ISSN : 2347 - 2243

Indo - American Journal of Life Sciences and Biotechnology

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Email : editor@iajlb.com or iajlb.editor@gamil.com

Indo-American Journal of Life Sciences and Biotechnology

Vol.5, Issue.2, June 2017

Trigeminal Neuralgia: A Clinical Overview

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ABSTRACT: The Trigeminal nerve, which is part of the cranial nerve system, runs from the cheeks to the roof of the mouth. Unilateral, intense, lancinating, stabbing, repeated bouts of pain within the distribution of one or more branches of the trigeminal nerve are the hallmark symptoms of trigeminal neuralgia (TN). Women, in comparison to males, have a higher incidence of TN. Compression and demyelination of the trigeminal nerve are the major causes of TN. Diagnostic procedures for TN include a physical examination, neuroimaging, and neurophysiological testing. Patients with TN often begin treatment with carbamazepine, an anti-epileptic drug, at a very low dosage. Surgery is a good alternative to medical treatment if the former doesn't work. Microvascular decompression, gamma knife radio surgery, Gasserian ganglion percutaneous treatments, and peripheral approaches are the surgical options available. The diagnostic procedures, therapeutic options, and clinical manifestations of TN are discussed in this article.

Keywords: Trigeminal neuralgia, Gasserian ganglion,anti-epileptic drugs, Microvascular decompression

INTRODUCTION:

Trigeminal neuralgia (TN) is also called as ticdouloureux.Trigeminal nerve or 5th cranial nerve,one of the most widely distributed nerves in the head. As the name indicates,it is composed of three large branches.They are the ophthalmic (V_1,sensory),maxillary (V_2,sensory),mandibular (V_3, motor and sensory) branches. Mostly occurs inthe V_2 and V_3 branches of the trigeminal nerve. Neuralgia is the stabbing, burning and often severe pain due to compression or demyelination of nerve. Trigeminal neuralgia is defined as unilateral, sudden, severe, brief,electric-shock like, lancinating,stabbing recurrent episodes of pain within the distribution of one or more branches of the trigeminal neuralgia(1).TN most commonly occurs unilaterally, bilaterally occurs in 5% cases. When it occurs in a young age or presents with bilateral symptoms or an abnormal neurological examination, lack of triggered pain, absence of a refractory period, then it is suspected as secondary causes such as multiple sclerosis.

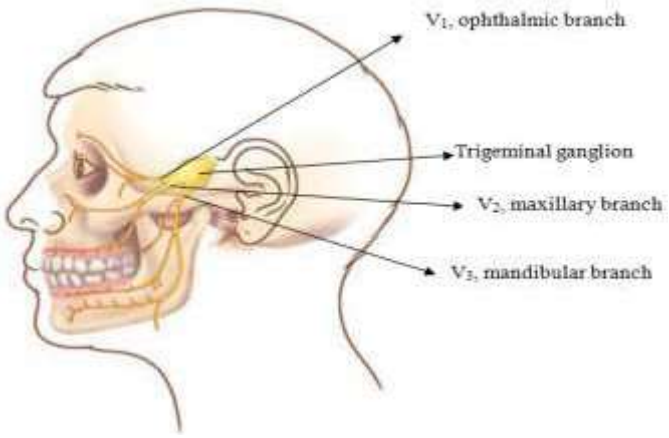


Diagram representing the distribution of trigeminal nerve (2)

PREVALENCE:

In thegeneral population,the prevalence of TN is 0.015%. The incidence of the TN has remained constant ranging from 12.6 per 100,000 people per year to 27 per 100,000 people per year.TN occurscommonly amongwomen (3).The National Institute of Neurological Disorders and Stroke estimates the incidence rate of 12/100,000/year.

