RADIOFREQUENCY CERVICAL ZYGAPOPHYSEAL JOINT NEUROTOMY FOR CERVICOGENIC HEADACHE: A PROSPECTIVE STUDY OF 15 PATIENTS

Hans A. van Suijlekom, Maarten van Kleef, Gerard A.M. Barendse, Menno E. Sluijter, Ottar Sjaaastad*, Wilhelm E.J. Weber

Pain Management and Research Centre, Dept of Anesthesiology, University Hospital of Maastricht, The Netherlands. *Department of Neurology, University of Trondheim, Norway

Reprint requests to: Dr H.A. van Suijlekom, Pain Management and Research Centre, Dept of Anesthesiology, University Hospital of Maastricht, P.O. Box 5800, 6202 AZ Maastricht, The Netherlands.

Accepted for publication: October 30, 1998

The present study assessed the clinical efficacy of radiofrequency cervical zygapophyseal joint neurotomy in patients with cervicogenic headache. Fifteen consecutive patients with cervicogenic headache were treated and then assessed one week prior to treatment and, at short-term (8 weeks), intermediate (mean 8.8 months) and long-term (mean 16.8 months) follow-ups. The following were taken as outcome parameters: Visual Analogue Scale (VAS), 7-point Verbal Rating Scale (VRS), number of headache days per week and analgesic intake per week.

The results of this study showed that radiofrequency neurotomy of the cervical zygapophyseal joints significantly reduced headache severity in 12 (80%) patients, both at short-term and long-term follow-up assessed by 7-point VRS. Mean VAS decrease was 31.4 mm (p<0.001) and 53.5 mm (p<0.0001) respectively in this period. The average mean number of headache days per week decreased from 5.8 days to 2.8 days (p=0.001) and the average analgesic intake per week showed a reduction from a mean of 17.5 tablets to a mean of 3.4 tablets (p=0.003).

A definitive conclusion about the clinical efficacy of this treatment can only be drawn from a randomized controlled trial.

KEY WORDS: Cervicogenic headache, radiofrequency lesions, treatment.

FUNCT NEUROL 1998;13:297-303

INTRODUCTION

Despite its long history, the concept of cervicogenic headache (CH), i.e. headache originating from putative abnormalities in the cervical spine, is still highly controversial. The early publications of this hypothesis, that head pain could originate from structures in the neck, include works by Barré, Bärtschi-Rochaix and Hunter and Mayfield in the first half of the century (1-3). In this hypothesis, the crucial feature distinguishing CH from the other headache syndromes is the concept that the pain originates from a structural abnormality in the cervical spine. Consequently, therapy has largely been surgical, attempting to correct putative abnormalities in the cervical spine. Numerous therapeutic procedures for CH have been
published, including neurolysis of the major occipital nerve, cervical rhizotomy, decompression of C2 root and ganglion and cervical zygaphyseal joint denervation (4-7).

Since many of these studies were not controlled and did not include precise description of diagnostic criteria, this vast body of literature only added to the controversy surrounding CH.

Criteria for the diagnosis of CH were published by Sjaastad et al. in 1990, thus enabling researchers to select patients rigorously for future trials (8,9). These diagnostic criteria are entirely clinical as the pathogenesis of CH remains unknown. Various structures in the cervical spine, such as the zygaphyseal joints, intervertebral discs, root ganglia, muscles and ligaments are capable of causing neck pain and headache (10-14). Of all possible cervical structures, the zygaphyseal joints are probably the most accessible targets for invasive therapy. In particular, cervical zygaphyseal joint neurotomy by radiofrequency is a procedure which is generally easy to control and which has no clinically recognizable side effects, furthermore it has recently been shown to be effective in treating another cervical pain syndrome, namely post-whiplash syndrome (15).

The aim of this prospective open study was to assess the clinical efficacy of radiofrequency cervical zygaphyseal joint neurotomy in patients with CH, diagnosed according to the current criteria (9).

