Unilateral pallidotomy for reduction of parkinsonian pain

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Object. The goal of this study was to determine whether unilateral pallidotomy reduces parkinsonian pain.

Methods. Twenty-one patients suffering from Parkinson’s disease (PD) were followed prospectively for 1 year after they had undergone a unilateral pallidotomy to assess the procedure’s effect on pain related to PD. Pain unrelated to PD was not studied. Patients scored the level of their PD pain on an ordinal scale (0–10 points) preoperatively and 6 weeks and 1 year postoperatively. The results were analyzed using Wilcoxon’s paired-ranks test (with Bonferroni correction) and showed a significant reduction in overall pain scores at 6 weeks (p < 0.001) and 1 year (p = 0.001) following pallidotomy. Various types of PD pain are described and their possible pathophysiological mechanisms are presented.

Conclusions. Unilateral pallidotomy significantly reduces pain attributable to Parkinson’s disease.

KEY WORDS • pallidotomy • Parkinson’s disease • pain

Pain has long been recognized as a feature of Parkinson’s disease (PD). Recent reviews have again focused attention on the alarmingly high prevalence of pain in patients with PD. The percentage of patients suffering pain attributable to their PD has been estimated to be between 15% and 46%. With the increased popularity of the pallidotomy procedure have come anecdotal comments on its ability to reduce pain. Laitinen and colleagues reported that 63% of their patients had some degree of “dystonia/pain” before pallidotomy and only 32% had some after surgery. Baron and associates reported that “pain and discomfort scores” were improved in 10 of 12 patients at 6 months but not at 1 year. We conducted a prospective study to determine whether unilateral pallidotomy reduces the pain attributable to PD. Data were also collected for secondary endpoints to determine how the procedure affected the different types of pain associated with PD and to observe any correlation with sleep disorders.

Clinical Material and Methods

Surgical Procedure

Patients suffering from PD who were followed at the University of British Columbia Movement Disorders Clinic were selected for pallidotomy based on their motor symptoms. The operative details and motor scores of an earlier cohort were previously described. Briefly, PD patients with severe motor manifestations (dyskinesia, bradykinesia, and tremor) unresponsive to medical therapy underwent unilateral pallidotomy performed on the side opposite their worst motor symptoms. Preoperative localization was performed with the aid of a computerized tomography–guided Cosman-Roberts-Wells stereotactic system (Radionics, Inc., Burlington, MA). The pallidal target was chosen 4 to 6 mm below the intercommissural line, 21 to 23 mm lateral to midline, and 2 mm anterior to the midpoint of the intercommissural line. Intraoperative localization was confirmed using macrostimulation, and a radiofrequency lesion was made in the ventroposterior pallidum.

Data Collection and Statistical Analysis

In this study, 50 patients were interviewed preoperatively. Patients with organic pain unrelated to PD were excluded following appropriate medical referrals; 21 patients were identified as having pain related to their PD. Data were collected from this cohort prospectively. All patients described the severity of their pain according to an ordinal scale (0–10 points) preoperatively and at 6 weeks and 1 year postoperatively. Pain scores at the three time points were then analyzed using Wilcoxon’s paired-ranks test with a Bonferroni correction introduced to adjust for multiple comparisons. The more commonly used continuous pain scales could not be used because PD made it difficult to draw a line on the pain scale. Descriptive data were also recorded on pain location, quality, and relation to PD symptoms, medications, and time of day. The PD pain was then grouped into categories based on a modification of the Goetz classification.
that pain is improved following the pallidotomy procedure. 2,12 Our a priori hypothesis that unilateral pallidotomy would improve pain associated with PD was prospectively confirmed. The severity of pain suffered by this cohort of patients was significantly reduced at both 6 weeks (p < 0.001) and 1 year (p = 0.001) postoperatively.

