Peripheral Nerve Blocks
Clinical Coverage Criteria

Description

A nerve block consists of an injection of a local anesthetic, with or without a steroid, into a peripheral nerve or a nerve ganglion. The predicted result is temporary interruption of conduction of impulses in peripheral nerves or nerve trunks (sympathetic nerves), to block pain signals and provide prolonged relief from pain.

Policy

This Policy applies to the following Fallon Health products:

☒ Fallon Medicare Plus, Fallon Medicare Plus Central (Medicare Advantage)
☒ MassHealth ACO
☒ NaviCare HMO SNP (Dual Eligible Medicare Advantage and MassHealth)
☒ NaviCare SCO (MassHealth-only)
☒ PACE (Summit Eldercare PACE, Fallon Health Weinberg PACE)
☒ Community Care (Commercial/Exchange)

Prior authorization is not required for peripheral nerve blocks.

Medicare Advantage
Fallon Health complies with CMS's national coverage determinations (NCDs), local coverage determinations (LCDs) of Medicare Contractors with jurisdiction for claims in the Plan's service area, and applicable Medicare statutes and regulations when making medical necessity determinations for Medicare Advantage members. When coverage criteria are not fully established in applicable Medicare statutes, regulations, NCDs or LCDs, Fallon Health may create internal coverage criteria under specific circumstances described at § 422.101(b)(6)(i) and (ii).

Medicare statutes and regulations do not have coverage criteria for peripheral nerve blocks. Medicare does not have an NCD for peripheral nerve blocks. National Government Services, Inc., the Medicare Administrative Contractor (MAC) with jurisdiction for Part A and Part B Services in our service area has an **LCD for Peripheral Nerve Blocks (L36850)** and an **LCA Billing and Coding: Peripheral Nerve Blocks (A57452)** (Medicare Coverage Database Search 03/18/2024).

MassHealth
Fallon Health follows Medical Necessity Guidelines published by MassHealth when making medical necessity determinations for MassHealth members. In the absence of Medical Necessity Guidelines published by MassHealth, Fallon Health may create clinical coverage criteria in accordance with the definition of Medical Necessity in 130 CMR 450.204.

MassHealth does not have Guidelines for Medical Necessity Determination for peripheral nerve blocks, therefore, Fallon Health Clinical Coverage Criteria are applicable (MassHealth website search 03/18/2024).

NaviCare HMO SNP, NaviCare SCO
For plan members enrolled in NaviCare, Fallon Health first follow's CMS's national coverage determinations (NCDs), local coverage determinations (LCDs) of Medicare Contractors with

jurisdiction for claims in the Plan's service area, and applicable Medicare statutes and regulations when making medical necessity determinations.

When coverage criteria are not fully established in applicable Medicare statutes, regulations, NCDs or LCDs, or if the NaviCare member does not meet coverage criteria in applicable Medicare statutes, regulations, NCDs or LCDs, Fallon Health then follows Medical Necessity Guidelines published by MassHealth when making necessity determinations for NaviCare members.

PACE (Summit Eldercare PACE, Fallon Health Weinberg PACE)
Each PACE plan member is assigned to an Interdisciplinary Team. PACE provides participants with all the care and services covered by Medicare and Medicaid, as authorized by the interdisciplinary team, as well as additional medically necessary care and services not covered by Medicare and Medicaid. With the exception of emergency care and out-of-area urgently needed care, all care and services provided to PACE plan members must be authorized by the interdisciplinary team.

Fallon Health Clinical Coverage Criteria

Peripheral nerve blocks are considered medically reasonable and necessary for normally temporary conditions, such as the following (1–7), for diagnostic and therapeutic purposes:

1. When pain appears to be due to a classic mononeuritis, but neuro-diagnostic studies have failed to provide a structural explanation. In this scenario, selective peripheral nerve blockade can usually clarify the situation (for diagnostic purposes only and not long-term treatment).
2. When peripheral nerve injuries/entrapment or other extremity trauma leads to complex regional pain syndrome.
3. When selective peripheral nerve blockade is used diagnostically in those cases in which the clinical picture is unclear (for diagnostic purposes only and not long-term treatment).
4. When an occipital nerve block is used to confirm the clinical impression of the presence of occipital neuralgia (for diagnostic purposes only and not long-term treatment).

   Chronic headache/occipital neuralgia can result from chronic spasm of the neck muscles as the result of either myofascial syndrome or underlying cervical spinal disease. It may be unilateral or bilateral, constant or intermittent. Nerve injury secondary to localized head trauma or trauma to the nerve from a scalp laceration can also cause this condition. Most commonly it is caused by an entrapment of the occipital nerve in its course from its origin from the C2 nerve root to its entrance into the scalp through the mid portion of the superior nuchal line. Blockage of the occipital nerve can confirm the clinical impression of occipital neuralgia particularly if the clinical picture is not entirely typical. If only temporary relief of symptoms is obtained, neurolysis of the greater occipital nerve may be considered via multiple techniques including radiofrequency and cryoanalgesia. In addition, the lesser and third occipital nerves can be involved in the pathology of headaches and can be treated in a similar manner.
5. When the suprascapular nerve block is used to confirm the diagnosis of suspected entrapment of the nerve.

   Entrapment of the suprascapular nerve as it passes through the suprascapular notch can produce a syndrome of pain within the shoulder with weakness of supraspinatus and infraspinatus muscles. When the history and examination point to the diagnosis, a suprascapular nerve block leading to relief of pain can confirm it. This may be followed by injection of depository steroids that sometime provide lasting relief.
6. When the trigeminal nerve is blocked centrally at the trigeminal ganglion, or along one of the three divisions or at one of the many peripheral terminal branches (i.e., supraorbital nerve).
7. Nerve blocks as preemptive analgesia; either:
   a. When a single injection peripheral nerve block provides post-surgical pain control; any:
      i. During the transition to oral analgesics

ii. In those procedures which cause severe pain normally uncontrolled by oral analgesics
iii. In cases otherwise requiring control with intravenous or parenteral narcotics
iv. In cases where the member cannot tolerate treatment with narcotics due to allergy or side effects, etc.

b. When a continuous peripheral nerve block provides the same as above, and furthermore may provide extended relief (i.e. 1–5 or more days) as a result of chronic administration of anesthetic.

Note: Preemptive analgesia starts before surgery, and a presumption of medical necessity is being made before the fact. Therefore, based on generally accepted clinical standards and evidence in peer reviewed medical literature the surgical procedure must be of such nature that the patient would benefit from the preemptive analgesia.

The signs and symptoms that justify peripheral nerve blocks should be resolved after one to three injections at a specific site.

Peripheral nerve blocks cannot be used for clinical situations where nerve blocks are not medically necessary as per this policy.

More than three injections per anatomic site (e.g., specific nerve, plexus or branch as defined by the CPT code description) in a six month period will be denied. These blocks should last at least two months in order to be deemed successful.

Injections of more than two anatomic sites (e.g., specific nerve, plexus or branch as defined by the CPT code description) or frequent or repeated injections is questionable and not supported by peer reviewed literature.

If the patient does not achieve progressively sustained relief after receiving two to three repeat peripheral nerve block injections on the same anatomical site, then alternative therapeutic options should be explored.

Exclusions

- The use of peripheral nerve blocks for the treatment of chronic neuropathic pain is considered not medically necessary and is not covered by Medicare or Fallon Health. Such use of peripheral nerve blocks is not supported by the current peer reviewed, published, evidence based scientific literature nor by specialty society guidelines.

Summary of Evidence

Headaches are commonly reported and can be classified as primary headaches, secondary headaches, painful cranial neuropathies and other facial pains, or other headache disorders (IHS, 2013).

