

Recent advances in the diagnosis and treatment of trigeminal neuralgia*Avances recientes en el diagnóstico y tratamiento de la neuralgia del trigémino**Avanços recentes nos diagnósticos e abordagens terapêuticas da neuralgia do trigêmeo***Nicolý Vitória Soares do Nascimento^{1*}**

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***Corresponding author:**nicolyvitoriasoares@gmail.com**Submission:** 10-28-2025**Approval:** 11-26-2025**Abstract**

The aim was to analyze recent advances in diagnostic methods and therapeutic approaches to neuropathy, with an emphasis on innovative strategies for pain control, improvement of clinical outcomes, and promotion of patients' quality of life. This is an integrative literature review, based on the PICO strategy, defining: P (population) people with neuropathy; I (phenomenon of interest) diagnostic and therapeutic methods; and Co (context) patients undergoing different treatments. The search was conducted in the PubMed, Virtual Health Library, and Google Scholar databases, including articles published between 2015 and 2025, with free access, full text, and in Portuguese, English, and Spanish. Data analysis followed the content analysis technique proposed by Laurence Bardin. Significant advances in diagnostic methods were identified, highlighting high-resolution magnetic resonance imaging and the use of artificial intelligence, which improve accuracy and therapeutic planning. In treatment, minimally invasive techniques such as radiofrequency and Gamma Knife, and new drugs such as lacosamide, botulinum toxin, and ketamine, stood out as effective in pain control and with a lower complication rate. It is concluded that the management of trigeminal neuralgia should be guided by an individualized, interdisciplinary, and evidence-based approach that integrates technological innovation, professional training, and humanized care.

Descriptors: Trigeminal Neuralgia; Facial Pain; Trigeminal Nerve Diseases; Neurology; Therapeutics.**Resumen**

El objetivo fue analizar los avances recientes en métodos diagnósticos y abordajes terapéuticos para la neuropatía, con énfasis en estrategias innovadoras para el control del dolor, la mejora de los resultados clínicos y la promoción de la calidad de vida de los pacientes. Esta es una revisión bibliográfica integradora, basada en la estrategia PICO, definiendo: P (población) personas con neuropatía; I (fenómeno de interés) métodos diagnósticos y terapéuticos; y Co (contexto) pacientes sometidos a diferentes tratamientos. La búsqueda se realizó en las bases de datos PubMed, Biblioteca Virtual en Salud y Google Académico, incluyendo artículos publicados entre 2015 y 2025, con acceso gratuito, texto completo y en portugués, inglés y español. El análisis de datos siguió la técnica de análisis de contenido propuesta por Laurence Bardin. Se identificaron avances significativos en los métodos diagnósticos, destacando la resonancia magnética de alta resolución y el uso de inteligencia artificial, que mejoran la precisión y la planificación terapéutica. En el tratamiento, las técnicas mínimamente invasivas como la radiofrecuencia y el bisturí de rayos gamma, así como nuevos fármacos como lacosamida, la toxina botulínica y la ketamina, se destacaron por su eficacia en el control del dolor y una menor tasa de complicaciones. Se concluye que el manejo de la neuralgia del trigémino debe guiarse por un enfoque individualizado, interdisciplinario y basado en la evidencia, que integre la innovación tecnológica, la formación profesional y la atención humanizada.

Descriptores: Neuralgia del Trigémino; Dolor Facial; Enfermedades del Nervio Trigémino; Neurología; Terapéutica.**Resumo**

Objetivou-se analisar os avanços recentes nos métodos diagnósticos e nas abordagens terapêuticas da NT, com ênfase em estratégias inovadoras para o controle da dor, melhoria dos desfechos clínicos e promoção da qualidade de vida dos pacientes. Trata-se de uma revisão integrativa da literatura, baseada na estratégia PICO, definindo-se: P (população) pessoas com NT; I (fenômeno de interesse) métodos diagnósticos e terapêuticos; e Co (contexto) pacientes submetidos a diferentes tratamentos. A busca foi realizada nas bases PubMed, Biblioteca Virtual em Saúde e Google Acadêmico, incluindo artigos publicados entre 2015 e 2025, com acesso gratuito, texto completo e nos idiomas português, inglês e espanhol. A análise dos dados seguiu a técnica de análise de conteúdo proposta por Laurence Bardin. Identificaram-se avanços significativos nos métodos diagnósticos, destacando-se a ressonância magnética de alta resolução e o uso de inteligência artificial, que aprimoram a precisão e o planejamento terapêutico. No tratamento, sobressaíram-se técnicas minimamente invasivas, como radiofrequência e Gamma Knife, e novos fármacos, como Lacosamida, toxina botulínica e cetamina, eficazes no controle da dor e com menor taxa de complicações. Conclui-se que o manejo da NT deve ser guiado por uma abordagem individualizada, interdisciplinar e baseada em evidências, que integre inovação tecnológica, capacitação profissional e cuidado humanizado.

Descritores: Neuralgia do Trigêmeo; Dor Facial; Doenças do Nervio Trigêmeo; Neurologia; Terapêuticas.

Introduction

Trigeminal neuralgia (TN) is a neuropathic condition characterized by intense and recurrent pain in the region innervated by the trigeminal nerve, considered one of the most severe forms of chronic pain known. The episodes are brief and resemble electric shocks. This pain profoundly affects patients' quality of life, compromising basic activities such as speaking, chewing, and smiling. TN is frequently described as a lancinating and debilitating pain, which can negatively impact patients' mental health, leading to the development of anxiety and depression¹.

The trigeminal nerve is the fifth cranial nerve pair and has three main branches: ophthalmic (V1), maxillary (V2), and mandibular (V3). It is responsible for facial sensation and part of the motor functions of mastication. Trigeminal neuralgia (TN) usually occurs due to vascular compression of the nerve at its entry root in the brainstem, causing focal demyelination and neuronal hyperexcitability, which is an abnormal increase in neuronal activity, making them more prone to firing electrical impulses. In addition, other causes may be associated, such as multiple sclerosis, tumors, sequelae of craniofacial trauma, and malformations in blood vessels^{2,3}.

The prevalence of TN is relatively low, affecting between 4 and 29 individuals per 100,000 inhabitants, being more common in women and in people over 50 years of age. The higher incidence in women may be related to a combination of hormonal, neurobiological, and neuroanatomical factors that influence both the perception and modulation of pain. Studies indicate that variations in estrogen levels can alter sensitivity to painful stimuli, making women more susceptible to neuropathic disorders; structural and functional differences in the central nervous system, such as genetic and neuroendocrine factors, may also contribute to the higher incidence of TN in women⁴⁻⁶.

