Deep brain stimulation targeting the Globus pallidus internus for Parkinson's disease and Tourette syndrome

Qiang Zhang, a,b,c, Teri R. Thomsen a,⁎

a Department of Neurology, University of Iowa Hospitals and Clinics, 200 Hawkins Dr., Iowa City, IA, United States of America
b Physician Scientist Training Program, University of Iowa School of Medicine, 200 Hawkins Dr., Iowa City, IA, United States of America
c Clinical NeuroScientist Training Program, University of Iowa Hospitals and Clinics, 200 Hawkins Dr., Iowa City, IA, United States of America

ABSTRACT

We present a case with co-existing Parkinson's disease and Tourette syndrome. Patient takes aripiprazole for Tourette syndrome, which unfortunately worsens his parkinsonian symptoms. We placed deep brain stimulation targeting the Globus pallidus internus. Strikingly, his parkinsonian motor symptoms and his tics are both well controlled with deep brain stimulation.

Keywords:
Globus pallidus internus (GPI)
deep brain stimulation (DBS)
Tourette syndrome
Tics
Tremor
Parkinson's disease
Frequency
Pulse width

A 61-year-old right-handed gentleman with Tourette syndrome (TS) presented with tremor. Patient's tics started when he was 10. He had vocal tics with throat clearing, and vocalizations, but he never had coprolalia. He also had motor tics with head shaking, eye blinking, facial grimacing, and occasionally limb movements. He was not diagnosed of TS until he was in his 20s. He developed right-hand resting tremor twenty years ago, after he started taking pimozide for TS. He continued to take pimozide for ten years and switched to risperidone (7 years) then ziprasidone (3 years) until aripiprazole was started 1 year ago. His tremor was mild initially but gradually got worse and did not improve after switching to aripiprazole. At his initial visit, he had unilateral resting right-hand tremor, as well as mild rigidity and bradykinesia only on the right. He also had a slightly flexed posture and reduced arm swing on the right. Of note, his son, father, paternal uncle, and maternal grandfather all had Parkinson's disease (PD). He may have had drug-induced Parkinsonism (DIP), however, given the asymmetric tremor predominant nature, along with a strong family history of PD, we favored a diagnosis of PD. His symptoms improved with amantadine, but as the disease continued to progress, we had to add ropinirole and carbidopa/levodopa, both worsened his tics. Eight years after his initial visit, he was taking aripiprazole at 30 mg twice daily with poorly controlled tics. He was also taking carbidopa/levodopa 25/100 extended-release twice daily, carbidopa/levodopa 50/200 extended-release at bedtime, ropinirole 8 mg three times daily, and amantadine 100 mg three times daily, but his tremor was still debilitating. We did a carbidopa/levodopa OFF/ON test, and his UPDRS motor score improved from 23.5 to 4.5. At this point, we decided to proceed with deep brain stimulation (DBS) targeting the Globus pallidus internus (GPI), in the hope of improving his parkinsonian motor symptoms as well as his tics. For GPI targeting, our surgical team employed a combination of 3D coordinates with MRI/CT, intra-operation microelectrodes recording, and intra-operation stimulation associated symptomatic improvement.

For his initial GPI DBS programming, we used monopolar settings and achieved adequate tremor control (Table 1.1). The patient also had significant improvement in tics. One month later, we increased the amplitude with further improvement in tremor and tics (Table 1.2). Over time, his parkinsonian motor symptoms continued to progress, however, we were able to manage his symptoms by adjusting the DBS settings. Three years after the DBS placement, patient continues to have good control of his parkinsonian symptoms and tics with double bipolar settings on the left GPI DBS, and mono-bipolar settings on the right GPI DBS (Table 1.3). Interestingly, patient has long standing obsessive-compulsive disorder, and anxiety. Both psychiatric conditions gradually worsened as we titrate up DBS settings, and he required the addition of escitalopram 2 years after DBS.
leptics can be very effective in TS, however, they can cause DIP. In our case, with poor response to medications may benefit the possibility that the patient does not have PD. DIP in PD is most likely. We did not order a DAT scan as this would not be helpful in DIP as well.

In summary, we report a patient with co-existing PD and TS, who benefited from GPI DBS. Specifically, with high frequency (130 Hz) and low pulse width (60 μs) stimulation, which is typically used in PD, we not only got parkinsonian motor symptoms well controlled, but also achieved great outcome with his tics (see videos with DBS ON/OFF). The conflicting nature of medical treatments for PD and TS makes it very difficult to manage both conditions at the same time. GPI DBS may be an option to consider in these cases.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.prdoa.2020.100077.

Declaration of competing interest

Q. Zhang and T. Thomsen report no relevant disclosures.

Acknowledgements

QZ is supported by the NINDS R25 grant, the NINDS NeuroNext fellowship, a pilot project grant from the Aging Mind and Brain Initiative at University of Iowa, and the University of Iowa Carver College of Medicine Physician Scientist Training Pathway. QZ was a trainee of the University of Iowa Clinical Neuroscientist Training Program (CNS-TP).

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