Case Report

Unveiling the Potential of Perineural Injection Therapy in Trigeminal Neuralgia Management

Vivid Pretty Anggraini[1], Fakhrur Razi[1]
[1]*Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Brawijaya University, Malang, Indonesia*

Correspondent:
Vivid Prety Anggraini, Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Brawijaya University, Malang, Indonesia
Email: vivid_anggraini@ub.ac.id

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Abstract

Trigeminal neuralgia is characterized by severe pain restricted to the trigeminal nerve and frequently causes abrupt, severe bouts of pain in the face. Trigeminal neuralgia, although having a severe effect, is a rather uncommon condition, affecting 4 to 13 persons per 100,000 per year. Women are more susceptible to the condition, which tends to manifest later in life. About 80% of cases of classical trigeminal neuralgia are classed as idiopathic. Using the numeric rating scale (NRS) and the SF-36 questionnaire, this case study aims to determine how perineural injection therapy (PIT) affects pain relief in trigeminal neuralgia patient and patient function. The patient presented with a history of 8 years of persistent facial pain localized to the right side of the face. Described as sharp and intermittent, the pain rated between NRS 6. It was exacerbated by activities such as chewing and combing yet alleviated by rest and medication. Injections of a 5% dextrose solution in sterile water (D5W) were administered subcutaneously and intracutaneously at the trigeminal nerve point. The PIT was performed three times, with an injection interval of 2-3 weeks. Injections were made at the trigeminal nerve point using a technique developed by Dr. Lyftogt. The NRS score on the first injection was changed from 6 to 2, the second injection from 2 to 1, and the third injection was 1 before and after. The quality of life is better than before. SF-36 questionnaire showed a change from 50-75% on the first injection, 75-100% on the second injection, and 100% on the third injection. This study showed that PIT can relieve chronic excruciating pain in patients with trigeminal neuralgia and improve patient's quality of life.

Keywords: *Chronic Facial Pain, Numeric Rating Scale, Perineural Injection Therapy, SF-36 Questionnaire, Trigeminal Neuralgia, Prolotherapy*

INTRODUCTION

Trigeminal neuralgia, also recognized as tic douloureux, manifests as excruciating pain localized in the trigeminal nerve region, often triggering sudden and intense attacks in facial areas. Routine activities like eating or speaking can incite this pain, typically described as stabbing and short-lived, akin to being shocked. Despite its severe impact, trigeminal neuralgia boasts a relatively low prevalence, affecting 4 to 13 individuals per 100,000 yearly, with a higher susceptibility observed in women and a predilection for onset after the age of 50. While the condition predominantly affects a single trigeminal nerve branch, it can occasionally involve both branches, albeit rarely impacting the ophthalmic branch.[1–3]

The etiology of classical trigeminal neuralgia remains elusive, with approximately 80% of cases classified as idiopathic. However, some instances stem from neurovascular compression, particularly by arterial vessels, or are symptomatic due to underlying tumors or vascular abnormalities. Micro-trauma from pulsating blood vessels pressing on the trigeminal nerve in the dorsal root entry zone leads to neurovascular compression, resulting in pain. Pathologically, this compression induces atrophy or hypertrophy of the trigeminal nerve, accompanied by demyelination and nerve fiber loss.[3–8]

Pain in trigeminal neuralgia typically surges suddenly, often reaching its peakintensity at the onset or during an attack. Such episodes can trigger facial muscle spasms, earning the condition the moniker 'tic douloureux.' Patients frequently liken the pain to an electric shock, lasting mere seconds and primarily afflicting one side of the face, albeit bilateral occurrences are exceedingly rare. Given the absence of definitive diagnostic tests, the diagnostic journey for trigeminal neuralgia hinges heavily on comprehensive symptom elucidation.

Although physical and neurological examinations may appear normal, subtle sensory abnormalities, including hypoesthesia, are common [5,8,9].

