PAIN MEDICINE CASE REPORTS

ISSN 2768-5152

Volume 9, Number 1, pp. 81-84

Efficacy of Botulinum Toxin Injection via Coronoid Approach in Refractory Trigeminal Neuralgia: A Case Report and Literature Review

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Background: Trigeminal neuralgia (TN) is a well-characterized form of cranial neuralgia that affects one or more divisions of the trigeminal nerve. The first-line treatment for TN is pharmacotherapy, though over 40% of patients may become refractory to medication or experience intolerable side effects. A Gasserian ganglion block is a minimally invasive procedure aimed at alleviating TN symptoms and reducing the reliance on pharmacotherapy.

Case Report: We present a case of TN that was refractory to 2 times Gasserian ganglion block. While botulinum toxin has been effectively used in various nerve blocks, we opted to manage the patient's TN by targeting the peripheral mandibular nerve (V3) via a coronoid approach by using botulinum toxin injection.

Conclusions: Our patient experienced 5 months' considerable pain relief, which demonstrates that the V3 injection of botulinum toxin may offer a viable alternative for managing refractory TN.

Key words: Botulinum toxin, case report, coronoid approach, Gasserian ganglion block, trigeminal neuralgia

BACKGROUND

Trigeminal neuralgia (TN) is a chronic pain disorder characterized by recurrent, unilateral, electric shock-like, burning, or stabbing pain, with abrupt onset and termination, confined to one or more divisions of the trigeminal nerve. Pain may be triggered by normally nonpainful stimuli or can occur spontaneously (1). Additionally, patients may experience continuous moderate pain within the affected nerve distribution(s) (2). Based on etiology, TN can be classified into 3 categories: classic, secondary, and idiopathic. Classic TN is typically caused by neurovascular compression (3), while secondary TN results from underlying conditions, such as multiple sclerosis, space-occupying lesions, or arteriovenous malformations (4,5). Idiopathic TN refers to cases in which no abnormalities are detected on magnetic resonance imaging (MRI) or electrophysiological tests, and no underlying disease is identified (3). Managing TN is challenging and ranges from pharmacological treatments to minimally invasive or invasive surgical interventions (4).

This article presents a case report of a patient with idiopathic TN that was resistant to pharmacologic treatment and refractory to Gasserian ganglion block. The objective of this study is to assess the efficacy of a trigeminal nerve block using botulinum toxin via a coronoid approach, providing a safer, extracranial alternative for the management of TN.

CASE PRESENTATION

A 75-year-old man presented with a 22-year history of sharp, electric shock-like pain on the left side of his

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Disclaimer: There was no external funding in the preparation of this manuscript.
Conflict of interest: Each author certifies that he or she, or a member of his or her immediate family, has no commercial association (i.e., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted manuscript.
Patient consent for publication: Consent obtained directly from patient(s).
This case report adheres to CARE Guidelines and the CARE Checklist has been provided to the journal editor.
Accepted: 2024-11-12, Published: 2025-02-28

face, primarily in the left mandibular region (V3) and, to a lesser extent, the skin of the left cheek. The pain was triggered by chewing hard foods, drinking water, touching the skin over the cheek and V3 regions, exposure to wind, and emotional stress, such as anger. After undergoing comprehensive dental and neurological evaluations, he was diagnosed with idiopathic TN. His TN had been managed with carbamazepine (CBZ) 200 mg once or twice daily for many years. However, in the past 6 months, his pain worsened and became nonresponsive to CBZ, even when increased to 4 times daily. The patient was unable to tolerate any other medications. The pain remained consistent in character—sharp and electric shock-like—lasting from a few seconds to 5 minutes. The severity of the pain greatly impacted his quality of life, making it difficult for him to eat, which caused significant anxiety for both the patient and his family. He was referred to our pain clinic for further management on April 8, 2024. A neurological consultation, including a brain MRI, was unremarkable, and dental evaluations revealed no abnormalities. Given his medical history and the exclusion of secondary causes (e.g., normal brain MRI, neurologist evaluation, and dental assessments), the patient was diagnosed with worsening idiopathic TN, with a pain intensity rated at 9 out of 10 on the Numeric Rating Scale (NRS-11) (on a scale of 0 = no pain to 10 = the most severe pain experienced).

