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Wireless Peripheral Nerve Stimulation at C2 and C3 to Treat Persistent Daily Headaches and Occipital Neuralgia

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Background: Headache is a very challenging condition to treat. We are presenting a unique approach for treating headache and occipital neuralgia that involves placing a wireless peripheral nerve stimulation system at the C2 and C3 levels.

Case Report: A 39-year-old man with a history of headache and occipital neuralgia resistant to several treatment modalities was treated with occipital nerve stimulation at the levels of C2 and C3.

Conclusion: Peripheral nerve stimulation at the C2 and C3 levels is a unique approach for treating resistant headache and occipital neuralgia.

Key words: C2, C3, headache, occipital neuralgia, peripheral nerve stimulation

BACKGROUND

Occipital nerve stimulation has been used to treat occipital neuralgia and headache. The procedure was first described by Weiner et al (1) in 1999.

The efficacy of this procedure has been tested on different types of headache disorders previously found to be resistant to standard treatment modalities. In these patients, the use of occipital nerve stimulation has resulted in beneficial improvements in reported pain symptoms (2).

This case report will discuss a patient with persistent daily headaches found to be resistant to medication and interventional therapy that were effectively managed with the placement of a wireless peripheral nerve stimulator at the levels of the C2 and C3 medial branches (Fig. 1).

CASE

A 39-year-old man presented to the pain clinic with a past medical history significant for persistent daily headaches that failed to improve despite trials of several medication and interventional therapies. In an effort to alleviate painful symptomology, the patient had previously attempted pain psychology therapy as well as medication therapy including opioids, antidepressants, antiseizure medications, lidocaine infusion therapy, and several other agents for treating headache.

The patient described the headaches as predominately impacting the occipital region and upper neck. Following a thorough discussion of potential risks and benefits, medial branch blocks were performed at the C2 and C3 levels using bupivacaine 0.25%. This procedure resulted in significant improvements in headache symptomology for a period of a few hours. A confirmatory block was then performed with similar excellent clinical results. Radiofrequency ablation (RFA) was then performed and resulted in a 60% reduction in headache pain that persisted for approximately 9 months.

While the patient was satisfied with the results of the RFA, he ultimately requested a procedure that might provide more sustained relief from his headache pain.

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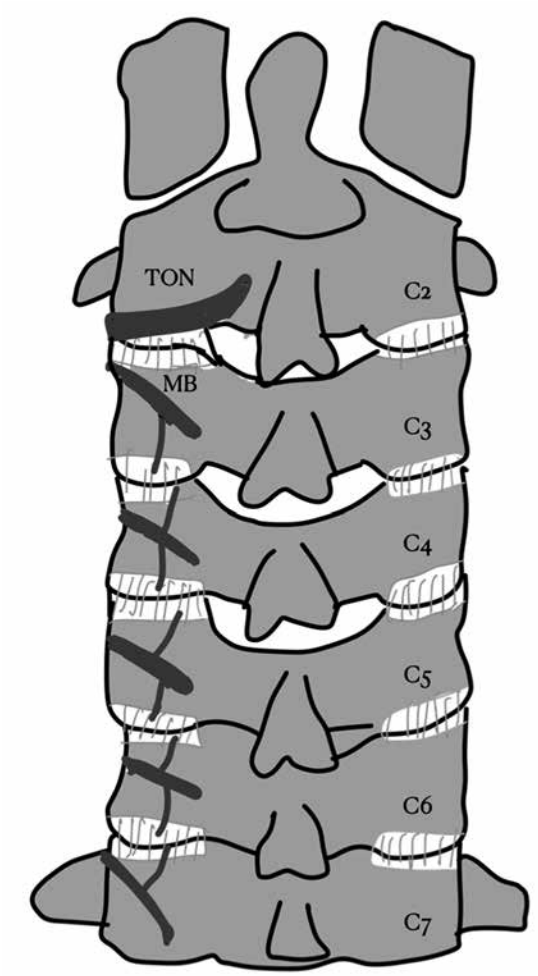

Fig. 1. Anatomy of cervical spine (MB, medial branch; TON, third occipital nerve)

Following a psychological evaluation and a thorough discussion of potential risks and benefits, the patient underwent a wireless peripheral nerve stimulator trial at the C2 and C3 levels to stimulate the occipital nerves. Following sterile preparation and drape, the trial was performed by positioning 2 Tuohy needles that were inserted from caudad to cephalad so that the tip of the needle was situated at the C2 level near the lateral border of the vertebral body at the medial branch area and close to the bone. Then, 2 Octad® leads were placed inside the needles until they were positioned adjacent to the C2 and C3 medial branches. Stimulation trials were performed during the procedure to validate stimulation at the occipital regions. The trial provided 70% to 80% relief of headache pain for one week (the duration of the trial). To facilitate permanent lead placement, 2 one-cm incisions were performed at the lower extent of the cervical spine; then a Tuohy needle was inserted through each incision and advanced to the C2 level close to the bone and the lateral border of the C2 vertebra, and then 2 leads with 4 contacts were placed through the needles to lie on the C2 and C3 vertebrae at the medial branch location (Figs. 2,3). Stimulation during the procedure was again performed and indicated desired stimulation in the occipital region. Both leads were then tunneled below the skin to a small pocket immediately superior to the right scapula. The ends of both leads were coiled and sutured down to the fascia.

