

Effectiveness of Percutaneous Radiofrequency Cervical Zygapophysal Neurotomy in Improving Chronic Cervicogenic Headache

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ABSTRACT:

Background: A variety of modalities have been developed to relieve cervicogenic headache. From these, percutaneous radiofrequency neurotomy is the most commonly investigated treatment option in the literature and has been reported to give satisfactory results.

Objective: The present research evaluated radiofrequency neurotomy's effectiveness in relieving cervicogenic headaches, originating from the zygapophysial joint.

Subjects and Methods: The current investigation was carried out at the Neurosurgery Department of Hospital of University of Suez Canal, Egypt, Ismailia. Twenty-four patients with chronic headache meeting the diagnostic criteria of cervicogenic headache were enrolled and underwent radiofrequency neurotomy. Afterwards, their pain intensity was assessed by Visual Analogue Scale (VAS) at one month, one week, twelve months, and at six months and compared to their baseline scores.

Results: VAS scores improved by over 75% in 62.5% of patients 1 week following the treatment. This percentage increased to 87.5% after 1 month; however, it declined again to 70.8% in patients after 12 months. After the course of therapy, patients saw a sixty-five percent reduction in their weekly average analgesic administration and an average of 5.8 fewer headache days per week (down from 5.8 to 1.9). There were no significant post-procedural problems.

Conclusion: Reducing the need for analgesics and alleviating chronic cervicogenic headaches are two major benefits of radiofrequency neurotomy.

Keywords: Cervicogenic headache, Radiofrequency neurotomy, Visual analogue scale.

INTRODUCTION

Cervicogenic headache may arise not only from the upper, but also from the middle and even from the lower cervical area⁽¹⁾. A headache originating from the upper cervical spine is known as a cervicogenic headache. 4.1 percent of people have it, making it a rather common ailment⁽²⁾.

The atlanto-axial (A-A) joint is thought to be the second most frequent origin, whereas the C2-C3 zygapophysial joint (Z-joint) accounts for the bulk of cases⁽³⁾. The atlanto-occipital (A-O) joint, the C2-C3 intervertebral disk, and the C3-C4 Z-joint have been less frequently reported as sources for such a condition⁽⁴⁾.

A variety of modalities have been suggested to relieve cervicogenic headache; including physical therapy, medications, manipulation, acupuncture interventional procedures and injections, and surgery⁽⁵⁾. Radiofrequency ablation and pulsed radiofrequency carry fewer risks compared to other invasive techniques, and thus, are commonly used to manage the chronic cervicogenic headache⁽⁶⁾.

In fact, percutaneous radiofrequency neurotomy is the most commonly investigated treatment option in the literature. The goal of radiofrequency neurotomy is to destroy the afferent nerve supply to the suspected source of cervicogenic headache⁽⁴⁾. Percutaneous radiofrequency neurotomy (PRN) introduces probes through the skin and overlying soft tissues to generate friction, using thermal energy to ablate the medial branch nerves via a conducting element. PRN has been shown to be a valid treatment for zygapophysal pain⁽⁷⁾.

Several studies have supported its efficacy in improving pain in the cervical Z-joint, both acute and chronic, when instances are effectively checked and selected for such procedure^(5, 8).

The present research aimed at evaluating the effectiveness of alleviating cervicogenic headache arising from the zygapophysial joint through percutaneous radiofrequency neurotomy.

PATIENTS AND METHODS:

From May 2020 to October 2020, the research was carried out at the Neurosurgery Department of Hospital of Suez Canal University in Ismailia, Egypt. Twenty-four patients who presented to SCU neurosurgery outpatient clinic with chronic headache (>6 months of duration) fulfilling the requirements for cervicogenic headache diagnosis⁽¹⁾ were enrolled (**Table 1**). Meanwhile, Individuals requiring multiple cervical blocks were not accepted.