The patient was then referred to our pain operating room for a Gasserian ganglion block. He was positioned supine with a pillow placed under his chest to achieve slight cervical spine extension. After applying standard monitoring (e.g., electrocardiography, noninvasive blood pressure, and pulse oximetry), the left hemifacial region was prepped and draped. The needle entry site was anesthetized with 2 mL of 2% lidocaine. Under fluoroscopic guidance, a 22-G, 90-mm spinal needle (Disposable Spinal Needle, Dr. Japan Co., Ltd., Tokyo, Japan) was advanced toward the foramen ovale. Once the needle position was confirmed through multiple coaxial fluoroscopic views and by reproducing the patient's characteristic pain, a left Gasserian ganglion block was performed using 8 mL of 0.5% ropivacaine and 80 mg of triamcinolone. After the injection, the needle was removed, and the patient was transferred to the recovery room. In the recovery, the patient was pain free and was able to chew bread under supervision 2 hours' postprocedure.

The patient reported being pain free for the first 48 hours following the procedure. However, the pain gradually returned, and by 2 weeks postprocedure, he was advised to return for a second Gasserian ganglion block. The second procedure was performed using the same medications and technique. As with the first block, the patient experienced 48 hours of pain relief, but the pain recurred, causing significant distress for both the patient and his family.

On May 8, 2024, the patient was called back for further evaluation, and we opted to manage his pain peripherally with a more selective V3 block to assess the response. The patient was positioned supine with the cervical spine in a neutral position. After applying standard monitoring (e.g., electrocardiography, noninvasive blood pressure, and pulse oximetry), the area was prepped and draped. The coronoid notch was identified by asking the patient to open and close his mouth. A high-frequency (5-13 MHz) linear ultrasound transducer (SonoSite S-Nerve, SonoSite, Inc., Bothwell, WA) was placed transversely over the coronoid notch. The zygomatic arch, masseter, and temporalis muscles, maxillary artery, pterygoid muscle and plate, and mandibular arch were visualized. A 22-G, 90-mm spinal needle (Disposable Spinal Needle, Dr. Japan Co., Ltd., Tokyo, Japan) was inserted using an out-of-plane approach. Upon contacting bone (the lateral pterygoid plate), the needle was withdrawn and redirected to posteriorly and slightly inferiorly so that it will slip past the inferior margin of the lateral pterygoid plate, near V3. After confirming negative aspiration, a diagnostic block was performed using 5 mL of 2% lidocaine (Lidocaine 2%, Aburaihan Pharmaceutical Co., Tehran, Iran) with 40 mg of triamcinolone. The needle was then removed, and the patient was monitored in the recovery room.

The patient experienced rapid pain relief and was able to chew bread without discomfort 3 hours after the block. Following the responsive outcome, and after consultation with the patient and his family, we decided to proceed with a second block using botulinum toxin, with their consent, in the same session. After prepping and draping the patient in the supine position, we performed a V3 block using the same technique described above. This time, we administered 100 units of botulinum toxin (Masport 500 Clostridium botulinum type A toxin complex (BoNT/A), MasoonDarou Biopharmaceutical Co., Alborz, Iran) mixed with 1.5 mL of 0.5% ropivacaine (Ropivacaine Hydrochloride, 5 mg/mL, Bioindustria LIM, Italy), a total volume of 1.6 mL.

RESULTS

At the 2-week and 1-month follow-ups, the patient reported complete pain relief, with an NRS-11 score of 0. He was able to eat comfortably on the left side, and both he and his family were highly satisfied with the outcome. At the 3-month follow-up, the patient reported > 85% pain relief, with significant improvement in his overall mood, and his family expressed continued satisfaction. This positive trend persisted at the 5-month follow-up, with > 70% pain reduction, highlighting the long-lasting benefits of this approach.

DISCUSSION

The trigeminal nerve originates from the brain stem at the midpons level and traverses Meckel's cave to reach the trigeminal ganglion (6). At the trigeminal ganglion, the nerve divides into 3 branches: the ophthalmic, V2, and V3 divisions. The V2, a purely sensory branch, supplies sensory innervation to the dura mater of the middle cranial fossa, the temporal and lateral zygomatic regions, the mucosa of the maxillary sinus, upper molars, premolars, incisors, canines, and the associated gingiva. It also innervates the mucous membranes of the cheek, nasal cavity, lower eyelid, skin of the lateral nose, and upper lip (7).

