Effect of subthalamic nucleus stimulation on obsessive–compulsive disorder in a patient with Parkinson disease

Case report

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The authors report on a patient with Parkinson disease (PD) and severe obsessive–compulsive disorder (OCD), in whom bilateral stimulation of the subthalamic nucleus (STN) was used to treat both PD and OCD symptoms. This 49-year-old man had displayed symptoms of PD for 13 years. Progressively, his motor disability became severe despite optimal medical treatment. In parallel, he suffered severe OCD for 16 years, with obsessions of accumulation and compulsions of gathering and rubbing that lasted more than 8 hours per day. Bilateral high-frequency STN stimulation was performed to treat motor disability. After surgery (at 1-year follow up), motor and OCD symptoms were dramatically improved. The pre- and postoperative Yale–Brown Obsessive–Compulsive Scale scores were 32 and 1, respectively. No additional antiparkinsonian drugs were administered.

This case and other recent reports indicate that OCD symptoms can be improved by deep brain stimulation, a finding that opens new perspectives in the surgical treatment of severe and medically intractable OCD.

Key Words • subthalamic nucleus • deep brain stimulation • obsessive–compulsive disorder • psychosurgery

The efficacy of DBS in the treatment of PD is now widely accepted.5 As in PD, the pathophysiology of OCD probably involves dysfunction of frontal–subcortical circuits.17,18 Recently, this procedure has been proposed to treat OCD.11,14 We report on a patient with PD who had a history of severe OCD, in whom bilateral stimulation of the subthalamic nucleus (STN) ameliorated both PD and OCD symptoms.

Case Report

History. This 49-year-old man had displayed symptoms of PD since 1990. The symptoms progressively worsened and he experienced levodopa-induced motor complications, despite optimal antiparkinsonian medications. The daily dose of levodopa equivalent was 1000 mg; therefore, bilateral STN stimulation was proposed.

In parallel, the patient had a personal and familial history of mood disorders. His mother had suffered from unipolar depression and committed suicide. He had a dysthymic temperament1 and experienced a hypomanic episode in 1983 after the death of his parents. At that time, he had exhibited an exaggerated activity of running, for several hours daily. As PD progressed, excessive fishing activity gradually replaced running. In 1987 he began to show signs of OCD. He had obsessions of accumulating objects with the hope of finding something precious and compulsions of gathering (pebbles, knives, and brass objects). Then, compulsions of rubbing appeared (rubbing pebbles and playing rub-off games); these compulsions took up more than 8 hours per day. He fulfilled the Diagnostic and Statistical Manual of Mental Disorders revision IV criteria for severe OCD. He had never been treated for his OCD but had received antidepressant agents (paroxetine 20 mg/day) since 2002. His cognitive functions were unimpaired.

Examination. Clinical evaluations were performed 1 month before and 6 months after surgery. The severity of PD symptoms was evaluated using the UPDRS III, where-as the levodopa-induced dyskinesias were assessed using the UPDRS IV (items 32+33). Psychiatric evaluation was conducted with a nonstructural and structural interview, the Montgomery and Asberg Depression Rating Scale,11 and the Yale–Brown Obsessive–Compulsive Scale.7 Neuropsychological assessment included the Trail Making Test10 and Mattis2 and Frontal15 scores.

Operation. Bilateral STN stimulation was performed in
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January 2003. The STN was localized on computerized tomography scans, and MR image fusion was acquired stereotactically with the aid of a Fischer ZD frame (Leibinger, Freiburg, Germany). Electrodes (Pisces Quad 33389; Medtronic, Inc., Minneapolis, MN) were implanted after induction of local anesthesia by using microelectrode recording and perioperative stimulation, and then connected to a subcutaneous stimulator (Kinetra; Medtronic, Inc.). There were no peri- or postoperative complications. Locations of the active electrodes were calculated on the postoperative stereotactic MR image as follows: 12.5 and 10 mm lateral to the AC–PC line; 13.4 and 10.2 mm anterior to the PC; and 1.5 and 4.8 mm below the AC–PC line, respectively. The AC–PC distance was 28 mm. The projection of the bicommissural line is designated AC–PC, whereas VCA and VCP denote vertical planes perpendicular to AC–PC line and passing through the AC and PC, respectively.