- Primary headaches have no known underlying cause and are most commonly further classified as migraine, tension-type headaches or trigeminal autonomic cephalgias. Primary headache disorders constitute the vast majority of headache disorders, with migraine and tension-type headache being the most prevalent. Trigeminal autonomic cephalgias are rare compared with migraine and tension-type headache. The most common trigeminal autonomic cephalgia is cluster headache. Cluster headache, often referred to as “suicide headache” because the intensity of the pain, occurs more commonly in men and is usually episodic, characterized by “clusters” of from 2 weeks to 3 months. The pain is extremely severe, with 1 to 8 episodes per day, often awakening the patient from sleep shortly after falling asleep (Rizzoli and Mulally, 2018).
- Secondary headaches are the result of another underlying condition, such as vascular disease, trauma, infection, toxicity, and medication withdrawal. There are an almost endless number of possible causes. Patients with secondary headaches have symptoms or red flags in their patient history that will help in the diagnosis. Inclusion in the list of secondary headaches is based solely on rigorous scientific literature support of the headache as having a secondary cause, and headaches are viewed as secondary if they begin or worsen in

relation to the development of the pathologic condition and, further, if they clear or improve with amelioration of the condition ((Rizzoli and Mulally, 2018; IHS, 2013).

- The painful cranial neuropathies include trigeminal neuralgia, which has several subtypes, glossopharyngeal neuralgia, nervus intermedius (facial nerve) neuralgia, occipital neuralgia, and optic neuritis, among others.

Neuropathy is defined as a derangement in structure and function of a peripheral motor, sensory, or autonomic nerve, involving the entire nerve or selected levels. Neuropathies may be either acquired or inherited and encompass several distinct entities commonly encountered in routine clinical practice affecting either the central nervous system or peripheral nervous system.

Peripheral neuropathy refers to the many conditions that involve damage to the peripheral nervous system, which is a vast communications network that sends signals between the central nervous system (the brain and spinal cord) and all other parts of the body. Peripheral neuropathy exists in 4 cardinal patterns:

1. polyneuropathy (generalized disorder);
2. mononeuropathy (disease involving a single nerve);
3. mononeuritis multiplex (inflammation of several separate nerves in unrelated parts of the body); and
4. autonomic neuropathy (collection of syndromes and diseases affecting the autonomic neurons, either parasympathetic or sympathetic, or both) (Candido and Kusper, 2018).

Mononeuritis multiplex

Mononeuritis multiplex is a painful, asymmetrical, asynchronous sensory and motor peripheral neuropathy involving isolated damage to at least two separate nerve areas. Multiple nerves in random areas of the body can be affected. As the condition worsens, it becomes less multifocal and more symmetrical.

Mononeuritis multiplex is associated with a wide range of underlying systemic disorders such as diabetes mellitus, vasculitis, amyloidosis, systemic lupus erythematosus, viral infections such as AIDS (acquired immunodeficiency syndrome), hepatitis, parvovirus B19, multiple compression neuropathies, and paraneoplastic syndromes.

Mononeuritis multiplex often is the clinical phenotype of an underlying vasculitis. Vasculitic neuropathies are a heterogeneous group of peripheral nerve disorders associated with vasculitis, either nonsystemic (only affecting the peripheral nerve) or systemic vasculitis. Systemic vasculitis can occur as primary vasculitis with no other reason for the vasculitis, or secondary vasculitis as a complication of other autoimmune or infectious disease. If the neuropathy is part of an already known systemic vasculitis, diagnosis is not difficult to make. However, if the neuropathy is the first manifestation of vasculitis, diagnosis may be difficult, since only a part of the vasculitic neuropathies shows the typical clinical picture of mononeuritis multiplex. Therefore, if vasculitic neuropathy is suspected, an extensive diagnostic pathway is necessary to confirm or to exclude the diagnosis (Blaes, F. 2015).

Vasculitic neuropathy can occur without any systemic involvement and is then called nonsystemic vasculitic neuropathy (NSVN). This type of neuropathy often develops subacute, although at least one third of the patients show a progressive course. Even there is no histological examination, NSVN should be suspected if an axonal neuropathy is asymmetric, progressive and painful and is associated with disabling paresis. Neurophysiological examination reveals axonal motor or sensorimotor neuropathy. Nerve biopsy should be performed in the case of suspected NSVN. However, about 50% of patients with suspected vasculitic neuropathy are lacking histological examination. If biopsy has been performed, the main histopathological finding is intramural infiltration with vascular wall damage. The Peripheral Nerve Society recently published a guideline on the diagnosis, investigation and treatment of NSVN (Collins et al. 2010). In this consensus report, criteria for definite, probable and possible vasculitic neuropathy have been established (Blaes, F. 2015).

Mononeuritis multiplex is the classic presentation of vasculitic neuropathy. Affected individuals develop stepwise, acute, or subacute dysfunction of multiple peripheral nerves. In some patients,

the areas of peripheral nerve damage may coalesce to produce a polyneuropathy that most commonly is asymmetric. Most patients have sensory and motor involvement, whereas isolated sensory involvement is present in a small number. The neuropathy is painful in most patients. Laboratory studies usually are undertaken to identify markers of inflammation and autoantibodies that indicate a systemic vasculitis or underlying connective tissue disease, and to identify organ involvement outside of the peripheral nervous system. The erythrocyte sedimentation rate is elevated in approximately 60% of patients with NSVN, usually mildly so. In contrast, approximately 90% of patients with systemic vasculitis have an elevated sedimentation rate, usually markedly so. Electrodiagnostic studies demonstrate an axonal sensorimotor polyneuropathy, which is often asymmetric. Nerve biopsy is the definitive diagnostic procedure. The sural nerve or superficial peroneal nerve is usually biopsied. Ideally, one should biopsy a nerve that is abnormal clinically or electrodiagnostically. The diagnostic pathologic findings in vasculitis are inflammatory infiltrates within the blood vessel wall and fibrinoid necrosis, hemorrhage, or endothelial cell disruption (Simmons, Z. 2011).

The current literature consists primarily of case reports.

Mononeuritis multiplex is a syndrome with many different causes. Zhang et al., 2015 reviewed the clinical, electrophysiological and nerve biopsy findings of 14 patients with mononeuritis multiplex. All patients were classified based on their clinical features. Routine blood tests, blood biochemical examination, serum immunological examination, serum tumor marker screening, cerebrospinal fluid (CSF) examination and other appropriate investigations were performed as needed to exclude other causes of neuropathy. All patients underwent electrophysiological tests, including the evaluation of motor and sensory conduction velocities in all four limbs. The electrophysiologic diagnosis of mononeuritis multiplex requires side-to-side asymmetry (greater than 50%) for motor and sensory evoked potential amplitudes in two or more nerves. Conduction velocities need to be at least 75% of the lower limit of normal or no more than 25% above the upper limit of the normal range. Skin biopsy was performed in eight cases clinically suspected with vasculitic neuropathy for subsequent hematoxylin-eosin staining. Nerve biopsy was performed in an affected territory, which was the sural nerve at the ankle level in all patients. Nerve biopsies confirmed clinical diagnosis in 78.6% of the patients (11/14). The most prominent finding was the high incidence of vasculitic neuropathy, which affected six patients. Of the six cases with vasculitic neuropathy, three patients had systemic vasculitis (i.e., systemic vasculitic neuropathy (patients 1, 2 and 6), and three patients had vasculitis confined to the peripheral nervous system. Nerve biopsy pathological diagnosis was critical to the etiological diagnosis of multiple mononeuropathy in this study.

Among the three cases of systemic vasculitic neuropathy (SVN), one patient (patient 1) had systemic lupus erythematosus, one patient (patient 2) had Sjögren's disease associated with rheumatoid arthritis, and one patient (patient 6) had antineutrophil cytoplasmic antibody (ANCA)-associated vasculitis. The mean interval between the onset of symptoms and referral for biopsy was 40 months (range: 24–60 months). Three patients had mononeuritis multiplex as the pattern of nerve injury at onset. Two of these patients became less multifocal and more symmetrical, characteristic of asymmetrical sensory-motor polyneuropathy, over time (2 months and 6 months later, respectively). The other patient continued to have mononeuritis multiplex as the pattern of nerve injury over a period of 36 months.

Three patients (patients 3, 4 and 5) had nonsystemic vasculitic neuropathy (NSVM). Two patients (patients 3 and 4) had mononeuropathy as the pattern of nerve injury at onset but progressed to mononeuritis multiplex over time (1 month and 0.5 months later, respectively).

Electrophysiological investigation was normal in patient 3, but pathology of the sural nerve was abnormal and showed inflammatory infiltrates in the vicinity of nerve vessels associated with mild axonal degeneration of nerve fibers. This finding indicates that pathological changes might precede electrophysiological changes.

