

# Radiofrequency Ablation at Gasserian Ganglion in Trigeminal Neuralgia

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## Abstract

**Introduction:** Trigeminal neuralgia (TGN), is a neurological condition affecting the sensory division of the fifth cranial (i.e., trigeminal) nerve and is characterized by recurrent episodes of severe, shock-like pain confined to the distribution of one or more of the nerve's three branches. TGN is characterized by sharp, shooting, 'electric shock-like' pain sensation that is limited to one or more branches of the trigeminal nerve. Medical line of treatment consists of oral carbamazepine as the main and most effective first line of treatment. Microvascular decompression (MVD) with craniotomy is a surgical procedure with having excellent results. Radiofrequency ablation [7-11] of one or more branches of trigeminal nerve at Gasserian ganglion is one of the best minimally invasive treatment with equally effective as MVD. Its day care procedure performed under light sedation and local anesthesia. **Aim and Objectives:** The study was aimed to evaluate the efficacy of single radiofrequency thermocoagulation (RFT) and objective to compare the success rates and its complications. **Materials and Methods:** A total number of 56 patients with trigeminal neuralgia, of age ranging from 50 to 75 years of age attending the pain clinic during June 2011 to December 2016 were studied. The conventional radiofrequency current was used for ablation at Gasserian ganglion. The patients were followed for first, third and fifth year after procedure. **Results:** The mean age of patients was  $56 \pm 4$  yrs. Patients with single branch involvement were 35 (62.5%) and patients having three branches involved were 06 (10.71%). Excellent pain relief was achieved in 53 (94.64%) patients at the end of the first year follow, 50 (89.28%) patients had pain relief at the end of 3 years and 46 (82.14%) patients had pain relief at the end of 5 years. Out of the 10 (10%) patients those had pain recurrence: 7 (70%) patients had medical treatment to control pain satisfactory and 3 (30%) patients underwent additional surgery, including repeat RFT. Total 13(23.21%) patients had different degrees of facial numbness immediately after RFT; that disappeared gradually on follow. While 9(16.07%) patients experienced mastication difficulties that improved during the follow-up and 8(14.28%) patients had headache. **Conclusion:** It was concluded that RFT is a safe and effective procedure for TN patients. Facial numbness should be considered as an expected side effect rather than an unexpected complication. Patients who have pain in all 3 trigeminal divisions and patients who desire no facial numbness should be cautious. Medical therapy remains the first line in the treatment of TN.

**Keywords:** Trigeminal; Neuralgia; Radiofrequency; Ablation; Gasserion Ganglion.

## Introduction

Trigeminal neuralgia (TGN), also called tic douloureux and Fothergill disease, is a neurological condition affecting the sensory division of the fifth cranial (i.e., trigeminal) nerve and is characterized by recurrent episodes of severe, shock-like pain confined to the distribution of one or more of the nerve's three

branches (i.e., the ophthalmic [V1], maxillary [V2] and mandibular [V3] divisions). TGN is characterized by sharp, shooting, 'electric shock-like' pain sensation that is limited to one or more branches of the trigeminal nerve. It is almost always unilateral. TGN most often affects the second and third divisions of the nerve. The sensory root of the trigeminal nerve expands into the trigeminal ganglion, which contains the cells of

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origin of the sensory fibers and from which the three divisions of the nerve arise, supplying the face, teeth, mouth, and nasal cavity. In TGN, sudden and excruciating unilateral facial pain arises following stimulation of specific trigger zones by movement, drafts or touch. TGN is diagnosed [1] based on clinical signs and symptoms. No specific diagnostic tests for TGN exist, although magnetic resonance imaging (MRI) is often used to exclude the presence of a tumor that could mimic symptoms similar to those of TGN. In younger persons with TGN, structural or other causes should be excluded (e.g., multiple sclerosis or compression due to tumors). Because of the possibility of association with structural lesions, the initial workup should include MRI studies to detail the cerebellopontine angle.

Medical line of treatment consists of oral carbamazepine as the main and most effective first line of treatment, other anticonvulsants [1-3] like gabapentine and pregabalin can be used in association with carbamazepine to reduce the side effect and increase the efficacy of pain control. But the dosage has to be taken regularly and the quality of pain control and quality of life may not be good. Sedation and drowsiness, dryness of mouth are the side effect of the medical line of treatment. Balloon compression [4] and glycerol rhizolysis [5] are well-known interventional treatment with limited success. Microvascular decompression (MVD) [6] with craniotomy is a surgical procedure with having excellent results. Radiofrequency ablation [7-11] of one or more branches of trigeminal nerve at Gasserian ganglion is one of the best minimally invasive treatment with equally effective as MVD. Its day care procedure performed under light sedation and local anesthesia.

