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CASE REPORT

A Case of Pulsed Radiofrequency Lesioning for Occipital Neuralgia

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ABSTRACT

Objective. This report describes a case where pulsed radiofrequency lesioning (RFL) of the greater occipital nerve (GON) offered a valuable and safe treatment for the management of greater occipital neuralgia. The case is considered in relation to a review of the medical literature on greater occipital neuralgia and RFL interventions.

Case Report. A 62-year-old man with a 43-year history of left suboccipital pain underwent pulsed RFL of the left GON (20-millisecond bursts at intervals of 0.5 second for 4 minutes at 42°C) after failing to achieve substantial analgesia with naproxen, a transcutaneous electrical nerve stimulator (TENS) unit and a greater occipital nerve blockade (GONB) utilizing local anesthetic and steroid. After obtaining 4 months of 70% pain relief, pulsed RFL was repeated and resulted in an additional 5 months of 70% pain relief.

Conclusions. Pulsed RFL of the GON is an alternative to continuous RFL with the proposed advantage of mitigating pain, as in continuous RFL, but without the potential risk of causing deafferentation pain. While placebo and other nonspecific analgesic effects cannot be ruled out, the apparent safety profile and potential efficacy of pulsed RFL suggests it may be a compelling option to consider before irreversible neuroablative therapies are applied.

Key Words. Greater Occipital Neuralgia; Greater Occipital Nerve Block; Pulsed Radiofrequency; Occipital Headache

Introduction

Greater occipital neuralgia is a common presenting condition in contemporary pain management practice. Greater occipital nerve blockade (GONB) has been safely and successfully performed for many years to manage pain in the occipital region. GONB with local anesthetic is typically used for diagnostic purposes, although steroid can also be added for potentially therapeutic purposes. Although continuous radiofrequency lesioning (RFL) (at 90°C for 90–120 seconds) of the GON has been described, thermomodulation with pulsed RFL at 42°C has not [1]. In this report, we describe the first published case where pulsed RFL of the GON resulted in prolonged pain relief. Finally, we also review the key features of greater occipital neuralgia and common difficulties experienced with GONB.

Radiofrequency lesioning was first introduced the RFL in 1974 [2] and since that time continuous RFL has been used to ablate various neural structures, e.g., the medial branch nerves in facet joint pain and the dorsal root ganglion in certain types of cancer pain. In general, the advantage of continuous RFL includes the ability to stimulate

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neural elements before lesioning, thereby offering precise targeting with avoidance of ablating the wrong nerves and providing long-lasting analgesia.

Pulsed RFL is a newer alternative to continuous RFL with the proposed advantage of avoiding the complication of deafferentation pain that sometimes can be seen after neural ablation [3]. While its mechanism of analgesia has not been precisely defined, pulsed RFL involves exposing the targeted neural structure to a train of short-duration, high-voltage radiofrequency (RF) pulses (500 kHz) rather than ablation by a continuous RF current. With pulsed RFL, the recommended maximal electrode temperature (<45°C) is below neurodestructive levels and is applied for 2–4 minutes at a voltage over 60 V. It is recommended that RF pulses be applied in 20-millisecond bursts at intervals of 0.5 seconds for 120 seconds [4]. Used at 42°C for three applications of 120 seconds each on medial branches of the C1 and C2 dorsal rami, less neuritis like reaction was reported compared with the continuous RF technique [5]. While the long-term efficacy and safety of pulsed RFL has not been completely established, a recent case series reported encouraging results using pulsed RFL in patients with neuropathic pain syndromes [6].

Case Report

We evaluated a 62-year-old man with a 43-year history of left suboccipital pain that resulted from a head injury while practicing gymnastics. He reported immediate onset of left-sided neck pain which gradually spread to the left suboccipital region over the next few weeks. At his initial visit to our Pain clinic and using the verbal analog scale of 0–10, he rated his pain as an 8/10, with 0 representing "no pain" and 10 representing "the most severe pain imaginable." The aggravating factors for the pain included activity, lying down, exercising, and walking. Although the pain occurred episodically several times per year, once aggravated, it often persisted for months at a time. His past medical history included hypertension and asthma. His medications included lisinopril and naproxen. Aside from naproxen 500 mg Q12 hours, his analgesic regimen consisting of a transcutaneous electrical nerve stimulation (TENS) unit and ice packs provided modest pain relief.

With the exception of exacerbation of neck pain upon cervical extension and myofascial tenderness over the left trapezius and region midway between the mastoid process and inion process along the skull. He also had tenderness at the suboccipital notch with radiation to the occipito-temporal region. The remainder of his neuromuscular examination was normal. A recent magnetic resonance imaging of the cervical spine demonstrated multilevel spondylosis and degenerative disk disease. A mild left paracentral disk bulge was noted at C4-5, C5-6, and C6-7 with bilateral neural foramina narrowing at C5-6 and C6-7.

