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Case Report

# Percutaneous Occipital Stimulator Lead Tip Erosion: Report of 2 Cases

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Occipital nerve stimulation is an emerging treatment modality for refractory headache disorders like migraine and cluster headache. Either percutaneous or surgical leads are implanted subcutaneously in the occipital region in an effort to stimulate the distal branches of the occipital nerves (C2-3). A number of complications of this technique have been reported, such as painful direct muscle stimulation and lead migration.

We report the first 2 cases of occipital lead erosion. In both cases, the lead erosion occurred many months after implantation. One patient lost a significant amount of weight between the time of implant and lead erosion, while the other patient had no obvious risk factors. One patient underwent lead removal with reimplantation 1 month later; the other was managed with excision of a granuloma at the erosion site and prophylactic antibiotics. Both patients returned to excellent headache control.

Lead erosion is a possible complication of occipital stimulation; strategies to reduce the risk of lead erosion are discussed, although further studies are needed to clarify the best surgical techniques.

**Key words:** Headache, occipital stimulation, migraine, cluster headache

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Occipital nerve stimulation is an emerging treatment modality for refractory headache disorders. We describe the first 2 reported cases of percutaneous occipital stimulator lead tip erosion. Mechanisms of this event will be discussed in addition to surgical techniques that may minimize this complication. Subcutaneous implantation of spinal cord stimulator leads in the occipital region is undertaken in an effort to stimulate the distal branches of the greater and lesser occipital nerves (C2-3). Pain relief may be secondary to activation of endogenous central antinociceptor networks or through direct inhibition of nociceptive neurons within the trigeminal nucleus caudalis (1,2). A number of uncontrolled studies, case series, and case reports have described the potential indications, outcome, and complications of this technique, while prospective, blinded studies are underway. Many of these reports document lead

migration as a major complication of subcutaneous occipital lead placement. This report will discuss lead erosion with suggestions as to avoiding and treating this complication.

## Case 1

A 27-year-old woman (weight, 123 kg; height. 171 cm) suffered from medically intractable chronic migraine. She was refractory to or intolerant of multiple preventive and acute therapies including triptans, antiepileptic drugs, tricyclic antidepressants, acetaminophen, NSAIDS, and opiates. She was referred to the chronic pain clinic for a trial of bilateral occipital nerve stimulation (ONS). After antibiotic prophylaxis, percutaneous Pisces Quad Plus leads (Medtronic, Inc, Minneapolis, MN) were inserted via a 15-gauge Tuohy needle at the C1 level after the technique described by Weiner and Reed (3).

Briefly, a Tuohy needle was bent to approximate the curvature of the occipital region and inserted subcutaneously and bilaterally from midline toward the mastoid process. The goal of each insertion was to keep the needle in the middle of the subcutaneous fat layer. A lead was inserted through each needle and the needles were withdrawn. Upon device activation, the patient experienced paresthesias in her bilateral occipital regions and a dramatic decrease in her headache intensity and frequency. At the end of the 3-day trial the leads were removed, and 2 months later she underwent permanent implant of an ONS system. The bilateral ONS leads (Medtronic Pisces Quad Plus) were again inserted via a Tuohy needle, this time through a midline incision at the C1 level. After testing, the leads were looped in a small pocket and attached to the fascia via silicone anchors. The leads were then tunneled and connected to a battery (internal pulse generator or IPG) in the left infraclavicular region.

The patient enjoyed excellent headache control; 2 years later she underwent bariatric surgery with a subsequent weight loss of 52 kg. About 21 months after her gastric bypass surgery, she awoke with a headache and discomfort in her right occipital region. A lead tip was seen to protrude through the skin and was associated with a small granuloma and serous drainage without obvious infection. There was no history of diabetes or other conditions that would predispose her to infection.

At that point, the patient was informed of her options with their associated risks. A surgically conservative approach, i.e., removing the entire lead to prevent a clinical infection, was offered to her. This would potentially result in a loss of therapy until the lead was replaced weeks or months later. Alternatively, the granuloma could be excised and the lead tip buried with close observation for local infection. Because of the severity of her headaches and the fear of loss of therapy, she returned to surgery where the granuloma was excised and cultured (staphylococcus capitis) and the lead tip was anchored to the fascia with a single suture. The wound was closed over the lead tip; she was treated with oral antibiotics (cephalexin) and the area healed without further complication. Five years after her initial implant, the patient continues to enjoy significant benefit from her ONS.

## Case 2

A 41-year-old woman (weight, 80 kg; height, 168 cm) was referred to the chronic pain clinic with a 12-month history of left occipital and parietal region headaches, described as constant and aching. There was no clear precipitating event. Evaluation, including MRI of the brain, was unremarkable, and she was diagnosed with new daily-persistent headache (4). She was refractory to multiple treatments including medications such as indomethacin and other nonsteroidal anti-inflammatories, gabapentin, topiramate, tiagabine, sumatriptan, and amitriptyline. Occipital nerve blocks and transcutaneous electrical nerve stimulation of the occipital region were also unsuccessful. She underwent an ONS trial with a unilateral (left) percutaneous lead. During the trial the patient experienced complete pain relief and she was implanted with a permanent system one month later. About 6 months after implantation, she returned with complaints of soreness and a palpable lead tip in the retromastoid region. As the area was not infected, observation was advised. Sixteen months later the patient presented with 2 weeks of discomfort in the left retromastoid region and acute lead tip erosion with localized infection. The lead was surgically removed after disconnecting it from the connector (to the IPG). After treatment with antibiotics and a one-month observation period, the lead was replaced. The patient continues to enjoy excellent pain relief more than 2.5 years after her initial implantation.