Diagnosis hinges on adhering to stringent criteria outlined by the International Classification of Headache Disorders (ICHD-3) and the International Association for the Study of Pain (IASP), establishing recurrent unilateral facial pain attacks meeting specific characteristics. Differential diagnosis necessitates ruling out secondary causes, necessitating thorough neurological examinations and trigeminal reflex testing. A comprehensive approach encompassing patient history, clinical examinations, and adherence to diagnostic criteria is pivotal in ensuring accurate identification and management of trigeminal neuralgia.[8,10,11]

The management of trigeminal neuralgia encompasses a multifaceted approach involving non-pharmacological and pharmacological strategies, with surgical interventions reserved for cases where initial treatments prove ineffective. Educating patients about pain triggers and medication side effects forms a fundamental part of non-pharmacological therapy, empowering individuals to better manage their condition. Pharmacotherapy serves as the initial line of treatment, with carbamazepine being the primary medication of choice, although alternatives like lamotrigine and oxcarbazepine are also available. Rehabilitation therapy complements medical treatment, incorporating modalities such as hot and cold compresses, electrical stimulation, and neurostimulation techniques to help manage neuropathic pain. Invasive therapies, including radiosurgery and percutaneous interventions, may be considered if conservative measures fail to provide adequate relief. [2,9,12,13]

Invasive therapy options for trigeminal neuralgia range from peripheral neurectomy to microvascular decompression, with the

choice depending on patient characteristics and response to previous treatments. Microvascular decompression, for instance, is indicated for patients with neurovascular compression leading to trigeminal neuralgia, whereas peripheral neurectomy or partial sensory root section may be more suitable for specific conditions such as multiple sclerosis. Further research is necessary to evaluate the efficacy and safety of these invasive procedures in managing trigeminal neuralgia effectively. [9,14]

Understanding the mechanism of pain occurrence in trigeminal neuralgia involves distinguishing between nociceptive and neuropathic pain. While nociceptive pain results from tissue damage activating nociceptors, neuropathic pain arises from lesions or disorders affecting the somatosensory system. Specific manifestations of neuropathic pain include neuritis and neuralgia, where neuritis refers to inflammation of nerve tissue, and neuralgia denotes pain following the distribution of a nerve. This understanding guides treatment approaches aimed at addressing the underlying pathophysiology of trigeminal neuralgia. [15]

Prolotherapy emerges as a promising method for addressing the pain and functional abnormalities associated with trigeminal neuralgia. By promoting tissue regeneration and cell renewal through the injection of irritant solutions like dextrose, prolotherapy aims to restore weakened structures such as ligaments and tendons. Various techniques within prolotherapy, such as Hackett-Hemwall and subcutaneous prolotherapy, offer therapeutic options for different musculoskeletal conditions. Additionally, perineural injection therapy (PIT) provides a safe and effective approach to treating inflamed and injured nerves associated with chronic pain, utilizing dextrose injections to alleviate inflammation and restore normal nerve function. Patients receiving PIT do

not have any therapeutic limits, and over 85% of them respond well to this approach. It is not necessary to cease taking anti-inflammatory medications for other diseases while undergoing therapy. However, because opioids compete with cell receptors to allow dextrose to enter cells, patients who use opioids for pain often do not respond effectively. These innovative therapies offer promising avenues for the management of trigeminal neuralgia, emphasizing a holistic approach to patient care. [16–20]

With the use of the numeric rating scale (NRS) and the SF-36 questionnaire, this case study aims to determine how PIT affects pain relief in early trigeminal neuralgia cases and how it can affect patient function.

Figure 3. Approximate sites of injection performed on the patient described in this case report. Each injection site is depicted by a red X.[5]

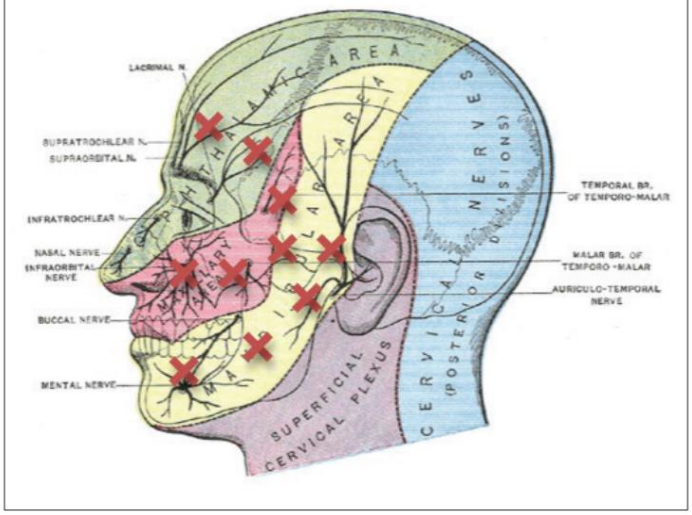

Figure 1. An example of a PIT injection site in a patient with trigeminal neuralgia.[21]

