Perineuromal Stimulation in the Treatment of Occipital Neuralgia: a Case Study

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■ **ABSTRACT**

This case study is presented to exemplify the application of a perineuromal approach in the treatment of recalcitrant occipital neuralgia. The patient was a 49-year-old female with severe and disabling occipital neuralgia. The pain persisted despite several surgical procedures, injections in the affected area, and medications. Threading the electrode into the cervical epidural space and attempts at peripheral stimulation using the Weiner and Reed approach were unsuccessful. Immediate benefit was derived when the electrode was advanced subcutaneously and positioned underneath the neuroma apparently created by a C2 nerve transection. A Medtronic Octad (model #3898) was utilized. The patient was contacted at seven and nine months post implantation. She reported 90% improvement in her pain. The improvements were also noted in numerical pain ratings, Beck Depression Inventory, and Oswestry Disability Scale. These improvements were corroborated by her husband. The Minnesota Multiphasic Personality Inventory (MMPI) remained relatively unchanged. This case illustrates the possible utilization of perineuromal stimulation in the treatment of occipital neuralgia. The specific mechanism of action remains unclear. Replication and controlled studies are required to determine the general applicability of this approach. ■

KEY WORDS: functional and psychological outcomes, neurostimulation, occipital neuralgia.

Occipital neuralgia, while not a common malady, can be devastating in its consequences when present. Occipital neuralgia is defined as paroxysms of pain following the distribution of the greater and/or lesser occipital nerves(1,2). Suspected causes include trauma to the occipital nerve, neuroma, cervical nerve root compression, and closed head injury. However, many patients have no identifiable lesion and the etiology often remains unclear.

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Management approaches include the use of various pharmacologic agents such as opioids, antidepressants, anti-inflammatory agents, and anticonvulsants. Local anesthetic blocks have been of some benefit. Surgical options have included decompression, ganglionectomy, and rhizotomy(3,4). More recently, Weiner and Reed(5) have explored the use of neurostimulation.

The present case study provides another example of the application of neurostimulation in the treatment of recalcitrant occipital neuralgia. In this instance, however, a perineuromal approach was required. The case study also expands on previous information by including more detailed pre- and post-assessment of pain and psychological status.

MATERIALS AND METHODS

Patient

The patient was a 49-year-old female referred because of continued complaints of intractable pain to the left occipital area. She was high school educated and functioned as a substitute teacher. The clinical interview revealed a stable family situation and supportive husband. Medical and psychosocial situations were uncomplicated. She was previously diagnosed with mitral valve prolapse but required no prophylactic medicine and her day-to-day activity was unencumbered by this. Her surgical history included a cholecystectomy in 1979 and partial hysterectomy in 1998. She was a nonsmoker, and denied any significant drug/alcohol history or excessive intake of caffeine.

The patient was in her usual state of uncomplicated and good health until 1992 when she developed head pain of unknown etiology. The pain was limited to the left occipital region. Initially, the pain was at a low level with intermittent episodes of severe pain but eventually became chronic and persistent. On one occasion she kept a diary but abandoned this effort after reaching some 50 "sharp/stabbing" episodes of pain in less than a day. She described the pain as though it were like "having labor contractions in your head." Additional descriptors used by the patient included stabbing, shooting, sore, sharp, deep, burning, gnawing, severe, occasionally unbearable. Exacerbating conditions included activity, massage, pressure, movement, lying down, sexual activity, and standing. There was no identifiable diurnal pattern. She denied any photophobia or phonophobia. Nothing could be identified that reliably suppressed the pain. Her sleep was restless and she was awakened two to four times a night by severe pain. Her pain ratings ranged from 9-10/10 (0 = no pain, 10 = intolerable pain).

Previously tried medications included gabapentin up to 4800 mg per day, dihydroergotamine (DAG), ratidine, clonazepam 2–3 mg per day, paroxetine, citalopram, buspirone, and divalproex sodium. Over-the-counter and prescription analgesics were of little value. At various times she had been treated by her regular physician, a pain-oriented anesthesiologist, a neurologist and a neurosurgeon.

Her previous treatments included left occipital nerve blocks with brief benefit; cryo-ablation of the greater and lesser occipital nerves with brief improvement followed by exacerbation of pain; intravenous lidocaine without benefit; left occipital neurectomy with some relief for 2–3 months; left occipital ganglionectomy resulting in hyperpathia and allodynia; subsequent exploration and transection of the greater occipital nerve resulting in no sustained benefit and somewhat worsening of symptoms.

