

Trigeminal neuralgia - A neuropathic pain

Syed S. Ahmed*, **Afshan Bey****, **Sarwat H. Hashmi*****

**** Department of Oral and Maxillofacial Surgery, **Department of Periodontics and Community Dentistry, Dr. Ziauddin Ahmed Dental College, Aligarh Muslim University, Aligarh, India

Abstract

Trigeminal neuralgia is a relatively common neuropathic pain which characterized by paroxysmal, sharp, shooting, shocking or piercing pain. The pain significantly affects the quality of life of patient. Various treatments extending from medical to neurosurgical procedures are available. Each treatment has its own advantages and disadvantages. The aim of this paper is to present various aspects of trigeminal neuralgia from the analysis of recent literature.

Key words: trigeminal neuralgia, micro-vascular decompression, trigger zones

Accepted February 17 2011

Introduction

Trigeminal neuralgia (TGN) is a debilitating neuropathic pain of maxillofacial region. The disease is characterized by sharp, shooting, boring and lancinating and piercing pain in relation to branches of fifth cranial nerve. The pain is characteristically paroxysmal and is usually unilateral. Each paroxysm of pain lasts only for few seconds but sometimes may extend to few minutes. Initially the gap between the two episodes is more. With the advancement of disease the number of bouts of pain increases in term of per month, per week or per day. Usually the pain is absent at the time of examination. Occasionally the patient may present with repeated bouts of pain in the clinic. Occasionally the pain is so intense that it makes the examination of face or oral cavity very difficult. Sometimes the pain appears at repetitive short intervals and the individual attack is superimposed and is described as lingering painful sensation.

The pain is usually provoked by a mechanical tactile stimulus like eating, talking, washing the face, cleaning the teeth or touching to any area of face or mouth. Sometimes, the pain may occur spontaneously. However, there is no associated neurosensory or motor nerve deficit.

When diagnosing the trigeminal neuralgia, other causes of facial pain should be excluded [1,2,3].

In some cases the pain may have similar characteristics but it may be associated with persistent pain between the paroxysm and mild sensory loss. This condition has been

termed as "atypical trigeminal neuralgia [4]. Patients suffering from atypical trigeminal neuralgia have symptomatic disease and often more refractory to treatment than with idiopathic trigeminal neuralgia [5]. Trigeminal neuralgia occurs in middle and old ages, females are more frequently affected [6,7].

Usually trigeminal neuralgia involves maxillary and mandibular nerve, and very rarely ophthalmic branch of trigeminal nerve may be involved.

Causes of trigeminal neuralgia

Exact etiology of TGN is not known- thus the term idiopathic TGN has been used. 80-90% of cases are referred to as idiopathic⁸, however, in most of the cases the neuralgic pain has been found to be associated with vascular compression of trigeminal nerve close to its exit from the brain stem by an aberrant loop of an artery or vein^{9,10}. With chronic vessel compression, segmental demyelination occurs in the trigeminal nerve¹⁰. At the point of segmental demyelination the incoming impulse of sensory input is reflected back. When the frequency of the incoming wave and the reflected wave come in resonance, an electrical short circuiting of current takes place which leads to sudden bout of pain. Less than 10% of patients suffer from symptomatic disease associated with identifiable cause; other than vascular compression usually a space occupying lesion, or multiple sclerosis (1-5% of patients) may be also a cause.

Thus TGN is either idiopathic or secondary due to structural lesions involving the trigeminal system, or associated with intracranial or neurological lesion⁸.

Diagnosis

The diagnosis of TGN is straight forward and is based on physical examination pertaining cranial nerve examination and characteristic nature of pain and presence of trigger zones. During the physical examination attempts should be made to explore the trigger zones, if present. Various techniques used for this purpose are light touch, sharp touch, temperature and two point discrimination. In addition, any hypoesthesia, anesthesia or paresthesia should also be considered in the examination.