Regarding age range, the incidence of the disease in people over 50 years of age can be explained by the structural and functional changes that naturally occur in the nervous system throughout aging. Among the main factors, the progressive degeneration of the myelin sheath stands out, compromising the functional integrity of the trigeminal nerve; in addition, hemodynamic changes and stiffening of vascular structures with age can favor the occurrence of neurovascular conflicts, mainly in the region of the nerve root entry, where there is greater anatomical vulnerability⁵.

Symptoms are characterized by severe pain attacks, described as an electric shock, which can last from a few seconds to minutes. This pain manifests unilaterally and can be triggered by simple stimuli, such as touching the face, talking, or even a breath of wind. Therefore, trigeminal neuralgia can be subclassified as classic, secondary, or idiopathic, depending on the underlying cause, with the classic type being the most common, representing 75% of cases, and occurring when there is neurovascular compression of the trigeminal nerve. This type is characterized by morphological changes in the nerve, such as distortion and atrophy, visible on magnetic resonance imaging (MRI)^{3,7}.

Treatment of TN involves pharmacological and surgical approaches. Anticonvulsants, such as carbamazepine and oxcarbazepine, are the first-line therapy, providing pain control in up to 90% of cases, although side effects lead to discontinuation in about 40% of patients. When the drug response is inadequate, surgical interventions are used, such as microvascular decompression, percutaneous radiofrequency ablation, and stereotactic radiosurgery, each with specific benefits and risks. With advances in research, new therapies are being developed to minimize adverse effects and offer lasting relief. Neuromodulation and minimally invasive techniques are emerging as promising, representing a constantly evolving field in the search for more effective and safe alternatives⁸⁻¹⁰.

Given the challenges posed by the disease, its interdisciplinary management has become essential. The combination of pharmacological interventions, physiotherapy, and psychosocial support can provide better adaptation of the patient to the condition, reducing its impact on daily routine, and constant monitoring by a specialized medical team is crucial for individualizing treatment¹⁰.

This study is relevant due to the clinical importance of trigeminal neuralgia, which, despite its low prevalence, presents severe functional and emotional impairment to affected patients. The intense and debilitating pain, associated with diagnostic difficulties and treatment complexity, demands constant updating and scientific deepening. Furthermore, advances in diagnostic and therapeutic techniques require close attention from the academic and professional community so that they can be applied effectively and safely. Thus, investigating recent progress in the management of TN contributes not only to expanding knowledge but also to promoting a more effective clinical practice focused on the quality of life of patients.

This study aims to analyze how the scientific literature addresses the main advances related to trigeminal neuralgia. The question posed is: "What are the recent advances in the diagnosis and therapeutic approaches for trigeminal neuralgia?". Emphasis will be given to innovative strategies for pain control and improvement of clinical outcomes, as well as exploring new therapeutic methods that may significantly contribute to reducing patient suffering and providing them with a better quality of life.

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Methodology

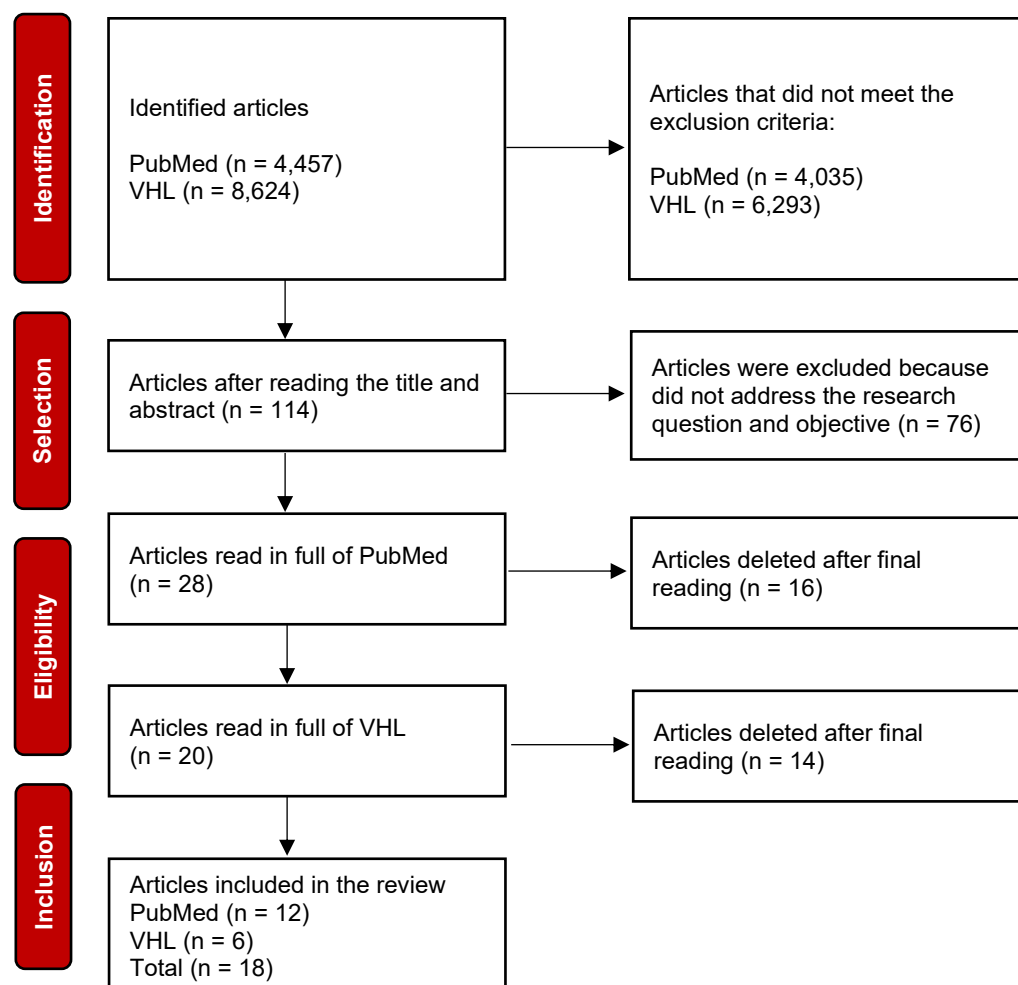
This study adopts an integrative literature review approach, aiming to synthesize and critically analyze the



existing scientific evidence available on advances in the diagnosis and treatment of trigeminal neuralgia. Furthermore, it seeks to identify innovative strategies for pain control and improved clinical outcomes, considering both pharmacological interventions and minimally invasive procedures. The PICo strategy was used to formulate the guiding question, allowing for a more precise search of scientific evidence related to the object of study. The acronym PICo refers to P: population, I: phenomenon of interest, and Co: context. In this study, the elements were defined as: P – people with trigeminal neuralgia; I – diagnoses and treatment approaches; Co – patients undergoing different treatment strategies.

