



**INTERNATIONAL JOURNAL OF  
PHARMACEUTICAL SCIENCES**  
[ISSN: 0975-4725; CODEN(USA): IJPS00]  
Journal Homepage: <https://www.ijpsjournal.com>



## Review Article

# Comprehensive Management Of Trigeminal Neuralgia

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## ARTICLE INFO

Published: 21 Aug. 2026

### Keywords:

Trigeminal neuralgia; Neuropathic facial pain; Trigeminal nerve; Neurovascular compression; Pharmacological management; Carbamazepine; Oxcarbazepine; Baclofen; Lamotrigine; Gabapentin; Pregabalin; Botulinum toxin type A; Microvascular decompression; Gamma Knife radiosurgery; Percutaneous rhizotomy; Balloon compression; Glycerol rhizotomy; Radiofrequency ablation; Magnetic resonance imaging (MRI); Diagnosis; Non-pharmacological management; Neuromodulation; Pain management; Quality of life; Evidence-based medicine.

### DOI:

10.5281/zenodo.22049176

## ABSTRACT

Trigeminal neuralgia (TN) is a chronic neuropathic pain disorder characterized by recurrent episodes of sudden, severe, electric shock-like facial pain distributed along one or more branches of the trigeminal nerve. It significantly impairs patients' quality of life, affecting daily activities, psychological well-being, and social functioning. The etiology of TN includes neurovascular compression, demyelinating diseases such as multiple sclerosis, tumors, and idiopathic causes. Early and accurate diagnosis based on clinical presentation, neurological examination, and magnetic resonance imaging (MRI) is essential for appropriate treatment planning. Comprehensive management of trigeminal neuralgia requires a multidisciplinary approach that integrates pharmacological therapy, surgical interventions, and supportive non-pharmacological strategies. Carbamazepine and oxcarbazepine remain the first-line pharmacological treatments, while lamotrigine, baclofen, gabapentin, pregabalin, and botulinum toxin type A may be considered in patients with refractory disease or medication intolerance. For patients who fail medical therapy or experience significant adverse effects, surgical procedures such as microvascular decompression, percutaneous radiofrequency rhizotomy, balloon compression, glycerol rhizotomy, stereotactic radiosurgery, and neuromodulation techniques provide effective pain relief with varying efficacy and risk profiles. Recent advances in neuroimaging, microsurgical techniques, and minimally invasive procedures have improved diagnostic accuracy, treatment outcomes, and long-term pain control. Patient education, psychological support, regular follow-up, and individualized treatment selection are essential components of comprehensive care. Emerging research on novel pharmacological agents, biomarkers, and neuromodulation technologies offers promising opportunities for improving future management strategies. This review summarizes the current evidence on the epidemiology, pathophysiology, diagnosis, pharmacological and surgical management,

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**Relevant conflicts of interest/financial disclosures:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



supportive care, and recent advances in trigeminal neuralgia, emphasizing the importance of personalized, evidence-based, multidisciplinary management to optimize clinical outcomes and enhance patients' quality of life.

## INTRODUCTION

Trigeminal neuralgia (TN) is one of the most severe forms of neuropathic pain and is characterized by sudden, recurrent episodes of intense, unilateral, electric shock-like facial pain affecting one or more branches of the trigeminal nerve (cranial nerve V). The attacks are typically brief, lasting from a few seconds to two minutes, but they may occur repeatedly throughout the day and are often triggered by routine activities such as chewing, talking, brushing the teeth, shaving, washing the face, or exposure to cold air. Because of its excruciating nature and unpredictable recurrence, trigeminal neuralgia is often referred to as the "suicide disease," reflecting its profound impact on physical, psychological, and social well-being.

The annual incidence of trigeminal neuralgia is estimated to be approximately 4–13 cases per 100,000 population, with the disorder occurring more frequently in women than in men. It predominantly affects individuals over the age of 50 years, although younger patients may develop trigeminal neuralgia secondary to multiple sclerosis, tumors, or other neurological disorders. The maxillary (V2) and mandibular (V3) divisions of the trigeminal nerve are most commonly involved, while ophthalmic (V1) involvement is relatively uncommon. Bilateral trigeminal neuralgia is rare and should prompt evaluation for secondary causes, particularly demyelinating diseases.

The pathophysiology of trigeminal neuralgia is complex and multifactorial. Classical trigeminal neuralgia is primarily caused by neurovascular compression of the trigeminal nerve root entry

zone, most commonly by the superior cerebellar artery, resulting in focal demyelination, axonal injury, and abnormal hyperexcitability of nerve fibers. Secondary trigeminal neuralgia may arise from multiple sclerosis plaques, intracranial tumors, arteriovenous malformations, or other structural abnormalities affecting the trigeminal nerve. Idiopathic trigeminal neuralgia is diagnosed when no definite cause can be identified despite comprehensive clinical and radiological evaluation. Advances in magnetic resonance imaging (MRI), particularly high-resolution three-dimensional imaging techniques, have significantly improved the identification of neurovascular compression and other structural abnormalities, enabling more accurate diagnosis and treatment planning.