The pain in TGN is usually unilateral, paroxysmal, shocking, excruciating, piercing and lancinating or boring pain along the course of branches of the trigeminal nerve. The bout of pain may occur spontaneously or may be characteristically provoked by tactile stimulation of specific area, the trigger zones, of face, oral mucosa, teeth or tongue at the time of eating or speaking. Each bout of pain persists for few seconds to minutes only. Rarely, repetitive pain attacks of short interval appear to overlap each other and give a feeling of persistent and lingering pain is described. The apprehension of pain severely affects the personality and the hygiene of patients that they don't clean or avoid to clean their face and brush their teeth. The male patients don't shave the beard on the involved side. Many patients become malnourished since they avoid eating due to apprehension of severe pain.

Sometimes times the pain is characteristically described in edentulous area. In such cases a positive history of severe shocking boring, piercing pain, no relief by medication and then followed by tooth extraction will be available.

Investigations

There are no specific tests to diagnose the TGN and the diagnosis is typically made on the basis of signs and symptoms of the disease. However a thorough clinical examination, including assessment of cranial nerve function should be carried out. Initial investigations needed are intraoral periapical xrays, orthopantomogram, radiographs for paranasal sinuses. Cerebral imaging, neurophysiologic testing, nerve block, hematological testing and biopsy should be done when necessary[12]. MRI should also be done to diagnose cases of TGN to explore the suspected compression of nerve in posterior canal fossa, to exclude lesions like multiple sclerosis or tumours of brain. Some time MRI scans very effectively detect blood vessels that come in contact of the trigeminal nerve.

The initial investigation should always be started from dental X-rays. A brain scan should always be done in younger patients with atypical clinical features like sensory loss or dull burning pain between paroxysms; and to patients who don't respond to initial therapy[9].

Differential diagnosis of trigeminal neuralgia.

The list of disease which should be considered in the differential diagnosis is long. However, some of the lesions which should not be ignored are specific and non specific facial pains, TMJ disorders, dental disorders, vascular migraine, cluster headache, chronic paroxysmal hemicranias, cracked tooth syndrome, post herpetic neuralgia and giant cell arteritis[13].

Treatment

The current treatment of idiopathic trigeminal neuralgia consists of medical and surgical treatments. The medical management consists of pharmacological, non-pharmacological therapies and surgical treatment consists of numerous peripheral and intracranial ablative procedures.

Drug treatment

The drug of choice of TGN is carbamazepine and approximately 70% of the patients suffering from this disease can be best treated for the painful paroxysms with this drug; further 10-15 % can be controlled by the addition or substitution of phenytoin sodium(Eptoin) [14]. Other drugs, which form the second line of treatment are beclufen, Valproate sodium, Gabapentine, pregabalin , topiramate or clonazepam in single or combinations. In some cases these medications prove ineffective or produce intolerable side effects like skin rashes, leucopenia, thrombocytopenia, abnormal liver function etc. In such patients the therapy has to be stopped and alternative therapy or review of diagnosis should be considered.

The effect of carbamazepine is so specific that sometimes it is used as a therapeutic test. When the treatment is initiated with carbamazepine, it is always better to increase the dose slowly. Common side effects of carbamazepine are dizziness and unsteadiness in the beginning of treatment. Some patients these side effects are so intense that patients stop taking the medication. We usually start carbamazepine in the dose of 100mg twice a day with the advice to patients to take it early in the morning and rest on bed if any dizziness or unsteadiness appears which will go within half an hour. This advice works well and in the same way the dose could be increased to thrice daily. If initial response is noticed, the dose is slowly increased to 200 mg to 400 mg thrice daily to achieve better pain relief. When patient responds well to carbamazepine therapy, a substitution of controlled released preparation should be considered for better compliance and convenience to patient.

If pain relief is incomplete with carbamazepine, the second line treatment drugs –phenytoin sodium, clonazepam may be added. We prefer to add Triamitriptyline 10 mg in TDS doses for better results.

Oxcarbazepine is suitable alternative to carbamazepine as it possesses similar efficacy and is better tolerated. It does not cause hepatic toxicity and can be given to patients who are unable to take carbamazepine due to liver enzyme derangement. Its other side effects are similar to carbamazepine and limit its use[15].