The search for studies was conducted between February and September 2025. The research area comprised the electronic databases US National Library of Medicine (PubMed), Google Scholar, and Virtual Health Library (VHL), from which the articles that make up the research corpus were retrieved. The article selection process was represented by a flowchart (Figure 1), developed according to the stages of search, screening, eligibility, and inclusion. This visual resource allows for a clearer understanding of how the publications initially identified in the PubMed and VHL databases were reduced until they comprised the final sample of the review. Thus, the flowchart reinforces methodological transparency and facilitates the visualization of the criteria applied at each stage of the process.

Figure 1. Flowchart of the article selection process based on the PubMed and BVS databases. Maringá, PR, Brazil, 2025



The search and selection process for the studies was carried out simultaneously by two researchers. For this stage, combinations of the following Health Sciences Descriptors (DeCS) were used: "Trigeminal Nerve", "Trigeminal Neuralgia" and "Trigeminal Nerve Diseases", in addition to the Medical Subject Headings (MeSH) terms: "Facial Neuralgia" and "Facial Pain", using the Boolean operators "AND" and "OR" to expand and refine the results.

The inclusion criteria were original articles, free of charge, available in full, published between 2015 and 2025, in Portuguese, English, and Spanish. The exclusion criteria

were case reports, dissertations, theses, guidance manuals, and literature review articles.

The analysis of the studies was carried out through critical reading and note-taking of the selected articles. For this purpose, a data collection spreadsheet created in Microsoft Excel was used. Subsequently, the data were organized and analyzed according to Laurence Bardin's methodological proposal, based on the content analysis technique. This method includes three phases: pre-analysis, exploration of the material, and treatment and interpretation of the results obtained. It is a systematic

process that aims at categorizing and inferring meanings from the collected data, allowing for a deeper understanding of the implicit content in the texts. Each study was examined for its theoretical contribution to advances in the diagnosis and therapeutic approaches to trigeminal neuralgia, as well as the practical or clinical strategies described in the research, thus allowing for a comparative analysis and a synthesis of the available evidence on the subject. In the

next step, terms dealing with the same subject were grouped, giving rise to identification codes. Based on these codes, a word cloud was created (Figure 2), which allowed for a more intuitive observation of the most relevant and frequent points in the literature. From the consolidation of the codes, analytical categories were constructed, understood as broader sets capable of organizing and interpreting the content found¹¹.

Figure 2. Word cloud constructed by coding the main results, based on Laurence Bardin's method. Maringá, PR, Brazil, 2025



Note: Capacitação da equipe: Team training. Tratamento e intervenções: Treatment and interventions. Tipos de neuralgia do trigêmeo: Types of trigeminal neuralgia. Sinais, sintomas, manifestações: Signs, symptoms, manifestations. Segurança e eficácia das abordagens cirúrgicas e farmacológicas: Safety and efficacy of surgical and pharmacological approaches. Resposta ao tratamento farmacológico: Response to pharmacological treatment. Recorrências e complicações: Recurrences and complications. Pacientes acometidos pela doença: Patients affected by the disease. Repetição do tratamento: Repeat the treatment. Diagnóstico: Diagnosis.

Because this is an integrative review, this project did not require submission to the Research Ethics Committee. Even so, the data and information extracted from the analyzed publications were presented with rigor and fidelity to the original sources.

Results

During the bibliographic review process, the initial search in the PubMed database resulted in 4,547 publications without filters. Applying the previously established eligibility criteria reduced this number to 512 articles. Subsequently, the titles were analyzed, from which 62 articles were selected for abstract reading. After this stage, only 28 studies were deemed relevant and were submitted for full-text reading. Of these, 12 articles fully met the defined criteria and were included in the final sample.

In the BVS database, an unfiltered search identified 8,624 publications. Applying filters reduced the total to 2,331 articles. Analysis of the titles allowed the selection of 52 studies, of which 20 were retained after reading the abstracts. A full reading of these works resulted in the inclusion of 6 articles that met the objectives of this review. Thus, at the end of the entire selection process, the sample consisted of 18 articles that rigorously met the established inclusion criteria, constituting the material analyzed in this review.

The selection of articles was summarized in a flowchart (Figure 1), which presents the steps of searching,

filtering, and including studies in the analyzed databases. This representation facilitates the visualization of the process and reinforces the methodological clarity of the review. Among the selected articles, it is observed that most publications are concentrated in the period after 2015, with greater emphasis on the last five years, which demonstrates a growing interest from the scientific community regarding trigeminal neuralgia and the different associated therapeutic modalities.

All articles were published in English, predominantly in the PubMed database, followed by the Virtual Health Library, highlighting the internationalization of research on the topic and the global nature of scientific production in this area. Regarding methodological design, there is a predominance of retrospective studies, followed by prospective cohort studies, clinical trials, technical reports, and experimental investigations using artificial intelligence. This distribution indicates that, although there is progress in research with greater scientific rigor, retrospective and observational studies still prevail. Concerning the level of evidence, the presence of clinical trials and prospective cohorts, which approach the highest levels, is noticeable, as well as intermediate investigations such as retrospective studies and technical reports. This diversity reinforces that the field already has significant contributions, but still requires further in-depth study through multicenter, randomized clinical trials that strengthen the consistency of the findings. Chart 1 makes it

possible to identify the approaches adopted in each study and to understand how the different diagnostic and

therapeutic approaches contributed to the advancement of knowledge about trigeminal neuralgia.