MATERIALS AND METHODS

Patients

Fifteen consecutive patients (4 males and 11 females) with CH were studied in the period from January 1996 to July 1996. Patients were seen at the outpatient clinic of the Pain Management and Research Centre of the University Hospital of Maastricht, The Netherlands. Patients were referred by neurologists and general practitioners. All patients were diagnosed by a neurologist (W.W.) according the diagnostic criteria, set out by Sjaastad et al. in 1990. Details of the sample are given in Table 1. All patients had undergone conservative treatment without any appreciable positive result, i.e., without relief of their headache. Conservative treatment consisted of analgesic medication, physical and/or manipulative therapy and sometimes TENS (Transcutaneous Electrical Nerve Stimulation).

Technique

Therapy consisted of a radiofrequency (RF) lesion of the medial branch of the dorsal ramus of the segmental nerve at the levels C3 to C6 on the symptomatic side. For RF lesions of the cervical dorsal ramus, the patient is positioned supine on the operating table. To reach the medial branch of the dorsal ramus, a C-arm intensifier (Type Philips BV-25, Eindhoven, The Netherlands) is used in an oblique position, as proposed by Sluiter (16,17). The dorsal ramus runs over the base of the superior articular process. The entry point of the electrode is marked approximately 1 cm posterior to the posterior border of the facetal column and slightly caudal to the target point. Under fluoroscopic guidance, the electrodes (TOP XE 6

<table>
<thead>
<tr>
<th>Table 1 - Details of the sample</th>
</tr>
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<tbody>
<tr>
<td>Number of patients</td>
</tr>
<tr>
<td>Females/males</td>
</tr>
<tr>
<td>Age range (mean)</td>
</tr>
<tr>
<td>Duration of headache</td>
</tr>
<tr>
<td>6-36 months</td>
</tr>
<tr>
<td>36-60 months</td>
</tr>
<tr>
<td>&gt;60 months</td>
</tr>
<tr>
<td>Cervicogeneic headache</td>
</tr>
<tr>
<td>unilateral</td>
</tr>
<tr>
<td>bilateral</td>
</tr>
<tr>
<td>Head/neck trauma</td>
</tr>
<tr>
<td>yes</td>
</tr>
<tr>
<td>no</td>
</tr>
</tbody>
</table>
needles, active tip 5 mm) are carefully introduced and advanced anteriorly and cranially until contact is made with the facetal column at the target point (Fig. 1). The position of the C-arm is changed to the anterior-posterior (AP) direction. This should confirm the position of the tip of the electrode adjacent to the waist of the ipsilateral articular pillar of the spine at the corresponding level (Fig. 2). After this anatomical localization a physiological control with electrostimulation is carried out. Sensory stimulation at a rate of 50 Hz should elicit a response in the neck at <0.7 Volt. When this criterion was not met we repositioned the electrode until sensory stimulation elicited a response in the neck at <0.7 Volt. On motor stimulation at 2 Hz, there must be no muscle movement in the ipsilateral shoulder/arm.

If these criteria are met, the medial branch of the dorsal ramus is anesthetized with 1-2 ml local anesthetic solution (lidocaine 1%), and a 20 Volt radiofrequency lesion is made for 60 seconds at each level (Radionics RFG-3C, Burlington, MA).

Outcome parameters

Pain intensity was measured by Visual Analogue Scale (VAS) and 7-point Verbal Rating Scale (VRS) (Table 2), before treatment, 8 weeks after treatment, 4 to 14 months after treatment (mean 8.8±2.83) and 12 to 22 months after treatment (mean 16.8±2.83). Other outcome parameters, assessed at the same intervals, were:

1. the mean number of days with headache per week (i.e. the week immediately prior to the follow-up);
2. the mean analgesic intake per week (i.e. the last week immediately prior to the follow-up).

Analysis was performed using the statistical software package for social sciences (SPSS 7.0). P-values are reported one tailed. Treatment effects were tested with paired t-tests.