Gabapentine is effective and widely used for neuropathic pain, but lacks its use as first line treatment in trigeminal neuralgia. Beclofen and Lamotrigine which have been suggested as second line treatment on the basis of small studies on trigeminal neuralgia[16].

Surgical treatment

Surgical treatment is considered in cases refractory to pharmacological therapy. Various surgical procedures that are currently practiced are:

1. Microvascular decompression (MVD)
2. Ablative procedures:
 - i. Percutaneous radiofrequency thermal rhizotomy (RTR),
 - ii. Glycerol rhizolysis (GR)
 - iii. Balloon compression of trigeminal ganglion (BC)
3. Gamma knife radiosurgery
4. Other procedures : neurectomy, cryotherapy and alcohol injections

Surgical treatment for trigeminal neuralgia is basically based on emerging knowledge about its etiology and pathogenesis. There are evidences to suggest that 80-90% of the cases that are classified as idiopathic, are caused by compression of trigeminal nerve close to exit from the brain stem by an aberrant loop of artery or vein[11,17]. Thus, micro-vascular decompression is progressively becoming the treatment of choice. However, the importance of neurectomy, cryotherapy and alcohol injections should also be considered.

Microvascular decompression

Microvascular decompression (MVD) is a conservative method of decompressing the vessels that are in contact with the trigeminal root entry zone from all arachnoid adhesions¹⁸. The arteries are separated from the nerve using inert sponge or felt [19]. It is very effective procedure provides excellent and long term pain control rate of about 70-80% .It does not produce any sensory deficit. *Microvascular decompression* has been termed as “gold standard” surgical procedure to younger patients who have shorter duration of disease, and history of no previous surgery [9]. Other complications are risk of cerebellar dysfunction, and facial sensory loss is an uncommon

complication. The commonest side effect is hearing loss which related to retraction injury of VIII nerve. With the use of intra-operative evoked potential monitor, such complications can now be controlled at 1%[20]. The risk of death is very rare and has been reported in 0.4% cases[21].

Ablative procedures

MVD is superior is superior to ablative procedures since sensory functions are not affected and pain is relieved. Major advantage of ablative procedures is they are simple, very effective and bear controlled characteristics. The disadvantage is sensory loss associated with the therapy. However, among the three procedures i.e. radiofrequency lesioning, chemical lesioning with glycerol, and balloon compression, the radiofrequency is a preferred technique[22].

Percutaneous radiofrequency thermal rhizotomy

This technique is suitable for elderly patients and utilizes controlled thermal ablation of nerves fibres in trigeminal ganglion or nerve root, producing loss of pain with relative preservation of touch and more complex facial sensations. This procedure allows pre-lesion testing for localization of in order to produce lesion in only in the division/divisions of the trigeminal nerve involved. This procedure gives good and long term pain relief. The recurrence rate is low and produces fewer side effects and complications. The worst complication of this procedure is creation of analgesia dolorosa, a syndrome of which no effective treatment is available.

Glycerol rhizolysis

Glycerol rhizolysis is not division specific, has very high recurrence rate and very high incidence of dysesthesia. In this procedure the needle is introduced into the trigeminal cisterns which are utilized by using fluoroscope. After the size of cistern has been evaluated, the glycerol is injected.

Balloon compression

In this procedure the trigeminal nerve is compressed by a small balloon which is percutaneously introduced into the Meckel's cavity. The effect of this technique is produced by ischemic damage of ganglion cells.

All of these procedures have high initial response rate. The stereotactic radiosurgery is exception which takes which provides maximum effect at 1-2 months of therapy. The ablative procedures are less effective in term of long term pain relief and more likely produce facial numbness. Chances of major complications are rare. These procedures are indicated in severely medically compromised patients and with high operative risk.