Chart 1. Characterization of the selected articles. Maringá, PR, Brazil, 2025

ID	Main results
01	The technique demonstrated a high rate of pain control, especially when moderate hypoesthesia was achieved without causing painful anesthesia; the procedure was considered safe, with few occurrences of serious complications, making it an effective option mainly for patients who do not respond well to drug treatment or are not candidates for more invasive surgeries.
02	In the study, the authors demonstrate, through a retrospective analysis of two clinical cases of bilateral trigeminal neuralgia, that craniotomy for bilateral microvascular decompression represents a new and effective therapeutic approach, as it is satisfactory due to its low recurrence rate and few complications for patients with the disease, considering that it is a very rare type of neuralgia.
03	Star-in technology is a promising tool for accurate interpretation of high-resolution MRI for the diagnosis of trigeminal neuralgia (TN), as it allows for the generation of segmentations of the trigeminal nerve and contact structures from the MRI.
04	Microsurgical vascular decompression is an effective and safe treatment approach when performed by a trained team; it should be proposed as a first-line treatment after failure of well-conducted medical treatment, intolerance, or allergy, as it provided immediate and definitive cure in the vast majority of TN cases among the patients included in the study, obtaining good results in the short, medium, long, and very long term.
05	Patients with neurothoracic neuralgia secondary to multiple sclerosis were younger, presented with bilateral pain more frequently, and had earlier pain recurrence compared to idiopathic neurothoracic neuralgia. Radiofrequency thermocoagulation was effective and safe, but in cases associated with multiple sclerosis, therapies with a longer-lasting effect may be necessary.
06	Turning to the disease we are analyzing, the study showed that totally endoscopic microvascular decompression (E-MVD) is an effective treatment option for TN, considering that most patients who underwent the procedure experienced complete postoperative pain relief, and only one did not experience pain relief.
07	The asymmetry in latency of trigeminal reflexes, predictive of classic trigeminal neuralgia (TN), likely reflects the association of classic TN with neurovascular compression. On the other hand, idiopathic TN may be associated with abnormal functioning of trigeminal nerve fibers, despite the absence of detectable impairment in large-caliber myelinated fibers.
08	GKRS is a safe and effective treatment option for refractory neuropathy, especially in elderly patients and those with serious comorbidities. Most patients experienced satisfactory results in terms of long-term pain relief.
09	There was consistent pain relief at both 68°C and 75°C, while there were fewer complications and greater patient satisfaction at 68°C compared to 75°C. All patients experienced pain relief after RFT at both temperatures, and most patients rated their pain relief as excellent at 75°C and 68°C, respectively, immediately after RFT.
10	Following the DVM (Dynamic Ventricular Dystrophy), most patients with mixed TN (Toxic Triangulum) included in the study experienced pain relief during the first three months; afterwards, they experienced a recurrence of classic or atypical TN pain. Patients with classic TN, after the DVM, mostly experienced pain relief in the postoperative period, and a small percentage had TN recurrence. Therefore, patients with mixed TN may benefit from DVM for short-term pain relief, with longer follow-up periods needed in future studies to assess recurrence rates and associated risk factors.
11	Patients who received BTX-A showed statistical and clinical improvement in pain intensity and attack frequency at each follow-up; a small percentage of patients experienced recurrence and underwent treatment again, showing improvement.
12	In a five- to seven-day course of continuous ketamine infusion, there was significant and lasting pain relief in some patients with refractory facial pain, particularly those with neuromuscular blockade. A small proportion of patients reported pain relief, but this was neither significant nor lasting.
13	The procedure proved highly effective in relieving pain, with good immediate and sustained clinical response over time. In cases of recurrence, repeating the treatment also proved effective. The complications observed were mild and transient, confirming the safety of the technique.
14	The artificial intelligence model demonstrated a good ability to distinguish patients with trigeminal neuralgia from control individuals, identifying specific regions of the skull as key areas for diagnosis. Although it still needs refinement, it showed potential as a complementary tool to magnetic resonance imaging and a possible clinical screening resource.
15	The use of two isocenters provided faster and more effective pain relief, but was associated with a higher incidence of facial numbness. The single isocenter, on the other hand, showed fewer adverse effects, but less effectiveness in pain control.
16	Lacosamide reduced pain intensity similarly to carbamazepine, showing a positive clinical effect in the first few weeks and good tolerability. Adverse effects were mild and no serious reactions occurred, indicating that the drug may be a viable therapeutic alternative.
17	The endoscopic technique proved to be safe and effective, showing better postoperative results compared to the microscopic technique, especially due to better visualization of the surgical field. There was no relevant difference in complications, surgical time, or length of hospital stay.
18	Patients who received conservative treatment for longer periods experienced greater pain intensity and a higher risk of recurrence after surgery. The study suggests that early surgical intervention may improve clinical outcomes.

The main results converge on the effectiveness of different treatment modalities. Radiofrequency thermocoagulation, for example, proved to be safe, with good immediate and sustained clinical response over time, especially in elderly patients or those refractory to drug

treatment. Microvascular decompression, both in its traditional and endoscopic forms, stood out as a first-line procedure after clinical therapeutic failure, providing high rates of pain relief in the short and long term.



Radiosurgery with Gamma Knife has also shown satisfactory results, especially in patients with severe comorbidities, establishing itself as a less invasive alternative. Other approaches, such as the use of botulinum toxin and lacosamide, are emerging as effective and well-tolerated pharmacological options, representing viable alternatives to carbamazepine. In parallel, new technologies, such as the application of artificial intelligence (AI) and high-resolution magnetic resonance imaging, have demonstrated promising diagnostic potential to complement conventional clinical and imaging methods.

The analysis highlights, on the one hand, the therapeutic advances achieved, which include safer, less invasive techniques capable of providing significant improvement in clinical outcomes. On the other hand, it emphasizes persistent weaknesses, such as the recurrence of pain in certain cases, the need for therapies with a longer-lasting effect in patients with associated conditions, such as multiple sclerosis, and transient complications, such as facial numbness in some procedures. Thus, the reviewed studies allowed the identification of both effective strategies for the management of trigeminal neuralgia and limitations that still challenge clinical practice.

This scenario points to the need to deepen scientific production on the subject, with emphasis on prospective,

multicenter research based on experimental methods to consolidate more robust evidence that can guide therapeutic approaches and increase the safety and efficacy in the treatment of trigeminal neuralgia.

The content analysis process followed the steps proposed by Bardin, which allowed the findings to be organized in a systematic and clear way. Initially, the selected studies were read, at which point keywords and recurring expressions related to the diagnostic and therapeutic modalities of trigeminal neuralgia were identified. To facilitate visualization, these words were highlighted with different colors, according to their similarity in meaning¹¹.

From this systematization, three main categories emerged: clinical characterization, diagnosis, and patient profile, encompassing types of neuralgia, signs and symptoms, epidemiological profile, and diagnostic methods; therapeutic interventions for trigeminal neuralgia, involving efficacy, safety, and professional training; and clinical follow-up and therapeutic outcomes, including treatment response, complications, and recurrences. Chart 2 presents a summary of the categorization performed, highlighting the relationship between the codes and categories, which served as the basis for the analysis and discussion of the results.

