Pulsed Radiofrequency for the Treatment of Occipital Neuralgia
A Prospective Study With 6 Months of Follow-Up

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Background and Objectives: Occipital neuralgia is a paroxysmal nonthrobberg, stabbing pain in the area of the greater or lesser occipital nerve caused by irritation of these nerves. Although several therapies have been reported, no criterion standard has emerged. This study reports the results of a prospective trial with 6 months of follow-up in which pulsed radiofrequency treatment of the greater and/or lesser occipital nerve was used to treat this neuralgia.

Methods: Patients presenting with clinical findings suggestive of occipital neuralgia and a positive test block of the occipital nerves with 2 mL of local anesthetic underwent a pulsed radiofrequency procedure of the culprit nerves. Mean scores for pain, quality of life, and medication intake were measured 1, 2, and 6 months after the procedure. Pain was measured by the visual analog and Likert scales, quality of life was measured by a modified brief pain questionnaire, and medication intake was measured by a Medication Quantification Scale.

Results: During a 29-month period, 19 patients were included in the study. Mean visual analog scale and median Medication Quantification Scale scores declined by 3.6 units (P = 0.002) and 8 units (P = 0.006), respectively, during 6 months. Approximately 52.6% of patients reported a score of 6 (pain improved substantially) or higher on the Likert scale after 6 months. No complications were reported.

Conclusions: Pulsed radiofrequency treatment of the greater and/or lesser occipital nerve is a promising treatment of occipital neuralgia. This study warrants further placebo-controlled trials.

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The International Headache Society defines occipital neuralgia (ON) as a paroxysmal nonthrobberg, stabbing pain in the area of the greater or lesser occipital nerve. The pain is located in the suboccipital region, radiates over the scalp, and can be elicited by applying pressure over the course of the greater or lesser occipital nerve. Sometimes, hypoesthesia or dysesthesia is noticed. These findings, in combination with a short-term improvement after local anesthetic infiltration, establish the diagnosis. In 85% of patients, the ON is unilateral. The greater occipital nerve is more frequently involved (90%) compared with the lesser nerve (10%). No data are available about the incidence or prevalence. Irritation of the occipital nerves often lies at the origin of the neuralgia. Reasons for this irritation are diverse, ranging from vascular compression by aberrant vessels, giant cell arteritis, compression by osteogenic tumors, arthrosis, callus formation after vertebral fractures, schwannomata, C2 myelitis, or, as is most often the case, tendinomuscular compression. One case report is published about PRF therapy for the treatment of ON. To date, no long-term prospective trials have been conducted concerning the treatment of ON. We present this first prospective clinical trial with 6 months of follow-up in which PRF current was used to treat patients with ON.

MATERIALS AND METHODS

Patient Selection
The study was initiated following approval of our ethics committee (Centraal Medisch Ethisch Committee Ziekenhuis Oost-Limburg). Patients presenting with ON (for inclusion and exclusion criteria, see Table 1) were included after obtaining their written informed consent. An infiltration with local anesthetic (bupivacaine 0.5%, 2 mL per nerve) of the culprit occipital nerves was performed. Patients with 50% or more reduction of pain on the visual analog scale (VAS) received a PRF treatment of the same occipital nerves. Correct injection was confirmed by the presence of scalp anesthesia in the dermatomes supplied by the lesser and/or greater occipital nerve. Infiltration sites for the greater and lesser occipital nerves were chosen according to the anatomic descriptions by Vital et al, Becser et al, Loukas et al, and Natsis et al. More detailed information regarding the infiltration sites is provided in Figure 1.

PRF Treatment of the Occipital Nerves
The target occipital nerves were identified using a 23-gauge CXE-6 needle (Cotop International BV, Amsterdam, The Netherlands; 60-mm/5-mm active tip) connected to a lesion generator (Cosman RFG-1B generator; Cosman Medical, Inc, Burlington, MA) providing a 50-Hz, 0.5-V current. Correct needle position was confirmed by the presence of paresthesia in the concordant
dramatomas with sensory thresholds lower than 0.5 V. Pulsed radiofrequency current consisted of 20-msec bursts with a frequency of 2 Hz and 45 V and was applied for 240 secs per nerve. Care was taken not to exceed 42°C. No local anesthetic was administered to prevent unintentional anesthesia of the occipital nerves.

Measurements
The primary outcome measure of the study was the effect of PRF treatment on pain measured by a VAS and a 7-point Likert scale. Secondary outcome measures were improvement in quality of life and reduction in medication intake assessed by a modified brief pain questionnaire and a Medication Quantification Scale (MQS) (Grüenthal GmbH, Aachen, Germany), respectively. A figure containing an example of the Likert scale, VAS, and modified brief pain questionnaire is provided as Supplemental Digital Content 1 (http://links.lww.com/AAP/A16).

Visual analog scale, modified brief pain questionnaire, and MQS scores were obtained before infiltration and 1, 2, and 6 months after PRF treatment. The Likert scale was acquired 1, 2, and 6 months after PRF treatment. Inquiries about adverse effects were made every visit.

Statistical Analysis
StatPlus:mac version 2008 (AnalystSoft, Vancouver, Canada) software was used to analyze the data. Mean values of the VAS for pain and the modified brief pain questionnaire before and after PRF treatment were compared using a paired t test at an α level of 0.05. One-tailed t test probabilities reported with P values < 0.05 were considered statistically significant. Data of the MQS before and after PRF treatment were compared using a Wilcoxon matched pairs test. Data are presented as mean values ± SEM for the VAS for pain and the modified brief pain questionnaire and as median/range for the MQS.