CASE REPORT

The patient complained of right-sided facial pain that has persisted for the last eight years. Pain on the numeric rating scale (NRS) was described as sharp and intermittent, scoring a 6. Chewing and combing were the things that made it worse, but rest and medicine helped to make it better. It went from level 3 on the

NRS. There were no obvious triggers, so the pain appeared spontaneously. A burning feeling and numbness, mainly on the right side of the face, were further complaints made by the patient. No specific conditions or injuries could be identified as caused preceding the symptoms.

The patient's sleep was further disturbed by the pain, which regularly resulted in nighttime awakenings and daytime feeling drained. Additionally, the patient was frequently distressed, even about insignificant issues or small noise disruptions. The absence of associated neurological or systemic symptoms is suggested by the patient's denial of any facial weakness, asymmetry, tingling feelings, unintentional weight loss, or fever despite these changes.

The patient's medical history indicates no family history of the current disease, pointing to a sporadic rather than inherited component. To control symptoms, the patient takes Gabapentin (300 mg once daily) and B12 vitamins (1 tablet twice daily). The patient smoked regularly. Prior attempts at rehabilitation using cryotherapy, TENS, and infrared treatment did not result in any improvement. Although the patient had previously engaged in independent activities of daily living (ADL) before the start of symptoms, discomfort has since been reported when eating and grooming. Chewing and combing worsen the pain, and the resulting pain-induced drowsiness makes the person prefer to rest and sleep.

According to the patient's employment history, he had worked at a motorbike spare parts shop before the work was terminated because of the intensity of their symptoms. Currently, the patient helps pick up their child from school. The mention of motorbike racing shows a notable lifestyle shift brought about by the illness as a passion. The pain also makes it difficult for the patient to interact with others. Regarding psychology and social work, the patient feels anxious about their health but is adamant about getting help. Living in a one-story home furnished with

necessities, they share a home with their partner and child. Relying on the patient's funds and family support for everyday costs since moving to Malang, the family operates in a low socioeconomic category.

Upon physical examination, the patient's body weight was normal, and the trigeminal nerve's V1 and V2 branches showed sensory deficits. The patient's right face V1 and V2 branches discomfort was assessed at NRS 6.

Intervention

Patients are administered 0.5-2 cc injections of a 5% dextrose solution in sterile water (D5W) subcutaneously and intracutaneously at the trigeminal nerve point. Based on a technique developed by Dr. Lyftogt, injection sessions are given three times, with a 2-week interval between sessions. One week after the injection, there should be no treatment other than taking acetaminophen to reduce pain. Patients are evaluated every week after the injection. Patients experience no other side effects, only temporary pain at the injection site that will resolve on its own within 1-2 days after the injection.

Outcome measure

The pain was assessed using a numerical pain rating scale. The patient picks a number from 0 to 10 to rate his pain, with 0 indicating no pain and 10 indicating the worst pain possible. Pain was assessed before the injection session and one week after the injection at the time of control. After the injection, the patient did not receive any therapy except acetaminophen for one week, and while waiting for the next injection session, he continued to receive LLLT therapy and cryotherapy. Patients are also assessed on their quality of life through the SF-36 short-form questionnaire. The SF-36 questionnaire consists of eight scales, yielding two summary measures: physical and mental health. The physical health measure includes four scales of physical functioning (10 items), role-physical (4 items), bodily pain (2 items) and general health (5 items). The mental health measure is composed of vitality (4 items), social functioning (2 items), role

emotional (3 items), and mental health (5 items). A final item, termed self-reported health transition, is answered by the client but is not included in the scoring process. The SF-36 offers a recall format at a standard (4-week) or acute (1-week) time frame. Likert scales and yes-or-no options are used to assess function and well-being in this 36-item questionnaire. To score the SF-36, scales are standardized with a scoring algorithm or by the SF-36v2 scoring software to obtain a score ranging from 0 to 100. Higher scores indicate better health status and a mean score of 50 has been articulated as a normative value for all scales.