When seen, the patient was diagnosed with left occipital neuralgia, deafferentation pain, post surgery dysesthesia, and depression. Her baseline pain rating was 9/10 and there were no periods of being pain free. Medications were ineffective. Her daily routine was disrupted and she was unable to engage in customary day-to-day activities, including interactions with her grandchildren. Her work as a substitute teacher was compromised.

Procedure

The patient underwent psychological screening, including a clinical interview, Minnesota Multiphasic Personality Inventory (MMPI), Beck Depression Inventory (BDI), and Oswestry Disability Scale. She had a spinal cord stimulation trial. Initially, an attempt was made to thread the catheter up the cervical epidural space to gain appropriate paresthesias. Attempts to do so were hampered by the presence of scar tissue and the approach was abandoned. Subsequently, she underwent a trial of peripheral nerve stimulation using a Medtronic 15 gauge epidural needle (Medtronic, Inc., Minneapolis, MN) which was advanced from the right to the left according to the procedure described by Weiner and Reed(5) in an effort to gain occipital nerve stimulation. The patient did not report concordant paresthesias, perhaps because of deafferentation created by previous surgery, nor did she report pain relief. At the behest of the patient a third trial was undertaken in which the electrode (Medtronic Octad: model #3898) was advanced subcutaneously and angled in such a fashion so as to lie underneath the surgical incision. (Fig. 1) When activated, the patient reported immediate pain relief of greater than 70% which persisted throughout the nearly two-week trial period despite the absence of completely concordant paresthesia in the zone of pain. There was a further waiting period of two weeks pending insurance approval prior to complete implantation. The "permanent" system (Matrix Receiver model 327 L, Medtronic; Matrix Transmitter, model #3210, Medtronic) was implanted with the power generator

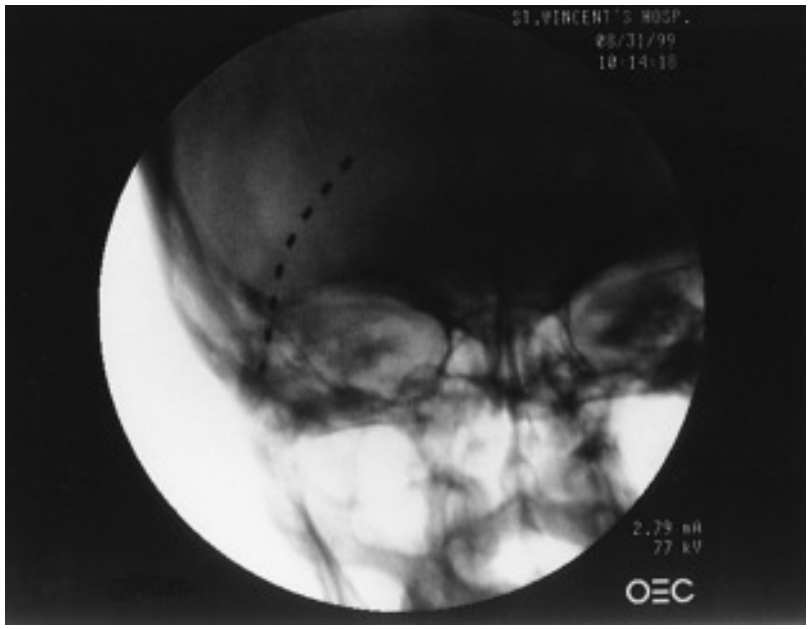

Fig. 1. Electrodes of the Medtronic Octad Plus (Minneapolis, MN). The electrode is positioned underneath the neuroma created by previous surgery involving transection of the greater occipital nerve. Contacts along the electrode lead are clearly visible.

located in the left flank. The power requirements included a pulse width of 240 and at 12 V necessitating a radio frequency system.

RESULTS

The patient was contacted approximately six months after implantation and seen nine months after implantation. She reported 90% relief of her pain with a numerical pain rating of 0-1/10, 90% of the time. She utilizes the stimulator during the day but turned it off most of the night. She could detect when her battery was wearing out because she had a warm feeling in her neck and some return of pain. She used two 9-volt batteries per day because of the voltage requirement. She occasionally had pain at a level of 9/10, but this was very rare and she could not identify any stimulating factors. She no longer took any type of regular medication for her pain but continued on an antidepressant and vitamin. Since her implant, she reported her mood was substantially better and she had returned to church activities. Her overall activity had increased by 90% and she was able to play with her grandchildren. Other than the wearing of the external device and the use of batteries throughout the day, she did not identify any "down side" to the procedure.

