Neurostimulation: occipital neuralgia and complicated migraine

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Background

- Occipital neuralgia is a paroxysmal jabbing pain in the distribution of the greater occipital nerve (GON) or lesser occipital nerve (LON) or of the third occipital nerve.[1]
  - When occipital neuralgia is medically intractable, favorable clinical evidence exists for the use of occipital nerve stimulation (ONS).[2]
- Communicating branches exist between the GON, the LON, and the auriculotemporal nerve (ATN).[3]
  - Patients have described numbness of posterior auricular and temporal [and retro-orbital] regions after CT-guided C2 and C3 nerve blocks.[4]
- Neurostimulation techniques have been combined with ONS to manage headache pain.[5]
  - ONS with infra- or supra- orbital stimulation.
- No neurostimulation techniques have been used in the treatment of complicated migraines.
  - Complicated migraine is a non-standardized term describing rare migrainous syndromes which include episodic, transient, and self-limited paroxysmal neurologic dysfunction (prolonged auras), such as hemiplegic migraine, basilar-type migraine, retinal migraine and ophthalmoplegic “migraine.”[1,6]

Case Report

A 44-year old Caucasian woman described headaches with separate and distinct origins—sharp jabbing pain across the occipital base and a throbbing component that encompassed the temporal region bilaterally. Some headaches were accompanied by photophobia, loss of vision, slurred speech, a dropping right eye, and left leg weakness.

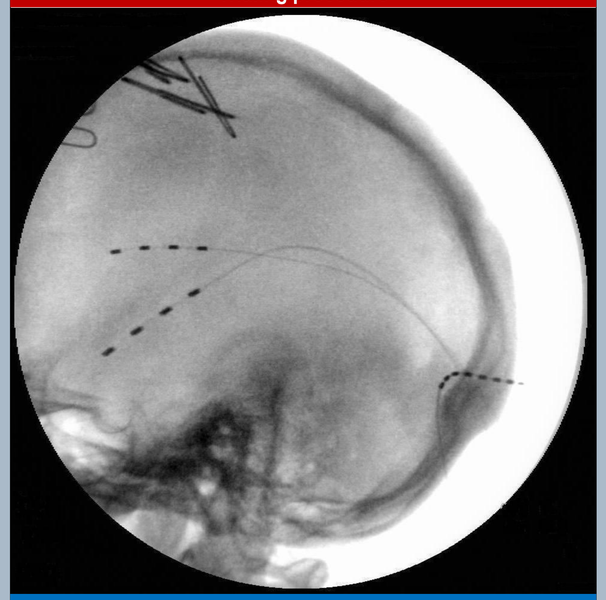
Past medical history: absence seizures with familial history.
Surgical history: Le Fort I osteotomy.
Social history: moderate cigarette smoking.

Headache profile: assigned by the referring neurologist:
- *Occipital neuralgia*, 4-5 episodes / week, 28 year history.
- *Complicated migraine*, 1 attack / month, 3 year history.

(No recognized triggering factors.)

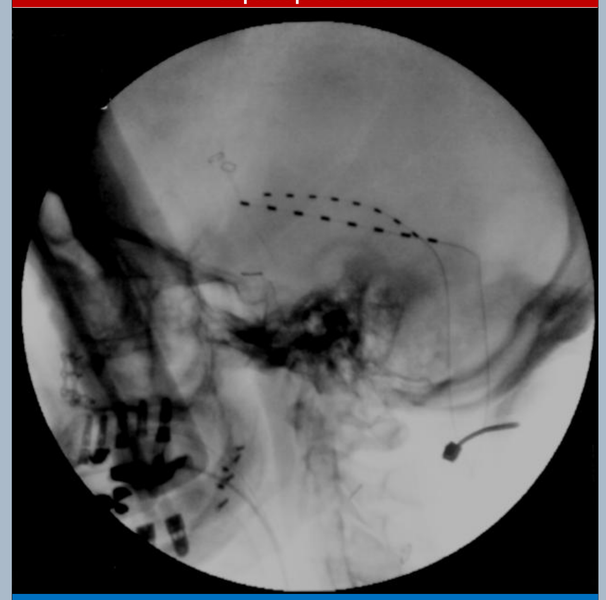
Previous treatments:
- Occipital nerve blocks, botulinum toxin injections, and rescue medications.
- (Note: ergots and triptans are contraindicated due to the nature of complicated migraines.)

Trialing procedure



1x8 Standard™ lead over the occiput and
1x4 Quad™ leads bitemporally,
Medtronic Neuromodulation, Minneapolis, MN, USA

Implant procedure



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Case Report – continued

Following a multidisciplinary approach, we focused on suppressing the dual location/complaints of headache pain (occipital and temporal regions).

- 7-day neurostimulation trial:
  - Technique: ONS in combination with bilateral subcutaneous electrical stimulation over the temporalis muscle.
  - Results: headache free during the trial period.
- Device implant: the above technique was implanted, differentiated by use of 1x8 leads over the temporalis muscles. Two Medtronic Restore Ultra™ neuropulse generators were also implanted, each into gluteal pockets created bilaterally.
- 18-months postimplant:
  - Only 2 “major” headaches, reducing the need for rescue medications.
  - No neurologic deficits.
  - 24-hour stimulator use.
  - Patient controls amplitude and rate: prefers slower "drumming” frequencies; amplitudes are consistent with levels reported elsewhere for ONS.[7]
  - No complications or adverse side-effects.

Discussion

<u>Complicated migraine: theory of pathogenesis</u>:
- Excessive activation of the sympathetic nervous system (SNS) in response to headache pain.[8,9]
  - Producing sympathetic-driven vasoconstriction and blood platelet activation.[10,11]

<u>Neurostimulation technique</u>:
- ONS modulates the trigeminocervical complex (TCC).
- Subcutaneous stimulation of the temporal region:
  - Provides alternate routes for convergence on the TCC, due to interconnections between the GON, LON, and ATN.
  - Offers direct local anti-inflammatory and membrane-depolarizing effects, reducing the sensitivity of circulating catecholamines.[12]

With reduced activation of the nociceptive sensitized third and second order neurons throughout the trigeminovascular system, headache pain was reduced—decreasing the likelihood of increased SNS activation.

By “turning-off” the potential for a sympathetic activation-response, the chance for pronounced sympathetic-driven vasoconstriction and blood platelet activation was “turned-off” as well.

Conclusions

The neurostimulation technique suppressed occipital neuralgia, as well as the frequency of migraines.
- Notably, the neurologic deficits that accompanied the migraine attacks were suppressed.

Case presentation provides initial assessment of treatment safety, not conclusive evidence of treatment effectiveness.
- It is reasonable to suggest inclusion of this technique (ONS/subcutaneous temporal-region electrical stimulation) in future studies to better quantify outcomes.

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