RESULTS
In a 29-month period (January 2006 to May 2008), 33 patients suspected with ON attended our multidisciplinary pain
Thirteen patients had less than 50% improvement after infiltration of the occipital nerves with local anesthetic and were excluded from the study. Of the remaining 20 patients, 19 received PRF treatment. One patient refused PRF treatment because she was still without pain at the time the treatment was scheduled. Demographic data are presented in Table 2. Mean VAS scores, mean modified brief pain questionnaire scores, mean MQS scores, and Likert scores of the 19 treated patients are presented in Figure 2. The mean ± SEM VAS score before treatment was 7.5 ± 0.4 and declined to 3.5 ± 0.8, 3.5 ± 0.7, and 3.9 ± 0.8 at 1, 2, and 6 months, respectively (P < 0.001, P < 0.001, and P = 0.002, respectively). The median MQS score before treatment was 11.2 (range, 18.2) and declined to 4.4 (range, 18.2), 3.4 (range, 17.1) and 2.2 (range, 17.1) at 1, 2, and 6 months, respectively (P < 0.01, P = 0.011, and P = 0.006, respectively). The results for the quality of life parameters (disturbance of daily activity, mood disturbance, and sleep disturbance) are presented in Table 3. Of the 19 patients, 13 (68.4%), 11 (57.9%), and 10 (52.6%) of patients mentioned a score of 6 or more on the Likert scale 1, 2, and 6 months after PRF treatment, respectively. No adverse effects were reported. The VAS score of the patient who refused PRF treatment was 6 at baseline and 0, 2, and 7, respectively, at 1, 2, and 6 months after infiltration with local anesthetic.

**DISCUSSION**

This first prospective study on PRF for the treatment of ON shows that the treatment provides significant pain relief and reduces medication intake for 6 months. Sleep, mood, and daily activity also improved during the 6 months of follow-up.

Kuhn et al.\(^{25}\) prospectively identified 12 patients in the emergency department who met the International Headache Society criteria for ON. After a positive test block (1–3 mL of bupivacaine 0.5% with epinephrine), the patients received an infiltration with corticosteroids. In 70% of patients, the pain recurred within 2 weeks. Prolonged pain relief for more than 2 months was observed in 20% of the patients. Comparable outcomes were found in a study performed by Hammond and Danta.\(^{2}\) In our experiment, only 1 patient (5%) had pain relief for more than 2 months after a single injection of local anesthetic. Mechanisms responsible for long-term pain relief after a single dose of local anesthetic still need to be elucidated. Injections with botulinum toxin type A\(^{26}\) in 6 patients relieved

**TABLE 3.** Evolution of Quality of Life Parameters 1, 2, and 6 Months After Treatment

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Baseline</th>
<th>1 mo</th>
<th>2 mo</th>
<th>6 mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disturbance of daily activity</td>
<td>6 ± 0.6</td>
<td>3.2 ± 0.8 (P = 0.0035)</td>
<td>3.2 ± 0.8 (P = 0.004)</td>
<td>3 ± 0.8 (P = 0.002)</td>
</tr>
<tr>
<td>Mood disturbance</td>
<td>4.8 ± 0.8</td>
<td>3 ± 0.8 (P = 0.06)</td>
<td>2.6 ± 0.8 (P = 0.025)</td>
<td>2.7 ± 0.8 (P = 0.037)</td>
</tr>
<tr>
<td>Sleep disturbance</td>
<td>6.6 ± 0.8</td>
<td>3.6 ± 0.9 (P = 0.009)</td>
<td>3.5 ± 0.9 (P = 0.009)</td>
<td>3.6 ± 1 (P = 0.01)</td>
</tr>
</tbody>
</table>

Values are mean ± SEM.
the sharp, shooting pain associated with ON, yet it had no effect on the dull, aching pain. Quality of life measures exhibited some improvement. No significant reduction in pain medication was demonstrated. However, in a retrospective case series of 6 patients with ON, Kapural et al.11 were able to demonstrate pain reduction after injection of botulinum toxin A (VAS declined from 8 ± 1.8 to 2 ± 2.7) with a mean duration of 16.3 ± 3.2 weeks. After implantation of a subcutaneous electrode at the level of C1,27 7 (50%) of 14 ON patients had significant to complete pain reduction. Of 10 patients, 3 had their neurostimulator removed (1 owing to infection, 1 owing to lead migration and spasm of the neck, 1 owing to spontaneous improvement of pain). In a case series of 6 patients with ON who underwent occipital nerve electrical stimulation, a reduction in VAS scores for pain (8.66 ± 1.0 to 2.5 ± 1.3) and pain disability index was noted after 3 months of follow-up.12 After performing intradural dorsal rhizotomies of C1 to C4 in 9 patients, Horowitz and Yonas28 found profound complete relief in 44% of patients. Two patients (22%) had complications (wound infection and muscular nerve pain resulting in reduced range of motion).

Compared with the aforementioned results of other treatment modalities, PRF treatment of ON shows a higher efficacy without any complications. Nevertheless, it should be mentioned that in 2 studies,27,28 the follow-up was longer than in our study. No adverse effects were reported by the patients.

Several limitations in our study are worth mentioning. First, although the VAS, Likert scale, and modified brief pain questionnaires are validated tools in the quantification of pain, they are subjective outcome measures because they are dependent on personal interpretation and variations. With the use of the MQS, we tried to circumvent part of this subjective interpretation. Second, the small sample size limits the power of the outcomes. Finally, it is worth mentioning that uncontrolled trials have a tendency to overestimate treatment effects.

In conclusion, PRF for the treatment of ON shows promising results that need to be confirmed by larger placebo-controlled studies.

REFERENCES


27. Likert R. A technique for the measurement of attitude. Arch Psychol. 1932;22.