

# Trigeminal Nerve Compression (TGNC) Technique for the Treatment of Trigeminal Neuralgia; Study of 80 Cases in 10 Years

AZMAT ULLAH KHATTAK, MUHAMMAD ISHFAQ, ALI HAIDER

Department of Neurosurgery, Lady Reading Hospital, Peshawer, KPK – Pakistan

## ABSTRACT

**Objective:** To evaluate the outcome of compression technique of trigeminal nerve at the intracisternal part of 5th nerve for trigeminal neuralgia.

**Methodology:** This cross sectional study was conducted in Hayatabad medical complex, Lady ready hospital and Abasin hospital Peshawer from Jun 2004 to December 2014. After taking consent from the ethical committee all post operative cases of trigeminal neuralgia of compression technique with either gender were included while post operative cases of it due mass lesion in the brain were excluded. Patient's particulars documentation were done in pre designed proforma. Post operatively patients were followed till to 1½ years. Results were analyzed by SPSS version 20 and presented in the form of graphs, charts and tables.

**Results:** Total 80 patients were included in this study in which males were 60 (75%) while females were 20 (25%) cases having males to females ratio of 2;1. All the patients were in the age range of 35 to 65 years with the mean range of  $45.76 \pm 9.6$  SD. V<sub>2</sub>, V<sub>3</sub> pain distribution was on the top having 33 (41.25%) cases followed by V<sub>2</sub> in 19 (23.75%). post operative outcome till to 1½ years out of 80 Patients 77 (96.2%) were completely pain free while 3 (3.8%) patients developed recurrence in the same branch of trigeminal nerve and 1(1.25%) case of CSF rhinorrhea, otorrhea and facial nerve paresis along with deafness for each of the three.

**Conclusion:** Compression technique for trigeminal neuralgia is safe, simple and cost effective.

**Key Words:** Compression, Intracisternal component, Trigeminal nerve, Trigeminal Neuralgia.

**Abbreviations:** TGNC: Trigeminal Nerve Compression. CBC: Complete Blood Count.

## INTRODUCTION

Trigeminal neuralgia is a painful condition of the facial region of the body in which the patient experience sudden, severe, shock like pain having short duration and is distributed in one or more sensory branches of trigeminal nerve.<sup>1</sup> Every year 4.3 new cases of trigeminal neuralgia are diagnosed in every 100000 population of the world and it is more common in females as compared to males.<sup>2</sup> It incidence increases after the age of 40 years and one series has showed that every year 25.9 new cases are diagnosed in every 100000 peoples of the world when the age crosses 80 years.<sup>3</sup> In ancient times work was done on trigeminal neuralgia which was improving slowly and gradually

with passage of time about its concept, diagnosis and treatment. Galen, Aretaeus and Hippocrates called it cephalalgias then from 1671 to 1677 detailed description of this condition came forward. In 1756 Andre gave it the name of tic douloureux, Jhon hunter described it more clearly that it is the disease of nervous system in which pain is referred to the teeth, gums and tongue where there is actual no disease.<sup>4</sup>

Trigeminal neuralgia is treated by both pharmacological and surgical methods. In pharmacological method of treatment there are first line and second line drugs. In first line drugs both carbamazepine and oxcarbazepine are used but the safety profile of oxcarbazepine is much better than the carbamazepine.

Although the exact mechanism of the both drugs is not known but it is hypothesized that it blocks the sodium channels which are sensitive to the voltage which leads to the stability of neuronal membranes already hyper excited and blockage of repetitive firing and spreading of synaptic impulses. In second line drugs therapy Lamotrigine and Baclofen are used. Regarding mechanism of action of these two drugs Baclofen blocks the excitatory neurotransmission by acting on GABA B receptors while Lamotrigine is neuronal membrane stabilizer along with additional effect of suppressing the excitatory neurotransmitter release by acting on sodium channels which are sensitive to voltage. Similarly in few studies good effect was noted by using the other antiepileptic drugs like pregebaline, levetiracetam, clonazepam, valproate and topiramate etc.<sup>5-8</sup>