Two patients (patients 9 and 10) were diagnosed with NSVN based on clinical, laboratory and electrophysiological findings. The nerve biopsies did not contribute to the diagnoses.

Patients 7 and 8 had suspected NSVN based on clinical and electrophysiological findings. The pathological findings of sural nerve biopsy were consistent with perineuritis. These two patients were thus diagnosed with perineuritis based on pathological characteristics. Both patients were improved with methylprednisone and immune inhibitors. These two patients had mononeuritis multiplex. Both had initial symptoms of numbness and pain, and then sensory and motor involvement.

Three patients (patients 11, 12 and 13) suffered from a chronic inflammatory demyelinating polyradiculoneuropathy (CIDP) based on clinical features and laboratory data. All three patients

in this subgroup had mononeuritis multiplex as the pattern of nerve injury at onset. Two of these patients (patients 11 and 13) developed asymmetrical sensory-motor polyneuropathy over time (2 months and 0.5 months later, respectively). Patient 12 had involvement of the cranial nerves, and patient 13 had associated sensory ataxia. The CSF was abnormal with elevated CSF protein and normal CSF cell numbers in all three patients.

Electrophysiological investigation in patients 12 and 13 showed multifocal demyelination. These two patients were diagnosed with CIDP based on clinical features, laboratory data and electrophysiological characteristics. The nerve biopsies confirmed the clinical diagnoses.

Electrophysiological study of patient 11 showed that sensory nerve action potentials were remarkably reduced in the right ulnar nerve and right sural nerve. Compound motor action potentials and motor nerve conduction velocity of all examined nerves were normal. Nerve biopsy showed mild demyelination. Therefore, patient 11 was diagnosed with CIDP based on clinical features and laboratory data, although the electrophysiological characteristics and nerve biopsy could not confirm the clinical diagnosis.

Patient 14 was diagnosed with Lewis-Sumner syndrome, i.e., multifocal acquired demyelinating sensory and motor neuropathy. Patient 14 was a young man with initial symptoms of sensory and motor deficit in the bilateral ulnar nerves. After intravenous injection of immunoglobulins, symptoms soon improved, although there was still slight weakness in the right ulnar of two fingers. Six months later, he had numbness and pain in the left ulnar of two fingers and weakness in his right foot. The CSF was normal. Electrophysiology showed multifocal demyelination associated with conduction block in nonentrapment sites in the bilateral ulnar nerves. Mild demyelination was found on nerve biopsy. Genetic studies did not identify chromosome 17 mutations.

Mononeuritis multiplex is an unusual form of peripheral neuropathy. Its global incidence is unknown because of the wide variety of underlying pathologies that may lead to the disorder. Mononeuritis multiplex is actually a group of disorders, not a true distinct disease entity, and may be seen in association with a variety of systemic illnesses, as we report here. Our 14 patients were diagnosed as vasculitic neuropathy in six patients, perineuritis in two patients, CIDP in two patients, and Lewis-Sumner syndrome in one patient, based on clinical features, laboratory data, electrophysiological investigations and nerve biopsies. Two patients were diagnosed with vasculitic neuropathy, and one patient was diagnosed with CIDP, based on clinical findings, but were not confirmed by nerve biopsy. Nerve biopsies confirmed or supported clinical diagnosis in 78.6% of the patients.

Mononeuritis multiplex mostly occurs in SVN and NSVN. There are five clinical patterns of nerve injury in vasculitic neuropathy—mononeuropathy, mononeuritis multiplex, polyradiculoneuropathy, asymmetrical polyneuropathy and symmetrical polyneuropathy. A definite diagnosis of vasculitic neuropathy is dependent on nerve biopsy.

Mononeuritis multiplex is not the most common pattern in vasculitic neuropathy, being found in only about one-third of vasculitic neuropathy cases. Asymmetrical polyneuropathy or symmetrical polyneuropathy, especially axonal sensory-motor polyneuropathy, is the most common clinical pattern, being found in about half of cases.

SVN has been reported associated with many systemic disorders, including primary systemic vasculitis neuropathy and secondary systemic vasculitis.

The diagnostic challenge presented by patients in this study was to determine the cause of sensorimotor mononeuropathy multiplex unaccompanied by evidence of an underlying systemic disease. In this study, vasculitis, perineuritis, CIDP and Lewis-Sumner syndrome were diagnosed based on clinical features, laboratory data, electrophysiological investigations and pathological testing of nerve biopsies. A detailed and complete medical history is vitally important in determining the possible underlying cause of mononeuritis multiplex.

Complex Regional Pain Syndrome

Complex regional pain syndrome (CRPS) is a chronic neuropathic pain disorder distinguished by significant autonomic features and typically develops in an extremity after acute tissue trauma. In addition to classic neuropathic pain characteristics (intense burning pain, hyperalgesia, and allodynia), CRPS is associated with local edema and changes suggestive of autonomic involvement (altered sweating, skin color, and skin temperature in the affected region). Trophic changes to the skin, hair, and nails and altered motor function (loss of strength, decreased active range of motion, and tremor) may also occur. CRPS is subdivided into CRPS-I (reflex sympathetic dystrophy) and CRPS-II (causalgia), reflecting, respectively, the absence or presence of documented nerve injury. Despite this traditional diagnostic distinction, signs and symptoms of the two CRPS subtypes are similar, and there is no evidence that they differ in terms of pathophysiologic mechanisms. CRPS is one of the more challenging chronic pain conditions to treat successfully. There is no definitive medical treatment, and clinical trials have failed to support the efficacy of many commonly used interventions (Bruel, 2019).

DIAGNOSIS

An expert consensus was that the diagnosis of CRPS can and should be established without any additional studies (Brunner et al., 2008, Harden and Bruehl, 2006). The diagnosis is essentially clinically assisted with the application of proposed criteria. The first widely accepted set of criteria was proposed in Orlando and endorsed by IASP in 1994 (Merksey et al., 1994). An advantage of these criteria is that they are easy to apply in everyday clinical practice and have a high sensitivity (0.98). However, studies have shown that their specificity is poor (0.36) and other conditions may mistakenly be considered as CRPS. Indeed, in only 40% of cases diagnosed with CRPS the diagnosis is correct, while up to 37% of patients with diabetic neuropathy meet criteria for CRPS. To overcome this, a workshop was held in Budapest in 2003, which resulted in a new, more detailed and likely more specific set of criteria (Budapest criteria) (Misidou and Papagoras, 2019).

IASP diagnostic criteria for complex regional pain syndrome (CRPS)*

1. The presence of an initiating noxious event, or a cause of immobilization†
2. Continuing pain, allodynia, or hyperalgesia in which the pain is disproportionate to any known inciting event
3. Evidence at some time of edema, changes in skin blood flow, or abnormal sudomotor activity in the region of pain (can be sign or symptom)
4. This diagnosis is excluded by the existence of other conditions that would otherwise account for the degree of pain and dysfunction

* If seen without “major nerve damage” diagnose CRPS I; if seen in the presence of “major nerve damage” diagnose CRPS II.
† Not required for diagnosis; 5–10% of patients will not have this.
The Budapest criteria for Complex Regional Pain Syndrome (CRPS) (Revised CRPS criteria adopted by the IASP in 2012)

CRPS describes an array of painful conditions that are characterized by a continuing (spontaneous and/or evoked) regional pain that is seemingly disproportionate in time or degree to the usual course of any known trauma or other lesion. The pain is regional (not in a specific nerve territory or dermatome) and usually has a distal predominance of abnormal sensory, motor, sudomotor, vasomotor, and/or trophic findings. The syndrome shows variable progression over time.

1. Continuous pain disproportional to any inciting event
2. At least one symptom in ≥3 of the following categories:

- Sensory (hyperesthesia, allodynia)
- Vasomotor (temperature asymmetry, skin color changes, skin color asymmetry)
- Sudomotor/Edema (edema, sweating changes, sweating asymmetry)
- Motor/Trophic (decreased range of motion, weakness, tremor, dystonia, trophic changes affecting the skin, nails, hair)

3. At least one sign present upon evaluation in ≥2 of the following categories

- Sensory (Evidence of hyperalgesia and/or allodynia)
  - Vasomotor (Evidence of temperature asymmetry and/or skin color changes/asymmetry
  - Sudomotor/Edema (Evidence of edema and/or sweating changes/asymmetry)
  - Motor/Trophic (Evidence of decreased range of motion and/or weakness, tremor, dystonia and/or trophic changes affecting the skin, nails, hair)

4. Absence of another diagnosis that would better explain the symptoms and signs

Current distinctions between CRPS type I and CRPS type II subtypes, reflecting, respectively, the absence and presence of evidence of peripheral nerve injury, were retained by consensus despite ongoing questions as to whether such distinctions have clinical utility.