Chart 2. Categorization of studies. Maringá, PR, Brazil, 2025

Categories	Codes
Clinical characterization, diagnosis, and profile of patients with the disease	Types of trigeminal neuralgia Signs, symptoms, and manifestations Patients affected by the disease Diagnostic methods
Therapeutic interventions for trigeminal neuralgia: safety and efficacy	Interventions/treatments Safety and efficacy of surgical and pharmacological approaches Team training
Clinical follow-up and therapeutic outcomes	Response to pharmacological treatment Recurrences and complications Repetition of treatment

Characterizing patients with trigeminal neuralgia: clinical and diagnostic profile

This category encompasses the fundamental elements for understanding the disease, including the identification of different types of trigeminal neuralgia, the most recurrent clinical manifestations, and the signs and symptoms presented by patients. It also integrates the diagnostic criteria used and the characterization of the profile of the affected population, allowing for a more comprehensive view of the condition's impact in the clinical and epidemiological context. Associated codes: types of trigeminal neuralgia; diagnosis; signs, symptoms, and manifestations; patients affected by the disease.

Identifying therapeutic interventions in trigeminal neuralgia: efficacy, safety, and professional training

This category encompasses the different intervention modalities aimed at treating trigeminal neuralgia, considering both pharmacological and surgical approaches. It emphasizes the analysis of the safety and efficacy of the procedures employed, as well as the

importance of training the healthcare team for the proper execution and monitoring of these approaches. Thus, the relevance of the careful selection of therapeutic strategies and professional qualification to ensure better clinical outcomes for patients is highlighted. Associated codes: intervention and treatment; safety and efficacy of surgical and pharmacological approaches; team training.

Understanding clinical follow-up and therapeutic outcomes in trigeminal neuralgia

This category covers aspects related to patient progress in response to drug treatment, including clinical response, as well as the occurrence of relapses and complications that may interfere with the continuity of therapy. Furthermore, it addresses the need for repetition or adjustments to the adopted regimens, highlighting the challenges for maintaining treatment efficacy and for the long-term management of the disease. Associated codes: response to pharmacological treatment; recurrences and complications; treatment repetition.



regions of the face can trigger intense pain episodes^{13,14,18}. Furthermore, ruling out other causes of facial pain and having in-depth knowledge of the disease classification and clinical characteristics are fundamental not only for more accurate diagnoses, but also for clinical practice and personalized therapeutic choices tailored to each patient^{13,24,25}.

Given the clinical complexity and the need for accurate diagnosis of TN, the literature suggests that technological innovations are playing an essential role in improving clinical practice and personalizing therapeutic approaches^{13,14}. In this context, it states that imaging methods complement clinical evaluation, highlighting high-resolution magnetic resonance imaging (HRMRI) as the gold standard for visualizing the trigeminal nerve and detecting neurovascular compressions; and three-dimensional sequences such as 3D FIESTA, CISS, and TOF angiography allow for the identification of minimal anatomical changes and the planning of surgical interventions with greater accuracy^{12,19,20}. Associated with the diagnostic method, it was also identified that the application of artificial intelligence (AI) has been increasing accuracy and longitudinal monitoring, allowing for the early detection of complications; this preventive strategy can reduce the progression of pain, avoid late recurrences after treatment, and contribute to a safer, more personalized, and effective approach²².

The analysis of the reviewed studies showed that surgical interventions represent the main therapeutic alternative in cases where pharmacological management does not provide adequate pain relief. Among the most frequently discussed techniques, microvascular decompression (MVD), radiofrequency thermocoagulation (RFT), and stereotactic radiosurgery with Gamma Knife (GKRS) stand out, each with specific mechanisms and indications. The analyzed publications indicate that, although all demonstrate efficacy in pain control, the choice should be individualized, considering the type of neuralgia, the duration of the condition, and the patient's clinical conditions²⁷⁻³⁴.

The studies analyzed demonstrated that DMV (vascular neurovascularization) stood out as the first-line procedure in patients with classic neuralgia, especially when there is evident neurovascular compression. Evidence points to high rates of immediate and sustained pain relief, as well as a low recurrence rate. Retrospective research indicates that performance by specialized teams guarantees lasting results and a positive impact on quality of life. The endoscopic variation of the technique proved equally effective, offering better anatomical visualization and less neural manipulation, which is associated with lower complication rates, including in rare bilateral cases²⁸⁻³⁶.

According to the reviewed studies, RFT (Rapid Facial Therapy) presents itself as a minimally invasive technique with a rapid clinical response, frequently indicated for elderly patients, those with associated comorbidities, or secondary neuralgia, such as in multiple sclerosis. The findings reveal a high rate of pain control immediately after the procedure and the possibility of repetition in cases of

Discussion

According to the analysis of the studies, Trigeminal Neuralgia (TN) was identified as a facial neuropathic condition characterized by paroxysmal episodes of intense, brief, and lancinating pain, affecting one or more divisions of the trigeminal nerve¹². According to the classification of the International Headache Society (IHS), described in the third edition of the International Classification of Headache Disorders (ICHD-3) and adopted by the Brazilian Headache Society (SBCe), trigeminal neuralgia (TN) is divided into three main forms: classic, secondary, and idiopathic. The classic form occurs due to neurovascular compression of the trigeminal root at its entry point, leading to focal demyelination; the secondary form is associated with structural or systemic diseases, such as multiple sclerosis and tumors; and the idiopathic form is diagnosed when there is no identifiable cause even after detailed investigation^{15,16}.

In the reviewed studies, trigeminal neuralgia (TN) is considered one of the most intense pains described in clinical practice, causing significant functional and emotional impact. Signs and symptoms include sudden, intense pain described by patients as electric shocks or stabbing sensations lasting from seconds to a few minutes. It was also shown that, in general, TN affects only one side of the face, with the right side being the most frequently affected, primarily involving the maxillary (V2) and mandibular (V3) divisions of the trigeminal nerve. Furthermore, the studies indicate that attacks have an abrupt onset and termination and can be triggered by mild, routine stimuli such as chewing, speaking, touch, dental hygiene, or even a draft. It is concluded that these manifestations compromise functionality and well-being, leading many patients to social isolation, anticipatory fear, and significant impairment in quality of life¹²⁻¹⁴.

Considering the category that encompasses the characterization of patients affected by the disease, from an epidemiological point of view, studies show that NT is predominant in women and in individuals over 50 years of age, and that this incidence in females may be related to a combination of hormonal, neurobiological, and neuroanatomical factors, such as fluctuations in estrogen levels, differences in the vascular anatomy of the posterior fossa, and lower myelin density, which increase vulnerability to neurovascular contact^{12,13,17-23}. Furthermore, regarding the clinical profile of patients, the literature has shown that many present with systemic comorbidities, such as hypertension and diabetes mellitus, conditions that can alter pain perception, the neural excitability threshold, and the response to pharmacological and surgical treatments^{13,24,25}.