CLASSIFICATION:

TN is classified into two types 1.Classical TN(CTN)
2.Symptomatic TN(STN)
CTN mainly occurs due to neurovascular compression of the trigeminal nerve.The most common causes of STN are multiple sclerosis (MS), space-occupying lesions,and neuropathy. Difference between CTN and STN is described in the table

FEATURES	CTN	STN
Cause	Neurovascular compression	Multiple sclerosis, arterial aneurysm, neurofibroma, acoustic schwannoma, meningioma, and other causes
Sensory loss	Absence of sensory loss	Presence of Sensory loss
Inter ictal numbness	Absence of interictal numbness	Presence of interictal numbness
Associated symptoms	No serious associated symptoms with 7^{th},8^{th} nerve palsy	Serious associated symptoms with 7^{th},8^{th} nerve palsy
Pain	The Patient is pain-free between paroxysm	Persistent aching between paroxysm

CTN which is an idiopathic episodic pain, lasting several seconds, with the pain free intervals with no sensory loss and interictal numbness and no serious associated symptoms with 7^{th}, 8th nerve palsy.STN is caused by underlining pathology and frequently on clinical examination, persistent of aching between paroxysms, presence of sensory loss, interictal numbness(4).

CLINICAL FEATURES:

The basic clinical features of TN are shooting, stabbing, sharp, electric shock- like pain. The pain is provoked by lighttouch; it may be due to intraoral triggers, extraoral triggers (5).
Major triggering factors are:

- Washing the face
- Brushing teeth
- Shaving
- Applying makeup
- Vibrations from walking
- Falling hair on the cheek
- Due to cold wind

The first onset of TN pain is memorable and patients explain briefly about the sharpness of the pain and also its rapidity and severity (6).There are some descriptions about pain in TN taken from patient narratives:

- An Electric shock-like pain
- Sheeting of the live wire and sparks are flyingoff that
- Shooting jolts of electricity directly into raw materials

The pain in TN condition is severe and debilitating, which have an impact on the quality of life.

ETIOLOGY:

Three most popular theories of TN etiology are:

1. Disease-related: vascular diseases, diabetes mellitus, multiple sclerosis, and others
2. Direct injury to the trigeminal nerve
- The Central part of trigeminal nerve system: neurovascular compression, schwannomas, meningiomas, tuberculomas, aneurysm
- The Peripheral part of the trigeminal nerve system: ‘allergic hypothesis’ due to odontogenic inflammatory pathology, getting cold, ‘compression syndrome hypothesis’due to the narrowing of the osseous canals.

3. Polyetiologic origin: all other possible aetiological factors that affectthe trigeminal nerve system (7).

PATHOPHYSIOLOGY:

The pathophysiology of TN shows a high complexity due to the involvement of various etiologic factors. Neuralgia mainly occurs due to compression of the nerve causing focal demyelination of the nerve to cause the ectopic generation of spontaneous nerve impulse results in episodes of pain. In TN patients painful stimuli occurred due to significant increased in the activity in spinal trigeminal nucleus, thalamus, primary and secondary somatosensory cortices, anterior cingulate cortex, insula, premotor/motor cortex prefrontal areas, putamen,hippocampus and non-painful stimulation of the trigger zone activated all except three of these structures(spinal trigeminal nucleus, brain stem, anterior cingulated cortex)(8,9)

DIAGNOSIS:

The most useful tool for diagnosing CTN is thepatient's history. For diagnosing STN neuroimaging techniques has been used(3,10)

From the ICHD-3 and IHS diagnostic criteria for trigeminal neuralgia,

A	Pain has all the following characteristics: • Pain lasting from a fraction of seconds to 2 minutes • Severe rapidity and intensity • An Electric shock-like, stabbing, shooting • Increased by the provoking factors at the affected trigeminal distribution
B	There is no clinically evident neurological deficit
C	Not attributed to other diseases

Differentiate the diagnosis of Diagnostic criteria for TN from neuropathic trigeminal pain (1):

SYMPTOMS	TN	NEUROPATHIC TRIGEMINAL PAIN
Character	Lancinating, shooting sharp, electric-shock like pain	Aching, throbbing
Site of pain and radiation	Trigeminal distribution	Around tooth or area of post-trauma or surgery
Severity of pain	Moderate- severe	Moderate
Duration	Seconds-2 minutes	Lasts for hours
Periodicity	Rapid onset	Continuous

There are neuroimaging and neurophysiological tests which are used to identify the cause in patients with STN, and in distinguishing symptomatic from classical TN.