EPIDEMIOLOGY

CRPS is more common in women and with increasing age. A population-based study in Olmsted County, Minnesota, over the period 1989–1999, applying the IASP criteria resulted in an incidence rate for CRPS type 1 of 5.46 per 100,000 person-years and a period prevalence of 20.57 per 100,000. On the other hand, CRPS type 2 incidence rate was just 0.82 per 100,000 person-years. The female-to-male ratio was 4:1, while the median age of onset was 46 years (Sandroni et al., 2003). In a subsequent Dutch study, the incidence of CRPS was estimated at 26.2 per 100,000 person-years, again with a female predominance (De Mos et al., 2007). Various comorbidities also seem to affect the occurrence of CRPS, including depression, headache and drug abuse (Misidou and Papagoras, 2019).

CLINICAL PRESENTATION

Although CRPS can develop virtually after any (even minimal) injury, the most common initiating events are surgery, fractures, crush injuries, and sprains. CRPS patients experience not only intense pain but also significant functional impairments and psychologic distress. Inciting events may be a fracture, particularly distal radius or Colles' fracture, which has been associated with a CRPS incidence up to 36.7%. Orthopedic surgery of the extremities has also been associated with the occurrence of CRPS, as well as other types of trauma, immobilization and stroke (Misidou and Papagoras, 2019). Due to the prevalence of anxiety and depression in patients with CRPS and the unusual nature of symptoms, psychological factors have been hypothesized to play a role in the development or propagation of CRPS (Goh et al., 2017).

Two phases of the syndrome have been described: first, the acute (warm) phase, during which the affected limb shows classical signs of inflammation. The symptoms usually appear distally to the area of trauma like a glove or stocking. Patients describe a constant, deep pain that exacerbates with movement or temperature changes. The clinical presentation of the acute phase of CRPS supports the hypothesis that the development of this condition is due to an exaggerated inflammatory response to trauma (Goh et al., 2017).

In the chronic (cold) phase of the clinical course of CRPS, inflammation subsides, and the CRPS-affected limb is cyanosed and clammy as a result of vasoconstriction and sweating. This suggests that excessive sympathetic nervous system outflow is a driving factor in progression of the condition and maintenance of the pain. Some patients experience muscular spasms. Atrophies may occur in the skin, subcutaneous tissue and muscles, even local osteoporosis of the underlying bones. Nail and hair growth are altered, either increased or decreased with quality changes.

Consistent with clinical observations, median CRPS duration was much shorter in the warm CRPS phase (4.7 months) than in the cold CRPS phase (20 months), with comparable pain intensity across these subtypes (Bruehl et al,. 2016).

Although the key distinguishing feature between type 1 and type 2 CRPS is the presence of nerve injury in the latter, the symptoms in type 2 still exceed the territory of the injured nerve and are far more complex than expected for neuropathic pain, resembling, thus, to the symptoms of CRPS type 1. Besides, in the Harden et al., 2007 article proposing the Budapest criteria, it is questioned whether there is a clinical utility in the differentiation between type 1 and 2, although the distinction was maintained (Misidou and Papagoras, 2019).

TREATMENT

Due to the complexity of CRPS, an interdisciplinary or multidisciplinary approach to treatment is recommended. This involves a team of healthcare professionals from different disciplines working together to manage the various aspects of the condition. The goal of the multidisciplinary approach is to improve pain relief, physical function, and psychological well-being, and to help the patient regain their quality of life. Clinicians who work with CRPS patients recognize that successful management of the syndrome presents a significant challenge. It is now generally agreed that successful treatment must simultaneously address the medical, psychological, and social aspects of the syndrome (Harden et al., 2022). While there is no cure for CRPS, a multidisciplinary approach can provide a comprehensive approach to managing the condition (Ghaly et al., 2023). The goal aim of treatment is to relieve pain and restore the functionality of the affected limb. Although the course of the disease is variable and there is no strong evidence that it is modified by treatment, therapy should not be delayed, as patients with a more chronic course carry a worse prognosis (Misidou and Papagoras, 2019).

All treatments focus on functional restoration of the affected limb; physical and occupational therapy are first-line treatments of CRPS. The use of medications, psychotherapy and nerve blocks is reserved for patients failing to progress in functional restoration. If patients do not progress through the functional restoration steps in a reasonable time, then other interventions may be progressively added to give the patient greater comfort or confidence so that they may proceed to the next level. However, if a patient presents with significant concomitant problems (e.g., severe depression or anxiety, pain too severe to engage in physical therapy) then medications, blocks or psychotherapies are recommended from the outset (Harden et al., 2022).

For the past 150 years, multiple drug treatments for CRPS have been tried. Unfortunately, most medications used clinically to manage CRPS have not yet been tested adequately in high quality, double-blinded, randomized, controlled trials (RCTs). Medications trialed specifically for CRPS include calcitonin and bisphosphonates, and several immune modulating drugs. Treatments better studied in neuropathic pain include tricyclic anti-depressants, gabapentin and pregabalin, carbamazepine, opioids, clonidine, nifedipine, a-adrenergic antagonists, lidocaine patches, and topical capsaicin. As with most treatments, drug therapy works best when prescribed in conjunction with functional restoration and treatment of other comorbid conditions (Harden et al., 2022).

Regarding drug therapy,

- To help avoid unrealistic expectations, patients should be told that while there is no treatment proven to cure CRPS or reduce symptoms in all patients, the drugs that patients will receive during their treatment have been shown to help with CRPS for some patients.
- Early CRPS (up to 6-18 months duration) can respond differently to interventions than persistent CRPS. Importantly, patients diagnosed with early CRPS likely will naturally improve and drugs or nerve-blocks that are effective even for only a few months may bridge the time to natural recovery. Approximately 15% of early CRPS patients fail to recover, and an early cold limb may be a poor prognostic sign.
- Understand that most patients will over time develop analgesic tolerance to available drugs whereas side effects often continue.
- Available drugs are not thought to “cure” the condition.
- Reasonable treatment outcomes should be agreed upon in partnership with the patient before treatment starts (e.g., a pain reduction of two points on a 0–10 scale, improvement in specific functional activities). If these targets are not achieved, or if initial beneficial effects later lessen, the drug treatment should then be reconsidered.

When patients are not making notable improvements in function with physical and occupational therapy, more invasive treatment may be considered to mitigate the status and progression of chronic CRPS. Numerous interventional therapies have been described but usually poorly studied. As the mechanisms and pathophysiology of CRPS are multifactorial, this presents unique challenges to treatment due to the dynamic and varied/diverse nature of its clinical symptoms. Various traditional therapies have been used in the treatment of CRPS, including sympathetic nerve blocks, intravenous regional anesthetic techniques, "other" blocks (including somatic blocks and spinal infusions), neurolytic sympathetic blockade, and implantable therapies (including neuromodulation and targeted drug delivery). Recent publications of randomized controlled trials and their supporting evidence for the interventional treatment of CRPS have come from the field of neuromodulation, and in particular, dorsal root ganglion stimulation. This is an advanced form of spinal cord stimulation used to treat focal neuropathic pain, and studies published in 2017 (Deer et al., 2017) and 2019 (Deer et al., 2019) allowed this therapy to emerge as important later stage considerations. Traditional spinal cord stimulation is an FDA-approved treatment for chronic pain, initially introduced to market in 1967 (Harden et al., 2022). Sympathetic blockade with local anesthetics has long been a traditional part of the armamentarium of regional nerve blocks utilized to treat CRPS. Several decades ago, the prevailing opinion was that the disorder causing the symptoms and physical exam findings of CRPS were due to an abnormal upregulation of the sympathetic nervous system (although this is questionable). Therefore, sympathetic nerve blocks were historically thought to be a necessary step in managing pain caused by CRPS and to facilitate progress in functional restoration of the affected limb (Harden et al., 2022).

