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Treatment of Idiopathic Trigeminal Neuralgia Utilizing a Novel Cryoablation Device

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Background: Trigeminal neuralgia (TN) causes intolerable pain that can be difficult to treat. Cryoablation is an underutilized pain management technique that can be incorporated into the treatment algorithm. Iovera® is a new handheld device that is small and lightweight making it very maneuverable and user friendly. It causes less tissue trauma enabling a more tolerable recovery period.

Case Report: This case involves a 43-year-old woman with a history of idiopathic TN with concomitant continuous pain in the ophthalmic and maxillary divisions. After successful diagnostic blocks of the peripheral branches of the aforementioned nerves, iovera® was selected for the definitive procedure.

Conclusions: This device offers the benefit of shorter procedure time with less tissue trauma and easy maneuverability. It completely eliminated the patient's pain from TN, which is known to be a debilitating disease. Longer periods of relief combined with less tissue damage and shorter procedure times make this an attractive option for pain relief in patients with TN or superficial neuropathic pain.

Key words: Trigeminal neuralgia, cryoablation, iovera

BACKGROUND

Trigeminal neuralgia is a unilateral, shooting, electric shock, or stabbing pain in the distribution of one or more of the branches of the trigeminal nerve. The pain can be excruciating and can last seconds up to a couple of minutes. There is a slightly higher incidence in women compared to men. Many attacks occur over a short period of time followed by longer intervals of no pain that can last several months. Pain triggers include extremes of temperature, chewing, talking, drinking, brushing teeth, or dental work. It frequently leads to a very poor quality of life and, in extreme cases, suicide. TN is classified as idiopathic or secondary. Idiopathic cases are marked by the presence or absence of neurovascular compromise. When this compromise exists, the root entry zone of the trigeminal tract has contact with vasculature that eventually causes ephaptic signaling resulting in the stereotypical pain seen in these patients. Secondary TN results from trauma, multiple sclerosis, herpes virus, or tumors (4-5). There are variants of TN that have a background continuous pain that accompanies these characteristic attacks as described above. The patient in this case report has such a variant. She has idiopathic TN with concomitant continuous pain. For TN patients, first-line therapy is typically medication. Our patient failed medical therapy with carbamazepine. Interventional procedures are typically the second-line treatment. These are classified as central or peripheral. Central procedures include trigeminal ganglion block followed by radiofrequency thermocoagulation, glycerol rhizolysis, balloon compression, or pulsed radiofrequency. Stereotactic radiosurgery can also be performed

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at the brainstem level. Peripheral intervention includes nerve blocks followed by cryoablation and pulsed radiofrequency. We opted for peripheral cryoablation based on previous experience of the senior author. Neuromodulation and surgical techniques would be the last treatment options according to the TN treatment algorithm if these procedures provided no benefit.

CASE PRESENTATION

A 43-year-old woman was referred to our pain management center for progressive right-side facial pain. The pain started 10 years ago with no inciting incident. She reported no known drug allergies and her past medical history included hypothyroidism, cervical radiculopathy, hyperlipidemia, migraines, bipolar disorder, and anxiety. Her medications included carbamazepine, escitalopram, and buspirone. Past surgical history consisted of 2 anterior cervical discectomy and fusions, an appendectomy, and Lap-Band® surgery. The patient described her pain as being behind the right ear, in the temporal area, zygoma, and around her eye. The pain was characterized as sharp and intermittently dull with an intensity ranging from 3/10 to 10/10. There was some associated numbness in the same distribution. It was exacerbated by touch but she had no other identifiable triggers, such as chewing, brushing her teeth, drinking, or mucosal trigger points. The patient reported sleep disturbances as a result of the pain. She reported receiving very little benefit from the carbamazepine. On physical exam, manual palpation elicited "electrical jolts" of pain in her maxillary nerve (V2) distribution A magnetic resonance imaging of her brain was read as normal showing no signs of vascular compression or other abnormalities. Her diagnosis was TN with background continuous pain. She was subsequently scheduled for a right-side V2 block.

A V2 block in the pterygopalatine fossa was performed with a solution of 0.5% bupivacaine and dexamethasone under fluoroscopic guidance. At the one-month follow-up, she reported ongoing resolution of pain in the V2 distribution with some faint numbness. However, this procedure unmasked periorbital pain described as burning with intermittent sharp, stabbing pain around her eye. She complained of blurry vision with the area being painful to palpation. The patient underwent right-sided supraorbital, supratrochlear, and infraorbital nerve blocks with local anesthetic and reported 100% relief of her periorbital pain for 10 hours.

Based on the success of the aforementioned peripheral nerve blocks, she was scheduled for cryoablation using the Iovera® device. After identifying the corresponding foramina with ultrasound, 2 60-second freeze cycles were performed on the supraorbital, supratrochlear, and infraorbital nerves (Figs. 1 and 2). Six weeks post-procedure, the patient reported 100% relief of her pain.