Neuroimaging techniques: These techniques are MRI (Magnetic resonance imaging), MRA (magnetic resonance angiography) are used to confirm the diagnosis of the cause of TN and exclude other possible causes of facial pain.MRIs are used to identify and determine where there is vascular compression of the trigeminal neuralgia. These techniques are helped for a clinician to locatethe area of the neurovascular loop and to find any secondary cause. By using functional MRI changes in the brain activity associated with stimulation of the cutaneous trigger zone in patients with Trigeminal neuralgia can be diagnosed.

Neurophysiology tests: These tests are useful in recording the abnormal trigeminal reflexes, abnormal trigeminal nerve evoked potentials and trigeminal sensory deficits and or bilateral involvement help to detect the lesions (11,12)

TREATMENT:

Management of TN is different from patient to patient based on the patient's age and general condition.

Treatments for TN are:

1. Medical management
   - Anti-epileptic drug therapy
   - Non anti-epileptic drug therapy
2. Surgical management
   - Peripheral techniques
   - Percutaneous procedure at the level of the gasserain ganglion
   - Gamma knife surgery
   - Microvascular decompression

1. Medical management:

Drugs used for TN are acts on the voltage- sodium channels, GABA receptors. Antiepileptic(AED's) drugs are work well for TN. Carbamazepine (CBZ) is the gold standard drug for TN approved by food and drug administration (FDA). Other AED's used for TN are Oxcarbazepine (OXC), Phenytoin, Gabapentin, Lamotrigine, and non-epileptic drugs like Baclofen,Botulinum toxin A (12,13,14,15).

The table explains Detail about drugs:

Drug name	Mechanism of action(MOA)	Daily dose range	Side effects
AED's Carbamazepine	Inactivate voltage-gated sodium channels and prevents which prevents repetitive and sustained firing of action potential	300-1000mg	Dose-related effects,sedation,at axia
Oxcarbazepine	OXC is analog of CBZ, MOA same as CBZ	300-1200mg	Hyponatremia at higher doses
Gabapentin	Analogue of GABA,which likely involves its inhibition of the alpha2-delta subunit of voltage-gated calcium channels	900-2400mg	Sedation and ataxia
Lamotrigine	Acting on sodium channels and inhibiting the release of excitatory amino acids	200-400mg	Rashes are common if dose increase quickly
Phenytoin	reducingelectricalexcitabilityo f cell membranes,mainly use-dependent block of sodium channel	300-600mg	Vertigo,headache, ataxia, nystagmus
Non-AED's Baclofen	Selective agonists at presynaptic $GABA_B$receptors.	50-80mg	Motor incoordination, drowsiness, behaviour effects
Botulinum toxin A (BTA)	They Act specifically to inhibit acetylcholine release	100 units of BTA+0.5mg human albumin+0.9mg sodium chloride diluted in 2ml saline solution	Dry mouth, blurred vision

2. Surgical management: For reducing compression of the trigeminal nerve only one procedure Microvascular decompression is present. However other surgical procedures aim to reduce sensory input.

The surgical procedures are mainly targeted in three areas:

- Peripheral Gasserian ganglion at specified trigger points
- Gasserian ganglion level
- Posterior fossa at the root entry zone

➢ Microvascular decompression(MVD):

It is the non-destructive procedure and invasive technique for TN. This surgical procedure is recommended in younger patients with longerlife expectancy. In MVD, Craniotomy is performed in the postauricular area, identifies the vessel which compresses the trigeminal nerve and then moved out of direct contact with the nerve(16,17).