Several weeks following his initial evaluation, he underwent a left GONB using 4.5 mL of 0.25% bupivacaine and 20 mg of triamcinolone which provided 95% pain relief for 3 days. Subsequently, he underwent a second left GONB with 3 mL of 0.25% bupivacaine and 40 mg of triamcinolone. With this he reported 95% pain relief for 9 days. Sixteen days later, the patient returned for pulsed RFL of the left GON. With an impedence of 470 Ω, the patient perceived the sensory stimulation at 0.6 V. Pulsed RFL was then performed at 42°C for 4 minutes. At his follow-up visit, the patient reported 60–70% pain relief that lasted for 4 months and elected to have the pulsed RFL repeated. The second pulsed RFL reproduced the same level of analgesia as the first, but for a slightly longer duration of 5 months.

Discussion

Occipital neuralgia is characterized by a paroxysmal jabbing pain in the distribution of the greater or lesser occipital nerve, often accompanied by diminished sensation or dysaesthesia in the affected area [7,8]. The exact diagnosis of pure occipital neuralgia is difficult and may be easily mistaken for other diagnoses, such as atlanto-axial or upper zygopophyseal joints pathology, cervical trigger points or C2 radiculopathy.

A variety of headache syndromes successfully treated with GONB have been described since the early 20th century. In 1912, Osler described occipital neurectomy with application of a local anesthetic and long-acting steroid for resistant cases of cervical occipital neuralgia [9]. Since then, several techniques and medications have been proposed for its treatment. A number of investigators have proposed possible mechanisms to explain the role of GONB in the treatment of occipital neuralgia [9]. Vincent et al. proposed that GONB may reduce the pool of exaggerated sensory input and antagonize a putative "wind-up-like effect" [10]. With injections performed using 1–2 mL of 0.5%

Table 1 Diagnostic criteria [7]

A. Migraine with GON irritation (MON)
1. History of established migraine
2. Recent increase in frequency/severity of headaches with occipital radiation/origin of pain
3. Headaches always or almost always on the same side of the head
4. Tenderness/reduced pain threshold of CON on the affected side
5. Absence of sensory changes in the area of distribution of the GON on the affected side
B. Occipital Neuralgia (ON)
6. Unilateral occipital headache, continuous or paroxysmal (neuralgic), always on the same side
7. Circumscribed tenderness over the GON as it crosses the superior nuchal line
8. Hypo- or hyperalgesia or dysaesthesia in the area of distribution of GON
9. Relief of acute attacks by infiltration of the GON with the local anesthetic

GON = greater occipital nerve.

bupivacaine without steroid, Vincent et al. described the "tilde pattern" whereby the pain relief is less marked for the first 2 days following the injection but lasting for 7 days thereafter [10].

Anthony described long-lasting pain relief with Depo-Medrol injection in a cluster of patients with occipital neuralgia [7]. He categorized the patients with idiopathic headaches into four groups: migraine, migraine with GON irritation, occipital neuralgia, and tension headache. He excluded all patients with headaches due to traumatic onset. His strict diagnostic criteria for differentiating migraine with GON irritation versus occipital neuralgia (see Table 1) along with precise localization of the GON using a nerve stimulator were probably key factors contributing to his successful outcomes.

The GON is primarily composed of C2 and C3 nerve fibers, although some contribution from C1 may occur. Becser et al. detailed the clinical significance of anatomic and interindividual variations of the GON [9,11]. They found the GON emerges from the nuchal muscles to the subcutis of the scalp anywhere from 5 mm to 18 mm below the intermastoid line [9,11], thus making localization of the nerve challenging. Furthermore, the GON frequently forms a rich neural network around the tortuous occipital artery making it difficult to approach directly. Several techniques have been described for localization of the GON [8]. As noted above, Anthony [7] favored approaching the nerve with a nerve stimulator, whereas Okuda et al. [2] have proposed guidance using ultrasound Doppler flowmeter.

Several theories have been proposed to explain why pulsed RFL is effective. Pulsing may cause selective C-fiber denervation, thereby decreasing the risk of residual sensory and motor deficit [3]. Alternatively, pulsed RFL may evoke neuroplastic changes in the central pain pathway that ultimately alter the processing of afferent pain signals. Evidence for this is demonstrated by the induction of c-Fos expression in laminae I and II of the dorsal horn with pulsed RFL but not with continuous RFL [3].

We believe our case represents the first published report describing the successful treatment of greater occipital neuralgia using pulsed RFL and adds to a growing descriptive literature suggesting this technique may represent an alternative treatment for the management of occipital neuralgia. While placebo and other nonspecific analgesic effects cannot be ruled out, the apparent safety profile and potential long-term efficacy of pulsed RFL makes it a compelling option to consider before irreversible neuroablative therapies are applied. Nonetheless, pulsed RFL will require further scientific review with randomized, controlled trials before it gains widespread acceptance.

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