

PRIMARY EXPERIENCE WITH CT GUIDED MANDIBULAR NERVE BLOCK IN PATIENTS WITH TRIGEMINAL NEURALGIA

By

Samy M Abdelraouf *, **Ashraf M Enite** and **Ola I Saleh**

Departments of Neurosurgery* and Radiodiagnosis, Al-Azhar Faculty of Medicine (Girls)

ABSTRACT

Background: Trigeminal neuralgia (TN) is a well-known facial pain syndrome characterized by excruciating paroxysmal shock pain attacks located in somato-sensory distribution of trigeminal nerve. Mandibular affection is a common presentation of TN.

Objectives: Studying the effect of injection of mandibular nerve with neurolytic solutions in trigeminal neuralgia that was unresponsive to pharmacotherapy.

Patients and Method: This prospective study included 21 patients treated for mandibular neuralgia by percutaneous injection of absolute alcohol under guidance of CT image. Their ages ranged from 35-60 years and male to female was 3:4. All patients suffered from moderate to severe TN, and did not respond to medical treatment. Entry and trajectory of needle was planned by CT and after local anesthesia. Alcohol was injected at the exit of mandibular nerve from foramen ovale.

Results: 85.7% of patients improved (71.4% became pain free and severity of pain decreased in 19%), while 9.6% of patients has no response after injection. The pain free patients became 61.9% after two years of follow up.

Conclusion: CT guided mandibular nerve block by neurolytic agent as absolute alcohol and showed its effectiveness as minimal invasive treatment option for intractable trigeminal neuralgia. CT guidance provided a clear view to secure the safety, accuracy and selectivity of nerve block.

Key words: Trigeminal neuralgia, computed tomography guided, nerve block.

Abbreviations: BNI-PS= Barrow neurological institute pain scale, CT= computed tomography, HIV= human immunodeficiency virus, MRI= magnetic resonant image, MVD= microvascular decompression, RF= radiofrequency, TN= trigeminal neuralgia, TNB= trigeminal nerve block, VAS= visual analogue scale.

INTRODUCTION

Trigeminal neuralgia is a paroxysmal lancinating pain lasting a few seconds, often triggered by sensory stimuli confined to the distribution of one or more branches of trigeminal nerve on one side of the face with no neurological deficit (Greenberg, 2016).

Nerve blocks are an optional method for relief of severe pain. Although analgesic may reduce the pain, nerve block can completely stop pain. In general, two types of nerve blocks are used, i.e. local anesthetic injection and neuro-destructive methods. Because of short duration of action of local anesthetic agents, it can be used to protect against

acute incidental pain and for diagnostic tests. Neuro-destructive blocks use neurolytic agents as alcohol, phenol, glycerol or radiofrequency thermo coagulation for intractable pain (**Curatolo and Bogduk, 2010**).

TNB should be guided by radiological imaging as X-ray fluoroscopy or CT. X-ray fluoroscopy is the most commonly used form of image guidance in interventional pain therapy. It gives wide field of view around target region and continuous real time view when needed. In addition, the apparatus is not excessively expensive. The limitation to fluoroscopy, however, is that it shows only bones. Therefore, it is suitable only for target nerve with a dependable relationship to bony landmark. Also, it gives only two dimensions picture, and its quality is not accurate as it with CT. CT provides clear view vessels that should be avoided by needle in addition to avoiding inadvertent puncture of vital structure. It allows accurate placement needle tip before injection of neurolytic agent with clear view of muscle and soft tissues (**Koizuka et al., 2014**).

PATIENTS AND METHODS

This study was completed at Al-Zahra'a University Hospital between August 2013 and September 2014 after the approval of the hospital local health committee and written informed consents were obtained. Twenty one patients of different ages ranging from 35-60 years were included in this work. They suffered from TN along mandibular branch distribution. All patients were evaluated regarding history, pain localization which was confirmed to mandibular nerve, severity of pain evaluated by visual analogue scale (VAS),

where 0 = no pain and 10 = the worst pain imaginable. Our patients ranged from moderate to severe pain. All of them did not respond to medical treatment. Pain chronicity and frequency varied from 3 per day to 10 per hours. Pain triggers and zone which was present in one half of the patients, and often lied near the nose or mouth. Chewing, talking, smiling and drinking cold or fluid may initiate the pain of TN. Assessment of muscles of mastication was important (which supplied by mandibular nerve). Examination was done for reflexes supplied by trigeminal nerve (absent corneal reflex was the earliest sign of TN when ophthalmic branch was affected).