Result

The PIT has been performed three times, with an injection interval of 2–3 weeks. Injections were made at the trigeminal nerve point based on a technique developed by Dr. Lyftogt. On the day before the first injection, the patient felt pain with NRS 6 (moderate pain). After the first injection and follow-up one week after the first injection, the patient felt a reduction in pain severity from NRS 6 to NRS 2 (mild pain) and a reduction in pain intensity. The patient already feels more comfortable in daily activities; sleep and emotions have become stable. SF 36 of average health is from 50% to 75%. On the day before the second injection, the patient felt pain with NRS 2 (mild pain). After the second injection and follow-up one week after the second injection, the patient felt a reduction in pain severity from NRS 2 to NRS 0-1 (mild pain), and the pain intensity was very rare. The patient felt more comfortable in daily activities, improved sleep quality, and could maintain emotions and socialize better than before when they often confined themselves at home. SF 36 ranges from an average health of 75% up to 100%. The patient underwent a third injection with NRS 0-1 before the injection. On follow-up one week after the third injection, the patient only felt pain at one point on the right frontal region. NRS 0–1 = mild pain, and a reduction in intensity was very rare. The quality of life is better than

before. SF 36 showed an average health score of 100%.

Figure 2. PIT injection site at right V1 and V2 trigeminal branches and cervical region**.**

DISCUSSION

Trigeminal neuralgia is a condition that often lacks a clear cause, but symptoms may arise due to pressure on the trigeminal nerve by vascular tissue, particularly arteries. Symptomatic trigeminal neuralgia can be associated with identifiable causes such as tumors or vascular issues. The condition results from neurovascular compression (NVC), where arteries in the dorsal root entry zone repeatedly press on the trigeminal nerve due to micro-trauma from pulsating blood vessels, causing pain.[3,5,8]

In the present case, we have a male patient complaining of acute, two-minute-long burning pain on the right side of his face, as per the trigeminal nerve dermatome. After receiving PIT utilizing dextrose, the patient's pain dramatically reduced till he was only experiencing sporadic pain in one location on their right frontal region. The number of studies examining PIT's efficacy in treating trigeminal neuralgia remains restricted. Consequently, there are limited opportunities to draw comparisons between trigeminal neuralgia cases. Itkin reported[21] that a 70-year-old man with trigeminal neuralgia described having severe, sharp pain in his face that affected the upper jaw, ocular region, and mandibular branch of the trigeminal nerve. He was treated with prolotherapy neural treatments, which required 15 injections to spread the three branches. After five months, the pain subsided, but it returned ten months

later following a head accident. Another head injury was the cause of the persistent pain.

Studies demonstrate[11,22] that patients receiving dextrose injections report lower pain scores on both the visual analog scale (VAS) and numeric rating scale (NRS) compared to those on conventional pharmacotherapy, which typically involves anticonvulsants like carbamazepine and oxcarbazepine. Dextrose injections are effective due to their targeted approach, directly impacting the nerve root to provide a more localized and rapid analgesic effect. [23]

In contrast, while traditional pharmacological treatments benefit many, they often have significant side effects and may not provide comprehensive relief. Carbamazepine, the current gold standard for trigeminal neuralgia, can have adverse effects that limit its long-term use[11,22]. Additionally, tolerance often develops with prolonged use, necessitating higher doses or alternative therapies. Recent treatment guidelines suggest that combining pharmacotherapy with adjuvant treatments like perineural injections may improve overall outcomes for trigeminal neuralgia. [11]

Low-level laser therapy (LLLT) is emerging as another non-invasive treatment option for trigeminal neuralgia. Evidence indicates that LLLT can significantly reduce pain, as shown by decreases in VAS and NRS scores. Its proposed mechanism involves photobiomodulation, which aids cellular repair and decreases inflammation[24]. However, while LLLT has shown promise, research suggests that dextrose injections may sometimes provide faster pain relief. [25]

Other complementary therapies, including cryotherapy and Transcutaneous Electrical Nerve Stimulation (TENS), are also utilized in managing trigeminal neuralgia, though with variable success. Cryotherapy can offer short-term pain relief by numbing the affected area, while TENS modifies pain perception via electrical stimulation, benefiting some patients[24]. Nevertheless, these methods lack robust evidence supporting pharmacological treatments and perineural injections and are

generally regarded as adjunct therapies rather than standalone solutions[11,24].

