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Peripheral Nerve Stimulation of the Occipital Nerve to Treat Postherpetic Neuralgia

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Background: Herpes zoster infection and subsequent postherpetic neuralgia can cause chronic neuropathic pain. Patients who do not respond well to pharmacotherapy require therapeutic options that are typically more invasive; our goal was to minimize invasiveness.

Case Presentation: We present a case of intractable postherpetic neuralgia refractory to conservative pharmacological treatment and multiple occipital nerve blocks, which was successfully treated using peripheral occipital nerve stimulation (ONS) with an external implantable pulse generator (IPG).

Conclusion: For interventionalists, one of the technical difficulties during ONS placement involves tunneling leads through the high-risk and difficult anatomy of the posterior neck. Further complicating placement and increasing patient discomfort are the long leads required for internal IPG implantation. The most commonly cited complication is lead migration or lead breakage. This difficulty can be attenuated by using an external IPG, such as was used in this case. An external IPG makes the ONS procedure significantly less invasive and reduces trauma and discomfort for the patient.

Key words: Peripheral nerve stimulation (PNS), occipital nerve, postherpetic neuralgia (PHN), occipital nerve stimulation (ONS), implantable pulse generator (IPG), external IPG

BACKGROUND

Herpes zoster infection and subsequent postherpetic neuralgia (PHN) can cause chronic neuropathic pain. Following an acute infection of varicella, the herpes zoster virus (HZV) remains dormant for many years while it is harbored in the geniculate, trigeminal, or dorsal root ganglia. With advancing age or immunocompromised states, the HZV reactivates and erupts with painful vesicles in a dermatomal distribution to cause shingles. The reemergence of HZV induces inflammation of sensory ganglia and peripheral nerves, resulting in abnormal sensitization of nociceptors and central hyperexcitability (1). The resulting pain is intense and may be described as stabbing, burning, or gnawing. PHN is neuropathic

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pain that recurs or persists even after the shingles rash subsides. Risk factors for development of PHN include old age, severity of shingles eruption, intensity of acute pain during eruption, and prodrome of dermatome pain before onset of eruptions (2). PHN occurs in about 40% of HZV patients who are older than 50 years and about 75% of those over 75 (3). In this case, the patient's PHN presented as occipital neuralgia. Typically, the pain of occipital neuralgia begins at the base of the head and spreads upward within the distribution of the greater and lesser occipital nerves.

The initial treatment for postherpetic neuralgia is pharmacologic and is focused on symptom relief (4). PHN therapy may include the use of analgesics, anesthetics, corticosteroids, tricyclic antidepressants, anticonvulsants, and antiviral agents. However, the benefit of pharmacological treatment may be limited by risks of polypharmacy and side effects. Most of the drugs used to treat PHN act on the central nervous system, which can lead to side effects such as lethargy, dizziness, and nausea. A study found that fewer than half of patients with PHN treated with pharmacotherapy experience pain reduction greater than 50% (5). Patients who do not respond well to pharmacotherapy require more invasive therapeutic options.

Secondary treatment options for occipital neuralgia include thermal and pulsed radiofrequency ablation (RFA), which yield promising results (6-8). RFA is a minimally invasive method that involves the use of thermal lesioning of the nerve to destroy peripheral sensory nerve endings, resulting in the alleviation of pain. Pulsed radiofrequency is delivered in short bursts, followed by a phase in which no current is applied, which allows for higher voltages while keeping the average temperature below the neurodestructive range so the risk of destroying nearby tissue is reduced. Additionally, there have been cases of occipital neuralgia successfully treated with cooled RFA (9). Thermal RFA can render long-term analgesia but also comes with the potential risks of hypesthesia, dysesthesia, anesthesia dolorosa, and painful neuroma formation (10). Anesthesia dolorosa describes a condition wherein the sense of touch is diminished or eliminated while a sensation of pain remains, resulting in painful numbness. Due to our patient's shingles-related nerve injury, there was concern for anesthesia dolorosa post thermal RFA, so thermal RFA was not considered the best option for this patient. Despite promising results, there isn't conclusive evidence yet in support of either pulsed RFA or thermal RFA as an interventional treatment option for occipital neuralgia. Therefore, RFA was not considered the best option for this patient.

