	1	1	1	0	1	1
28	**posture**	1	2	1	1	2	3
29	**gait**	0	2	1	0	2	3
30	**postural stability**	1	2	2	1	1	1
31	**body bradykinesia**	1	3	2	2	3	3
	Subtotal	**33**	**65**	**57**	**56**	**54**	**64**

REFERENCES

1. Snyder AM, Stricker EM and Zigmond MJ. Stress-induced neurological impairments in an animal model of parkinsonism. *Ann Neurol* 1985;18:544-551.
2. Jankovic J and Van der Linden C. Dystonia and tremor induced by peripheral trauma: predisposing factors. *J Neurol Neurosurg Psychiatry*. 1988 Dec;51(12):1512-1519.
3. Koller WC, Wong GF and Lang A. Posttraumatic movement disorders: a review. *Mov Disord*. 1989;4(1):20-36.
4. Jankovic J. Post-traumatic movement disorders: central and peripheral mechanisms. *Neurology* 1994 Nov;44(11):2006-2014.
5. Cardoso F and Jankovic J. Peripherally-induced tremor and parkinsonism. *Arch Neurol* 1995;52:263-270.
6. Sankhla C, Lai EC and Jankovic J. Peripherally induced oromandibular dystonia. *J Neurol Neurosurg Psychiatry*. 1998 Nov;65(5):722-728.
7. Bhatt M, Desai J, Mankodi A et al. Posttraumatic akinetic-rigid syndrome resembling Parkinson's disease: a report on three patients. *Mov Disord*. 2000 Mar;15(2):313-317.
8. Jankovic J. Can peripheral trauma induce dystonia and other movement disorders? Yes! *Mov Disord.* 2001 Jan;16(1):7-12.
9. Weiner WJ. Can peripheral trauma induce dystonia? No! *Mov Disord*. 2001 Jan;16(1):13-22.
10. Krauss JK and Jankovic J. Head injury and posttraumatic movement disorders. *Neurosurgery* 2002 May;50(5):927-939.
11. Costa J, Henriques R, Barroso C et al. Upper limb tremor induced by peripheral nerve injury. *Neurology* 2006 Nov 28;67(10):1884-1886.