Postoperative Course. Symptoms of OCD began to improve 1 week after surgery. Six months post-surgery, PD motor symptoms had improved dramatically and his OCD symptoms had disappeared (Table 1). This effect remained the same 1 year after surgery. Antiparkinsonian medications have been completely discontinued. There was no change in mood (the antidepressant medication was maintained), but his anxiety was slightly improved after surgery.

Discussion

In this patient, both PD and OCD symptoms were alleviated after STN stimulation. The effect on OCD symptoms was obtained by stimulation of the focus where the best motor improvement was observed during the perioperative tests and in the postoperative period. According to the stereotactic coordinates, this focus could be located in the STN, the zona incerta, or the Forel fields. We hypothesis that improvement of OCD symptoms was directly due to DBS. Nevertheless, other possible causes must be ruled out. The improvement of OCD was unlikely to have been due to natural variations in the severity of the disorder, because the patient’s symptoms had been stable for more than 10 years before surgery. The improvement of OCD after surgery could have resulted from the improvement of PD symptoms, because obsessive–compulsive personality traits are common in patients with PD. Nevertheless, OCD was far more severe than PD, and began at least 3 years earlier. We cannot exclude the possibility that improvement of OCD symptoms could have resulted from the improvement in anxiety levels, but STN stimulation usually has little or no effect on anxiety. Because levodopa had been introduced 10 years after the beginning of the patient’s manifestation of OCD, without any psychiatric change, improvement in OCD is unlikely to be due to the reduction of levodopa following surgery. We hypothesize that improvement in OCD symptoms was due to the modulation of neuronal corticobasal circuits after inhibition of STN activity by high-frequency stimulation. We did not stop the stimulation to confirm this hypothesis, because several members of our team believed that it would have been unethical, and because the patient refused.

Among the parallel frontal–subcortical circuits described by Alexander, et al., metabolic and lesion studies have shown that the paralimbic and limbic corticobasal circuits are involved in the pathophysiology of OCD. Obsessive–compulsive disorder could result from an imbalance between the direct and the indirect pathways. The STN is involved in the indirect pathway and is common to both circuits. Thus, inhibition of the STN by high-frequency stimulation could act by restoring the balance between the two pathways.

This action could explain the mild improvement in obsessive–compulsive personality traits observed after STN stimulation in patients with PD who do not have OCD, and the reduction in symptoms of OCD in patients with both PD and OCD. Recently, symptoms of OCD have been partially reduced by bilateral stimulation of the anterior limb of the internal capsule in patients with severe manifestations of this disorder. The pathophysiology could be different.

### Table 1

<table>
<thead>
<tr>
<th>Parameter</th>
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<th>6 Mos Postop</th>
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</thead>
<tbody>
<tr>
<td>motor assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UPDRS III score</td>
<td>29</td>
<td>7</td>
</tr>
<tr>
<td>levodopa-equivalent dose</td>
<td>1000 mg/day</td>
<td>0</td>
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<tr>
<td>psychiatric assessment</td>
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<td></td>
</tr>
<tr>
<td>Y-BOCS score</td>
<td>32</td>
<td>1</td>
</tr>
<tr>
<td>obsessions</td>
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<td>0</td>
</tr>
<tr>
<td>compulsions</td>
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<td>1</td>
</tr>
<tr>
<td>MADRS score</td>
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</tr>
<tr>
<td>paroxetine</td>
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<td>20 mg/day</td>
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<tr>
<td>cognitive assessment</td>
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<tr>
<td>Mattis score</td>
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<td>141</td>
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<tr>
<td>Frontal score</td>
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<td>48</td>
</tr>
<tr>
<td>Trail Making Test A</td>
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<td>32 secs</td>
</tr>
<tr>
<td>Trail Making Test B</td>
<td>60 secs</td>
<td>85 secs</td>
</tr>
</tbody>
</table>

* MADRS = Montgomery and Asberg Depression Rating Scale; Y-BOCS = Yale–Brown Obsessive–Compulsive Scale.
however, in primary OCD and that associated with PD. Nevertheless, findings in our case and in previous reports indicate that the STN could also be considered a potential target in this indication.

Conclusions

Findings in this case and in recent reports indicate that symptoms of OCD can be improved by DBS. This discovery opens new perspectives in the surgical treatment of severe and medically intractable OCD.

References


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