For our patient's postherpetic occipital neuralgia, secondary therapeutic interventions included occipital nerve blockade and occipital nerve stimulation (ONS). A local occipital nerve block has the potential of being both diagnostic and therapeutic (11). Occipital nerve block can be repeated if pain persists. The next treatment option after multiple failed nerve blocks is peripheral nerve stimulation (PNS). ONS involves the placement of peripheral nerve-stimulating electrodes over the occipital nerves to produce paresthesia along the territory innervated by those nerves, which is an off-label use of the PNS device. ONS provides a promising therapy for occipital neuralgia refractory to conservative management (12,13). Prior to implantation of the permanent PNS system, a trial is performed in which leads are placed under the skin and are connected to an external battery. A permanent device is implanted only if the patient reports significant improvements in pain and quality of life after the trial. If the prerequisite dermatomal paresthesia is achieved, then pain relief for occipital neuralgia as a result of permanent implantation of PNS has been reported to be as high as 80% (14). Placement of ONS with ultrasound guidance, which allows real-time imaging of both the needle and surrounding tissue, improves precision and safety (15). This may enable the proceduralist to avoid unnecessary trauma. Another consideration for reducing trauma is to use an external implantable pulse generator (IPG), which makes the ONS procedure significantly less invasive by avoiding the need for tunneling for IPG implantation. This unique approach was used for our patient, and the evidence continues to grow for using PNS without an implanted IPG for occipital neuralgia (16,17).

We present a case of intractable PHN refractory to conservative pharmacological treatment and multiple occipital nerve blocks, which was successfully treated using peripheral ONS with an external IPG.

CASE PRESENTATION

An 80-year-old man with a past medical history of atrial fibrillation on warfarin presented to the interventional pain clinic with a chief complaint of burning, sharp, shooting, and throbbing pain located on the left side of his head and radiating to the left side of his face, consistent with PHN. His symptoms interfered

with his daily activities, his ability to exercise, and sleep. The pain started 2 months prior following a shingles outbreak and had been worsening since onset. At this time, the patient was taking 300 mg of gabapentin 3 times daily and hydrocodone-acetaminophen 10-325 mg without relief. Following evaluation, the patient was prescribed a 5% lidocaine topical cream and scheduled for a left occipital nerve block with 0.25% bupivacaine and triamcinolone.

At an appointment following the occipital nerve block, the patient reported complete relief in his PHN pain; however, his relief was only temporary, lasting approximately 2 days. He was then instructed to discontinue his gabapentin and was prescribed 30 mg of duloxetine daily to be taken in conjunction with the topical lidocaine cream. Approximately 6 weeks later, the patient presented for follow-up stating he did not tolerate taking the duloxetine and had restarted his gabapentin. He was instructed to gradually increase his gabapentin dose to 600 mg, 3 times daily. He was seen in the clinic approximately 3 months later with no improvement in his pain. At this time, he was scheduled for a repeat left occipital nerve block with bupivacaine and dexamethasone and prescribed a compounded topical cream containing diclofenac 2.5%, gabapentin 2.5%, lidocaine 2.25%, and prilocaine 2.25%. Following the repeat left occipital nerve block, the patient reported 2 days of complete pain relief followed by return of his symptoms with only mild improvement attributed to gabapentin. After a discussion with the patient and his wife, it was determined that he would likely benefit from PNS of the left occipital nerve. Occipital nerve RFA was not considered in this patient due to the potential increased risk of anesthesia dolorosa with this procedure. The patient was amenable to moving forward with the PNS trial and appropriate plans were made to hold his anticoagulation perioperatively.

The patient provided informed consent for implantation of the PNS with an external pulse generator. The patient received 1 g of cefazolin 30 minutes prior to incision. Sedation was achieved with administration of 2 mg of midazolam and 50 mcg of fentanyl. The patient was placed in the prone position, and the occipital area and posterior neck area were prepped first with chlorhexidine and then draped in the usual sterile fashion. Ultrasound guidance was used to place the lead with direct observation as a conduction medium.

