Simultaneous Improvement of Tics and Drug-Induced Parkinsonism after GPI DBS: a Case Report

Neepa Patel, M.D.; Joohi Jimenez-Shahed, M.D.

Parkinson’s Disease Center and Movement Disorders Clinic, Department of Neurology, Baylor College of Medicine, Houston, Texas

**BACKGROUND**

- Deep brain stimulation (DBS) of the globus pallidus interna (GPI) is a widely accepted treatment for Parkinson’s disease (PD) and dystonia.
- Recent reports have demonstrated the efficacy of GPI DBS in the treatment of treatment refractory Tourette Syndrome (TS).
- Prior to considering DBS, patients with TS should have failed therapy for tic suppression and psychiatric co-morbidities with dopamine receptor blockers, dopamine depletors, and other therapies.
- These medications can cause drug induced parkinsonism (DIP) through reduced post-synaptic receptor blockade or presynaptic dopamine depletion.
- We describe a case of malignant TS treated with adjunctive GPI DBS who developed acute recurrent symptoms of DIP after interruption of DBS therapy.

**CASE REPORT**

- 21 year old right handed woman with long-standing history of TS first evaluated at our center at age 14.
- Symptoms were refractory to multiple medication therapies used in combination:
  - Tetrabenazine 150mg/day
  - Fluphenazine 3mg/day
  - Topiramate 225mg/day
  - Clonidine & guanfacine
  - Backofen, metaxalone, benzodiazepines
  - Methylphenidate
  - Multiple serotonin reuptake inhibitors
  - Botulinum toxin injections to vocal cords for coprolalia
- Symptoms included:
  - Self-injurious motor tics (whip lash tics, arm flailing, leg extension, punching and kicking walls, self-cutting.
  - Vocal tics: partial word repetition, loud sounds and coprolalia.
  - Obsessive compulsive behaviors (OCB)
  - Attention deficit and hyperactivity disorder (ADHD)
  - Depression
- Symptoms were complicated by mild, non-impairing parkinsonism (subtle bradykinesia and rigidity).
- Pre-operative medications included:
  - Tetrabenazine 112.5mg/day
  - Aripiprazole 4mg/day
  - Fluphenazine 3mg/day
- After consensus review, the patient underwent bilateral GPI DBS (3387 leads, Activa PC pulse generator, Medtronic, Minneapolis, MN) in February 2011.
  - pre-operative YGTSS= 89 (39 severity; 50 impairment)
- At 6month follow-up with stimulation (Table 1) there was reduction in YGTSS scores (Figure 1).
- Neuroleptic medications were reduced to:
  - Tetrabenazine 64.5mg/day
  - Aripiprazole 5mg/day for depression
- Patient was intermittently compliant with medications due to psychosocial stressors, and rapidly re-initiated her regular neuroleptics.

**RESULTS/ TABLES & FIGURES**

**Table 1: Optimized DBS settings**

<table>
<thead>
<tr>
<th>Polarity</th>
<th>Left GPI</th>
<th>Right GPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency (Hz)</td>
<td>150 Hz</td>
<td>150 Hz</td>
</tr>
<tr>
<td>Amplitude (V)</td>
<td>5.5 V</td>
<td>5.5 V</td>
</tr>
<tr>
<td>Pulse Width (µs)</td>
<td>110 µs</td>
<td>90 µs</td>
</tr>
</tbody>
</table>

Achieved over 7 months of follow-up scheduled monthly.

**Figure 1:** YGTSS scores before and after stimulation

**Figure 2:** Total MDS-UPDRS part 3 scores

**Figure 3:** Basal Ganglia in Motor Control

**DISCUSSION**

- Our case demonstrates simultaneous improvement in hyperkinetic (tic) and hypokinetic (parkinsonian) movements with GPI stimulation.
- To our knowledge this is the first case of DIP reported to improve with bilateral GPI DBS, though medication adjustment is the treatment of choice in typical cases of DIP.
- Improvement of tics and Parkinson’s disease (PD) with subthalamic nucleus (STN) DBS has previously been described.
- No known STN pathology has been described in TS.
- Pallidal DBS is a mainstay of PD and dystonia therapy and it is increasingly being considered for the management of other hyperkinetic movement disorders.
- There is irregular and reduced firing of GPI neurons in TS.
- There are increased oscillatory bursts and synchrony of GPI neurons in PD.
- The observed simultaneous improvement of tics and parkinsonism supports theories that the beneficial effects of high frequency stimulation are attributable to normalization of firing patterns within the diseased nuclei.
- GPI may be a uniquely suitable target to treat co-existing hyper- and hypokinetic disorders due to its down stream influence on thalamocortical pathways.

**REFERENCES**

4. No known STN pathology has been described in TS.