Diagnosis of trigeminal neuralgia is primarily based on a detailed clinical history and neurological examination, following the diagnostic criteria established by the International Classification of Headache Disorders (ICHD-3). Neuroimaging is recommended to exclude secondary causes and to identify surgically treatable neurovascular compression. Accurate differentiation between classical, secondary, and idiopathic trigeminal neuralgia is essential because treatment strategies and long-term outcomes vary considerably among these subtypes.

Management of trigeminal neuralgia has evolved substantially over the past several decades. Pharmacological therapy remains the cornerstone of initial treatment, with carbamazepine and oxcarbazepine recommended as first-line agents because of their proven efficacy in reducing pain attacks. Alternative medications, including baclofen, lamotrigine, gabapentin, pregabalin, phenytoin, and botulinum toxin type A, may be used in patients who are resistant to or intolerant of first-line therapy. However, prolonged medical



treatment may be limited by adverse drug reactions, declining efficacy, and reduced patient adherence.

For patients with medically refractory trigeminal neuralgia or intolerable medication-related adverse effects, several surgical and minimally invasive procedures are available. Microvascular decompression is considered the preferred surgical option for patients with classical trigeminal neuralgia associated with neurovascular compression, offering durable pain relief while preserving nerve function. Other effective procedures include stereotactic radiosurgery (Gamma Knife), percutaneous radiofrequency rhizotomy, glycerol rhizotomy, balloon compression, and emerging neuromodulation techniques. The choice of intervention depends on patient age, comorbidities, imaging findings, pain severity, previous treatments, and individual preferences.

In addition to pharmacological and surgical therapies, comprehensive management should incorporate patient education, psychological support, lifestyle modification, multidisciplinary pain management, and regular follow-up to optimize long-term outcomes and improve quality of life. Recent advances in neuroimaging, microsurgical techniques, targeted drug therapies, and neuromodulation have expanded treatment options and improved clinical outcomes. Ongoing research is focused on identifying novel therapeutic targets, predictive biomarkers, and personalized treatment strategies to further enhance the management of trigeminal neuralgia. {5,6,7,8,9,10,11,12}

Comprehensive Management of Trigeminal Neuralgia

Comprehensive Management of Trigeminal Neuralgia

The management of trigeminal neuralgia (TN) aims to achieve rapid pain relief, prevent recurrence, minimize treatment-related adverse effects, and improve the patient's quality of life. Because TN is a chronic neuropathic pain disorder with varying etiologies and clinical presentations, management should be individualized and involve a multidisciplinary team, including neurologists, neurosurgeons, pain specialists, primary care physicians, and rehabilitation professionals.

## 1. Initial Assessment

**Management begins with a thorough clinical evaluation, including:**

- Detailed medical history and pain characteristics.
- Neurological examination.
- Identification of trigger factors.
- Assessment of pain severity using validated pain scales.
- Evaluation of psychological status and quality of life.
- Magnetic resonance imaging (MRI), preferably high-resolution MRI with MR angiography, to identify neurovascular compression or secondary causes such as multiple sclerosis or tumors.
- Accurate diagnosis is essential to differentiate classical, secondary, and idiopathic trigeminal neuralgia, as treatment strategies differ among these subtypes.

## 2. Pharmacological Management

- Drug therapy remains the first-line treatment for most patients.
- First-line Medications
- Carbamazepine
- Gold-standard therapy for TN.
- Blocks voltage-gated sodium channels.



- Effective in approximately 70–90% of patients.
- Requires monitoring of liver function, complete blood count, and serum sodium due to potential adverse effects.
- Oxcarbazepine
- Preferred alternative because of improved tolerability.
- Similar efficacy with fewer drug interactions.
- Lower risk of hematological toxicity than carbamazepine.
- Second-line and Adjunctive Medications
- Preferred treatment for classical TN with neurovascular compression.
- Relieves vascular compression without damaging the trigeminal nerve.
- Provides long-term pain relief in most patients.
- Preserves facial sensation.
- Requires craniotomy and is associated with operative risks.
- Percutaneous Procedures
- Suitable for elderly patients or those at high surgical risk.
- These include:
- Radiofrequency thermocoagulation
- Balloon compression
- Glycerol rhizotomy

**When first-line therapy is ineffective or poorly tolerated, alternative medications include:**

- Baclofen
- Lamotrigine
- Gabapentin
- Pregabalin
- Phenytoin
- Topiramate
- Clonazepam
- Combination therapy may be considered in patients with refractory symptoms.
- Botulinum Toxin Type A
- Botulinum toxin injections have demonstrated effectiveness in reducing pain frequency and intensity, particularly in patients who do not respond adequately to oral medications. Treatment is generally well tolerated with minimal systemic adverse effects.