At first, the left occipital nerve was visualized with ultrasound guidance. The superficial tissue was then anesthetized with 1% lidocaine and deeper to approximately a 1-cm depth with 0.5% bupivacaine, approximately 2 mL of each.

An approximately 1-cm incision was made through the anesthetized tissue using a 15-blade scalpel. Through this incision, a guidewire and a testing wire were placed with direct visualization of the occipital artery right next to the occipital nerve. At this point, local stimulation was confirmed with extremely low submilliampere amplitude. Finding this to be in perfect location and seeing twitch with 0.2 milliampere, the Jamshidi sheath (Becton, Dickinson and Company, Franklin Lakes, NJ) was deployed and dissection down to the left occipital nerve was initiated. At this point, the Bioness StimRouter (Bioness, Inc, Valencia, Santa Clarita, CA) lead and the implantable pulse generator-pickup were then deployed into the left occipital nerve. An extremely low 0.1-0.2 milliamp twitch was reconfirmed in this position. A distal, more caudad location was selected and the lead was tunneled underneath the skin directly and implanted. Pulling the passing needle out, all leads were found to be subcutaneous, and local twitch was reconfirmed. Closure was achieved with deep interrupted horizontal mattress of 4-0 Vicryl (Ethicon, Inc, Bridgewater, New Jersey) to approximate the deep tissues and superficial tissues. The skin was then sealed in approximation with occlusive dressing. The patient was discharged to the recovery area in unchanged neurologic condition. He was seen one week later for placement of the external communicating generator, which was uncomplicated.

At a follow-up appointment 6 weeks after his PNS placement, the patient reported near-complete resolution (approximately 80% pain relief) of his PHN pain, rating his pain 2 out of 10, down from 10 out of 10 at initial presentation. The patient also noted an improvement in his ability to perform his daily activities and cited he was able to start exercising again.

DISCUSSION

ONS exists as a minimally invasive and reversible intervention for occipital neuralgia as well as chronic daily headaches intractable to conservative medical management. ONS is indicated in patients with refractory chronic headache or occipital neuralgia that may occur as PHN. Efficacy has been demonstrated in randomized control studies for migraine-related pain, while benefit in PHN and other forms of chronic daily headache continue to be found (18). An evidence-based guideline generated by a systematic literature review

in the journal Neurosurgery recommends ONS in the treatment of refractory occipital neuralgia (19). Candidate patients are those who have failed medication management as well as possibly botox therapy.

A recent metanalysis has been conducted aiming to identify optimal treatment pathways in the utilization of ONS (20). Findings indicate that proper diagnosis is critical to successful trial and treatment. It is recommended that 3 different specialists identify a patient as a potential candidate for ONS: headache specialist, psychologist, and pain management physician. Practitioners should be aware that the neuromodulatory activity of ONS can take longer than 2 weeks to take effect. Patients reporting improvement shortly after implantation may be demonstrating placebo effects. It should again be noted that ONS implantation is entirely reversible. The most commonly cited complication is lead migration or lead breakage. This is likely due to the highly mobile cervical anatomy. Various studies have been performed regarding ONS lead migration and have found incidences ranging from 24% to 60% (21). It should be noted that the self-anchoring tined leads may decrease the incidence of lead migration substantially.

CONCLUSION

For interventionalists, one of the technical difficulties during PNS placement involves tunneling leads through the high-risk and difficult anatomy of the posterior neck. Further complicating placement and increasing patient discomfort are the long leads required for internal IPG implantation. This difficulty can be attenuated by using an external IPG, such as was used in this case, removing the need for tunneling and implantation. PHN occurs more commonly in the distribution of the trigeminal nerve than the occipital nerve, which accounts for the lack of prospective studies in this patient population. However, the evidence of benefit from ONS in occipital neuralgia is strong and should be discussed with PHN patients as a potential therapy.

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