Considering the diagnosis of the disease under study, during the analysis it was observed that it is essentially clinical, supported by a detailed medical history, a focused physical examination, and the application of the ICHD-3 criteria, which include intense, brief, unilateral paroxysmal pain precipitated by innocuous stimuli within the affected trigeminal area^{13,15,20}; the identification of trigger zones is also a characteristic and fundamental clinical finding for differential diagnosis, since minimal stimuli in specific



recurrence, which expands its therapeutic value. However, it was observed that the duration of relief tends to be shorter in patients with demyelinating involvement, suggesting the need for complementary approaches. A temperature of 68°C was associated with a lower occurrence of hypoesthesia and facial dysesthesia, while maintaining satisfactory efficacy³⁴⁻⁴⁰.

Analysis of the reviewed articles demonstrated that GKRS has established itself as a safe and non-invasive alternative, especially indicated for patients at high surgical risk or with contraindications to general anesthesia. The literature points to significant pain relief in the medium and long term, although with a slower response compared to other techniques. The use of two isocenters has been shown to accelerate relief, but increases the risk of facial numbness, requiring a balance between efficacy and safety³⁰⁻³⁴.

In general, the reviewed evidence indicates that DMV remains the gold standard for classic cases, while RFT and GKRS represent effective and less invasive alternatives for specific clinical profiles. Despite the good results, complications such as hypoesthesia, facial dysesthesia, and transient hearing deficits can occur, reinforcing the importance of team training and careful patient selection^{27-29,31,36,40}. The methodological limitations observed, such as heterogeneity of study designs and lack of standardization in success criteria, indicate the need for more robust clinical trials to directly compare techniques and strengthen therapeutic recommendations²⁷⁻³⁴.

The findings also reinforce the importance of multidisciplinary postoperative follow-up, involving a medical team, physiotherapists, and nurses. Continuous monitoring, education about warning signs, and observation of possible adverse effects contribute to reducing complications, improving adherence, and ensuring a more humane and safe approach^{26,28,34}.

Analysis of the reviewed studies demonstrated that classic anticonvulsants, such as carbamazepine and oxcarbazepine, remain the first-line treatment for trigeminal neuralgia due to their high initial efficacy in pain control. However, adverse effects and intolerance observed in some patients have prompted the investigation of new alternatives, including lacosamide, botulinum toxin type A (BoNT-A), and ketamine, used as adjuvant or second-line options^{24,37}.

The included studies showed that lacosamide has a favorable tolerability profile and efficacy like carbamazepine, with fewer adverse effects. Pilot trials indicate a significant reduction in pain in patients with refractory neuropathy, suggesting its potential as a substitute or adjunctive therapy. However, it should be noted that most of the available evidence comes from small samples, and larger-scale randomized studies are needed to consolidate its effectiveness^{24,35}.

Regarding BoNT-A, the reviewed findings indicate significant improvement in pain and a reduction in seizure frequency, with a rapid onset of action and few adverse effects, generally mild and transient. Despite its promise as an option for cases refractory to or intolerant of anticonvulsants, the literature highlights the need for

standardization of doses and application sites, since variability between protocols limits direct comparisons between studies^{24,38}.

Analysis of publications on ketamine revealed that its administration via continuous infusion can provide significant pain relief in patients with refractory neuropathy, especially in a hospital setting. However, variable responses and side effects requiring rigorous monitoring are observed, restricting its use to specialized centers and rescue therapy contexts³⁹.

In summary, the reviewed studies indicate that carbamazepine and oxcarbazepine remain the initial standard of care, while lacosamide, BoNT-A, and ketamine represent viable alternatives in cases of treatment failure, intolerance, or the need for a rapid response. Despite the promising potential of these new therapies, the evidence is still limited, reinforcing the need for broader research and standardized protocols. For nursing and multidisciplinary teams, the use of these drugs requires constant monitoring, guidance on adverse effects, and close patient follow-up, ensuring efficacy and safety in clinical management^{24,37-39}.

Conclusion

Integrative analysis has made it possible to recognize significant advances in the diagnosis and treatment of Trigeminal Neuralgia, driven by the incorporation of imaging technologies and artificial intelligence. High-resolution magnetic resonance imaging has established itself as the most effective method for identifying neurovascular compressions and assisting in therapeutic planning, while artificial intelligence-based tools improve diagnostic accuracy and clinical monitoring.

In the therapeutic field, microvascular decompression stood out as a first-line treatment for classic cases, in addition to the increased use of minimally invasive techniques, such as radiofrequency thermocoagulation and stereotactic radiosurgery with Gamma Knife, and new drugs with good tolerability, such as Lacosamide, Botulinum Toxin type A, and Ketamine.

The essential role of nursing in clinical monitoring, health education, and emotional support for patients with the disease is highlighted, contributing to therapeutic adherence, safe pain management, and continuous improvement in quality of life. Furthermore, its educational and preventive actions promote patient empowerment, encouraging self-care and strengthening adherence to treatment; in addition, nursing plays a fundamental role in welcoming and providing psychosocial support, offering active listening and helping to reduce fear and anxiety associated with the disease, factors that directly impact well-being and therapeutic response. In this way, the nurse consolidates itself as an indispensable link between the patient, the family, and the multidisciplinary team, promoting comprehensive, humanized, and evidence-based care that aims not only at pain control but also at restoring autonomy and quality of life.

It is concluded that the management of trigeminal neuralgia should be guided by an individualized, interdisciplinary, and evidence-based approach that



integrates technological innovation, professional training, and humanized care. Although recent advances have increased the safety and effectiveness of interventions, further research aimed at improving diagnostic methods and therapeutic approaches is essential to enhance the

precision, effectiveness, and safety in the management of trigeminal neuralgia. This scientific advancement is indispensable for strengthening evidence-based practices, optimizing interdisciplinary care, and promoting increasingly comprehensive and humanized assistance.

