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Improvement of Pisa syndrome with contralateral pedunculopontine stimulation

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Pedunculopontine nucleus (PPN) deep brain stimulation (DBS) has been proposed to improve gait freezing and other axial motor features in advanced Parkinson's disease (PD) patients [1–4]. However, its effects on abnormal posture such as Pisa syndrome [5] have not been specifically described.

A 62-year-old right handed woman presented with a six-year history of PD, initially manifesting as right hand resting tremor and difficulty writing. Tremor, rigidity and bradykinesia responded well to dopaminergic medications. After 5-year disease duration, she developed right sided axial lean and postural instability with falls occurring 2–3 times daily. Plain films demonstrated complex sigmoid scoliosis with mild dextroscoliosis within the thoracic spine, without osteoporosis. Trials of rotigotine, donepezil, and amantadine did not reduce fall frequency. Therefore, she was referred for PPN DBS surgery. Medications at the time of pre-surgical evaluation included carbidopa/levodopa 25/100 1.5 tabs five times

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daily and pramipexole 3 mg daily. Pre-operative off-medication motor UPDRS score was 18.5/108, with right upper extremity resting tremor, right greater than left rigidity, mild focal bradykinesia in the hands, slow gait with significant right tilt, and mild but recoverable retropulsion on pull test. The motor score improved to 12.5/108, 30 minutes after 350 mg levodopa challenge. She was offered left lead implantation given right greater than left PD severity.

Left PPN DBS surgery was performed at the Toronto Western Hospital under local anesthesia. The surgical procedure has been previously described [2]. An implantable pulse generator (Solectra, Medtronic, Inc.) was implanted the same day under general anesthesia. She tolerated surgery well, aside from mild post-operative encephalopathy and word finding difficulty which recovered within two weeks.

Programming of the left PPN stimulation started 1 month after surgery. The patient was programmed weekly using monopolar stimulation at each contact at 1.0V, at 20Hz, 50Hz, 70Hz and 130Hz over 16 weeks. The patient kept a diary of falls, which significantly decreased from 2–3 falls/daily to less than 1 fall per week. The best setting was found as contacts 3+ 2–/1.5V/90µsec/130Hz. Videos taken throughout 14 months of follow-up demonstrate progressive improvement of her asymmetric bradykinetic gait and right axial lean (Video).

Lateral flexion of the trunk has been described in PD, either as scoliosis related to parkinsonism with leaning usually opposite the most affected side or as Pisa syndrome, originally described as an axial dystonia in patients treated with neuroleptics but also seen in patients with PD [5]. Prior studies of PPN DBS in PD patients have not described significant alterations in axial lean, which can contribute significantly to falls and postural instability whereas several small case series and reports describe mixed results of STN DBS on various postural abnormalities including Pisa syndrome [6].

Stimulation of the PPN and surrounding pontomesencephalic tegmental field may not only affect gait but also extensor muscle tone, thus leading to changes in posture. Chronic electrical stimulation of ventral parts of this region in freely moving cats is accompanied by an increase in tone and facilitation of walking [7]. Based on this patient's improvement in Pisa syndrome following PPN DBS, we suggest that further studies investigating the impact of PPN DBS closely examine postural abnormalities prior to and following stimulation.

The video demonstrates pre- and post-operative gait and posture examinations all taken 3 hours post-levodopa intake. The improvement in the axial lean was temporally related to the reduction of falls.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Ferraye MU, Debu B, Fraix V, Goetz L, Ardouin C, Yelnik J, et al. Effects of pedunculopontine nucleus area stimulation on gait disorders in Parkinson's disease. *Brain*. 2010; 133:205–14. [PubMed: 19773356]
2. Moro E, Hamani C, Poon YY, Al-Khairallah T, Dostrovsky JO, Hutchison WD, et al. Unilateral pedunculopontine stimulation improves falls in Parkinson's disease. *Brain*. 2010; 133:215–24. [PubMed: 19846583]
3. Thevathasan W, Coyne TJ, Hyam JA, Kerr G, Jenkinson N, Aziz TZ, et al. Pedunculopontine nucleus stimulation improves gait freezing in Parkinson disease. *Neurosurgery*. 2011; 69:1248–53. [PubMed: 21725254]
4. Plaha P, Gill SS. Bilateral deep brain stimulation of the pedunculopontine nucleus for Parkinson's disease. *Neuroreport*. 2005; 16:1883–7. [PubMed: 16272872]
5. Gambarin M, Antonini A, Moretto G, Bovi P, Romito S, Fiaschi A, et al. Pisa syndrome without neuroleptic exposure in a patient with Parkinson's disease: case report. *Mov Disord*. 2006; 21:270–3. [PubMed: 16161148]
6. Upadhyaya CD, Starr PA, Mummaneni PV. Spinal deformity and Parkinson disease: a treatment algorithm. *Neurosurg Focus*. 2010; 28:E5. [PubMed: 20196652]
7. Mori S, Sakamoto T, Ohta Y, Takakusaki K, Matsuyama K. Site-specific postural and locomotor changes evoked in awake, freely moving intact cats by stimulating the brainstem. *Brain Res*. 1989; 505:66–74. [PubMed: 2611678]

Figure 1.

Axial MRI taken 1 day after insertion of Left PPN electrode showing position of the active contact, 7 mm from midline and 8 mm anterior to the dorsal surface of the inferior colliculus.