### 3. Surgical Management

Surgery is recommended for patients with persistent pain despite optimal medical therapy or those unable to tolerate medication-related adverse effects.

- Microvascular Decompression (MVD)

**Advantages:**

- Minimally invasive
- Immediate pain relief
- Short hospital stay

**Disadvantages:**

- Facial numbness
- Risk of pain recurrence
- Corneal sensory loss in some patients
- Stereotactic Radiosurgery (Gamma Knife)
- Non-invasive outpatient procedure.
- Delivers focused radiation to the trigeminal nerve root.
- Particularly useful for medically fragile patients.
- Pain relief develops gradually over several weeks.
- Lower complication rates than open surgery.
- Neuromodulation

**Emerging techniques include:**

- Peripheral nerve stimulation
- Motor cortex stimulation



- Deep brain stimulation
- These approaches are reserved for highly refractory cases.

#### 4. Non-Pharmacological Management

**Supportive therapies improve overall patient outcomes.**

- Patient Education
- Patients should receive education regarding:
- Disease nature
- Medication adherence
- Recognition of adverse effects
- Expected treatment outcomes
- Importance of regular follow-up
- Lifestyle Modification

**Patients are advised to:**

- Avoid known pain triggers.
- Maintain good oral hygiene.
- Eat soft foods during painful episodes.
- Reduce emotional stress.
- Maintain adequate sleep.
- Avoid exposure to cold wind when possible.
- Psychological Support

**Chronic facial pain often leads to:**

- Anxiety
- Depression
- Social isolation
- Reduced quality of life
- Psychological counseling, cognitive behavioral therapy, stress management, and support groups may improve coping ability and treatment adherence.
- Nutritional Support
- Patients with severe pain may experience difficulty chewing and swallowing.

**Recommendations include:**

- Soft diet
- Adequate hydration
- Small frequent meals
- Nutritional supplementation when necessary

#### 5. Follow-Up and Long-Term Care

**Long-term management includes:**

- Regular pain assessment.
- Monitoring medication effectiveness.
- Early identification of adverse drug reactions.
- Dose adjustment according to clinical response.
- Repeat imaging if neurological deficits develop.
- Timely referral for surgical intervention when appropriate.
- Long-term follow-up is essential because recurrence may occur even after initially successful treatment.

#### 6. Emerging and Future Therapies

**Recent research has focused on:**

- Novel sodium channel blockers
- Selective ion channel modulators
- Monoclonal antibody therapies
- Gene-based therapies
- Advanced neuromodulation techniques
- Artificial intelligence-assisted diagnosis
- Personalized medicine approaches
- These strategies may improve efficacy while minimizing adverse effects.

#### 7. Multidisciplinary Approach

**Optimal management requires collaboration among:**

- Neurologists
- Neurosurgeons





- Pain specialists
- Primary care physicians
- Radiologists
- Dentists
- Psychologists
- Rehabilitation specialists
- Clinical pharmacists {13,14,15,16,17,18,19,,20}

## CONCLUSION

Migraine is a complex neurological disorder that requires a comprehensive, patient-centered, and multidisciplinary approach to management. Current evidence supports the integration of lifestyle modifications, including regular sleep, balanced nutrition, adequate hydration, routine physical activity, stress management, and avoidance of individual migraine triggers, as the foundation of effective migraine prevention. Non-pharmacological interventions such as cognitive behavioral therapy, mindfulness, biofeedback, yoga, physiotherapy, manual therapy, acupuncture, and non-invasive neuromodulation have demonstrated beneficial effects in reducing migraine frequency, intensity, disability, and improving quality of life. These approaches are most effective when combined with appropriate acute and preventive pharmacological therapies tailored to the individual patient's clinical needs. Although substantial progress has been made, further high-quality randomized controlled trials and long-term studies are needed to establish standardized treatment protocols and identify the most effective combinations of lifestyle and non-pharmacological interventions. Overall, an individualized, evidence-based, multimodal management strategy offers the greatest potential to reduce the burden of migraine and enhance long-term patient outcomes. {21,23,24,25,30,34,35,36,37,38,39,}.

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**HOW TO CITE:** Nayan Mundhe, Dr. Prajakta Kelgaonkar, Bhumika Gaikwad, Rutuja Sherkhane, Dhanshree Bhosle, Comprehensive Management Of Trigeminal Neuralgia, *Int. J. of Pharm. Sci.*, 2026, Vol 4, Issue 8, 3429-3435. <https://doi.org/10.5281/zenodo.22049176>