Table 1. Diagnostic criteria of cervicogenic headache (Modified diagnostic criteria⁽⁹⁾)

I. Unilateral headache without side shift.
II. signs and Symptoms of neck involvement:
1. Provocation of attacks:
a. Pain triggered by neck movement and/or sustained awkward head position.
b. Pain that is comparable to its character and distribution to pain that occurs spontaneously when external pressure is applied to the ipsilateral upper or posterior neck region, or the occipital region.
2. Ipsilateral neck, arm and shoulder pain of a rather vague, non-radicular nature
3. Decreased range of motion in the cervical spine.

Upon selection, patients were clinically examined to assess their pain and how far the cervical spine can move. The intensity of their pain was assessed using the Visual Analogue Scale. Both the number of headache days and analgesic medications utilized on each week were documented.

An X-ray of the cervical spine was taken to assess any unusual posture or deterioration of flexion-extension. In order to rule out any definite anatomical anomalies that might result in neurologic impairments, MRIs of the brain and cervical spine were performed. Percutaneous radiofrequency neurotomy was then carried out.

The SMK-C10 cannula (Twenty-two gauge; length, ten centimeters; exposed tip, five millimeters) was utilized with a radiofrequency generator (RFG-3C

Graphic, Radionics Inc., Burlington, MA, U.S.A.) with the proper connections and a large diathermy ground plate.

The individual being treated stayed prone for the procedure, which was carried out in an aseptic environment. Systemic analgesics or sedatives were not administered to the participants.

In order to attain the target position, the electrode was percutaneously placed posterolaterally, tangential to the lateral margin of the articular pillar, and parallel to the medial branch of the C three-C four facet joint. To keep an eye on the entire process, C-arm image intensifier screening was used. The goal's position was the intersection of two diagonal lines drawn from the infero-anterior and infero-posterior articular pillars to the supero-posterior and supero-anterior. Figure 1 illustrates the C3-C4 degrees of lesioning.



Figure 1. C3-C4 lesioning. The target point lies at the intersection of 2 diagonal lines drawn from supero-anterior and supero-posterior to infero-posterior and infero-anterior articular pillar.

The placement of the electrode was verified and noted on the lateral and antero-posterior films once it reaches the intended point. For the two, the motor and sensory thresholds (0.3-0.9 V and 0.6-1.8 V, respectively), a stimulating current was employed to guarantee that the electrode was positioned correctly.

Next, the target nerve received an injection of 0.5 milliliters of one percent lidocaine prior to lesion production and the lesioning was done at 80°C for 90 seconds. Following the procedure, patients were monitored for 1 to 2 hours before discharge to see whether there were any unpleasant consequences.

Patients were followed up to evaluate the effect of the procedure on their condition. Their pain intensity was assessed using the VAS at one week, one month, six months, and at twelve months, following the treatment. Additionally, every patient was requested to notice how many days they had headaches and how much analgesic they took every week. If over seventy-five percent of the preoperative discomfort was alleviated, the outcomes were considered effective.

Ethical Considerations:

The patients provided written informed permission to participate in the trial. Permission to conduct the study was received from the Neurosurgery Department at Suez Canal University Hospitals, in addition to clearance from the Research Ethics Committee of the Faculty of Medicine in Suez Canal University.

For the purpose of conducting research involving human subjects, this study has been carried out in conformity with the Declaration of Helsinki, which is the Code of Ethics of the World Medical Association.

Statistical analysis

Quantitative data were presented as means and qualitative data were presented as frequency and percentage.

RESULTS

More than half of our cases were males and their mean age was 56 years. The mean VAS score of the patients prior to the procedure was 7.1, which improved by over 75% in 62.5% of patients 1 week following the treatment.

This percentage increased to 87.5% after 1 month; however, it declined again to 70.8% of patients after 12 months. From 5.8 days to 1.9 days each week, the average number of headache days dropped and patients' average intake of analgesic per week was reduced by 65%. There have been no significant post-procedural problems (Table 2).