When contacted, her husband reported that she was at least 80–90% improved. Prior to implantation she had engaged in many types of activity avoidance for fear of increased pain. However, her spouse noted that since implantation they were able to do many things as a couple that they had done prior to the onset of her pain problem. She continues to avoid areas of cigarette smoke. She was able to return to working up to seven hours a day. Her husband was particularly thankful that she was no longer taking medications that appeared to produce a state of lethargy, weight gain, and constipation.

Her Beck Depression Inventory decreased from 29 to 2. Her Oswestry Disability scale was 46% pre implant, indicating a moderate level of perceived disability secondary to pain and was 0% at follow-up. On the McGill Pain Questionnaire the patient's weighted scores pre implant were sensory = 12, affective = 0, evaluative = 5, miscellaneous = 4, with a present pain intensity (PPI) 4.5/5. Post implant weighted sensory score = 4, affective = 0, evaluative = 0, miscellaneous = 1 with PPI = 1/5. Total number of words chosen pre implant = nine, post implant follow-up = two. The pre and post implant MMPI profiles are indicated in Fig. 2. The architecture is very similar. In each case, scale three (the hysteria scale) is the most elevated of the scales.

DISCUSSION

This case expands on the existing literature regarding the use of peripheral electrical stimulation in the treatment of occipital neuralgia. It also describes

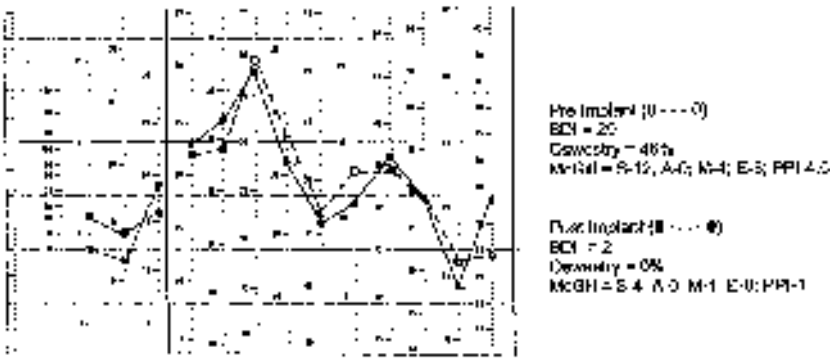

Fig. 2. Pre-implant (solid line) and follow-up (dashed line) MMPI profiles. Beck Depression Inventory (BDI) and Oswestry Disability Scale score (0) note. Sensory (S), Affective (A), Miscellaneous (M), Evaluative (E), and Present Pain Intensity (PPI) subscales on the McGill Pain Questionnaire.

a variant of the procedure described by Weiner and Reed(5). Furthermore, it reinforces previous findings indicating the potential benefit of the electrical stimulation therapy in the setting of deafferentation pain(6,7). In such instances pain relief has been observed in the absence of concordant paresthesia in the zone of pain. The mechanism in action of such circumstances remains unclear and may involve some combination of those generally proposed(8). It is, however, highly unlikely that the results can be explained by stimulating surrounding musculature. Muscle contraction and therefore increased pain would likely have been observed because of the intensity of stimulation required.

The power requirements in this case are somewhat higher than those noted by other authors. This may be explained by the extent of the trauma to the nerve and/or minor variations in placement technique. Other possibilities include increased current requirements to stimulate peripheral collateral nociceptors from Cl or C2, or perhaps antidromic activity in a partially deafferentated C2 afferent. This latter possibility is supported, in part, by the recent observation of the effectiveness of spinal cord stimulation in some incomplete, but not complete, spinal cord injury patients(9).

The use of various measures of pain, disability, and psychological functioning yielded interesting information. Clearly the patient's perceived impairment, as measured by the Oswestry Disability Scale, decreased dramatically. This is confirmed by reports from her spouse and the patient. Her Beck Depression Inventory score also decreased significantly. There was less of a decrease in the depression scale as measured by the MMPI, compared to the Beck Depression Inventory. The McGill Pain Questionnaire revealed changes in both the sensory and nonsensory components of pain. Of interest was the relative stability of the patient's MMPI profile. This may reflect a general personality style. In some instances(10), elevations in scale three of the MMPI have been thought to be a contraindication to the use of spinal cord stimulation therapy. North et al.(11) found elevations in scale three to be correlated with subjective improvements during the trial and short-term but not long-term results.

In this case, peripheral stimulation in the treatment of occipital neuralgia appeared to be safe and effective. There would appear to be more than one approach to securing stimulation of the occipital nerves. Replication and controlled studies are required to demonstrate the general applicability of this approach. The perineuromal approach may hold promise in the treatment of neuropathic pain including that of the deafferentation type, where more standard procedures are ineffective.

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