Gamma knife radiosurgery

Gamma knife radiosurgery is an essentially non-invasive, safe, effective therapy for TGN. It is complication free procedure and renders very high rate of pain relief without any sensory loss or facial numbness and side effect but it takes about 1-2 months time to produce maximum effect[23, 24]. Gamma knife radiosurgery is inferior to percutaneous radiofrequency thermal rhizotomy, glycerol rhizolysis and balloon compression in terms of pain relief and recurrence, but superior in terms of complications

Other procedures: the peripheral procedures

The peripheral procedures are basically neuro ablative procedures and are usually performed either in severely medically compromised patients or who don't wish to have other procedure done. There is no strict indication of these procedures and each patient should be evaluated and planned individually[24]. These procedures are performed on easily accessible branches of trigeminal nerve - the infraorbital and inferior alveolar nerve. All these procedure are very effective in term of pain relief and post operative risks and complications, however, these procedures are less in use and their mention in current literature is progressively fading due to dyesthesia or sensory loss associated with these procedures.

Neurectomy is a simple and effective oldest surgical procedure for trigeminal neuralgia. The mean pain relief period by this method has been reported as 24-32 months[25,26]. In another study an excellent pain relief (total loss of pain without need of medication) lasting 5 years or more has been shown[27]. It is the dyesthesia or sensory loss which follows the neurectomy and is considered as a significant morbidity of the surgery.

Alcohol injection is a simple technique and is given as nerve block for inferior alveolar nerve and infraorbital nerve. Since alcohol is very toxic to tissues; it should be injected very precisely. The mean period of pain relief has been as reported as about 12 months[28,29]. The complications reported with this procedure are local tissue necrosis, diplopia, and sensory loss. Shah et al. have reported it as suitable, safe and practical option among peripheral procedures with a pain relief period of 2-56 months with high patient satisfaction[30].

Cryotherapy is performed on well accessible peripheral nerves by 2-minutes freeze-thaw cycles using cryoprobes. The technique is simple and practical too. The mean period of pain relief ranges from 6 to 9 months. The common complication which accompanies the pain relief is loss of sensation in relation to respective peripheral nerve[31,32]

References

1. Classification Subcommittee of the International Headache Society. The international classification of headache disorders. *Cephalalgia* 2004;24(suppl 1):1-160.
2. Katusic S, Williams DB, Beard CM, et al. Epidemiology and clinical features of idiopathic trigeminal neuralgia and glossopharyngeal neuralgia: similarities and differences, Rochester, Minnesota, 1945-1984. *Neuroepidemiology* 1991;10:276-281.
3. Zakrzewska JM. Diagnosis and differential diagnosis of trigeminal neuralgia. *Clin J Pain* 2002;18:14-21.
4. Zakrzewska JM, Jassim S, Bulman JS. A prospective, longitudinal study on patients with trigeminal neuralgia who underwent radiofrequency thermo-coagulation of the Gasserian ganglion. *Pain* 1999;79:51-8.
5. Lopez BC, Hamlym PJ, Zakrzewska JM. Systemic review of ablative neurosurgical techniques for the treatment of trigeminal neuralgia. *Neurosurgery* 2004;54:973-82.
6. Chole R, Patil R, Degwekar SS, Bhowate RR. Drug treatment of trigeminal neuralgia: A systematic review of the literature. *J Oral Maxillofac Surg* 2007;65:40-5.
7. Headache Classification Subcommittee of the International Headache Society: The international classification of headache disorders. *Cephalalgia* 2004; 24:9-160.
8. Love S, Coakham HB. Trigeminal neuralgia: pathology and pathogenesis. *Brain* 2001;124:2347-60.
9. Luke Benneto, Nikunj K Patel, Geraint Fuller : Trigeminal Neuralgia and its management. *BMJ* 27 January 2007; 334: 201-205.
10. Nurmikka TI, Eldridge PR, Trigeminal neuralgia-pathophysiology, diagnosis and current management. *Br J Anaesth* 2001; 87:117-132.
11. Love S, Coakham HB. Trigeminal neuralgia: pathology and pathogenesis. *Brain* 2001;124:2347-60.
12. Aleksander Rabinovich, James Fang, Steven J Scrivani. Diagnosis and Management of Trigeminal neuralgia. *Columbia Dental Review* 2000; 5; 4-7.
13. Nurmikko NJ and Eldridge PR . Trigeminal Neuralgia - Pathophysiology, diagnosis and treatment ; *Br J Anaesth* 2001; 87:117-32.
14. Ong PL. *Management of trigeminal neuralgia; Singapore Medical Journal*;28(1): 72-75: 1987
15. Zakrzewska JM, Patsolos PN, Oxcarbazepine- new drug in the management of trigeminal neuralgia. *J Neurol Neurosurg Psychiatry* 199; 52: 472-476.
16. Benneto L, Patel NK, Fuller G : Trigeminal Neuralgia and its management. *BMJ* 27 January 2007, Volume 334: 201-205 cross ref.
17. Numikko TJ, Eldridge PR. Trigeminal neuralgia – Pathophysiology, diagnosis and current treatment. *Br J Anaesth* 2001; 87: 117-132,
18. Sindou M, Leston JM, Decullier E, Chapuis F Microvascular decompression for trigeminal neuralgia: the importance of a non compressive technique—Kaplan-Meier analysis in a consecutive series of 330 patients. *Neurosurgery* 2008; 63:341-351.
19. Jannete PJ, Mc Laughlin MR, asey KF. Technique of microvascular decompression. Technical note. *Neurosurg Focus*. 2005; 18: E 5.
20. Barker FG et al. “ preoperative evaluation of neurovascular compression inpatients with trigeminal neuralgia by use of three dimensional reconstruction