Multiple mechanisms have been postulated in the development of CRPS, including the involvement of nociceptor/peripheral and regional sensitization, central sensitization, the somatosensory, sympathetic, and motor systems. Autonomic signs of CRPS include skin temperature and color asymmetry, local inflammation and edema, that contribute to pain out of proportion to the initial injury. Sympathetic nerve blocks have historically been considered an important procedure both in the diagnosis (i.e., sympathetically maintained pain; SMP) and treatment of CRPS. In the subgroup of CRPS patients with SMP (responsive to sympathetic blocks), there is some evidence suggesting the coupling of sympathetic nerves with several types of afferent nerve fiber types in the peripheral and central nervous system completing feed-back and feedforward loops in CRPS (Harden et al., 2022).

Sympathetic nerve blockade is performed at the transverse process at the level of Chassaignac's tubercle (the sixth cervical vertebral body) for upper extremity CRPS (stellate ganglion block), and for lower extremity CRPS it is performed at the second and third lumbar vertebral body (Lumbar sympathetic block). The pain relief following sympathetic nerve block generally outlasts the effects of the local anesthetic and may be long lasting in some cases (Harden et al., 2022).

Sympathetic nerve blocks lack high quality evidence to support a definitive role in the treatment of CRPS. Previously, it was felt that at least one sympathetic nerve block was necessary in order to classify CRPS as sympathetically maintained pain (SMP) or sympathetically independent pain (SIP) with the simple pragmatic goal of determining if sympathetic blocks should be part of the treatment regimen. This procedure is now usually performed with fluoroscopy; after performing these blocks there are often differences between clinical assessment (pain and function) and the observed clinical success of the sympathetic nerve block (vasomotor changes) secondary to varying degrees of sympatholysis. Thus, the role of this block is largely empiric. Although currently out of favor, these blocks may be clinically important in a subset of SMP cases if these blocks mitigate pain, improve function, and provide a less painful "window of opportunity" for rehabilitation techniques (Harden et al., 2022).

A significant confounding factor is a lack of consensus on defining "a successful sympathetic block." There are several studies available to clarify relevant issues. Price et al., 1998, performed a comparative study of local anesthetic versus saline stellate ganglion or lumbar sympathetic blocks in seven CRPS patients in a double-blind crossover fashion. Onset of analgesic effect occurred within 30 minutes in both groups, with the local anesthetic group (lidocaine/bupivacaine mixture) having a significantly greater duration of relief (mean of 3 d, 18 h vs 19 h), thus showing

at least short-term analgesic efficacy of local anesthetic sympathetic blockade for CRPS (Harden et al., 2022).

A systematic review by Cepeda et al. published in 2002, reviewed the published literature regarding local anesthetic sympathetic nerve blockade from 1966 through 1999. English language only. Studies were included if local anesthetic sympathetic blockade was used in at least 10 patients. Pain relief was classified as full, partial, or absent. This review assessed 29 studies performed on 1144 patients with CRPS. Nineteen studies were retrospective, 5 prospective case series, 3 RCTs, and 2 nonrandomized controlled studies. The quality of the publications was generally poor. Twenty-nine percent of patients had full response, 41% had partial response, and 32% had absent response. It was not possible to estimate the duration of pain relief. Less than a third of the patients reported temporary relief of pain symptoms following a sympathetic blockade. It is unclear whether response is due to a placebo effect.
Serial diagnostic blocks may be required to rule out a placebo response.

These same authors conducted a Cochrane Systematic Review in 2005 (Cepeda et al., 2005). This systematic review had three objectives: to determine the likelihood of pain alleviation after sympathetic blockade with local anesthetics in the patient with CRPS; to assess how long any benefit persists; and to evaluate the incidence of adverse effects of the procedure. Two small randomized double blind cross over studies that evaluated 23 subjects were found. The combined effect of the two trials produced a relative risk to achieve at least 50% of pain relief 30 minutes to 2 hours after the sympathetic blockade of 1.17 (95% CI 0.80-1.72). It was not possible to determine the effect of sympathetic blockade on long-term pain relief because the authors of the two studies evaluated different outcomes. The author's concluded that this systematic review revealed the scarcity of published evidence to support the use of local anesthetic sympathetic blockade as the gold standard treatment for CRPS. The two randomized studies that met inclusion criteria had very small sample sizes, therefore, no conclusion concerning the effectiveness of this procedure could be drawn. There is a need to conduct randomized controlled trials to address the value of sympathetic blockade with local anesthetic for the treatment of CRPS.

A subsequent Cochrane Systematic Review published in 2013 (Stanton et al., 2013), included an additional 10 studies (combined n = 363) in this update. Overall 12 studies (combined n = 386). The purpose of this review was to assess the efficacy of local anesthetic sympathetic blockade (LASB) for the treatment of pain in CRPS. Four studies from the previous review with follow-up of 48 hours or less were excluded because such studies are of more value in terms of investigating the diagnostic potential of LASB and this was not the purpose of this review. Three small studies compared LASB to placebo/sham. The authors were able to pool the results from two of these trials (intervention n = 23). Pooling did not demonstrate significant short-term benefit for LASB (in terms of the risk of a 50% reduction of pain scores). The authors concluded that this update found similar results to the original systematic review. There remains a scarcity of published evidence to support the use of local anesthetic sympathetic blockade for CRPS. From the existing evidence it was not possible to draw firm conclusions regarding the efficacy or safety of this intervention but the limited data available do not suggest that LASB is effective for reducing pain in CRPS.

In 2016, O'Connell et al. conducted another Cochrane Systematic Review to assess the efficacy of LASB for the treatment of pain in CRPS. RCTs published up to September 2015 were included. Overall 12 studies (N = 461) were included, all of which were judged to be at high or unclear risk of bias. All included studies evaluated only adult participants. Nine studies included only people with upper limb CRPS treated with stellate ganglion blockade, and two studies included only people with lower limb CRPS treated with lumbar sympathetic blockade. The remaining study included a mix of upper and lower limb CRPS. All included studies were small, with total numbers of participants ranging from 7 to 82. Two studies compared LASB versus placebo, nine studies compared LASB to other interventions, and two studies evaluated the efficacy of LASB as an addition to other therapeutic management. Overall, the quality of evidence was low to very low, downgraded due to limitations, inconsistency, imprecision, indirectness, or a combination of these.

Two small studies compared LASB to placebo/sham (N = 32). For pain intensity, one study found no difference between lidocaine and normal saline; the same number of participants (6/7) achieved at least 50% pain relief at 2 weeks. The mean duration of relief was longer in the saline group (3 days versus 19.9 hours). Adverse events were not reported. The other study found that spontaneous pain scores were no different from baseline to post-treatment in either the group receiving lidocaine plus sham ultrasound or in the group receiving sham lidocaine and sham ultrasound (p=0.45). Spontaneous pain scores were no different from baseline to one-month follow-up in either the group receiving lidocaine (plus sham ultrasound (p=0.29) or in the group receiving sham lidocaine and sham ultrasound (p = 0.50). Authors reported no between-group comparisons. Adverse events were not reported.

Regarding LASB versus placebo or no treatment, this update reveals little progress in developing high quality evidence to support the use of LASB for CRPS since the last update in 2013. There are only two placebo-controlled randomized studies that met our modified inclusion criteria for this update, both of which have very small sample sizes. The authors can draw no firm conclusions from this evidence. It is notable that the results to date are not suggestive of a significant effect of LASB over placebo even in the very short term (30 minutes to two hours), the time frame that theory would suggest local anesthetic is likely to have its maximum benefit. The authors could not estimate the duration of pain relief, if any.

Nine studies compared LASB to other interventions. Most comparative studies reported no significant difference in pain between groups. Due to the variation in the interventions, there were not adequate data to allow pooling of the results. One study reported a significantly longer duration of analgesia in the botulinum toxin A group (median time to analgesic failure 71 days (95% CI, 12 to 253) compared with bupivacaine alone < 10 days (95% CI 0 to 12; p < 0.02). However, while the authors reported that pain intensity declined significantly in the botulinum toxin A group, they did not provide numeric pain scores for either treatment group. Only six studies provided specific data regarding adverse events, and the level of detail of this reporting was mixed.