References

1. Ministério da Saúde. Neuralgia do trigêmeo: a pior dor do mundo | Biblioteca Virtual em Saúde MS [Internet]. Saude.gov.br. 2024. [citado 09 de março de 2025]. Disponível em: <https://bvsm.sau.gov.br/neuralgia-do-trigemeo-a-pior-dor-do-mundo/>
2. Melo PGB de MB de, Silva GP da, Almeida KB de. Neuralgia do nervo trigêmeo e seus impactos na área odontológica. Braz. J. Implantol. Health Sci. [Internet]. 24 de setembro de 2024 [citado 9 de março de 2025];6(9):2677-86. Disponível em: <https://bjhs.emnuvens.com.br/bjhs/article/view/3634>
3. Araya EI, Claudino RF, Piovesan EJ, Chichorro JG. Trigeminal Neuralgia: Basic and Clinical Aspects. Curr Neuropharmacol. 2020;18(2):109-119. Doi: 10.2174/1570159X17666191010094350. PMID: 31608834; PMCID: PMC7324879.
4. Xu R, Xie ME, Jackson CM. Neuralgia do trigêmeo: abordagens atuais e intervenções emergentes. Journal of Pain Research [Internet]. 2021;14:3437-63. [citado 9 de março de 2025]. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/34764686/>
5. Spina A, Mortini P, Alemanno F, Houdayer E, Iannaccone S. Neuralgia do trigêmeo: em direção a uma abordagem multimodal. World Neurosurgery. 2017;103: 220-230. <https://doi.org/10.1016/j.wneu.2017.03.126>.
6. Kilgore CB, So RJ, Storm K, Nair SK, Ran KR, Kalluri AL, et al. Resultados de dor específicos para cada sexo após descompressão microvascular para neuralgia do trigêmeo. World Neurosurgery. 2023;173: e431-e435. <https://doi.org/10.1016/j.wneu.2023.02.074>.
7. Maarbjerg S, Di Stefano G, Bendtsen L, Cruccu G. Trigeminal neuralgia - diagnosis and treatment. Cephalalgia. 2017 Jun;37(7):648-657. doi: 10.1177/0333102416687280.
8. Lambu G, Zakrzewska J, Matharu M. Trigeminal neuralgia: a practical guide. Pract Neurol. 2021 Oct;21(5):392-402. Doi: 10.1136/practneurol-2020-002782.
9. Niemeyer CS, Harlander-Locke M, Bubak AN, Rzasa-Lynn R, Birlea M. Trigeminal Postherpetic Neuralgia: From Pathophysiology to Treatment. Curr Pain Headache Rep. 2024 Apr;28(4):295-306. Doi: 10.1007/s11916-023-01209-z.
10. Khawaja SN, Scrivani SJ. Trigeminal Neuralgia. Dent Clin North Am. 2023 Jan;67(1):99-115. Doi: 10.1016/j.cden.2022.07.008.
11. Valle PRD, Ferreira JDL. Análise de conteúdo na perspectiva de bardin: contribuições e limitações para a pesquisa qualitativa em educação. Educ rev [Internet]. 31 de janeiro de 2025 [citado 26 de maio de 2025];41:e49377. Disponível em: <https://www.scielo.br/j/edur/a/hhywJFvh7ysP5rGPn3QRFwf/?lang=pt>
12. Radoš I, Pašić MB, Stojić A, Šimunović F, Buljan K, Bilić E, et al. Clinical and neuroimaging characteristics of trigeminal neuralgia. Brain Sci. 2022;12(2):256. [citado 14 de outubro de 2025]. Disponível em: <https://pmc.ncbi.nlm.nih.gov/articles/PMC9942467>
13. Chong MS, Bahra A, Zakrzewska JM. Guidelines for the management of trigeminal neuralgia. Cleveland Clinic Journal of Medicine. 2023;90(6): 355-362. <https://doi.org/10.3949/ccjm.90a.22052>.
14. Snel BJ, Cohen SP, Erdine S, Day MR, Van Zundert J, Vissers K, et al. 13. Neuralgia do trigêmeo. Prática da Dor . 2025;25(5): e70051. <https://doi.org/10.1111/papr.70051>.
15. Sociedade Brasileira de Cefaleia. Classificação Internacional das Cefaleias – 3ª edição (versão SBCE). 2020. [citado 15 de outubro de 2025]. Disponível em: <https://share.google/8Y2AL4AsFnjsLr352>
16. Headache Classification Committee of the International Headache Society. The International Classification of Headache Disorders, 3rd edition (ICHD-3), 2018. Disponível em: <https://ichd-3.org>
17. Shankar KN, Nagalli S. Neuralgia do trigêmeo. Em: StatPearls . Ilha do Tesouro (FL): StatPearls Publishing; 2025. [citado 14 de outubro de 2025]. Disponível em: <http://www.ncbi.nlm.nih.gov/books/NBK554486/>
18. Liu Y, Tanaka E. Patogênese, diagnóstico e tratamento da neuralgia do trigêmeo: uma revisão narrativa. Journal of Clinical Medicine . 2025;14(2): 528. <https://doi.org/10.3390/jcm14020528>.
19. Bulla LL, Araujo PT, Fadel NN, Freitas RV de. Diferenciação entre neuralgia do trigêmeo e dor orofacial. Brazilian Journal of Implantology and Health Sciences. 2024;6(10): 2813-2821. <https://doi.org/10.36557/2674-8169.2024v6n10p2813-2821>.
20. Viau KT, Nascimento EJD, Ferreira TA, Silva SGD, Moura GSD, Freitas MOMD, et al. Neuralgia Trigeminal: um tipo de dor neuropática - diagnóstico e tratamento. Revista Brasileira de Revisão de Saúde . 2025;8(2): e78569. <https://doi.org/10.34119/bjhrv8n2-150>.
21. Latorre G, González-García N, García-Ull J, González-Oria C, Porta-Etessam J, Molina FJ, et al. Diagnóstico e tratamento da neuralgia do trigêmeo: documento de consenso do Grupo de Estudo de Cefaleas da Sociedade Espanhola de Neurologia. Neurologia . 2023;38: S37-S52. <https://doi.org/10.1016/j.nrl.2021.09.015>.
22. Mariano EE, Silva MEB, Silva ALP da, Iasmin I, Morais ACS. Neuralgia do trigêmeo: uma revisão de literatura. Editora Licuri. 2024; 21-29. <https://doi.org/10.58203/Licuri.22563>.
23. Medeiros MFPG de, Linhares PVA, Freire GC de F, Medeiros SCS, Melo CR, Souza FJJ de. Neuralgia do Trigêmeo: uma revisão integrativa sobre o uso de anticonvulsivantes e os impactos na saúde mental do paciente. REAS [Internet]. 2025 [citado 15 out.2025];25:e19235. Disponível em: <https://acervomais.com.br/index.php/saude/article/view/19235>
24. Silva PS da, Rodrigues STF de P, Gomes SP, Alvares I da S, Loureiro L dos SB, Rioga GAG, et al. Neuralgia do trigêmeo: revisão sobre aspectos importantes quanto a terapias farmacológicas. Brazilian Journal of Implantology and Health Sciences. 2024;6(3): 229-242. <https://doi.org/10.36557/2674-8169.2024v6n3p229-242>.
25. Paz VN, Freire RJB, Amaral JN, Ramos APQ, et al. Neuralgia do trigêmeo: avaliação acerca da sua epidemiologia e fisiopatologia. Rev. Contemp. [Internet]. 2024 [citado 15 de outubro de 2025];4(5):e4236. Disponível em: <https://ojs.revistacontemporanea.com/ojs/index.php/home/article/view/4236>



