

General

Case Report: Percutaneous Peripheral Nerve Stimulation for the Treatment of Occipital Neuralgia

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Headaches are among the most prevalent medical complaints globally. Occipital neuralgia is a chronic headache disorder characterized by unilateral or bilateral severe pain originating in the neck or skull base and radiating up along the occipital nerve distribution. Effective treatment options for occipital neuralgia can be challenging and some patients may prove to be refractory to conventional medical and interventional therapies. We present a case report on a patient with severe occipital neuralgia that was refractory to conventional therapies that responded to percutaneous peripheral nerve stimulation.

INTRODUCTION

Occipital neuralgia (ON) is a chronic headache disorder characterized by unilateral or bilateral paroxysmal pain originating in the neck or skull base and radiating up along the occipital nerve distribution.¹⁻³ The pain may last seconds to minutes and is described as an acute, sharp, and stabbing pain.^{1,2} These occipital nerves branch from the upper cervical spine and synapse in the trigeminocervical complex (TCC) onto second order neurons.¹ The convergence of these nociceptive afferent neurons in the trigeminal spinal nuclei may result in the fronto-orbital referred pain that is sometimes seen with ON.^{1,2,4} ON represents approximately 4% of all cranial neuralgias with a mean age of diagnosis at 54 years and a female predilection.³

With use dating back to 1967, neuromodulation with peripheral nerve stimulation (PNS) has increased in prominence as treatment for refractory pain conditions such as ON as technologies have continued to expand.^{4,5} PNS delivers electrical current directly to a peripheral nerve by placing an electrode array next to the target nerve.⁵ For ON, PNS involves electrical stimulation of the occipital nerve trunk through such implanted subcutaneous electrodes. A postulated mechanism of action of PNS is thought to be through excitation of inhibitory dorsal horn interneurons, thereby inhibiting pain signals from the spinal cord to higher centers in the central nervous system. In particular, the second order neurons within the TCC that the occipital nerves synapse with project to the thalamus, relaying sensory information to the cortex.⁶ By decreasing this afferent sensory input into the TCC, pain transmission is interrupted, resulting in pain relief for these patients.^{4,6} It is hypothesized that percutaneous PNS systems may activate a greater proportion of these inhibitory dorsal horn interneurons

without the unwanted activation of nociceptive afferents.⁷ PNS has also been found to reduce ectopic action potentials peripherally and downregulate neurotransmitters and pro-inflammatory molecules. Prostaglandins and endorphins that increase blood flow in chronic pain have also been shown to be decreased in the setting of PNS. The full mechanism of PNS is complicated and likely has yet to be fully understood.⁵ Here, we present a case of a patient with refractory ON with prior cervical surgery treated with PNS of the third occipital nerve under fluoroscopy.

CASE PRESENTATION

The patient was a 65-year-old woman with a prior surgical history of a posterior cervical decompression and fusion from C2-T2 who presents with severe right-sided suboccipital and occipital pain for roughly 6 months. She reported a pain score of 10/10 on the numerical rating scale with debilitating sharp pain in the distribution of the occipital nerves. Imaging results showed no new pathology or hardware complications. The patient tried and failed conservative therapy with ongoing physical therapy, massage, and rest. Pharmacotherapy was then trialed including acetaminophen, nonsteroidal anti-inflammatory drugs (NSAIDs), gabapentinoids, and opioid therapy, all without significant improvement. The patient also failed interventional therapies such as trigger point injections, cervical medial branch blocks, occipital nerve blocks, and a C1-2 facet joint injection with only minimal short-term improvement. The patient consented to proceed with a temporary percutaneous trial of PNS to treat her refractory pain complaints.

The patient was brought to the operating room and placed in the prone position. The cervical facet joints were