#### *Aim and Objectives*

The study was aimed to evaluate the efficacy of single radiofrequency thermocoagulation (RFT).

- To compare the success rates at the end of first, third and fifth year
- To study the complications.

#### **Materials and Methods**

A total number of patients included in the study were 56, of age ranging from 50 to 75 years of age attending Varad The pain clinic, Aurangabad. The study was conducted from June 2011 to December 2016. Patients thorough checkup was done including

physician's opinion regarding the comorbid conditions like hypertension, DM, were included in the study after good control of the parameters. Patients and relatives consent was obtained after informing the probable side effects of the RFTC immediate, like a headache, vomiting, numbness on face, difficulty in mastication etc and delayed complications, like numbness of face for many months to years, dryness in the eye on same side and corneal opacity and blindness in future, recurrence of neuralgic pain after a year and so. The conventional radiofrequency current was used for ablation at Gasserian ganglion. After securing intravenous line, mild sedation was given to patients, antibiotic was given prior to procedures to all patients. A multipara monitor applied to the patients. Visualization of the foramina oval was done under fluoroscopy. On an average, the foramina are well visualized at an angle of 30 to 40 degree lateral and 15 to 25 degree caudal orientation of the image intensifier. After infiltration of local anesthesia on cheek around 2 to 3 cm lateral of the angle of mouth on the ipsilateral side, an 18G jelco inserted as an end on view in most medial and anterior part of the foramina oval. After hitting the bone at antero-medial part of foramina oval the needle is slightly redirected in the foramina and its depth is confirmed in lateral view. After sensory stimulation at 50 Hz and 1 msec at less than 0.5 volts and motor stimulation at 2 Hzs at 1 msec at 1volts, then IV sedation was given again and thermocoagulation was done at 60 to 80 centigrade depending on the sensory stimulation volts, for 60 sec each with three cycles. The patients were followed every year upto 5 years.

#### *Observations*

After correct position of needle in AP and lateral view, most of the patients feel tingling at sensory stimulation at around 0.2 to 0.3 volts and hence the RFTC was done at 60, 65 and 70 degrees for 60sec in most of the patients, motor stimulation was not there at the volts double to that of sensory stimulations.

In the present study total, 56 patients underwent unilateral RFT. The mean age of patients was  $56 \pm 4$  yrs. Patients with single branch involvement were 35 (62.5%), two branch involvement were 15 (26.78%) and patients having three branches involved were 06 (10.71%). 31 were males and 25 were females included in the study.

Immediate pain relief after the procedure at the time of hospital discharge was 100% in all patients. Excellent pain relief was achieved in 53 (94.64%) patients at the end of the first year follow, 50 (89.28%)

**Table 1:** Distribution of patients according to Gender and no. of nerve branches involved

No. of Branches Involved	Male	Female	Total
1	18 (58.06%)	17 (68.0%)	35 (62.5%)
2	09 (29.03%)	06 (24.0%)	15 (26.78%)
3	04 (12.9%)	02 (8.0%)	06 (10.71%)
Total	31 (55.35%)	25 (44.64%)	56

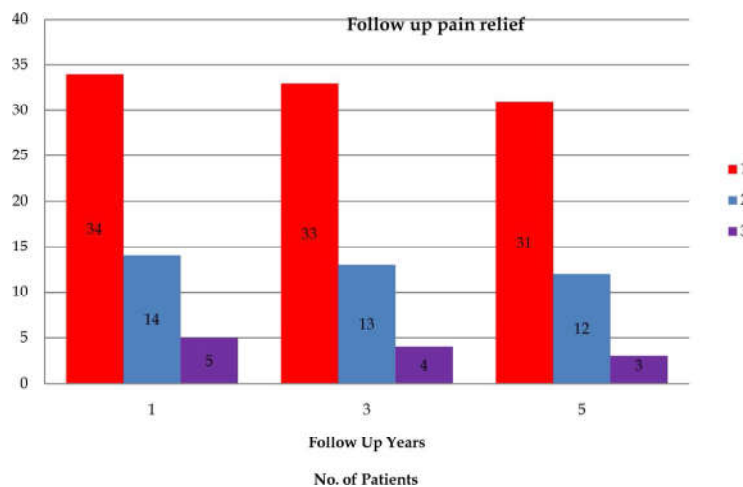
**Table 2:** Distribution of patients according to efficacy in pain relief and pain recurrence