Two studies investigated the effectiveness of adding LASB to rehabilitation versus rehabilitation or medication alone. One study found no benefit of adding LASB at 10 days or 20 days. The other study reported treatment efficacy (proportion with at least 50% pain reduction) at the two-month follow-up to be 46% in favor of the SGB group, an absolute risk reduction of 17% in favor of the SGB group with a number needed to treat for an additional beneficial outcome (NNTB) of 6. The NNTB suggests that six people with CRPS would need to be treated with SGB (in addition to physical and pharmacological therapy) to prevent one relapse. There was a higher relapse rate in the control group (37%) versus the SGB group (20%) (hazard ratio (HR) 2.7, 95% CI 1.1 to 6.7). The Kaplan-Meier estimates of the cumulative probability of not having a relapse at two months was 80% in the SGB group and 63% in the control group. Neither study specifically presented data on the duration of pain relief or adverse events.

Regarding LASB versus other interventions, in a change from the original version of this review, the authors made the decision to include trials that compared LASB with alternative interventions or that evaluated the effect of adding LASB to other treatments. The authors identified a number of such studies investigating a range of comparisons, and the majority of these demonstrated no significant difference between the intervention and control groups. It is notable that in one small study, LASB did not demonstrate superior effectiveness when compared to intravenous regional blockade (IVRB) with guanethidine, an intervention for which there is consistent evidence of no effect. Given the limited evidence available and the various sources of potential bias and uncertainty, the authors conclude that there is little credible evidence to support the use of LASB for CRPS and that the majority of the limited evidence available suggests that LASB may be ineffective.

The authors noted that only three included studies used a positive response to a prior LASB to attempt to establish sympathetically maintained pain as part of their inclusion criteria. This speaks to a wider issue concerning the use of LASB in CRPS. It is possible that LASB might only be effective in a subgroup of people with CRPS with sympathetic dysfunction, or perhaps in people

with other characteristics. However, to date evidence of predictors of a positive response to LASB are elusive.

The reporting of adverse events in the identified studies was inconsistent and limited. Given this lack of reporting and the small size of all of the included studies, the authors cannot confidently draw conclusions regarding the safety of LASB. While those adverse events that have been reported appear to be minor, it is not currently possible to rule out the potential for rare but serious adverse events. To obtain a better estimate of the incidence and nature of adverse events, it might be necessary to review evidence from non-randomized observational study designs, but that was beyond the scope of this review.

The available evidence relating to the effectiveness of LASB for CRPS is not compelling. While there is substantial uncertainty regarding the effectiveness of alternative therapeutic options, it is not clear that investment in this procedure provides clinical value. If LASB is to continue to be offered to people with CRPS, there is a clear need for further, better quality research into its efficacy (O'Connell et al., 2016).

Occipital Neuralgia

The occipital nerves are a group of nerves that arise from the C2 and C3 spinal nerves. There are three major occipital nerves in the human body: the greater occipital nerve (GON), the lesser occipital nerve (LON), and the third occipital nerve (TON). The GON, LON, and TON are commonly associated with occipital neuralgia, cervicogenic headaches, and migraine headaches. It is sometimes difficult to distinguish these disorders.

Occipital neuralgia is described as unilateral or bilateral paroxysmal, shooting or stabbing pain in the posterior part of the scalp, in the distribution of the greater, lesser or third occipital nerves, sometimes accompanied by diminished sensation or dysesthesia in the affected area and commonly associated with tenderness over the involved nerve(s). Occipital neuralgia is a result of greater occipital nerve (GON) pathophysiology in 90% of cases. Ten percent of cases are due to lesser occipital nerve (LON) causes, and rarely is the third occipital nerve (TON) thought to be involved. Occipital neuralgia can be the result of pinched nerves, muscle tightness in the neck, or head or neck injury. Other causes include osteoarthritis of the cervical spine, compression of the occipital nerves, tumors affecting the cervical spine, gout, diabetes, blood vessel inflammation, or infection (AANS, 2024). Diagnostic criteria have been described by the International Headache Society (IHS, 2013).

Neuralgia is pain in one or more nerves caused by compression and/or irritation of peripheral nerve structures. In occipital neuralgia, irritation of the GON and/or LON by chronically contracted muscles and spondylosis of the upper cervical spine is often implicated. In addition, compression from intra- or extra cranial vessels, giant cell arteritis, callus formations after vertebral fractures, schwannomas, and other masses are rare causes of occipital neuralgia. Possible known causes of irritation of the GON and/or LON include vascular, neurogenic, muscular and osteogenic causes (Choi and Jeon, 2016).

Patients with occipital neuralgia suffer from a shooting or stabbing pain in the neck that radiates over the cranium. The pain is characterized as persistent, paroxysmally aggravating, and of variable distribution; can be perceived in the retro-orbital area due to the convergence of the C2 dorsal root and the nucleus trigeminus pars caudalis. Due to connections with the VIII, IX, and X cranial nerves and the cervical sympathicus, vision impairment/ocular pain (67%), tinnitus (33%), dizziness (50%), nausea (50%), and congested nose (17%) can also be present (Choi and Jeon, 2016).

Diagnostic Criteria of The International Classification of Headache Disorders 3 (ICHD3)

A. Unilateral or bilateral pain in the distribution(s) of the greater, lesser, and/or third occipital nerves and fulfilling criteria B-D
B. Pain has at least two of the following three characteristics:
1. recurring in paroxysmal attacks lasting from a few seconds to minutes
2. severe in intensity
3. shooting, stabbing, or sharp in quality

C. Pain is associated with both of the following:
    1. dysaesthesia and/or allodynia apparent during innocuous stimulation of the scalp and/or hair
    2. either or both of the following:
        a. tenderness over the affected nerve branches
        b. trigger points at the emergence of the greater occipital nerve or in the distribution of C2
D. Pain is eased temporarily by a local anesthetic block of the affected nerve(s)
E. Not better accounted for by another ICHD-3 diagnosis.

Diagnosis of occipital neuralgia is typically clinical, and patients present with intermittent, painful episodes associated with the occipital region and the nerves described above. Most cases are unilateral pain, however bilateral pain can be present, and the pain can radiate to the frontal region and face. Physical examination is the first step in the diagnosis of occipital neuralgia and patients may demonstrate tenderness along the course of the greater and lesser occipital nerves (Swanson et al., 2022). Along the course of the GON (over the occipital protuberance) and/or the LON (about 3 cm superomedially to the tip of the mastoid process), tenderness is detected by palpation. Tingling may be evoked by light pressure or percussion on the nerve (Tinel's sign). In addition to the IHS criteria, patients may demonstrate a positive Tinel's sign (Bond and Kinslow, 2015). The Tinel sign is the tingling or prickling sensation elicited by the percussion of an injured nerve trunk at or distal to the site of the lesion. When patients lie on a pillow and hyperextend or rotate their neck, pain can occur ("pillow sign") (Choi and Jeon, 2016).

The diagnosis of occipital neuralgia can be difficult to make. The criteria consist of subjective pain or sensory abnormalities in areas related to nerves in the occipital region. Responsiveness to local anesthetic blockade of the greater and/or lesser occipital nerves is considered diagnostic. Clinicians should keep in mind, however, that occipital nerve block relief is not specific for occipital neuralgia and that false-positive results occur with migraine and cluster headaches (Choi and Jeon 2016).

The clinical presentation (i.e., tenderness over the occipital nerves) and a temporary improvement in the headache with a local anesthetic diagnostic block of the occipital nerve on the affected side confirm the diagnosis (Choi and Jeon, 2016). This is a criteria for diagnosis per ICHD-3 (IHS, 2013). The patient should have pain relief with the nerve block for at least the duration of the local anesthetic. Single diagnostic blocks carry false-positive rates up to 40%, so the performance of a second block is prudent. Thus, the anatomy of the occipital nerve and the location of the exact target site are very important. Clinicians should keep in mind that occipital nerve block relief is not specific for occipital neuralgia and that false-positive results occur with migraine and cluster headaches (Choi and Jeon, 2016).

Several disorders share certain features with occipital neuralgia, such as pain in the posterior neck and head. Occipital neuralgia can be mistaken for migraine, cluster headache, tension headache, or hemicrania continua. Occipital neuralgia must be distinguished from referred pain from the atlantoaxial or upper zygapophyseal joints or from trigger points in neck muscle or their insertions (cervicogenic headache). The critical differential point is that occipital neuralgia is neuralgia from the occipital nerve, whereas cervicogenic headache is nociceptive referred pain from cervical structures (Choi and Jeon, 2016).