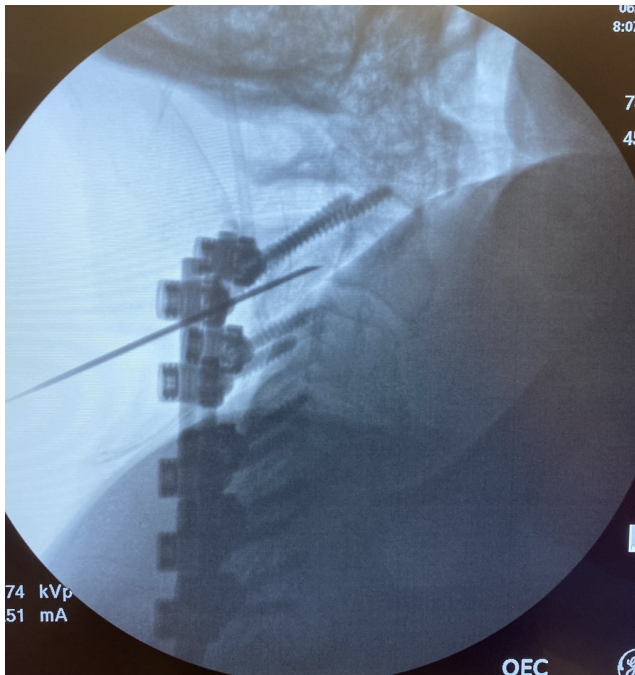


Figure 1. Fluoroscopic image in lateral view demonstrating the introducer needle placed superior to the C2/3 facet joint for PNS lead placement.

visualized under standard fluoroscopy. The introducer needle was advanced until it contacted the lateral border of the C2/3 facet joint. A lateral view was then obtained and the needle was positioned appropriately above the facet joint line (Figure 1). The needle and lead were repositioned until a satisfactory paresthesia was reported targeting the suboccipital and occipital region on the right side. The lead was left in place and secured by surgical glue and bandages.

At one week follow up, the patient was reporting 50% improvement pain in her overall pain. By three weeks, the patient had noted 70% improvement in pain and quality of life and reduced her reliance on opioid pain medications. The temporary PNS lead was removed after 60 days, however the patient still was achieving > 50% relief of her occipital pain complaints which was sustained.

DISCUSSION

ON presents a challenging condition that may be difficult to diagnose due to the varying etiologies and overlapping symptoms with other chronic pain conditions.⁸ Although commonly considered idiopathic, ON can be related to specific causes such as trauma, rheumatoid arthritis, and nerve entrapment.^{2,3} On physical examination, ON may present with a positive Tinel sign and tenderness to percussion or palpation along the occiput from mastoid to mastoid.^{1,3} A passive range of motion neck assessment may also yield similar pain or paresthesia.³ Involvement of the greater occipital nerve (GON) as opposed to the lesser occipital nerve (LON) in ON is estimated to be 9:1.² The GON arises from the medial branch of C2 dorsal ramus while the LON arises from ventral rami of C2 and C3 spinal nerves, innervating the posterior scalp and the ear/temple region, respec-

tively.^{1,3} The third occipital nerve (TON) is a superficial branch of C3 dorsal rami innervating the C2-3 facet joint and parasagittal region covering the upper neck and lower scalp.¹ Given the patient's history of a prior C2-T2 posterior cervical decompression with persistence of sharp pain in the distribution of the occipital nerves, we opted to target the third occipital nerve in her treatment.

Initial treatment of ON includes rest, warm/cold compresses, and massage therapy and pharmacotherapies such as NSAIDs, muscle relaxants, tricyclic anti-depressants, and neuropathic agents, though efficacy of such is varied.^{1,2,9} Interventional treatments are considered when conservative treatments fail.¹ Our patient trialed both conservative and pharmacotherapy treatment options with no improvement in symptoms. Occipital nerve stimulation has demonstrated sustained pain relief in patients, consistent with the improvement observed in this patient following PNS treatment.^{1,9-13}

With our patient's pain pattern and refractory nature of her condition following all conservative, pharmacological, and interventional therapies, we chose to proceed with a temporary percutaneous trial of PNS for her condition. The lead was positioned just superior to the C2-3 joint to allow for maximal stimulation of the occipital nerves branching from this location leading to significant improvement in her pain and functionality that remained even after lead removal. Post-operatively, our patient reported a 50% improvement at one week and 70% improvement at three weeks with an overall reduction in opioid pain medication use. After removal of the leads, she reported a sustained improvement of > 50%.

Given the increasing technologies that have become available with percutaneous PNS, this neuromodulation technique has increased in prominence as treatment for refractory pain conditions such as ON.^{14,15} Our case is of interest as we successfully targeted the TON under fluoroscopy in a patient with extensive surgical changes as well as provided ongoing relief even after lead removal.

CONCLUSION

ON is a challenging, debilitating condition and can become refractory to conservative management. PNS may be an effective and safe treatment for patients with refractory occipital neuralgia. This case report highlights significant pain relief and enhanced quality of life in a patient unresponsive to conventional treatments. The minimally invasive nature of percutaneous PNS coupled with its reversibility makes it an attractive option for managing this condition.

DISCLOSURES

JH is a consultant for SPR Therapeutics and Nevro. VO is a consultant for Medtronic

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