Subthalamic Stimulation in Parkinson Disease

With or Without Anesthesia?

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Objective: To study the effects of general anesthesia on the postoperative outcome of patients with Parkinson disease (PD) who underwent surgery using bilateral placement of stimulating electrodes within the subthalamic nucleus (STN).

Design: Retrospective analysis.

Setting: Hôpital de la Salpêtrière, Paris, France.

Patients: Fifteen PD patients who underwent bilateral implantation of electrodes within the STN received general anesthesia because of severe anxiety, poorly tolerated off-period dystonia, or respiratory difficulties. These patients were compared with 15 patients matched for age, disease duration, and parkinsonian motor disability who underwent the same neurosurgical procedure under local anesthesia.

Main Outcome Measure: Motor disability scores.

Results: After surgery, the severity of parkinsonian motor disability was markedly improved in both groups of patients. Compared with patients who were under local anesthesia during the operation, the residual parkinsonian motor score under stimulation (with "on" or without "off" levodopa) and the intensity of stimulation were higher in patients who were under general anesthesia during the operation.

Conclusions: Although the improvement of parkinsonian motor disability is greater in PD patients who receive local anesthesia during surgery, general anesthesia can be performed in patients unable to tolerate prolonged states without levodopa.

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METHODS

Of the 105 consecutive PD patients who underwent bilateral placement of stimulating electrodes within the STN at the Hôpital de la Salpêtrière, Paris, France, between May 1997 and December 2002, 15 (11 men, 4 women; mean ± SD age, 59.0 ± 8.0 years; mean ± SD disease duration, 13.4 ± 3.7 years) received general anesthesia rather than local anesthesia during the procedure because of severe anxiety (n = 9), painful dystonia (n = 5), respiratory difficulties while without ("off") levodopa (n = 3), or an unexplained loss of consciousness during the positioning of the stereotactic frame with the patient under local anesthesia (n = 1) (some patients had ≥1 condition). All experienced severe PD (Hoehn and Yahr stage while off levodopa, ≥3) and levodopa-related motor complications (Table). These patients were compared with 15 PD patients (9 men, 6 women) matched for age (mean ± SD age, 58.0 ± 6.1 years), disease duration (mean ± SD disease duration, 13.5 ± 2.6 years), and parkinsonian motor disability who underwent the same procedure while under local anesthesia (Table).

The neurosurgical procedure was performed as previously described, except the pa-
Clinical Characteristics of Patients 1 Month Before and 6 Months After Surgery

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>General Anesthesia</th>
<th>Local Anesthesia</th>
<th>General Anesthesia</th>
<th>Local Anesthesia</th>
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<tbody>
<tr>
<td>Motor disability (UPDRS Part III)</td>
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<tr>
<td>&quot;Off&quot; levodopa</td>
<td>47.1 ± 15.4</td>
<td>39.9 ± 13.9</td>
<td>17.0 ± 8.6 (63)†</td>
<td>10.9 ± 7.2 (74)‡†</td>
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<tr>
<td>&quot;On&quot; levodopa</td>
<td>10.4 ± 5.7 (78)</td>
<td>9.4 ± 5.2 (78)</td>
<td>8.9 ± 4.5 (79)†</td>
<td>5.3 ± 4.7 (87)‡‡</td>
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<tr>
<td>Receiving stimulation, off levodopa</td>
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<td>Receiving stimulation, on levodopa</td>
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<td>Axial score</td>
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<tr>
<td>Off levodopa</td>
<td>9.4 ± 4.8</td>
<td>8.5 ± 3.5</td>
<td>3.5 ± 2.4 (54)†</td>
<td>2.5 ± 3 (68)†</td>
</tr>
<tr>
<td>On levodopa</td>
<td>2.5 ± 1.4 (73)</td>
<td>2.4 ± 1.9 (74)</td>
<td>2.5 ± 1.8 (63)†</td>
<td>1.5 ± 1.8 (78)‡</td>
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<td>Receiving stimulation, off levodopa</td>
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<td>Receiving stimulation, on levodopa</td>
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<td>Levodopa-induced complications</td>
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<tr>
<td>UPDRS Part IV</td>
<td>8.4 ± 2.8</td>
<td>11.1 ± 2.3</td>
<td>1.1 ± 1.7 (85)†</td>
<td>2.3 ± 2.6 (79)‡</td>
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<tr>
<td>Dyskinesias (part A)</td>
<td>4.1 ± 1.6</td>
<td>6.3 ± 2.7</td>
<td>1 ± 1.5 (63)†</td>
<td>1.1 ± 1.7 (79)‡</td>
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<tr>
<td>Motor fluctuations (part B)</td>
<td>3.5 ± 1.4</td>
<td>3.6 ± 1.4</td>
<td>0 (100)†</td>
<td>0.73 ± 1.3 (87)‡†</td>
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<td>Levodopa equivalents, mg/d</td>
<td>1449 ± 398</td>
<td>1507 ± 465</td>
<td>310 ± 350 (78)†</td>
<td>392 ± 440 (76)†</td>
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</table>