All those patients which becomes refractory to the medical management are subjected to various surgical procedures which includes neurectomy of the involved branch of 5<sup>th</sup> nerve, glycerol and radiofrequency rhizotomy, trigeminal ganglion micro compression by balloon, stereotactic radiosurgery. All these procedures are destructive in nature but in 1967 Dr. Peter Jannetta was the person who performed first MVD for trigeminal neuralgia by separating the 5<sup>th</sup> nerve from offending vessel by means of the sponge. On comparison with the other surgical techniques microvascular decompression is safe, effective in the terms of the pain control and the rate of recurrence of the pain is much less as compared to other techniques making it a procedure of choice for young and fit patients having trigeminal neuralgia.<sup>9-15</sup> In 2013 *Revuelta – Gutierrez R* and colleagues introduce a novel technique for trigeminal neuralgia in which there was no offending vessel at the area of DREZ. Compression of intracisternal part of trigeminal nerve was done by Mallis coagulation forcep to give iatrogenic neuropraxia and when results were compared with MVD these were comparable to it.<sup>15</sup> Pain control of trigeminal neuralgia for prolong periods can be obtained by this novel technique of intracisternal compression of trigeminal nerve with minimum morbidity and mortality in the experienced hands.<sup>16</sup>

Rational of the current study is to evaluate the outcome of compression of intracisternal part of trigeminal nerve for trigeminal neuralgia which is a novel technique. This study is important because there is only one study published uptill now and by doing this study in our set up it will open a gateway for future researchers. Furthermore the results will be com-

pared with both local and international studies done on efficacy of different surgical techniques which will show us the effectiveness of this technique and if proved to be effective then this will be a step to provide safe surgical treatment to the patients of trigeminal neuralgia with minimum morbidity and mortality.

## **METHODOLOGY**

This cross sectional study was conducted in multi-center including Hayatabad medical complex, Lady Ready hospital and Abasin hospital Peshawar from Jan 2004 to December 2014 having total duration of 10 years. After taking approval from the ethical committee all those cases who were operated by Dr Azmat Ullah Khattak for trigeminal neuralgia by using compression technique with either gender were included while cases of it due to any mass lesion in the brain. All documentation including patient's age, gender, pre operative symptoms and signs, post operative complications were done according to the pre designed proforma. Post operatively patients were followed till to 1½ years for any post operative complications and pain in the distribution of trigeminal nerve by using visual analogue scale. Results were analyzed by SPSS version 20 and presented in the form of graphs, charts and tables.

All the patients were undergone through thorough history, detailed clinical examination and relevant investigations including MRI of the brain with and without contrast. All admitted patients for surgery were continued on tab tegral during ward admission along with analgesics. Before surgical intervention patients were subjected to pre-operative preparation, like complete blood count (CBC) and viral serology (HbsAg and Anti-HCV Ab) was done. Blood and surgical disposables were arranged accordingly. An informed consent was taken from all patients and prognosis was explained. The ethical approval was taken from the hospital ethical committee, "Postgraduate Medical Institute, Institutional Research and Ethics board".

## **Surgical Technique**

We used the 6 Ps protocol for compression technique ***Pre-operative preparation***; in the form of detailed history, all relevant examinations and investigations like MRI of the brain with and without contrast to exclude any mass lesion of the brain causing trigeminal neuralgia. All hematological investigations like hepatitis B and C, complete blood count, Random blood sugar were done. Blood and surgical stuff were arranged.

**Position:** All the patients were placed in the park bench position.

**Portal (Incision):** Linear paramedian incision having dimensions of  $5 \times 6 \times 4$  (5 mm medial to the mastoid notch, 6 cm above it and 4 cm below it) was used.

**Procedure:** Then  $3 \times 3$  cm craniotomy was done followed by inverted Y shaped dural opening having vertical limb towards the transverse and sigmoid junction. CSF was drained from the CP angle cisterns. Then petrotentorial corridor which is the junction of petrous bone and tentorial cerebelli was strictly followed. By following the petro tentorial corridor first petrosal vein was localized when needed coagulated but in majority of the cases it was avoided because of obstruction in

the surgical field. 5<sup>th</sup> nerve was located by followed the petro tentorial corridor which is often located deep in it. Arachnoid was separated from it and intracisternal part was compressed by bayonet forcep at the different sites without searching for vascular loop or inserting Teflon between vascular loop and fifth nerve. By this method all diagnosed cases of trigeminal neuralgia were operated except those from mass lesion in the CP angle. Wound was closed in the water tight fashion.