➢ Gamma knife radiosurgery:

Gamma knife radiosurgery is an ablative procedure. In this procedure, radiation is used for blocking the conduction of excessive sensory information responsible for triggering pain attacks (18).The Duration for pain relief is 3 years. This procedure is most acceptable as it is least invasive and no side effects (19). Pain relief also

delayed for some months after the procedure.A better resultoccurs in typical neuralgia with single nerve distribution pain.

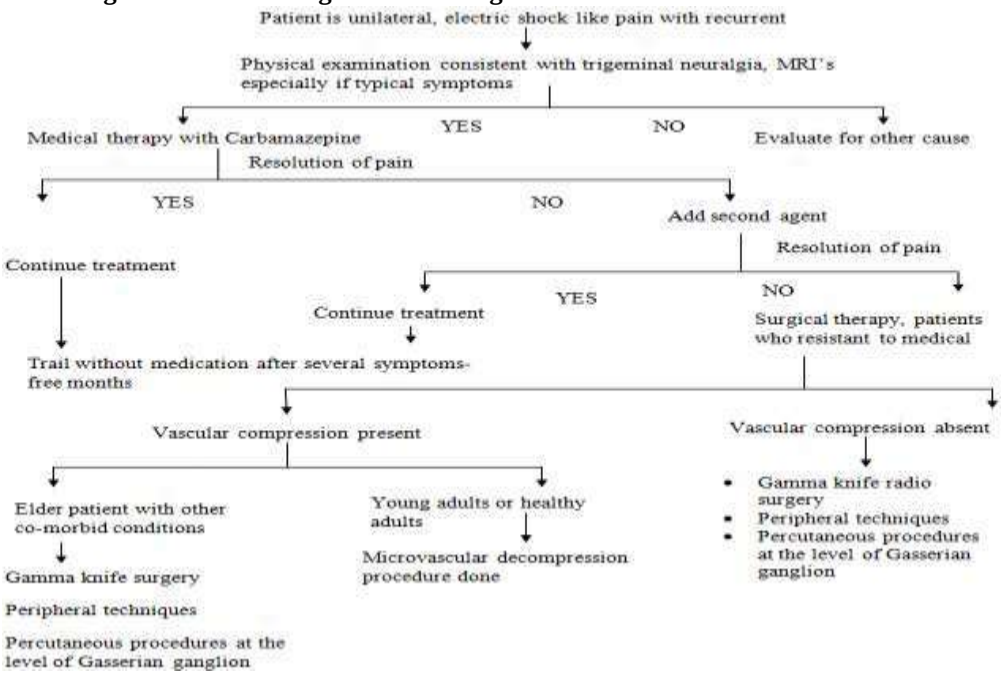
- Percutaneous procedures at the level of Gasserian Ganglion:

This procedure involves the insertion of a cannula through foramen ovale into the trigeminal ganglion under general anaesthetic and then ganglion is lesioned using heat, injection of glycerol or mechanical compression by using a balloon. Pain relief duration is for 5 yrs and shortest pain relief duration after glycerol injection (20, 21).

- Peripheral techniques:

Techniques for peripheral nerve repair are: peripheral acupuncture, neurectomies, cryotherapy, radiofrequency thermocoagulations and variety of injections such as phenol, alcoholand streptomycin.The Pain relief duration is 10 months (1, 20).

Algorithm showing Treatment for trigeminal neuralgia



I. CONCLUSION:

Although, TN is a rare disease condition, its excruciating and debilitating pain may impactthe patient's quality of life. Due to the lack of exactpathogenesis of TN, medical therapy is not satisfying the patient. The various neurological conditions can mimic its symptoms, and the diagnosis is recommended before initiation of the treatment.CBZ is the only drug that is approved by the FDA for TN. surgical procedures are done when the patient is resistant to medical therapy.

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