Massage and relaxation therapies are also commonly recommended as part of a comprehensive rehabilitation strategy for trigeminal neuralgia, focusing on reducing muscle tension and promoting relaxation. These techniques can enhance the quality of life as reflected by SF-36 scores, although their direct impact on pain scores is unclear and varies among individuals. [11,24]

Clinical studies further support the effectiveness of perineural dextrose injections in reducing pain and enhancing functional outcomes in neuropathic pain conditions. For example, a randomized controlled trial by Maniquis-Smigel et al.[26] demonstrated that epidural injections of 5% dextrose provided short-term analgesic benefits for chronic low back pain, suggesting the potential for dextrose in neuropathic pain management. Similarly, Siahaan et al.[27] found that dextrose injections, guided by ultrasound, effectively alleviated pain from inferior cluneal nerve entrapment, highlighting dextrose's biochemical impact on peripheral nerve function.

Dextrose injections work by hyperpolarizing nerve membranes, reducing neuron excitability and inflammation. Khalil [28] reported a 90% success rate in treating myofascial pain syndrome with dextrose injections, showing a significant drop in VAS scores over six months. Similarly, Avşar et al. [29] found that 5% dextrose periarticular injections significantly reduced pain scores in patients with osteoarthritis compared to alternative therapies, underscoring dextrose's efficacy in pain management.

Quality of life improvements following perineural dextrose injections are also well-documented. Using the SF-36, a comprehensive health-related quality-of-life assessment, Wu et al.[30] found that patients receiving D5W injections experienced significant improvements in physical functioning and pain levels compared to those given corticosteroid injections. Lin et al.[31]

similarly reported that dextrose injections for carpal tunnel syndrome led to substantial SF-36 score improvements over a six-month follow-up. Altogether, perineural injection therapy with hypertonic dextrose emerges as an effective strategy for managing neuropathic, chronic, and musculoskeletal pain. The data highlight its pain-relieving potential as evidenced by VAS and NRS scores and the quality-of-life benefits of SF-36 improvements. Given its immediate analgesic effects and tissue repair capabilities, dextrose prolotherapy is a promising therapeutic approach for addressing chronic pain conditions.

Determination of the PIT injection point is based on the exit mark and branches of the trigeminal nerve, such as the preauricular area and its branches and the area of sensitive pain points that are felt based on feedback from the sufferer. In this study[32], determination of the V1 branch of the trigeminal nerve began with palpation of the supraorbital foramen. Then, the pain pattern was followed linearly superiorly across the forehead and scalp with patient feedback to identify sensitive areas. With each subsequent treatment, the area of pain progressively decreased, and, therefore, he required injections in fewer locations. A 27gauge ½ inch needle was used to inject a 5% dextrose solution into subcutaneous tissues, with 1-2cc in each area. Tender points were injected at a 45-degree angle, 0.5- 1cm deep and approximately 1-2 cm apart, creating a skin bleb while withdrawing the needle. The interval between injections varies from one week to one month. [16,21,32]

Research on the natural progression of the disease in patients with trigeminal neuralgia is limited. In the past, many believed that trigeminal neuralgia was a disease that got worse over time. However, the results of these two studies challenge this belief. In a retrospective study in Italy, conducted at an advanced pain management centre, with a mean follow-up of nine months, only 15 (8%) of 171 patients showed resistance to treatment of trigeminal neuralgia or reported an increase

in pain intensity. Of 178 patients with trigeminal neuralgia, 13 patients (7%) underwent neurosurgery during the follow-up period [8].

In this case, the patient experienced significant changes following three injection treatments. Even though he only experienced discomfort during the first injection, the patient was ecstatic afterwards, realized its benefits, and consented to continue the injection until the following session. After the injection, the patient experienced an amazing impact due to the pain reduction effect. The patient's sleep quality improved, and he felt more comfortable during daily tasks, especially due to the family's emotional changes. The patient is now willing to interact socially with neighbors and smiles frequently.

CONCLUSION

A minimally invasive treatment for trigeminal neuralgia is perineural injection therapy. PIT can be considered as an alternative therapy used to treat trigeminal neuralgia to lessen the degree and severity of pain.

DISCLOSURES

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Conflict of Interest

The authors have no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript.

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Author Contribution

All authors have contributed to all processes in this research, including preparing, drafting, and approving this manuscript for publication.

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