**Post-operative Care:** All the patients were kept in ICU for first 24 hours for monitoring. All the post-operative patients were discharged from the hospital when stable.

**Post-operative follow-up:** All the patients were followed up till 1½ years at regular intervals by means of visual analogue scale and for any post operative complications.

**Table 1:** Age wise distribution of patients with trigeminal neuralgia  $N = 80$ .

Age of the Patients	Frequency	Percent	Valid Percent	Cumulative Percent
35 – 45 years	40	50.0	50.0	50.0
46 – 55 years	26	32.5	32.5	82.5
56 – 65 years	9	11.2	11.2	93.8
66 – 75 years	3	3.8	3.8	97.5
76 – 85 years	2	2.5	2.5	100.0
Total	80	100.0	100.0	

**Table 2:** Pre-operative branch involvement of trigeminal nerve  $N = 80$ .

	Frequency	Percent	Valid Percent	Cumulative Percent
V1	3	3.8	3.8	3.8
V2	19	23.8	23.8	27.5
V3	9	11.2	11.2	38.8
V1, V2	10	12.5	12.5	51.2
V2, V3	33	41.2	41.2	92.5
V1, V2, V3	6	7.5	7.5	100.0
Total	80	100.0	100.0	

## RESULTS

Total 80 patients of trigeminal neuralgia were included in our study. There were 21 (26.2%) females and 59 (73.8%) males with males to females ratio of 2.80;1. The patients ages were in the range of 35 to 85 years with mean of  $45.76 \pm 9.6$  SD (Table 1). Majority of the patients were complaining of pain in the right side of the face having frequency of 59 (73.8%) and V<sub>1</sub> and V<sub>2</sub> were combined involved in the facial pain with greatest proportion with frequency of 33 (41.2%) (Table 2). All those patients who were operated by this technique 77 patients were those of idiopathic trigeminal neuralgia, 2 with post neurectomy pain in distribution of trigeminal nerve and 1 patient with signs and symptoms of trigeminal neuralgia already diagnosed for multiple sclerosis (Table 3). Post operatively up till 1½ years follow up we found that in 77 patients pain was completely relieved and 3 patients again presented with recurrent pain in the same area and side of the face (Table 4). The most common complication which occurred post operatively was temporary facial hypoesthesia which occurred in 42 patients and other less common complications were recurrence of pain in the same branch of 5<sup>th</sup> nerve, facial nerve paresis, CSF otorrhea

and rhinorrhea (Table 5).

**DISCUSSION**

Trigeminal neuralgia is a extremely painful condition which involves the oral and facial region for which different treatment modalities are available ranging from pharmacological therapies , different types of ablative procedures and microvascular decompression done either by open technique or endoscopically depending upon patient conditions and disease status.<sup>17</sup> Recently a novel technique has come forward which was performed by *Revelta–Gutierrez R* and colleagues<sup>15</sup> for the treatment of trigeminal neuralgia in which there was no vascular conflict at the area of DREZ involving compression of intracisternal part of trigeminal neuralgia. They collected data of 44 patients in 10 years duration from the year 2000 to 2010 treated by this technique in which there was no vascular conflict and they found it extremely impressive in terms of pain control, recurrence and post operative morbidity and mortality. Furthermore this technique was highly appreciated by *Broggi G*<sup>16</sup> and *Chen KS et al*,<sup>18</sup> in their commentary based articles.

We also adopt this novel technique in total 80 cases of trigeminal neuralgia from year 2004 to 2014 in total 10 years duration. MRI of brain was done pre operatively to exclude any mass lesion of the brain causing this condition. Then in all patients’ compression of intracisternal part of 5<sup>th</sup> nerve was done without searching for any vascular loop and inserting muscle patch or Teflon. In our series all the patients were in the age range of 35 to 80 years with the mean range of 45.50 ± 9.6 years SD while the females were predominantly affected with the male to female’s ratio of 2.70:1.