No. of Branches Involved	Years Pain Free			Total
	1	3	5	
1	34 (97.14%)	33 (94.28%)	31 (88.57%)	35 (62.5%)
2	14 (93.33%)	13 (86.66%)	12 (80%)	15 (26.78%)
3	5 (83.33%)	4 (66.66%)	3 (50%)	06 (10.71%)
Total	53 (94.64%)	50 (89.28%)	46 (82.14%)	56

patients had pain relief at the end of 3 years and 46 (82.14%) patients had pain relief at the end of 5 years.

The pain recurrence was observed in 1 (2.87%) patient, 2(5.71%) patients and 4(11.42%) patients at the end of 1,3 and 5 years in single branch treated patients respectively. While 1(6.66%) patient, 2(13.33%) patient and 3(19.98%) patients at the end of 1,3 and 5 years with two branches treated had a

recurrence. And it was seen that 3(50%) patients, had a recurrence at the end of 5 years those who were treated for 3 nerve branches. Out of the 10 (10%) patients those had pain recurrence: 7 (70%) patients had medical treatment to control pain satisfactory; 3 (30%) patients underwent additional surgery, including repeat RFT.

**Fig. 1:** Distribution of patients according to efficacy in pain relief**Table 3:** Distribution of patients according to complications

Sr. No.	Complication	No. of Patients
1	Numbness on the face	13(23.21%)
2	Mastication difficulties	9(16.07%)
3	Headache	8(14.28%)
4	Dysesthesia	2(3.57%)
5	Corneitis	1(1.78%)

Total 13(23.21%) patients had different degrees of facial numbness immediately after RFT; that disappeared gradually on follow. While 9(16.07%) patients experienced mastication difficulties that improved during the follow-up and 8(14.28%)

patients had headache. The medications, patients were receiving for pain control i.e. carbamazepin, gabapentine, pregabalin etc. was tapered over a period of 4 to 6 weeks and then stopped completely.

## Discussion

The treatment of patients with idiopathic TN is often a challenge in clinical practice, and conservative management with drug therapy is always the first-line treatment. When drugs are not efficacious or produce intolerable adverse effects, interventional pain treatment or surgery remains the possible option.

Microvascular decompression (MVD) and gamma knife surgery (GKS) are surgical options available to patients with TN. Minimally invasive percutaneous techniques for treating TN include balloon compression, glycerol rhizolysis, and radiofrequency (RF) rhizotomy.

In the present study total, 56 patients underwent unilateral RFT. The mean age of patients was 56 ± 4yrs. Patients with single branch involvement were 35 (62.5%), two branch involvement were 15 (26.78%) and patients having three branches involved were 06 (10.71%). 31 were males and 25 were females included in the study.

In the present study, immediate pain relief after the procedure at the time of hospital discharge was 100% in all patients. Excellent pain relief was achieved in 53 (94.64%) patients at the end of the first year follow, 50 (89.28%) patients had pain relief at the end of 3 years and 46 (82.14%) patients had pain relief at the end of 5 years. The pain recurrence was observed in 1 (2.87%) patient, 2(5.71%) patients and 4(11.42%) patients at the end of 1,3 and 5 years in single branch treated patients respectively. While 1(6.66%) patient, 2(13.33%) patient and 3(19.98%) patients at the end of 1,3 and 5 years with two branches treated had a recurrence. And it was seen that 3(50%) patients had a recurrence at the end of 5 years those who were treated for 3 nerve branches. Out of the 10 (%) patients, those had pain recurrence: 7(70%) patients had medical treatment to control pain satisfactory; 3 (30%) patients underwent additional surgery, including repeat RFT.