Prior to discharge, the patient received education regarding his ability to control lead stimulation via an external antenna. The patient did well immediately post operation but did experience migration of the left lead which ultimately required revision.

At 15 months' follow-up, the patient continued to report a 70% improvement in headache pain with remarkable improvements noted in his physical activity and quality of life. The patient was able to return to work and perform activities he could not perform before. His wife mentioned at the follow-up visit that after this procedure "I have my husband back."

Unfortunately, the patient started to feel loss of efficacy after 2 years, potentially due to lead breakage, and the device had to be explanted; the patient's pain is back to baseline.

We are currently in the process of evaluating the patient for placement of a temporary peripheral nerve stimulation system as an option to provide some long-term pain relief.

DISCUSSION

Chronic headache is one of the top causes of disability worldwide and it affects about 3% to 5% of the world's population (3).

While headaches may be managed by several medication classes, they can be resistant to all noninterventional modalities and medications. Interventions can be an option for these patients. While nerve blocks can be effective, they are usually of limited duration and patients will typically require several injections every year. Occipital nerve stimulation can be an option for headaches in the occipital region that are found to be resistant to other treatment modalities. This technique is associated with historical data to support its administration and occipital nerve stimulation via implanted

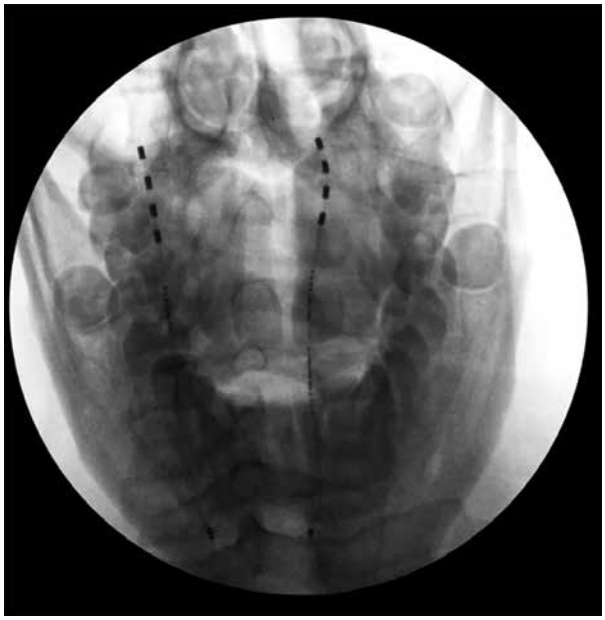

Fig. 2. Introducers to the C2 level

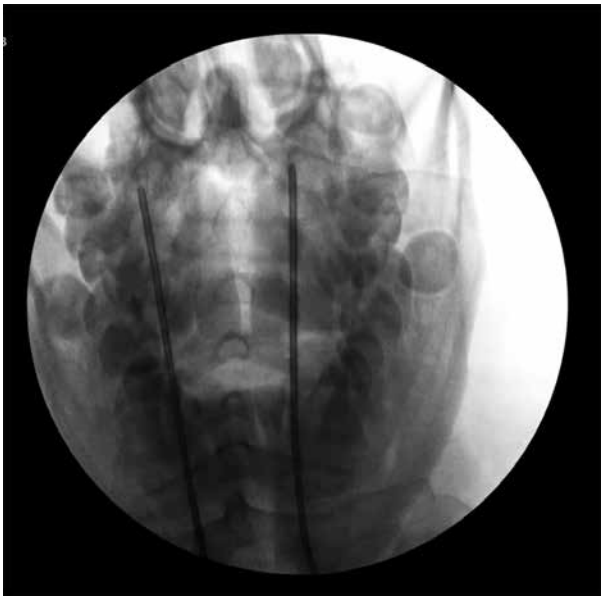

Fig. 3. Placing 2 leads at the C2 and C3 levels

leads has been previously reported to improve migraine headache pain (4).

This case is unique in that we treated a patient with persistent daily headache pain via stimulation of the occipital nerves at their origin in the C2 and C3 cervical spine. In addition, we used a wireless peripheral nerve stimulator and an external generator which negated the requirement for tunneling to a distant site for implanted battery placement. Using wireless neuromodulation systems reduces the incidence of potential complications associated with the placement of a battery including infection, pain at the battery site, and the need for future surgery to replace the battery (5). In addition, it is more cost-effective and provides a better cosmetic option for patients.

CONCLUSION

We present a case of persistent daily headache pain that was resistant to noninterventional modalities and responded to wireless peripheral nerve stimulation of the C2 and C3 medial branches.

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