All patients underwent to MRI brain to exclude organic cause of TN. Laboratory investigations as complete blood count, bleeding time, coagulation profile, hepatitis markers and HIV antibodies were done for all patients.

Inclusion criteria:

1. Age 18-60 years old.
2. Males and non-pregnant or lactating females.
3. Subjects have mean attacks frequency of at least 3 episodes per day and VAS ≥ 5 .
4. Diagnosis of classical TN using international classification of headache disorders (ICHD-II).
5. Subjects on stable dose of concomitant preventive medication for treatment of TN for at least four weeks prior to intervention.
6. Subjects who required "rescue" analgesic medication during study were allowed to use their current (pre-study) opioid

and/or non-opioid analgesic as clinically indicated, e.g. NSAIDs and topical analgesics.

- Subjects were prohibited, willing and able to abstain from initiating and alternative therapy, e.g. acupuncture, massage or physical therapy, for pain relief during the study.

Exclusion criteria:

- Symptomatic TN.
- Serious hepatic, respiratory, hematologic, cardiovascular or renal conditions.
- Neurologic pain other than TN except for occasional migraine or tension headache (<4 headaches per month).
- Psychiatric or medical condition that might compromise participation in study as determined by investigator.
- Administration of any interventional drug within month prior to screening.
- Substance abuse or alcoholism.

Technique: All patients were monitored with continuous electrocardiogram (ECG), pulse monitoring and intermittent noninvasive blood pressure. An intravenous line was inserted. 1 to 5 mg I.V. midazolam, 25-50 mg fentanyl were given to produce slight sedation and analgesia during the procedure. The block was performed with the patient in supine position on CT table, and skin disinfection was done by betadine (bovidone iodine) solution. Under local anesthesia, 2-3 ml of 1% lidocaine, using the standard anatomical landmark and under CT guidance, 22 gauge, 3.5 inches, 0.7 × 90 mm pd spinal needle was inserted to reach the foramen ovale at the base of skull. We should be sure that the needle tip was at

the target position by clear CT image, and confirmed by injection of 0.5 ml of 10% diluted iodine contrast material. We used Iopamidol (Io-pamiro 300, 300 mg of iodine/ml; Bracco Diagnostic Princeton, New Jersey, USA). Also, mandibular paresthesia can be elicited by injection of 0.2-0.3 ml of lidocaine 1%. A series of CT scan slides were done immediately to confirm the needle tip position. The needle tip was then walked carefully into the foramen ovale. A negative test for CSF and blood aspiration was proved, a 0.1 to 0.2 ml increment of dehydrated absolute ethanol were injected every 30 seconds up to 1 ml.

Patient reported outcome scales (PRO): The visual analogue scale (VAS) and Barrow Neurological Institute pain scale (BNI-ps) were the 2 PRO measures used in this study. VAS provided an estimate of pain intensity on a continuous scale, with a score 0 representing no pain and a score 10 representing worst pain. The BNI-ps rates pain on a scale of 1 to 5, incorporating degree of dependence on medication, as a score 1 representing no pain and no medication, while a score 5 representing severe pain or no pain relief (John, 2016).

After the procedure, patient was observed in recovery room, or short stay unit for 1-2 hours depending on the patient condition. All patients were clinically evaluated before and after injection at 1 to 3 days, 2 weeks and 6 months by using VAS and BNI -ps.

Trigeminal sensory function was evaluated on the pain side and contralaterally by testing for light touch and pin prick. The response was ranked according to four grade scale (normal,

slightly decreased, severely decreased and totally impaired).

In pain free patients, a further follow up was conducted by telephone and in pain persistent patients. Repeated injection was done or referral to other option of management in more resistant cases. A pain free condition was defined as, the patient being completely free from trigeminal pain without medication.

Statistical analysis: Kaplan-Meier analysis was used to construct pain free survival curves for censored survival data, and the log rank test was used to compare the survival curves. The relationships between independent preoperative variables and treatment outcomes were analyzed with Wilcoxon signed ranks test. Other side effects were with Fisher exact test. χ^2 was used for comparison.

Values of $P < 0.05$ were considered significant.

RESULTS

Twenty one patients who fulfilled inclusion criteria were studied, male to female was 3:4, and their ages ranged from 35 to 60 years. They presented by moderate to severe pain along the distribution of mandibular nerve (Table 1).

Adequate pain relief was obtained in eighteen of them, and they stopped or decreased (fourteen stopped and four decreased) their pain medications.