26. Brinzeu A, Sindou M. Radiofrequência trigeminal retrogasseriana-termorhizotomoy para neuralgia do trigêmeo. *Acta Neurochir* [Internet]. 10 de maio de 2024 [citado 18 de outubro de 2025];166(1):209. Disponível em: <https://link.springer.com/10.1007/s00701-024-06074-2>
27. Liu Y, Zhang K, Li H, et al. Abordagem unilateral para neuralgia trigeminal bilateral primária via descompressão microvascular bilateral. *J Craniofac Surg* [Internet]. 2022 [cited 2025 Oct 18];33(5):e497-e499. Available from: <https://journals.lww.com/10.1097/SCS.00000000000008417>
28. Louges MA, Kleiber JC, Bazin A, Chays A, Dubernard X. Eficácia da descompressão vascular microcirúrgica na neuralgia do trigêmeo. *Anais Europeus de Otorrinolaringologia, Doenças de Cabeça e Pescoço* [Internet]. setembro de 2020 [citado 18 de outubro de 2025];137(4):285–9. Disponível em: <https://linkinghub.elsevier.com/retrieve/pii/S1879729619301498>
29. Peng W, Zhao R, Guan F, Liang X, Jing B, Zhu G, et al. Descompressão microvascular totalmente endoscópica para o tratamento de espasmo hemifacial, neuralgia do trigêmeo e neuralgia do glossofaríngeo: um estudo retrospectivo. *BMC Surg* [Internet]. 27 de outubro de 2023 [citado 18 de outubro de 2025];23(1):331. Disponível em: <https://bmcsurg.biomedcentral.com/articles/10.1186/s12893-023-02214-0>
30. Okunlola AI, Pattankar S, Warade A, Khandhar A, Mistry V, Misra BK. Segurança e eficácia da radiocirurgia gama faca para o tratamento da neuralgia do trigêmeo: um estudo retrospectivo e transversal. *Neurologia Índia* [Internet]. março de 2023 [citado 18 de outubro de 2025];71(Suppl 1):S161–7. Disponível em: <https://journals.lww.com/10.4103/0028-3886.373623>
31. Wu A, Doshi T, Hung A, Garzon-Muvdi T, Bender MT, Bettgowda C, et al. Resultados imediatos e de longo prazo da descompressão microvascular para neuralgia trigeminal mista. *Neurocirurgia Mundial* [Internet]. setembro de 2018 [citado 18 de outubro de 2025];117:e300–7. Disponível em: <https://linkinghub.elsevier.com/retrieve/pii/S1878875018312300>
32. Türk Börü Ü, Duman A, Bölük C, Coşkun Duman S, Taşdemir M. Toxina botulínica no tratamento da neuralgia do trigêmeo: acompanhamento de 6 meses. *Medicina* [Internet]. setembro de 2017 [citado 18 de outubro de 2025];96(39):e8133. Disponível em: <https://journals.lww.com/00005792-201709290-00039>
33. Garcia R, Chen Q, Posadas E, Tran J, Kwon A, Qian X. Infusão contínua de cetamina como tratamento para dor facial refratária. *Cureus* [Internet]. 1º de março de 2023 [citado 18 de outubro de 2025]. Disponível em: <https://www.cureus.com/articles/139652-continuous-ketamina-infusion-as-a-treatment-for-refractory-facial-pain>
34. Ahmed K, Kalhor A, Shibli Z, Hashim AS. Radiocirurgia com Gamma Knife para neuralgia do trigêmeo intratável - um estudo comparativo entre alvos isocêntricos simples e duplos. *Turkish Neurosurgery* [Internet]. 2024 [citado em 18 de outubro de 2025]; Disponível em: http://www.turkishneurosurgery.org.tr/summary_en_doi.php3?doi=10.5137/1019-5149.JTN.44110-23.2
35. Lappichetpaiboon P, Tiamkao S, Ruangsri S, Paphangkorakit J, Pitiphat W, Jorns TP. Efficacy and safety of lacosamide in patients with trigeminal neuralgia: an 8-week pilot dose-escalation study. *J Oral Facial Pain Headache* [Internet]. 2025 [citado 18 de outubro de 2025]; Disponível em: <https://www.jofph.com/articles/10.22514/jofph.2025.011>
36. Feng B, Chai X, Yu Y, Xia H, Wu J, Ren Y, et al. Descompressão microvascular endoscópica para neuralgia trigeminal primária: experiência cirúrgica e resultados iniciais. *Representante Científico* [Internet]. 25 de março de 2025 [citado 18 de outubro de 2025];15(1):10289. Disponível em: <https://www.nature.com/articles/s41598-025-94797-2>
37. Lambrou G, Zakrzewska J, Matharu M. Neuralgia do trigêmeo: um guia prático. *Pratique Neurol* [Internet]. outubro de 2021 [citado 18 de outubro de 2025];21(5):392–402. Disponível em: <https://pn.bmj.com/lookup/doi/10.1136/practneurol-2020-002782>
38. Tereshko Y, Dal Bello S, Lettieri C, Belgrado E, Gigli GL, Merlino G, et al. Toxina botulínica tipo A para neuralgia do trigêmeo: uma revisão abrangente da literatura. *Toxinas* [Internet]. 20 de novembro de 2024 [citado 18 de outubro de 2025];16(11):500. Disponível em: <https://www.mdpi.com/2072-6651/16/11/500>
39. Garcia R, Chen Q, Posadas E, Tran J, Kwon A, Qian X. Infusão contínua de cetamina como tratamento para dor facial refratária. *Cureus* [Internet]. 1º de março de 2023 [citado 18 de outubro de 2025]; Disponível em: <https://www.cureus.com/articles/139652-continuous-ketamina-infusion-as-a-treatment-for-refractory-facial-pain>
40. Yao P, Hong T, Wang Z bin, Ma J ming, Zhu Y qiang, Li H xi, et al. Tratamento da neuralgia trigeminal idiopática bilateral por termocoagulação por radiofrequência em diferentes temperaturas. *Medicina* [Internet]. julho de 2016 [citado 18 de outubro de 2025];95(29):e4274. Disponível em: <https://journals.lww.com/00005792-201607190-00032>