RESULTS

Short-term follow-up 8 weeks after treatment revealed complete (no.=1) and good pain relief (no.=11) in 12 (80%) patients and no pain relief in 3 (20%) patients, assessed by 7-point VRS. At the 8-week follow-up, mean VAS decrease (measuring pain relief) was 31.4 mm (p<0.001) (Table 2). Follow-up at 4 to 14 months showed complete (no.=4) and good (no.=8) pain relief in 12 patients and no pain relief in 3 patients (these 3 patients also reported no pain relief at the 8 week interval). Mean
Table 2 - Results of treatment

<table>
<thead>
<tr>
<th></th>
<th>pre-treatment</th>
<th>short-term (8 weeks)</th>
<th>intermediate (4-14 months)</th>
<th>long-term (12-22 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Analogue Scale (mean VAS scores in mm)</td>
<td>No. = 15</td>
<td>No. = 15</td>
<td>No. = 15</td>
<td>No. = 14</td>
</tr>
<tr>
<td></td>
<td>90.4±2.3</td>
<td>59.0±7.8</td>
<td>36.1±8.8</td>
<td>36.9±7.3</td>
</tr>
<tr>
<td>Headache days (mean days per week)</td>
<td>5.8±0.5</td>
<td>3.7±0.7</td>
<td>2.1±0.8</td>
<td>2.8±0.8</td>
</tr>
<tr>
<td>Analgesic consumption (mean tablets per week)</td>
<td>17.5±3.9</td>
<td>10.5±3.6</td>
<td>7.4±3.5</td>
<td>3.4±1.4</td>
</tr>
<tr>
<td>Verbal Rating Scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>complete relief</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>good relief</td>
<td>11</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>little relief</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>no relief</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>little worse</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>much worse</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>excruciating</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Values are mean±SE

VAS decrease at this follow-up was further improved to 54.3 mm (p=0.0001). Long-term follow-up at 12-22 months revealed complete (no.=1) or good pain relief (no.=8) in 9 (60%) patients, little relief in 2 subjects and no pain relief in 3 patients. Mean VAS decrease at long-term follow-up was 53.5 mm (p=0.0001). One patient who had sustained a motor vehicle accident with severe neck pain was lost to follow-up 18 months after treatment.

The average mean number of headache days per week (last week prior to treatment) per person was 5.8 days (range 1-7) before treatment. At the 8 week follow-up this number had decreased to 3.7 days (range 0-7, p=0.0015). A further decrease, to 2.1 days (range 0-7), was observed at 4-14 months. This decrease in the number of headache days was statistically significant (p<0.0001). The last follow-up at 12-22 months showed a slight increase to 2.8 days (range 0-7, p=0.001).

The mean analgesic intake per week (the week immediately prior to treatment) per person was 17.5 tablets (range 1-45) before treatment. This was reduced, 8 weeks after treatment, to 10.5 tablets (range 0-45, p=0.0025) and to 7.4 tablets (range 0-45) at follow-up after 4-14 months. This mean reduction in analgesic consumption for headache relief was statistically significant (p=0.001). At the final follow-up at 12-22 months the mean analgesic intake was 3.4 tablets (range 0-19, p=0.003), which still represented a significant reduction. Analgesics used, at least 6 months prior to treatment, by the patients were acetaminophen (no.=5), Non Steroidal Anti Inflammatory Drugs (NSAIDs) (no.=9) and tramadol (no.=1). Besides the NSAIDs one patient used ergotamine and one patient used sumatriptan. Withdrawal of analgesics was not applied in this patient group before RF treatment.

Therapy failed in 3 female patients. One of these patients had a bilateral CH and 2 had a unilateral CH. None of these three patients had a history of head or neck trauma. All three patients had a high analgesic consumption ranging from 56 to 120 tablets per 4 weeks and in retrospect one of them fulfilled the criteria for drug abuse headache. Apart from their older age (75, 72 and 68 years against the mean age...
of 56.0) the characteristics of these patients were not markedly different from the responders.

Side effects were assessed. One patient reported a burning pain in the neck after the RF lesion, which disappeared spontaneously after 1 to 2 weeks. Sensory/motor deficits did not occur in any patient.