The V3 provides sensory innervation to portions of the dura mater, the mucosal lining of the mastoid sinus, the skin overlying the muscles of mastication, the tragus and helix of the ear, the posterior temporomandibular joint, the chin, and the dorsal aspect of the anterior two-thirds of the tongue and the associated oral mucosa. The smaller motor component of V3 innervates the masseter, lateral pterygoid, and temporalis muscles (7).

TN is one of the most extensively studied cranial neuralgias, with an estimated global prevalence ranging from 4 to 28.9 per 100,000 individuals (8). The first-line treatment for TN typically involves anticonvulsant medications, such as CBZ or oxcarbazepine. However, these medications are often ineffective or poorly tolerated by some patients (2,7). Alternative pharmacological options, including lamotrigine, gabapentin, pregabalin, and baclofen, may be used as monotherapy or adjunctive therapy, although their efficacy remains uncertain (2,7). Furthermore, patients may develop resistance to these medications or experience adverse effects. Surgical interventions, while available, are frequently associated with significant risks, leading many patients to decline these options (9). In a case report by Shah et al (10), a patient with refractory right-sided TN was responsive to inferior alveolar nerve stimulation for up to 6 months. Here, we present a case of refractory TN successfully managed using a peripheral V3 block via the coronoid approach with BoNT/A (Masport, MasoonDarou Biopharmaceutical Co., Alborz, Iran).

Botulinum toxin, produced by the bacterium Clostridium botulinum, inhibits the release of acetylcholine (ACh) at neuromuscular junctions, leading to muscle paralysis (11). There are 7 serotypes of botulinum toxin (A-G), with type A (BoNT/A) being the most potent (12). In the mid-20th century, Naderi et al (11) discovered that BoNT/A inhibits ACh release from neuromuscular junctions in skeletal muscles.

In the 1970s, BoNT/A was first utilized for the treatment of strabismus, and it is now US Food and Drug Administration (FDA)-approved for a variety of therapeutic and cosmetic applications (11). The mechanism of action of BoNT/A involves blocking the release of ACh from neuromuscular junctions, resulting in muscle relaxation. As can be found in Kayani et al (12), experimental studies have demonstrated that BoNT/A also inhibits the release of nociceptive neuropeptides, such as substance P, calcitonin gene-related peptide, and glutamate.

Additionally, it suppresses the expression of the transient receptor potential vanilloid 1 receptor on peripheral nociceptors, which are responsible for inflammatory hyperalgesia, thereby reducing neurogenic inflammation and nociceptive signaling (13,14). Evidence suggests that BoNT/A's analgesic effects may involve retrograde axonal transport, with its action potentially extending to the dorsal root ganglion and central terminals (14). The analgesic properties of BoNT/A were first reported in 1986 (15). Currently, its only FDA-approved pain indication is for chronic migraine, following 2 large randomized controlled trials in 2011 that confirmed its efficacy (16). The European Academy of Neurology guideline on TN, published by Bendtsen et al (17), provides a weak recommendation for the use of BoNT/A as an add-on therapy for medium-term management of TN. Our findings further support the use of BoNT/A for nerve blocks, demonstrating its effectiveness and long-lasting pain relief.

In a systematic review by Rana et al (18), published in 2023, it was concluded that BoNT/A, in doses ranging from 25 mcg to 75 mcg administered intradermally or submucosally, may serve as a therapeutic option for refractory TN. Consistent with these findings, our case showed over 70% pain relief 4 months after a V3 block using BoNT/A.

CONCLUSIONS

This case report demonstrates the potential efficacy of BoNT/A injection via the coronoid approach as a treatment option for patients with refractory TN, especially those who were nonresponsive to standard pharmacotherapy and Gasserian ganglion block. BoNT/A appears to provide long-lasting pain relief by targeting the peripheral branches of the trigeminal nerve, as evidenced by over 70% pain reduction at 4 months postinjection. This extracranial approach offers a less invasive alternative to more aggressive surgical options, with a favorable safety profile and significant improvements in patient quality of life. Future studies, including larger clinical trials, are necessary to further validate the use of BoNT/A for refractory TN and establish optimal treatment protocols.