Three patients did not improve and still complaining of pain as pre-procedure. Repeated injection was done, two of them had a good response but the third did not respond to block.

Table (1): Descriptive statistics for the studied patient's demography and neurolysis.

Parameters	Count	No.	%
Age (years)	Mean \pm SD	45.8 \pm 9.51	
	Range	35 - 60	
Sex	Females	12	57.1%
	Males	9	42.9%
Pain before	No pain	0	0.0%
	Mild	0	0.0%
	Moderate	7	33.3%
	Severe	14	66.7%
Pain after	No pain	15	71.4%
	Mild	3	14.3%
	Moderate	2	9.5%
	Severe	1	4.8%

All of them underwent to percutaneous CT guided mandibular nerve

block by absolute alcohol at the level of foramen ovale (Figure 1).

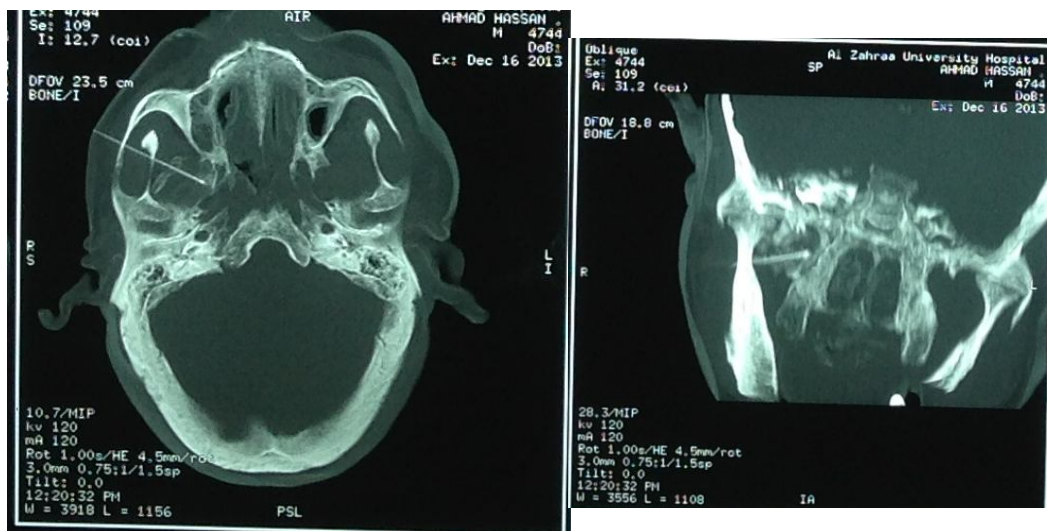


Figure (1): CT guided percutaneous mandibular nerve injection at its exit from foramen ovale.

According to outcome results, many patients had significant improvement. There was a highly statistically significant

decrease in the level of pain after than before injection (p value was 0.00001 - Table 2).

Table (2): Comparison between the level of pain before and after injection.

Parameters \ Pain level	Pain before		Pain after		Chi - square test	
	No.	%	No.	%	X ²	P - value
No pain	0	0.0%	15	71.4%	32.04	0.00001
Mild	0	0.0%	3	14.3%		
Moderate	7	33.3%	2	9.5%		
Severe	14	66.4%	1	4.8%		

Regarding adverse effects, peripheral nerve blocks were invariably associated with swelling and discomfort lasting several days. Anesthesia dolorosa developed in one case after repeated blocks.

DISCUSSION

TN is a debilitating syndrome consisting mainly of unilateral short bursts of lancinating pain in one or more branches

of trigeminal nerve. According to the ICHD-II criteria (international classification of headache disorders II), classic TN is the most common idiopathic disorder characterized by brief electric shock like pain, abrupt in onset and termination, limited to distribution of one or more division of trigeminal nerve (**Bokhari, 2012**). Advances in imaging and improved understanding of the physiology and anatomy of pain have led to significant

development in neurosurgical management (**Chenur and Colin, 2017**).

Neuro-destructive procedures is indicated with regards to medically refractory cases of trigeminal neuralgia (**Malgorzata et al., 2015**). TNB with alcohol is an accepted treatment for TN, but is not widely used as other percutaneous procedures or microvascular decompression because it provides limited pain relief and the repeated blocks have a lower success rate and higher morbidity including neuritis (**Han and Kim, 2010**). Therefore, we evaluated the efficacy of alcohol block on the mandibular division of trigeminal nerve as a treatment of TN.