Pain related to PD is well reported. 8,14,16,20,21 Our patients described several different types of pain. Somatic pain exacerbated by PD was seen in six patients. All had arthritic joints or tendonitis with pain triggered by repetitive movements (tremor or dyskinesia) or increased joint stress (simultaneous rigidity of agonist and antagonist muscles). This pain was resolved or improved in all patients at 6 weeks and remained so in all except one at the 1-year follow-up examination. The motor improvements in this cohort of 21 patients parallels previously reported postoperative improvements in dyskinesia, tremor, and rigidity. 2,10,12 There was a dramatic reduction in dyskinesia and a more modest improvement in tremor and rigidity. All patients presenting with somatic pain exacerbated by their parkinsonism had involuntary movements in the affected limb that were reduced postoperatively. Although our cohort was too small to begin to prove that one aspect of motor improvement caused the pain relief, it is likely that the reduced involuntary movements of the painful limb resulted in significant pain reduction. The long-term improvement (or resolution) of this type of pain is undoubtedly hindered by progression of the underlying somatic disorder.

The most commonly reported pain was musculoskele-

### Results

The overall pain severity at the three time points specified is shown in Fig. 1. The data displayed in this figure are descriptive and represent the means of the ordinal values for our 21 patients. Preoperative overall pain scores were significantly decreased at both 6 weeks (p < 0.001) and 1 year (p = 0.001) postoperatively. There was a small but significant (p = 0.02) increase in pain from 6 weeks to 1 year postoperatively.

A few patients had more than one type of pain. Postoperative pain severity scores for each patient were compared with their preoperative levels and displayed in Table 1 as either 1) “resolved”; 2) “better” (score lower); or 3) the “same/worse” (score not lowered). Ten patients had musculoskeletal pain located in both legs and four had pain in both forearms. Six weeks following unilateral pallidotomy, 12 of these patients with resolved or improved pain reported the effects to be bilateral. At 1 year postsurgery, this bilateral effect was still present.

The proportion of patients with pain who also reported having sleep disturbance (eight [38%] of 21 patients) was not significantly different from the proportion of those patients without pain (12 [41%] of 29 patients). Major depression was a relative contraindication to surgery, and thus, the number of patients was too small to form the basis for a comment on its effect on pain.

Motor scores were improved in a fashion similar to that of our previously reported cohort. 10 Compared with preoperative scores, contralateral dyskinesia for the cohort with pain was reduced to 16 ± 5% (mean ± standard deviation) at 6 weeks and 18 ± 5% at 1 year postoperatively. Tremor was reduced to 50 ± 4% at 6 weeks and 55 ± 5% at 1 year. Rigidity was reduced to 60 ± 12% at 6 weeks and 64 ± 12% at 1 year. Patients reported that improvements in tremor and rigidity were more dramatic during their “off” state, but this was not measured.

### Discussion

Reviewing this cohort of patients presenting for unilateral pallidotomy, we found that 21 (42%) of 50 patients had complaints of pain attributable to their PD. This proportion falls within the range of previously reported values. 8,21,23 Several authors have commented retrospectively

### Table 1

Different types of pain associated with PD in 21 patients who underwent unilateral pallidotomy