Abbreviation: UPDRS, Unified Parkinson's Disease Rating Scale.

*Values are the mean ± SD (percentage of improvement compared with the drug-free condition before surgery).
†P< .05 when compared with the preoperative off-levodopa condition, Wilcoxon signed rank test.
‡P< .05 when compared with the patients under general anesthesia during the operation, Mann-Whitney test.

RESULTS

Six months after surgery, the parkinsonian motor score (UPDRS Part III, axial score) under stimulation with or without levodopa was significantly improved compared with the preoperative state (off levodopa) in both groups. Parkinsonian motor disability (UPDRS Part III) under stimulation alone (residual score: receiving stimulation, off levodopa) or under stimulation and medication (receiving stimulation and on levodopa) was significantly lower in the local anesthesia group. The postoperative axial score under stimulation alone or under stimulation and levodopa tended to be lower in the local compared with the general anesthesia group, although this was not statistically significant (P= .07 and P= .06, respectively).

The postoperative levodopa-equivalent dosage was significantly reduced in both groups of patients. The se-
verity of levodopa-related complications was markedly reduced in both groups of patients but remained significantly higher in the local anesthesia group (UPDRS Part IV, motor fluctuations) (Table).

Although the frequency and pulse width of stimulation did not differ between the 2 groups, the intensity of stimulation was significantly higher in the general compared with the local anesthesia group for the right side (general anesthesia: 2.85±0.42 V; local anesthesia: 2.52±0.32 V; \( P = .02 \); left side, general anesthesia: 2.81±0.54 V; local anesthesia: 2.71±0.31 V; \( P = .19 \)).

No adverse reactions to the use of propofol were observed. One patient who needed an endotracheal intubation had a transient pulmonary atelectasia. No other intraoperative or postoperative complications were observed.

Although this is a retrospective study, we think that the results are valid. First, the patients who were under general anesthesia during the operation were carefully matched for age, disease duration, severity of parkinsonian motor disability, and response to levodopa treatment, and to levodopa-induced dyskinesias (Table), and absence of contraindications such as cognitive or psychiatric impairment. Third, the intraoperative characteristics of STN neuronal activity were recorded in all patients whether or not they received general anesthesia. Therefore, apart from general anesthesia, the only difference between the general vs local anesthesia patients was the absence of intraoperative assessment of parkinsonian motor disability and of stimulation-induced dyskinesias. 5,10

The severity of parkinsonian motor disability assessed postoperatively was more important in the general compared with local anesthesia patients. The results suggest that the bilateral targeting of the STN was less precise in the absence of intraoperative clinical assessment in the general anesthesia group. This is confirmed by the fact that the intensity of stimulation tended to be higher in general anesthesia patients. Such a conclusion is not unexpected, since the definitive electrode implanted was the central one in almost all cases (29 of 30) in the general anesthesia group and in only 83% of the cases in the local anesthesia group (25 of 30). This suggests that the long-term clinical benefit of neurosurgery will not be optimal in a nonnegligible fraction of patients who received general anesthesia during the operation. Although this study needs to be replicated prospectively in a larger population of patients, the results nevertheless suggest that STN stimulation can be performed with general anesthesia in patients with severe off-period dystonia or anxiety who receive general anesthesia during neurosurgery because they would not tolerate undergoing the operation while under local anesthesia.

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REFERENCES