**Table 3:** *Patients of trigeminal neuralgia operated by compression of intracisternal component of 5<sup>th</sup> nerve N = 80.*

Different Types of TGN	Frequency	Percent	Valid Percent	Cumulative Percent
Classic trigeminal neuralgia pain	77	96.2	96.2	96.2
Trigeminal neuralgia pain after neurectomy	2	2.5	2.5	98.8
Multiple Sclerosis trigeminal neuralgia Pain	1	1.2	1.2	100.0
Total	80	100.0	100.0	

**Table 4:** *Pre-operative outcome of compression technique for trigeminal neuralgia in terms of pain relief N = 80.*

	Frequency	Percent	Valid Percent	Cumulative Percent
Complete Pain Relief	77	96.2	96.2	96.2
With Pain	3	3.8	3.8	100.0
Total	80	100.0	100.0	

**Table 5:** *Post-operative outcome of compression technique of intracisternal component of 5<sup>th</sup> nerve in terms of complications N = 80.*

	Frequency	Percent	Valid Percent	Cumulative Percent
No complications	29	36.2	36.2	36.2
Recurrence of pain in the same branch of 5 <sup>th</sup> nerve	3	3.8	3.8	40.0
Facial nerve paresis	3	3.8	3.8	43.8
Temporary facial hypoesthesia’s	42	52.5	52.5	96.2
Deafness	1	1.2	1.2	97.5
CSF rhinorrhea	1	1.2	1.2	98.8
CSF otorrhea	1	1.2	1.2	100.0
Total	80	100.0	100.0	

Right side involvement was more and V<sub>2</sub>, V<sub>3</sub> distribution pain was on the top having 33 cases followed by V<sub>2</sub> having 19 cases. International studies conducted on trigeminal neuralgia shows that females are effected more from the orofacial pain of trigeminal neuralgia while right side involvement and V<sub>2</sub>, V<sub>3</sub> distribution of pain is dominant in majority of cases.<sup>19,20</sup> In series of *Revuelta – Gutierrez R* and colleagues<sup>15</sup> the mean of the patients in which the patients was 49 years which is slightly more the mean age of the patients in our series this is because the patients of our region are less educated and they does take medications regularly for the diseases and the compliance to the drugs prescribed for the trigeminal neuralgia pain was poor therefore they presented early to us for surgery.

Our total post operative follow up was 1½ year after the procedure in which we found that complete pain relief in 77 (96.25%) patients out of 80 patients and recurrence of pain in the same branch of 5th nerve was noted in 3 (3.75%) cases but the initial pain relief was noted in all 80 (100%) patients by using the visual analogue scale. *Revuelta – Gutierrez R* and colleagues<sup>15</sup> when analyzed the results of this technique also noted that initial pain relief excellent in all 44 (100%) patients but their recurrence rate was 12 (27.2%) while the initial pain relief in case of microvascular decompression was noted in 211 (92.9%) out of 233 patients while the rate of recurrence was 14.8% (32) which was much than the intracisternal compression of 5<sup>th</sup> nerve for trigeminal neuralgia. This shows this technique is more efficacious than microvascular decompression in terms of initial pain relief and recurrence of the pain. The rate of recurrence of pain in the series of *Revuelta – Gutierrez R et al*,<sup>15</sup> is slightly more as compared to our series. This is may be due to short post operative follow-up in our patients. Microvascular decompression for trigeminal neuralgia is a choice procedure because it has low complications, safe and very much effective in terms of pain control when compared to other procedures. Its efficacy in immediate pain relief ranges from 76.4 to 98.2% while its recurrence rate increases with increase in the post operative duration. In international series the rate of recurrence has been mentioned in the range of 8.3 to 30 % based on different durations of post operative follow from 5 months to 120 months.<sup>21-25,27-31</sup>

Peripheral procedures for trigeminal neuralgia are those which are used to block those branches of trigeminal nerves involved in pain. These procedures inclu-

de peripheral neurectomies and local blocks in the form glycerol and alcohol injections.

## CONCLUSION

Compression of intracisternal component of trigeminal nerve for trigeminal neuralgia excluding those which are due to mass occupying lesion in the brain is most safe and effective procedure and alternative to MVD if performed by experienced surgeon.

**Azmat Ullah Khattak Theory of Trigeminal Neuralgia:** Trigeminal neuralgia which is extremely painful condition of the facial region is mainly due peripheral abnormal discharge of the signals and vascular loop is not the basic pathology. If the fifth nerve is manipulated by mild compression in the intracisternal part then these abnormal discharges of the nerve reverses back to normal pattern and the role is similar to pharmacological therapy which acts mainly peripherally on nerve to block the abnormal signals.