Table 2. Characteristics of study subjects

Characteristics	
Sex (Men:women)	13:11
Mean age (years)	56
Preoperative VAS	7.1
No. of patients showed pain relief by greater than 75%	
1 week	15 (62.5)
1 month	21 (87.5)
6 months	18 (79.17)
12 months	16 (70.83)
Average number of headache-day/week (mean)	
Preoperative	5.8
Postoperative	1.9
Reduction of analgesic intake/week	65%
VAS: Visual Analogue Scale	

Three individuals did, nevertheless, experience temporary alleviation (three months). Cutaneous numbness, dysesthesia, or increasing pain were not noticed by any of the instances. Seven of the instances, nevertheless reported discomfort in their posterior necks for two to seven days after the surgeries. All patients were informed of these potential adverse reactions prior to surgery and were advised to use short-term oral painkillers for the first two to five days following surgery. No special precautions were required. These symptoms; all subsided in an entire week. It's interesting to note that following the treatments, the majority of the patients had noticeable improvement by at least two to four weeks. No cases of after surgery infection or other procedure-related problems were observed.

DISCUSSION

The current study assessed the role of radiofrequency neurotomy in relieving cervicogenic headache. We found that radiofrequency neurotomy was very effective in improving chronic cervicogenic headache. In fact, the majority of the enrolled cases showed a significant improvement of their pain intensity after the procedure, by at least 75% reduction of their VAS scores. Moreover, the number of headache days and analgesics taken per week was effectively reduced. These findings are consistent with most of the published literature.

For example, van Suijlekom *et al.* ⁽¹⁰⁾ assessed the effectiveness of radiofrequency ablation of the cervical Z-joint in cases with cervicogenic headache. They evaluated the patients prior to the procedure, short term (eight weeks), intermediate term (nearly eight months), and long term (nearly seventeen months) of follow-up. They reported a reduction in mean VAS of 31.4 and 53.5 millimeters at long and short-term monitoring, correspondingly.

They also informed a significant reduction in the mean quantity of days with headaches and the number of analgesic pills taken. Similarly, in a retrospective investigation by Park *et al.* ⁽¹¹⁾, 11 cases who were

subjected to radiofrequency neurotomy of the C four-C seven (“lower”) cervical medical branches, reported a significant improvement of their condition at 6 months after the procedure.

If the thermal injury to the nerve was uncompleted, the afferent neuronal structures might regrow. In fact, it has been reported that the observed alleviation of suffering after the duration of radiofrequency neurotomy is restricted, despite meticulous choice of the patient and cautious application of appropriate methods⁽¹²⁾. This explains the decline we found in the percentage of improved patients after 6 months of the procedure. Meanwhile, and contrary to our findings, two previous studies reported that Radiofrequency neurotomy was not effective for cervicogenic headache patients^(12,13).

However, these studies had several limitations as described by **Govind et al.**⁽¹⁴⁾, they didn't establish the pain generator clearly. Second, they used a non-validated neurotomy technique. Third, several cervical segmental stages that were not linked to the genesis of cervicogenic headache were addressed by them. There were no significant difficulties resulting from the surgeries in terms of postoperative issues. Some patients did nevertheless report discomfort in their posterior neck for two to seven days after the treatments. Ataxia, numbness, itching, hypersensitivity, and paresthesias are examples of neuropathic adverse reactions that have been reported before⁽¹⁵⁾. In fact, twenty-nine percent of cases treatment with a cervical medial branch neurotomy from C three to C seven have been reported to have numbness in the cutaneous distribution of a targeted nerve. Nevertheless, it has been noted that these side effects are transient and don't require more care⁽⁴⁾.

We were just able to include a limited number of patients because the study was interventional in nature and was carried out in a single institution. Furthermore, we lacked a control group with which to assess the treatment's outcomes.

CONCLUSIONS

Radiofrequency neurotomy is highly effective in improving chronic cervicogenic headache and reducing the use of analgesics. Multi-centric large researches with an extended monitoring period are required to have a good understanding of the role of radiofrequency neurotomy.

DECLARATIONS

- **Consent for publication:** I verify that the submission of the work has received the prior approval of all authors.
- **Availability of data and material:** Available
- **Competing interests:** None
- **Funding:** No fund

- **Conflicts of interest:** No conflicts of interest.

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