The incidence is not clearly known because of presumed underreporting and misdiagnosis (Hoffman et al., 2018). Koopman et al., 2009, estimated that around 3.2 out of 100,000 people experience occipital neuralgia, with a mean age of diagnosis of 54.1 years. Matthew et al. (2019) diagnosed occipital neuralgia in 195 of 800 patients seen at the Cambridge Health Alliance Headache Clinic and concluded that occipital neuralgia was highly prevalent occurring in patients presenting with a chief complaint of headache to their clinic. Matthew et al. noted that although the study was conducted at a community hospital headache clinic and not a tertiary hospital headache clinic, it may still not reflect the prevalence of occipital neuralgia in the general population. Among the 195 patients, diagnosed with occipital neuralgia by Matthew et al. (2019), 146 had a positive occipital Tinel sign on examination, 46 had a negative Tinel sign and 3 had no

physical examination. Among the 605 patients not diagnosed with occipital neuralgia, none had a positive occipital Tinel sign, which would distinguish occipital neuralgia from migraine. A positive Tinel sign should elicit pain or paresthesias that travel from the skull base toward the apex in the case of the greater occipital nerve and toward the ipsilateral ear in the case of the lesser occipital nerve. A positive Tinel sign should not be confused with percussion causing worsening head pain, which can occur with percussion or movement of the head in someone experiencing a migraine.

There is no current consensus on the optimal treatment method for occipital neuralgia given the lack of randomized controlled studies. Treatment options include standard conservative methods (hot or cold compresses and postural readjustments), pharmacological approaches (nonsteroidal anti-inflammatory drugs and neuropathic medications), physical therapy and various intervention options in refractory cases (pulsed radiofrequency of the occipital nerve, neurosurgical procedures). Evidence for the success of this approach is weak. Well-designed studies have rarely been reported. Patient education is also an important component of treatment (Choi and Jeon, 2016).

Occipital nerve block, as well as an essential diagnostic tool, can often have a significant therapeutic benefit. For those patients with a positive but temporary response to the block, radiofrequency ablation of the third occipital nerve commonly results in more sustained improvement (Laguerre et al., 2020).

The rationale for injecting local anesthetics is to block sensory signals from the region being injected. Although often used for diagnosis—because it should only lead to a temporary blockade—an injection of local anesthetic has the potential to decrease sensitization, which is a feature of chronic or persistent pain, thereby possibly prolonging the treatment effect of local anesthetic beyond its pharmacological duration of action (Shanthanna et al., 2016).

Peripheral nerve blocks have been used for the acute and preventive treatment of a variety of primary headache disorders for decades. These procedures provide prompt pain relief for many patients with various headache types. Moreover, their analgesic effect typically lasts beyond the duration of anesthesia caused by the nerve blockade, providing some patients with pain relief for several weeks or even months. The most widely used target for peripheral nerve blocks is the GON. Other commonly targeted nerves are the lesser occipital nerve LON and several branches of the trigeminal nerve.

Despite the common use of peripheral nerve blocks by clinicians involved in the care of patients with headache, there has been no standardized approach for the performance of these procedures. A survey conducted by the Special Interest Section of the American Headache Society in 2010 evaluated the use of peripheral nerve blocks and trigger point injections among headache practitioners in the U.S. Invitations to participate in the Internet-based survey were sent to 1,230 American Headache Society members and 161 provided usable data (13.1%). Of responders, 69% reported performing peripheral nerve blocks and 75% performed trigger point injections. The most common indications for the use of nerve blocks were occipital neuralgia and chronic migraine. The most common indications for trigger point injections were chronic tension type headache and chronic migraine. Patterns of use varied greatly. The most common local anesthetics used for these procedures were lidocaine and bupivacaine. Dosing regimens, volumes of injection, and injection schedules varied greatly. There was also a wide variation in the use of corticosteroids when performing the injections (Blumenfeld et al., 2010).

A similar survey was conducted by the Pediatric & Adolescent Section of the American Headache Society. A survey was sent to 82 members of the Pediatric & Adolescent Section of the American Headache Society in June 2015. The survey asked about current practice and use of nerve blocks, as well as respondents' opinions regarding gaps in the evidence for use of nerve blocks in this patient population. There was a 50% response rate. Thirty-three respondents perform or refer patients for nerve blocks. Chronic migraine with status migrainosus was the most common indication for nerve blocks (82%), though occipital neuralgia (79%), status migrainosus (73%), chronic migraine without flare (70%), post-traumatic headache (70%), and new daily persistent headache (67%) were also common indications. All respondents inject the greater occipital nerve

(GON), with 23% injecting only the GON. Eighteen (69%) typically inject the lesser occipital nerve (LON). All use a local anesthetic, either lidocaine and/or bupivacaine, though at varying concentrations. About half of respondents (n=12/26) add corticosteroid. Of the 26 respondents (63%) who perform injections themselves, 11 (42%) stated that they usually do an injection once, 9 (35%) indicated that they would repeat an injection if the patient reported sufficient benefit, and 6 (23%) indicated that they would plan to repeat injections, with planned intervals ranging from 2–12 weeks. The most commonly recommended interval between injections without corticosteroid was 1–2 weeks, versus over 11 weeks for injections containing corticosteroid. When asked about the minimum necessary response to consider repeating a nerve block in the same patient (without specifying condition), the most common answers were improvement in symptoms for ≥24 hours (n=8/32, 25%) and improvement in symptoms for ≥1 week(n=8/32, 25%). Seven (22%) indicated it would depend on diagnosis, patient preference, and balance of benefit and side effects. Some respondents clarified that they would plan to do a single injection for status migrainosus, but repeated injections for chronic migraine. One raised the opinion that the first nerve block is always the most effective, and that there is decreased effectiveness with repeated blocks. All respondents were queried about what they consider the minimum clinically-meaningful response to treatment with nerve blocks. For chronic migraine the most common answers were ≥50% reduction in headache frequency at 4 weeks (n=17, 41%) and ≥30% reduction in headache frequency at 4 weeks (n=10, 24%). For status migrainosus the most common answer was ≥50% decrease in severity (n=17, 41% if same). This survey demonstrated significant variability in the implementation of nerve blocks as a headache treatment.

Respondents use nerve blocks for many different headache diagnoses. All respondents use lidocaine and bupivacaine, but in varying combinations and concentrations. While respondents tended to recommend a longer interval between injections if corticosteroid were used, there was variability in the use of repeated injections. There was also variability regarding injection location - respondents inject anywhere from 1–10 sites around the head in a single procedure session. This variability closely paralleled the results of the adult practice pattern survey from 2010 (Blumenfeld et al., 2010). Similar to that study, there was wide variability in the indications for injection, sites and frequency injected, and medications used. Given the demonstrated variability, additional placebo-controlled studies should be done. Thirty of 41 (73%) respondents indicated willingness to participate in a trial of nerve blocks for pediatric headache disorders.

To address the variability in practice patterns members of the American Headache Society convened with the goal of reaching a consensus on the recommended techniques for the performance of peripheral nerve blocks for headaches. Potential indications for peripheral nerve blocks in the treatment of headache disorders include primary headache disorders (migraine, cluster headache, chronic daily headache, hemicrania continua, new daily persistent headache), secondary headache disorders (cervicogenic headache, post-traumatic headache, post-dural puncture headache) and cranial neuralgias (supraorbital neuralgia, auriculotemporal neuralgia). The said recommendations represent the current recommendations among the AHS-IPS members on this topic. It should be noted that there is a paucity of evidence from controlled studies for the use of peripheral nerve blocks in the treatment of primary and secondary headache disorders, with the exception of GON blockade for cluster headache. Further research on this topic is strongly encouraged, and may result in revision of the said recommendations, aiming at further improving the outcome and safety of this treatment modality for headache.