Points in the favor of theory and technique:

1. If vessel causes neuralgia then throughout the body along the nerves vessels are also present side by side why neuralgias of peripheral nerves does not occur?
2. If vessel irritates the 5<sup>th</sup> nerves and leads to demyelination of 5<sup>th</sup> nerve at the contact point then why it gives immediate response to the surgery although demyelination is still present post operatively?
3. Why trigeminal neuralgia gives response to stereotactic radiosurgery in the presence of vessel which causes TGN although the vessel has been physically removed.

*Address for Correspondence:*

*Dr. Azmat Ullah Khattak*

*Department of Neurosurgery*

*Lady Reading Hospital, Peshawar, KPK – Pakistan*

*E-mail: ishfaqtk83@gmail.com*

## REFERENCES

1. Trigeminal neuralgia. Torpy JM, Rogers JL, Golub RM. JAMA. 2013; 309 (10): 1058.
2. Obermann M. Treatment options in trigeminal neuralgia. Ther Adv Neurol Disord. 2010 Mar; 3 (2): 107–15.
3. Katusic S, Beard CM, Bergstralh E, Kurland LT. Incidence and clinical features of trigeminal neuralgia, Ro-

- chester, Minnesota, 1945 – 1984. *Ann Neurol.* 1990; 27 (1): 89–95.
4. Eboli P, Stone JL, Aydin S, Slavin KV. Historical characterization of trigeminal neuralgia. *Neurosurg.* 2009 Jun; 64 (6): 1183-6.
  5. Cruccu G, Gronseth G, Alksne J, Argoff C, Brainin M, Burchiel K, et al. AAN – EFNS guidelines on trigeminal neuralgia management. *Eur J Neurol.* 2008 Oct; 15 (10): 1013-28.
  6. Obermann M. Treatment options in trigeminal neuralgia. *Ther Adv Neurol Disord.* 2010 Mar; 3 (2): 107–115.
  7. Fromm GH, Terrence CF, Chattha AS. Baclofen in the treatment of trigeminal neuralgia: double – blind study and long-term follow-up. *Ann Neurol.* 1984 Mar; 15 (3): 240-4.
  8. Lindström P, Lindblom U. The analgesic effect of tocainide in trigeminal neuralgia. *Pain.* 1987 Jan; 28 (1): 45-50.
  9. Ashkan K, Marsh H: Microvascular decompression for trigeminal neuralgia in the elderly: a review of the safety and efficacy. *Neurosurg.* 2004; 55: 840-850.
  10. Broggi G, Ferroli P, Franzini A: Treatment strategy for trigeminal neuralgia: a thirty years experience. *Neurol Sci.* 2008; 29 (Suppl. 1): S79-S82.
  11. Dellaretti M, Rayns N, Touzet G, Sarrazin T, Dubois F, Lartigau E, Blond S: Clinical outcomes after Gamma Knife surgery for idiopathic trigeminal neuralgia: Review of 76 consecutive cases. *J Neurosurg.* 2008; 109 (Suppl.): S173-S178.
  12. Gronseth G, Cruccu, G, Alksne J, Argoff C, Brainin M, Burchiel K, Nurmikko T, Zakrzewska JM: Practice parameter: the diagnostic evaluation and treatment of trigeminal neuralgia (an evidence – based review): report of the Quality Standards Subcommittee American Academy of Neurology and the Europea Federation of Neurological Societies. *Neurology*, 2008; 71: 1183-1190.
  13. Tolle T, Dukes E, Sadosky A: Patient burden of trigeminal neuralgia: results from cross – sectional of health state impairment and treatment patterns in six european countries. *Pain Pract.* 2006; 6: 153-160.
  14. Jannetta PJ. Arterial compression of the trigeminal nerve at the pons in patients with trigeminal neuralgia. *J Neurosurg.* 1967; 26: 159-62.
  15. Revuelta – Gutierrez R, Martinez – Anda JJ, Coll JB, Campos – Romo A, Perez – Peña N. Efficacy and safety of root compression of trigeminal nerve for trigeminal neuralgia without evidence of vascular compression. *World Neurosurg.* 2013; 80 (3-4): 385-9.