Neurolytic agents like alcohol act immediately after coming into contact with the nerve fiber, and there is a rise in the endoneural fluid pressure, secondary to the mast cell degeneration and release of vasoactive substances. The elevated pressure cause stretching of the perineurium and compression of perineural vessels which lead to ischemia of nerve fiber and interruption of nerve impulses. It also extracts cholesterol, phospholipids, and cerebrosides from the nervous tissue and causes precipitation of lipoproteins and mucoproteins (**Dwarkadas et al., 2016**).

Han and Kim (2010) proved that pain relief duration observed in their study of mandibular nerve block with alcohol is comparable with that reported for alternative techniques such as radio-frequency, thermo-coagulation. The rates of complete pain relief after 1, 2 and 5 years if procedures were 70%-90%, 62%-65% and 51%-56% respectively.

TNB with alcohol became less effective in terms of pain relief duration and increased morbidity when treatment was repeated. Although **Shah et al. (2011)** reported that pain free interval of repeated block was shorter than first block, the

other previous studies showed that repeated TNB with alcohol did not lose effectiveness, even after 14 blocks had been administered in one individual over many years.

In this study, significant pain relief, occurred by decreased VAS (decreased severity of pain), and decreased BNI-ps (decreased analgesic consumption) 2 weeks after injection and continued throughout follow up period.

Pain relieve after 1 and 2 years in studied patients were 71.4% and 61.9% compared with the study of **Han and Kim (2010)** who stated that 70% and 62% occurred after the same durations respectively.

Few studies have been conducted on TNB with alcohol or its related complications. **Macleod and Patton (2007)** reported that 4% of their patients experienced local symptoms such as pain, burning, swelling, local infection, and avascular necrosis of the skin. **Kyung et al. (2017)** reported that 8.6% of their cases experienced complications. The most common complication was sensory discomfort including itching, bothersome dysesthesia, and deep hyposthesia in 5.7% of patients. The majority resolved within 6 months. The other complications were also subsided or well tolerated by patients in several months.

Generally, all neuro-ablative procedures for TN treatment involved trigeminal nerve disturbances, both sensory and motor, and troublesome dysesthetic disturbances affect approximately 4 to 10% of patients treated with any ablative technique for TN. Anesthesia dolorosa and corneal sensory disturbance can occur after denervation procedure for TN, especially in patients that undergo RF in whom it occurs at a rate of 0.3-22%. Percutaneous surgical techniques are less likely to be associated with mortality or

hearing loss, which is their greatest benefit as compared with MVD (**Kyung et al., 2017**).

Anesthesia dolorosa occurred in 4.8% of patients compared with **Han and Kim (2010)** who stated that 11.3% of patients underwent alcoholic nerve block. They complained of parasthesia, dysesthesia, or deep sensory loss, 4.3% of masseter muscle weakness, 1.8% of heavy salivation, 1.8% of tinnitus, and 0.6% hematoma in the upper cheek, although all study patients had varying degrees of sensory deficit on the mandibular area. However, all sensory discomforts gradually decrease, patients adapted without medication, and the majority of complications resolved within 6 months. No significant difference in the incidence of complications was found between patients with and without previous alcohol blocks.

CONCLUSION

Neurolytic mandibular nerve block offered a simple office-based neurosurgical option for treating intractable and pharmacologically unresponsive TN. The advantage of CT over plain X-ray fluoroscopy was the proper visualization of the foramen ovale facilitating the injection of neurolytic substance properly, reducing the incidence of side effects.