These findings were consistent with the study conducted by *Cheng, Jason S(2014)* [12], reported that pain control rates up to 91% at 6 months and 66% at 3 years have been reported. RF allows somatotopic nerve mapping and selective division lesioning and provides pain relief in up to 97% of patients initially and 58% at 5 years. Multiple treatments improve outcomes but carry significant morbidity risk. GR offers similar pain-free outcomes of 90% at 6 months and 54% at 3 years but with higher complication rates (25% vs 16%) compared with BC. Advantages of percutaneous techniques include shorter procedure

duration, minimal anesthesia risk, and in the case of GR and RF, immediate patient feedback.

*Chua NHL(2012)* [13] observed that use of PRF for a longer duration (6 minutes) in 36 patients provided excellent pain relief of ≥80% in 55.9% during a follow-up of patients at 12 months but with continued medications. *Van Zundert and coworkers (2003)* [14] studied 5 patients with TN who received 2 cycles of PRF at 120 seconds each (4 minutes) with an output at 45 V. The pain relief varied from months to years with the need of a second PRF of the GG in 2 patients. In a retrospective analysis by *Luo F (2013)* [15] extending the duration of PRF to the GG up to 8 minutes in 2 individual cases of refractory classic TN resulted in long-term pain relief and improved quality of life. The extended benefits of the neuromodulatory may also have resulted in decreased requirement of carbamazepine. However, this requires further evaluation and multicentric randomized controlled trials to confirm the benefit of extended duration PRF as observed in our patients.

In the present study total, 13(23.21%) patients had different degrees of facial numbness immediately after RFT; that disappeared gradually on follow. While 9(16.07%) patients experienced mastication difficulties that improved during the follow-up and 8(14.28%) patients had a headache. The medications, patients were receiving for pain control i.e. carbamazepin, gabapentine, pregabalin etc. was tapered over a period of 4 to 6 weeks and then stopped completely.

In a study by *Dessy R Emril (2010)* [16] which was a large-scale, long-term follow-up of 1600 patients who had received percutaneous RF rhizotomy of the trigeminal ganglion, complications reported include diminished corneal reflex (5.7%), masseter weakness and paralysis (4.1%), dysesthesia (1%), anesthesia dolorosa (0.8%), keratitis (0.6%), and transient paralysis of cranial nerves III and VI (0.8%). Permanent cranial nerve VI palsy was observed in two patients, CSF leakage in two, carotid-cavernous fistula in one, and aseptic meningitis in one.

Also in a study by *Yuan-Zhang Tang (2015)* [17] found that Postoperative facial numbness is common following RFT. It usually accompanies the relief from pain. Facial numbness or painful dysesthesia is a serious side effect of RFT that affects the quality of life. For this reason, we further study the painful dysesthesia occurred in different branches division. Therefore, we recommend RFT for patients who have pain in all 3 trigeminal divisions and patients who desire no facial numbness should be cautious. The rates for complications including masseter muscle

weakness, corneitis, low-pressure headaches, diplopia, hearing loss, ptosis, and limitation of mouth opening are similar to other published series of RFT to treat trigeminal neuralgia, these complications were all transient. Corneitis and Diplopia may be related with the cornea nerve (originated from V1 branch) and abducens nerve was injured in the procedure. Intracranial hypotension headache intracranial hypotension headache could occur when the needle punctures the wall of Meckel's cave. It usually happens when the needle inserted to oval foramen, cerebrospinal fluid could be drained out of the hole on the wall of Meckel's cave.

In a prospective, randomized study by *Fachuan Nie (2014)* [18] on Sixty patients with primary trigeminal neuralgia was randomly assigned to a study group with the patients underwent X-ray imaging combined with skin stimulation potential-guided percutaneous radiofrequency thermocoagulation of the Gasserian ganglion and the patients in the control group underwent C-arm X-ray-guided puncture through the foramen ovale. They found that the incidence of postoperative side effects was significantly reduced, and immediate and mid-term analgesic efficacy was better in patients in the study group comparing with those in the control group ( $P < 0.01$ ).

## Conclusion

It can be concluded that RFT is a safe and effective procedure for TN patients. Facial numbness should be considered as an expected side effect rather than an unexpected complication but it gives prolonged freedom from pain. Patients who have pain in all 3 trigeminal divisions and patients who desire no facial numbness should be cautious. Medical therapy remains the first line in the treatment of TN, and drugs such as carbamazepine and oxcarbazepine can be used. Surgery and interventional pain treatment can be considered in patients who have persistent pain despite drug therapy or who are unable to tolerate adverse effects of drugs.

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