<table>
<thead>
<tr>
<th>Type of Pain</th>
<th>6 Wks Postop</th>
<th>1 Yr Postop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%Resolved</td>
<td>%Better</td>
</tr>
<tr>
<td>somatic, exacerbated by PD</td>
<td>6</td>
<td>66</td>
</tr>
<tr>
<td>musculoskeletal</td>
<td>16</td>
<td>63</td>
</tr>
<tr>
<td>dystonic</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>dysesthetic</td>
<td>2</td>
<td>0</td>
</tr>
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</table>
tal. This occurred in the thighs, calves, or forearms and tended to fluctuate in proportion to muscle rigidity (that is, it was worse during “off” periods). The pain was often described as a prolonged “cramp” or “deep ache.” This pain responded well to pallidotomy. Eighty-eight percent of patients with musculoskeletal pain were improved 6 weeks postoperatively and remained improved for 1 year. It is tempting to postulate that this pain is musculogenic because of the prolonged contractions sustained by these abnormally rigid muscles. There are several arguments against this. First, there are patients with severe rigidity who do not have pain. Goetz and colleagues4 found that the severity of PD symptoms did not differ significantly between those with and without pain. Second, Sage and associates5 reported on one patient whose pain continued despite receiving an epidural anesthetic agent that was sufficient to induce flaccid muscles. Third, pain can begin before the motor manifestations.10 Fourth, the improved rigidity following pallidotomy is seen contralaterally at 1 year10 and yet our patients experienced bilateral pain relief. Fifth, the motor improvements in this cohort showed only modest reduction in rigidity, despite dramatic reduction in this type of pain. Although the origin of this pain may be multifocal (musculogenic and abnormal spinal/basal ganglia sensory processing), it is likely that the pallidotomy exerts part of its effect on pain centrally.

Dystonic pain was seen in four individuals. It had improved in all of these patients at 6 weeks but in only half of them at 1 year. There are two reasons why this pain is likely to reflect more than a severe form of the aforementioned “musculoskeletal” pain occurring in muscles contributing to dystonic postures. First, it did not respond to the pallidotomy as well as the musculoskeletal pain. Second, Pacchetti, et al.,15 described complete disappearance of painful foot dystonia in 21 of 30 patients treated with botulinum toxin injections into the affected muscles. The origin of this pain is likely musculogenic. Pallidotomy may improve this pain by reducing the frequency or severity of dystonic foot contractions. We would predict that unilateral pallidotomy would not result in long-term bilateral effects; however, our number of patients was too small to test this hypothesis.

Dysesthesias were rare and were present in only two of our patients. This was less than expected from previous reports.11,12 The numbers were too small to discuss the effects of pallidotomy on this group, but neither patient improved. The origin of this pain is likely complex and may be due to altered basal ganglia function. Chudler and Dong14 reviewed the role of the basal ganglia in nociception and pain. They concluded that the basal ganglia may be involved in the sensory, affective, and cognitive dimensions of pain, as well as the modulation and gating of nociceptive information. Others have shown an association between the basal ganglia and central pain processing1,17 Impaired modulation of the thalamus and its sensory projections by the substantia nigra has been postulated as a cause of pain in patients who have PD.11,12 Alterations in neurotransmitter levels in the spinal cord13 and the striatum19 may also lead to sensory abnormalities. The quality of pain described by our two patients fits in with the idea of a central origin (poorly localized and often burning in character).

Sleep disturbance was not more common in the cohort with pain than in those without; however, those patients with musculoskeletal pain (five of 16) were more likely to have a sleep disturbance than those with somatic pain (one of six). The muscle rigidity that contributes to musculoskeletal pain is often increased at night, whereas in contrast, those factors that exacerbate somatic pain (tremor and dyskinesia) are reduced or absent during sleep. Goetz and colleagues6 reported a relationship between parkinsonian pain, depression, and sleep alterations. We cannot comment on whether sleep deprivation may have worsened pain in these patients. Because major depression was a relative contraindication for surgery, too few patients were available for us to be able to comment on its effect on pain.

Conclusions

Pain is a common feature of PD occurring in 15 to 40% of patients. There are several types of pain that can occur in these patients: 1) exacerbations of somatic pain; 2) musculoskeletal pain; 3) dystonic pain; and 4) dysesthetic pain. In this cohort of patients who underwent unilateral pallidotomy, pain associated with PD was reduced at 6 weeks (p < 0.001) and 1 year (p = 0.001) postoperatively. Musculoskeletal pain and exacerbations of somatic pain were best treated. The potential benefit of pallidotomy on parkinsonian pain should be considered in the preoperative evaluation of potential surgical candidates.


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