REFERENCES

- Bokhari K (2012):** Trigeminal neuralgia involving all three branches of trigeminal nerve treated by peripheral neurectomy, An interesting case report; The Internet Journal of Dental Science, 10 (2): 1-5.
- Chenur O and Colin SH (2017):** Surgical management of chronic pain. Surgery, 35 (2): 110-112.
- Curatolo M and Bogduk N (2010):** Diagnostic and therapeutic nerve block In: Fishman SM, Ballontyne JC, Rathmell JP, editors. Bonica's management of pain, 4th ed, Pbl.: Lippincott, pp: 1401-1423.
- Dwarkadas KB, Sajay B, Sanjeeva G and Raghbir SP (2016):** Pharmacotherapy of drugs used in interventional pain treatment procedures, interventional pain management: a practical approach 2nd ed. Pbl. Jaypee Brothers Publishers Ltd, London, UK, chapter 5: 48-52.
- Greenberg MS (2016):** Trigeminal neuralgia; Handbook of Neurosurgery, 8th ed, Pbl. Thieme Publishers New York, USA, 28: 480-493.
- Han KR and Kim CH (2010) :** The long-term outcome of mandibular nerve block with alcohol for the treatment of trigeminal neuralgia, Anesthesia and Analgesia, 3 (2): 550-553.
- John YK (2016):** Measurement of trigeminal neuralgia pain – Penn facial pain scale, Neurosurg Clin N Am., 27: 327- 336.
- Koizuka S, Nikujina K and Mieda RI (2014):** CT guided nerve block; a review of the features of CT fluoroscopic guidance for nerve block. Anesthesia, 28: 94-101.
- Kyung RH, Yun JC, Jung DL and Chan K (2017):** Trigeminal nerve block with alcohol for medically intractable classic trigeminal neuralgia: long-term clinical effectiveness on pain. Int. J. Med Sci., 14(1):29-36.
- Malgorzata MM, Bartosz H, Dariusz K, Agnieszka S and Hanna K (2015):** The effectiveness of neurolytic block of sphenopalatine ganglion using zygomatic approach for the management of trigeminal neuropathy. Neurologia I Neurochirurgia, Polska, 49: 389 – 394.
- McLeod NM and Patton DW (2007):** Peripheral alcohol injections in the management of trigeminal neuralgia. Oral Surg., Oral Med., Oral Pathol., Oral Radiol. and Endod., 104: 12-17.
- Shah SA, Khan MN, Shah SF, Ghafoor A and Khattak A (2011):** Is peripheral alcohol injection of value in the treatment of trigeminal neuralgia? An analysis of 100 cases. Int. J. Oral Maxillofac. Surg., 40: 388-392.

خبرة أولية في الإستدلال بجهاز الأشعة المقطعية لإحصار العصب الفكي في مرضى إعتلال العصب المخي الخامس

سامي موسى عبدالرؤوف* - أشرف محمد عنایت - علا إسماعيل صالح

قسمي جراحة المخ والأعصاب* و الأشعة التشخيصية - كلية طب الأزهر (بنات)

خلفية البحث: إعتلال العصب الخامس هو متلازمة الألم الوجهي المعروفة جيدا والتي تتميز بنوبات من صدمة الألم الشديد في الوجه يتوزع على مسار العصب الخامس أو أحد فروعها، ويعد تأثر العصب الفكي شائعا في هذه الحالات.

الهدف من البحث: دراسة تأثير حقن مواد مخربة للعصب حول العصب الفكي في حالات إعتلال العصب الخامس (الفرع الفكي) غير المستجيبة للعلاج الدوائي.

المرضى وطرق البحث: تضمنت هذه الدراسة واحد وعشرين مريضا من الذين يعانون آلام العصب الخامس على مستوى الفرع الفكي ، وانطبقت عليهم شروط الدراسة بالإستدلال بجهاز الأشعة المقطعية لحقن العصب بالكحول المركز عند خروجه من قاع الجمجمة، وتراوح أعمارهم بين ١٨ و ٦٠ عاما، وكانت نسبة الذكور إلى الإناث ٤:٣، وجميعهم كانوا يعانون ما بين إعتلال شديد إلى متوسط ولم يستجيبوا للعلاج الدوائي، وقد تم تحديد نقطة دخول الإبرة وإتجاهها بالإستدلال بجهاز الأشعة المقطعية ، وتم حقن الكحول حول العصب الفكي عند خروجه من الثقب البيضاوي بقاع الجمجمة.

النتائج: تحسنت الحالات بنسبة ٨٥,٧٪، و اختفى الألم تماما في ٧١,٤ ٪، منهم وقلت حدته في ١٩ ٪، بينما لم يتحسن ٩,٦ ٪ من المرضى وقد تم متابعة المرضى وإعادة الحقن للحالات التي قل فيها الألم والحالات التي لم تتحسن. وبعد عامين من متابعة المرضى، كانت نسبة المرضى الذين لا يعانون من الألم هي ٦١,٩ ٪.

الإستنتاج: يعد الإستدلال بالأشعة المقطعية لإحصار العصب الفكي عن طريق حقنه بعوامل مخربة للعصب كالكحول المركز من الخيارات الهامة والفعالة كإحدى طرق العلاج ذو التدخل المحدود في حالات إعتلال العصب الخامس التي لم تستجب للعلاج الدوائي حيث أنه يعطى نتائج أكثر دقة وأمانا و بأقل مضاعفات ممكنة .