## Discussion

There is emerging evidence that implantation of occipital stimulator leads is effective in the management of patients with refractory primary chronic

headache disorders such as chronic migraine and chronic cluster headache (3,5-16). Although prospective controlled studies are ongoing, these early reports document some of the potential complications of the technique, including lead migration, infection, and painful stimulation with cervical muscle spasm. Erosion is a potential risk of any implanted device. For instance, a review of surgical complications of subthalamic stimulation noted extension erosion as a complication, with overall hardware complications occurring in approximately 26% of patients (17). Of note, Slavin et al (18) reported on occipital, supraorbital, and infraorbital stimulators implanted in 22 patients with one lead erosion. However, they did not report on the location of the lead that eroded. We believe these cases illustrate several important considerations in surgical implantation of ONS leads.

Conservative surgical management would dictate removing any eroded component and treating with antibiotics. Even if the exposed component is not grossly infected, it is contaminated and excising local tissue (e.g., a granuloma) with coverage of the remaining device which places the patient at risk for clinical infection. In Case 1, it was decided that the risk/benefit ratio favored not removing the lead. The patient's severe, disabling headaches and lack of risk factors for poor wound healing were considerations. She was given oral antibiotics to cover presumed skin contamination of the lead and closely observed; happily, no clinical infection developed. However, it must be stressed that close follow-up is mandatory in a situation such as this. Leaving an eroded component in place is "the exception rather than the rule," as the patient will be at increased risk of a clinical infection, including fasciitis. If there was extension of the system to the spine, such as a spinal cord stimulator or intrathecal pump, then removal of the component would have been indicated. In the second case, the lead was clearly infected and therefore it was removed. There is no consensus in the literature regarding the interval before reimplantation after an infection. In the second case, the lead was replaced one month after explantation with good result.

The ideal lead placement technique in ONS is not known. There are at least 2 surgical approaches (retromastoid versus midline) described for placement of occipital stimulator components. Percutaneous (wire) leads or paddle (surgical) leads can be inserted via either approach. Several authors (3,6,7,9,13,16,19) describe a retromastoid approach to lead placement, where the incision is made posterior and inferior to the mastoid process. In our practice, we have exclusively used the midline approach with percutaneous rather than paddle leads. Kapural et al(12) described implantation of paddle leads via a midline approach, and opined that the midline approach may be advantageous in terms of lead migration.

Despite the potential advantages of the midline approach, our cases illustrate the risk of wire leads eroding through the skin. In Case 1, the patient lost a significant amount of weight after bariatric surgery. This no doubt reduced the subcutaneous fat in her occipital region, contributing to the eventual lead erosion. In Case 2, the lead tip was palpable subcutaneously 16 months before it eroded outward. In neither case did we suspect superficial lead placement at the time of implantation. Fortunately, in both cases the patients again achieved excellent pain control after surgical revision.

Paddle (surgical) leads require dissection of surrounding tissues to allow insertion, in contrast to percutaneous leads which are inserted via a needle. The needle is bent to conform to the occipital region after the technique described by Weiner and Reed (3), but this process is imperfect, as the curve of the occipital region is not uniform. Therefore, a needle inserted from the midline into the middle of the fat layer can terminate at a point much more superficial at its distal aspect, increasing the risk of erosion. This challenge is exacerbated in thin patients, especially if the needle tip reaches the thin skin behind the mastoid process. Deeper needle placement likely decreases the risk of erosion but may increase the risk of painful direct muscle stimulation. At the time of implant, the needle tip and/or the lead tip may not be easily palpable due to edema from needle placement or obstructing surgical drapes. When the patient is in the lateral decubitus position (rather than prone), visualizing and palpating the occipital region on the dependent side can be especially difficult. In addition, the highly mobile neck region places the ONS system at risk for both lead migration and lead tip erosion due to mechanical "push-pull" on the lead. It is unknown if the use of paddle leads will decrease the risk of lead tip erosion.

## Recommendations

These cases demonstrate a need to logically analyze aspects of ONS implantation technique that may influence the incidence of erosion. First, although the midline insertion approach appears effective, care must be taken at the time of implant to

ensure the lead, particularly the lead tip, is not too superficial. If the lead is driven too far lateral where the skin becomes quite thin, it may be at higher risk for erosion. Deep insertion can also be problematic. If the lead tip is palpable, it should be withdrawn toward the midline or reinserted at another location where there is more subcutaneous tissue. Second, in as much as possible, the operator should be able to see and palpate the occipital region during lead placement. The lateral decubitus position and surgical drapes can be obstructive, resulting in superficial lead placement. Third, thin patients or obese patients who lose weight may be at risk for eventual lead erosion.

## Conclusion

Occipital nerve stimulation is capable of providing substantial relief to patients with severe and frequent headaches but lead erosion is a potential complication. Studies will have to confirm that recommendations for technique modification will decrease the risk of lead erosion.

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