  16. Broggi G. Trigeminal neuralgia without evidence of neurovascular conflict: microvascular compression or route entry zone exploration? *World Neurosurg.* 2013 Sep-Oct; 80 (3-4): 300-1.
  17. Punyani SR, Jasuja VR. Trigeminal neuralgia: An insight into the current treatment modalities. *J Oral Biol Craniofac Res.* 2012 Sep-Dec; 2 (3): 188–97.
  18. Chen KS, Sagher O. Trigeminal neuralgia without vascular conflict: strategies and outcomes when the culprit goes missing. *World Neurosurg.* 2013; 80 (3-4): 302-3.
  19. Van Loveren H, Tew J M, Keller J T, et al. A 10 – year experience in the treatment of trigeminal neuralgia: Comparison of percutaneous stereotaxic rhizotomy and posterior fossa exploration. *J Neurosurg.* 1982; 57: 757-64.
  20. Taha JM, Tew JM. Comparison of surgical treatments for trigeminal neuralgia: Reevaluation of radiofrequency rhizotomy. *Neurosurgery*, 1996; 38: 865-71.
  21. Tyler – Kabara EC, Kassam AB, Horowitz MH, Urgo L, Hadjipanayis C, Levy EI, et al. Predictors of outcome in surgically managed patients with typical and atypical trigeminal neuralgia: comparison of results following microvascular decompression. *J Neurosurg.* 2002; 96: 527–31.
  22. Barker FG, II, Jannetta PJ, Bissonette DJ, Larkins MV, Jho HD. The long-term outcome of microvascular decompression for trigeminal neuralgia. *N Engl J Med.* 1996; 334: 1077–83.
  23. Sindou M, Leston J, Decullier E, Chapuis F. Microvascular decompression for primary trigeminal neuralgia: long-term effectiveness and prognostic factors in a series of 362 consecutive patients with clear – cut neurovascular conflicts who underwent pure decompression. *J Neurosurg.* 2007; 107: 1144–53.
  24. Kondo A. Follow-up results of microvascular decompression in trigeminal neuralgia and hemifacial spasm. *Neurosurgery*, 1997; 40: 46–51.
  25. Tronnier VM, Rasche D, Hamer J, Kienle A, Kunze S. Treatment of idiopathic trigeminal neuralgia: comparison of long-term outcome after radiofrequency rhizotomy and microvascular decompression. *Neurosurgery*, 2001; 48: 1261–68.
  26. Klun B. Microvascular decompression and partial sensory rhizotomy in the treatment of trigeminal neuralgia: personal experience with 220 patients. *Neurosurgery*, 1992; 30: 49–52.
  27. Adams CB, Kaye AH, Teddy PJ. The treatment of trigeminal neuralgia by posterior fossa microsurgery. *J Neurol Neurosurg Psychiatry*, 1982; 45: 1020–1026.
  28. Olson S, Atkinson L, Weidmann M. Microvascular decompression for trigeminal neuralgia: recurrences and complications. *J Clin Neurosci.* 2005; 12: 787–789.
  29. Lee KH, Chang JW, Park YG, Chung SS. Microvascular decompression and percutaneous rhizotomy in trigeminal neuralgia. *Stereotact Funct Neurosurg.* 1997; 68: 196–199.
  30. Zakrzewska JM, Lopez BC, Kim SE, Coakham HB. Patient reports of satisfaction after microvascular decompression and partial sensory rhizotomy for trigeminal neuralgia. *Neurosurgery*, 2005; 56: 1304–1311.
  31. Zakrzewska JM, Thomas DGT. Patient’s assessment of outcome after three surgical procedures for the manage-

ment of trigeminal neuralgia. Acta Neurochir. 1993; 122: 225–230.

32. Poppen J L: An atia of neurosurgical technique and W.B. Saunders, Philadelphia, 1960.

**AUTHORS DATA**

<b>Name</b>	<b>Post</b>	<b>Institution</b>	<b>E-mail</b>
Dr. Azmat Ullah Khattak		Department of Neurosurgery, Lady Reading Hospital, Peshawar KPK – Pakistan	ishfaqtk83@gmail.com
Dr. Muhammad Ishfaq			
Dr. Ali Haider			