DISCUSSION

Although most researchers agree that headache may originate from abnormalities in the cervical spine, the concept of CH is still controversial. This controversy was fueled both by lack of consensus about the diagnostic classification of CH and lack of controlled studies. The diagnostic criteria published by Sjaastad et al. in 1990 enable researchers to select patients for future trials. We used these criteria to select patients with CH for treatment with RF cervical zygapophyseal joint neurotomy. Since RF neurotomy of the cervical zygapophyseal joints appears a simple and safe technique this is the procedure of first choice to study in a randomized controlled trial (RCT). Moreover, the cervical zygapophyseal joints have been implicated in the pathogenesis of CH, and denervation of these joints has recently been shown to be effective in another cervical pain syndrome (15).

We have now done a prospective open study to investigate the feasibility of such a RCT. We show here, in patients diagnosed according to the criteria, that RF neurotomy of the cervical zygapophyseal joints reduces headache both on a short- and long-term basis. These results are confirmed by a reduction of analgesic intake and of the average number of headache days/week. This positive effect appears to be maximal in the 4-14 months (mean 8.8) after treatment, with a tendency of some variables to worsen gradually in the long term. This observation is in accordance with data from a recently published trial (15). Our median long-term follow-up was 16.8 months and there was one patient reporting recurrence of headache complaints who needed a second RF neurotomy of the cervical zygapophyseal joints on the same side after 17 months. A longer follow-up period is needed to assess the value of RF treatment in patients with CH. However, our study demonstrated that this RF neurotomy did not produce any serious side effects.

Our technique for producing the actual RF lesion differs from the one recently described by Lord et al. (18). These authors described a technique in which the electrodes were introduced parasagitally and at a 30-degree angle to the sagittal plane so that the electrodes were placed tangentially to the articular pillar and more parallel to the target nerve with the patient in a prone position. Using this technique, the higher cervical area (C2-C3) is difficult to treat due to technical problems and each operation lasts about three hours. We use a posterolateral approach by oblique projection to reach the medial branch of the dorsal ramus (13,19,20). Advantages of this technique are: 1) the possible application of RF neurotomy at the C2-C3 zygapophyseal joints; 2) easy access to the origin of the medial branch with the patient in a supine position; 3) a proper distance between the electrode tip and the ventral ramus is safeguarded by using oblique projection visualizing the intervertebral foramina; 4) the time for the procedure is 20-30 minutes. We always employ electrostimulation to verify electrode position. In a cadaver study, Stolker pointed out that the electrodes were found to be positioned in the vicinity of the target nerve in only 60% of the cases (21). He concluded that electrostimulation should always follow anatomical electrode positioning.

Another essential difference between the study by Lord et al. and our study is the use of diagnostic nerve blocks. We did not use diagnostic nerve blocks for the following reasons. First, we employed strict clinical criteria to reach the diagnosis of CH (9). Second, diagnostic
zygapophyseal branch blocks have been reported to be false positive in 27% of cases (22). In addition to Bogduk, Lord et al. advocate the use of double-blind, placebo-controlled blocks to reach a precise diagnosis of zygapophyseal joint pain (15-23). However, the specificity of these diagnostic nerve blocks, used by Lord et al., has not been validated in long-term studies of ablative procedures (24). North et al. confirmed that false positive results are common with nerve blocks used to localize or diagnose sources of pain and that the sensitivity and specificity of such blocks are low (25). This is especially true for diagnostic cervical zygapophyseal nerve blocks (21).

This prospective open study demonstrates that RF cervical zygapophyseal joint neurotomy leads to a significant reduction in headache severity, in the number of days with headache and in analgesic intake in patients with CH diagnosed according to the criteria of Sjøaastad et al. (9). A substantial proportion of our patients took high amounts of analgesics. As is the case with most types of headache, CH too, can possibly lead to analgesic abuse, thus transforming the headache into a chronic daily (drug induced) headache. In our prospective trial we will exclude patients with possible drug induced headache. However, a definitive conclusion about the clinical efficacy of the procedure can only be drawn from a RCT, which is currently under way.

ACKNOWLEDGMENTS

The authors wish to thank Dr. Lousberg, for conducting the statistical analysis.

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