REFERENCES

1. Tereshko Y, Valente M, Belgrado E, et al. The therapeutic effect of botulinum toxin type A on trigeminal neuralgia: Are there any differences between type 1 versus type 2 trigeminal neuragia? *Toxins (Basel)* 2023; 15:654.
2. Benzon HT, Rathmell JP, Wu CL, et al. Evaluation and Treatment of Pain in Selected Neurologic Disorders. In: *Practical Management of Pain.* Sixth Edition. Elsevier Health Sciences, Philadelphia, PA 2023, p 578.
3. Arnold M, Headache Classification Committee of the International Headache Society (IHS). The International Classification of Headache Disorders, Third Edition. *Cephalalgia* 2018; 38:1-211.
4. Majeed MH, Arooj S, Khokhar MA, Mirza T, Ali AA, Bajwa ZH. Trigeminal neuralgia: A clinical review for the general physician. *Cureus* 2018; 10:e3750.
5. Hughes MA, Frederickson AM, Branstetter BF, Zhu X, Sekula RF Jr. MRI of the trigeminal nerve in patients with trigeminal neuralgia secondary to vascular compression. *AJR Am J Roentgenol* 2016; 206:595-600.
6. Sindou M, Brinzeu A. Anatomy of the trigeminal nerve (TGN). In: *Trigeminal Neuralgias: A Neurosurgical Illustrated Guide.* Springer International Publishing, 2023, Cham, Switzerland, pp 9-20.
7. Waldman SD. *Atlas of Interventional Pain Management*. Fifth Edition. Saunders Elsevier, Philadelphia, PA 2021.
8. Xiromerisiou G, Lampropoulos IC, Dermitzakis EV, et al. Single onabotulinumtoxinA session add-on to carbamazepine or oxcarbazepine in treatment-refractory trigeminal neuralgia: A case series with 24-week follow up. *Toxins (Basel)* 2023; 15:539.
9. Kandari A, Devaprasad BATP, Hernandez-Rivera P, Hernandez IA, Friesen R. Botulinum toxin-A as a treatment option for refractory idiopathic trigeminal neuralgia of the ophthalmic branch: A case report and literature review. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2024; 137:e73-e82.
10. Shah NA, Patel CB, Patel AA, Padalia D. Inferior alveolar nerve radiofrequency ablation for refractory trigeminal neuralgia: A case report. *Pain Manag Case Rep* 2019; 3:49-54.
11. Naderi Y, Rad M, Sadatmoosavi A, et al. Compared to oxcarbazepine and carbamazepine, botulinum toxin type A is a useful therapeutic option for trigeminal neuralgia symptoms: A systematic review. *Clin Exp Dent Res* 2024; 10:e882.
12. Kayani AMA, Silva MS, Jayasinghe M, et al. Therapeutic efficacy of botulinum toxin in trigeminal neuralgia. *Cureus* 2022; 14:e26856.
13. Wei J, Zhu X, Yang G, et al. The efficacy and safety of botulinum toxin type A in treatment of trigeminal neuralgia and peripheral neuropathic pain: A meta-analysis of randomized controlled trials. *Brain Behav* 2019; 9:e01409.
14. Capon C, Crevant A, Pointin A, Sulukdjian A, Moreau N. Botulinum toxin A for management of refractory concurrent buccal and inferior alveolar nerve post-traumatic neuropathies: A case report. *J Int Med Res* 2022; 50:3000605211047704.
15. Tsui JK, Eisen A, Stoessl AJ, Calne S, Calne DB. Double-Blind study of botulinum toxin in spasmodic torticollis. *Lancet* 1986; 2:245-247.
16. Matak I, Bolcskei K, Bach-Rojecky L, Helyes Z. Mechanisms of botulinum toxin type A action on pain. *Toxins (Basel)* 2019; 11:459.
17. Bendtsen L, Zakrzewska JM, Abbott J, et al. European Academy of Neurology guideline on trigeminal neuralgia. *Eur J Neurol* 2019; 26:831-849.
18. Rana MH, Khan AAG, Khalid I, et al. Therapeutic approach for trigeminal neuralgia: A systematic review. *Biomedicines* 2023; 11:2606.