Iovera® is a handheld cryoablation device used to reversibly lesion peripheral nerves utilizing temperatures below -20°C (Fig. 3). The resulting lesion is a second-degree Sunderland nerve injury classification (Wallerian degeneration) (1). Pain signals are blocked as a result of axonal and myelin degeneration, but the endoneurium, perineurium, and epineurium remain intact. The freezing temperatures prevent the nerve from transmitting pain signals. Once axonotmesis occurs, the nerve will regenerate at a rate of 1 to 2 millimeters per day. Despite return of nerve function, pain relief may continue. Pain relief has been reported up to 90 days with the device, but in the experience of the senior author, longer durations are not uncommon (1). Common complications associated with this procedure and device include: skin hypo- or hyperpigmentation, skin dimpling, hair loss in the treated area, local tenderness and swelling, ecchymosis, edema, erythema, localized dysesthesia, or loss of motor function. Deafferentation pain is not experienced with cryoablation, but frostbite is a possibility.

The needle used for this patient was the Smart Tip 309 (Fig. 4) and consisted of three 27-gauge needles that are 8.5 mm long. The total width of the 3 needles is 8 mm. This is ideal for accessing superficial nerves in a quick and efficient manner, while causing minimal tissue trauma as compared to traditionally larger cryoablation probes. The device is loaded with nitrous oxide cartridges that provide 8 separate one-minute freezes before they need to be replaced. The device is rechargeable and cordless.

When comparing traditional console cryoablation machines with iovera®, the initial cost of this device is much less being around $5,000 and the console machines being $20,000. The probes cost around $300 a piece for the handheld, which can drive the cost up depending on how often it will be used. Other drawbacks to the handheld device include a smaller diameter ice-ball size and flexible probes that can deflect when trying to reach deep targets. This is not a problem with stiffer, traditional probes. An advantage to the handheld device over a traditional probe is its smaller size making it more ideal for facial procedures as it causes less tissue damage and the use of an introducer needle

Fig. 1. Cryoablation of the supraorbital nerve.

Fig. 2. Cryoablation of the infraorbital nerve.

is not necessary. Finally, venting of gasses in conventional cryoablation machines is required. This is not so with the handheld device as it utilizes gas cartridges (2-3).

CONCLUSIONS

This case study illustrates a 43-year-old woman with a history of TN. She had persistent pain in V1 (ophthalmic division) and V2 distributions for a decade. The pain interfered with her daily life and interrupted her sleep. She trialed and failed medical therapy utilizing a first-line medication. Diagnostic blocks completely eliminated her pain. Cryoablation with the iovera® device provided her ongoing 100% pain relief. This device offers the benefit of shorter procedure time, less tissue trauma, and easy maneuverability, making this an attractive option for pain relief in patients with TN.

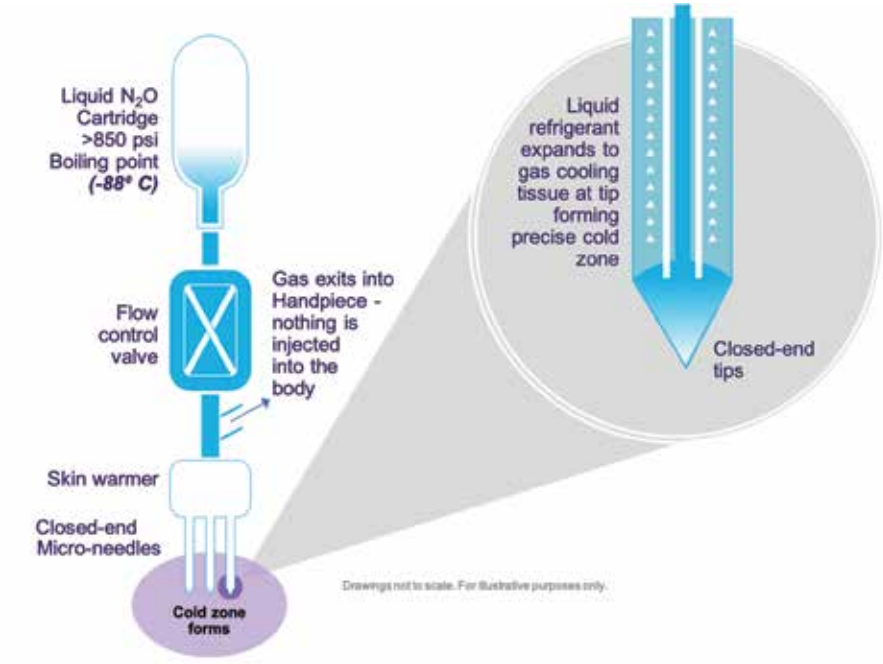

Fig. 3. How the device works.

Fig. 4. Iovera® device Smart Tip 309.

Author Contributions

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