- from two types of high resolution magnetic resonance imaging.” *Neurosurgery* 2002; 51(4): 956-61.
21. Ashkan K, Marsh H. Microvascular decompression for trigeminal neuralgia in the elderly: a review of the safety and efficacy. *Neurosurgery* 2004;55:840-8.
 22. Dr. Yiu-wah-fan. Management of trigeminal neuralgia . the Hong Kong medical Diary 2006; 11(12): 3-4.
 23. Young RF, Vermeulen SS, Grimm P, Blasko J, Posewitz A Gamma Knife radiosurgery for treatment of trigeminal neuralgia: idiopathic and tumor related. : *Neurology*. 1997 Mar ;48 (3):608-14.
 24. Toda K. Operative treatment of trigeminal neuralgia: review of current techniques. *Oral Surg Oral med Oral Path Oral Radiol Endod* 2008 Dec;106(6):788-805, 805.e1-6. Epub 2008 Jul 26.
 25. Quinn JH. Repetitive peripheral neurectomies for neuralgia of second and third divisions of trigeminal nerve. *J OralSurg*. 1965;23:600-608,
 26. Grantham EG, Segerberg LH. An evaluation of palliative surgical procedures in trigeminal neuralgia. *J Neurosurg*. 1952; 9:390-394
 27. Murali R, Rovit RL. Are peripheral neurectomies of value in the treatment of trigeminal neuralgia? An analysis of new cases and cases involving previous radiofrequency gasserian thermocoagulation. *J Neurosurg*. 1996; 85:435-437.
 28. Fardy MJ, Patton DWP. Complications associated with peripheral alcohol injections in the management of trigeminal neuralgia. *Br J Oral Maxillofac Surg*. 1994;32:387-391.
 29. Fardy MJ, Zakrzewska JM, Patton DWP. Peripheral surgical techniques for the management of trigeminal neuralgia- Alcohol and glycerol injections. *Acta Neurochir (Wein)* 1994; 129: 181-185.
 30. Shah SA, Khan MN, Shaf SF, Ghafoor A, Khattak A. Is peripheral alcohol injection of value in the treatment of trigeminal neuralgia? An analysis of 100 cases, *Int J Oral Maxillofac Surg* (2010), doi:10.1016/j.ijom.2010.11.010
 31. Zakrzewska JM, Nally FF. The role of cryotherapy in the management of paroxysmal trigeminal neuralgia: a six years experience. *Br J Oral Maxillofac Surg*. 1988;26: 18- 25
 32. Zakrzewska JM. Cryotherapy for trigeminal neuralgia: a 10 years audit. *Br J Oral Maxillofac Surg*. 1991;29:1-4.

Correspondence to:

Syed S. Ahmed
Department of Oral and Maxillofacial Surgery
Dr. Z.A. Dental College, Aligarh Muslim University
Aligarh 202002,
India