Case Series

Sahai-Srivastava and Subhani (2010) conducted a retrospective chart review of 89 consecutive patients presenting to the headache clinic at the University of California during 2005 to January 2010 with occipital neuralgia as determined by the International Headache Society criteria. The objective of the study was to determine whether there are differences in the adverse effect profile between 1, 2 and 5% Lidocaine when used for occipital nerve blocks in patients with occipital neuralgia. The average age of this cohort was 53.25 years, and the majority (78%) of patients were females (69/89). These 89 patients received a total of 315 occipital nerve blocks. Only 3 patients reported symptoms out of 173 ONB blocks with Lidocaine 1%, which is consistent with other studies. Dizziness is a common side effect with local Lidocaine injections and the most

commonly reported adverse effect in this case series. Slurring of speech was observed in all patients who developed intermittent hypertension and dizziness. This study showed a very slight (3%) increase in adverse events with 5% Lidocaine compared to 1% Lidocaine. All subjects, including those who had side effects reported complete pain relief for at least 3–7 days, the maximum period of pain relief being 33 days. Of the 89 patients injected, 15 received occipital nerve block for the first time, of which 5 subjects had side effects. Of the 74 patients who received an occipital nerve block more than once, 3 had side effects. This data indicates that patients receiving injections for the first time were more likely to experience adverse effects. The authors speculate that repeated injections might have produced a tolerance, reducing the likelihood of adverse effects.

The manufacturer label for Lidocaine HCL states that repeated doses of lidocaine HCl may cause significant increases in blood levels with each repeated dose because of slow accumulation of the drug or its metabolites. Tolerance to elevated blood levels varies with the status of the patient.

Patients who receive multiple blocks may need to be monitored for the development of a very rare side effect, Cushing's syndrome. Lavin et al. 2001, reported a case of 39-year-old female with chronic daily headaches who had six bilateral GON blocks containing corticosteroids over a period of 3 months and developed signs of Cushing's syndrome with intermittent hypertension, severe muscle weakness, and fluid retention.

Chowdhury et al., 2021, conducted a systematic review of the literature regarding the safety and efficacy of GON blocks in various headache disorders. The authors searched PubMed for randomized controlled trials, observational studies, open-label studies, case series and case reports published through December 31, 2020. A total of 226 articles were identified and 72 were included in this review, including 27 studies for migraine, 9 studies for trigeminal autonomic cephalgias (including cluster headache), 3 studies for other primary headaches (including tension type headache), 4 studies for neuralgias (including 2 for occipital neuralgia), 15 studies for secondary headaches (including cervicogenic headache), and 14 studies in mixed populations. Studies of GON blocks for occipital neuralgia were Vanderhoek et al. 2013 and Kastler et al. 2015, which are discussed below. The authors conclude that GON block is a useful modality for the treatment of various headache disorders because of its early effect in reducing sever pain, sustained effect following a single injection, minimum invasiveness and no drug-to-drug interactions.

VanderHoek et al. (2013) reported on two cases in which ultrasound was used to guide diagnostic GON blocks and GON pulsed radiofrequency ablation for treatment of occipital neuralgia. The first patient is a 35 year-old male active duty United States Army Soldier with chronic occipital headaches following several blast exposures between 2004 and 2006 from improvised explosive device (IED) explosions. His medical history includes post-concussive syndrome, essential hypertension, obstructive sleep apnea, post-traumatic stress disorder, and chronic low back pain. His pain from headaches ranged from 3-7 on a scale of 1-10 (1 being no pain and 10 being the worst pain he can imagine), with the headaches occurring three times per week. To determine if occipital neuralgia was the cause of his headache, we proceeded with diagnostic bilateral greater occipital nerve blocks under ultrasound guidance. Nearly all of the patient's pain was relieved immediately post-block. The patient received therapeutic GON blocks every 4 – 6 weeks for treatment of occipital neuralgia before moving out of the area serviced by our pain management clinic. The second patient is a 32-year-old male active duty United States Army Soldier with occipital neuralgia that had been previously successfully treated with several traditional GON blocks (landmark-guided) that provided pain relief for 2-3 months apiece. He also underwent a traditional bilateral GON pulsed radiofrequency ablation (also landmark-guided) with pain relief for 4-6 months. Using a linear, high frequency ultrasound probe, the GON and occipital artery were visualized. First one and then a second standard radiofrequency probe needle with 10 millimeter active tips was advanced in-plane with the beam until adjacent to the GON on either side. PRFA was performed twice at each site with a rate of 2 Hertz and duration of 20 milliseconds for 120 seconds at a temperature between 38–42 degrees Centigrade. The procedure was tolerated well without complications and his occipital neuralgia was completely relieved for several months. The authors concluded that further study is needed to examine any

difference in outcomes or morbidity between the traditional landmark method versus ultrasound-guided blocks and pulsed radiofrequency ablation of the greater occipital nerves.

Kastler et al., 2015, reported on the efficacy of simplified CT-guided GON block for the treatment of occipital neuralgia. Thirty three patients suffering from severe refractory occipital neuralgia who underwent a total of 37 CT-guided GON blocks between 2012 and 2014 were included. Pain was evaluated via VAS scores. Clinical success was defined by pain relief greater than or equal to 50 % lasting for at least 3 months. The pre-procedure mean pain score was 8/10. Patients suffered from left GON occipital neuralgia in 13 cases, right GON occipital neuralgia in 16 cases and bilateral GON occipital neuralgia in 4 cases. The clinical success rate was 86%. In case of clinical success, the mean pain relief duration following the procedure was 9.16 months.

Madore et al. (2017) conducted a retrospective chart review of 71 patients who received occipital nerve blocks with or without trigger point injections. Inclusion criteria for this study included being diagnosed with occipital neuralgia or migraine, tenderness of the occipital region on exam, and occipital nerve block performed during that visit. 80% of patients were female with an average age of 47. Eighteen were treated with occipital nerve block only, while 53 received nerve block and trigger point injection. In the occipital nerve block only group, 17 of 18 patients (94%) received benefit with a mean duration of 8.6 weeks; 1 patient received no benefit, and 1 patient received benefit for < 4 weeks. The authors report that 15 patients (83%) received benefit for 4-12 weeks. In the occipital nerve block plus trigger point injection group, 48 of 53 patients (90.5%) received benefit with a mean duration of 9.1 weeks; 5 patients received no benefit; 8 patients received benefit for < 4 weeks. The authors report that 34 patients (64%) received benefit for 4-12 weeks. The authors defined benefit as patient reported reduction in frequency or severity of headaches by at least 50%. Prior to treatment, patients had already undergone medication trials and lifestyle modifications. Limitations of this study are that results are not separately reported for occipital neuralgia and migraine. Also, a large percentage of patients in each group received benefit for 4-12 weeks (83% and 64%). It would be more precise to report a consistent intervals.

Seeger et al., 2015 conducted a retrospective chart review of 15 teenage patients with post-concussion syndrome and subsequent occipital neuralgia. Patients (mean age 15; range 13-17) received greater occipital nerve blocks with a lidocaine and triamcinolone solution (most often bilaterally). The headache burden was high with all except one having headaches 15 or more days per month. There was a reduction in headache frequency of ≥ 50% in 64% of patients, with associated improved quality of life and decreased post-concussion symptom scores ($P < .05$). Mean headache frequency decreased from 26 to 17 days per month. Improvements were also noted in concussion symptomatology and quality of life. The procedure was well tolerated with only one patient experiencing temporary alopecia.

Hascalovici and Robbins (2017) performed a retrospective chart review for peripheral nerve blocks for the treatment of various headache disorders in patients 65 years of age and older over a 6 year period. Sixty-four patients were mostly female (78%) with an average age of 71 years (range 65-94) were included. Representative headache diagnoses were chronic migraine 50%, episodic migraine 12.5%, trigeminal autonomic cephalalgia 9.4%, and occipital neuralgia 7.8%. The average number of headache days/month was 23. Common comorbidities were hypertension 48%, hyperlipidemia 42%, arthritis 27%, depression 47%, and anxiety 33%. Eighty-nine percent were prescribed at least 1 medication fulfilling the Beers criteria (medication potentially inappropriate in older adults). The average number of peripheral nerve blocks per patient was 4. Peripheral nerve blocks were felt to be effective in 73% for all headaches, 81% for chronic migraine, 75% for episodic migraine, 67% for chronic tension type headache, 67% for new daily persistent headache, and 60% for occipital neuralgia. There were no adverse events related to peripheral nerve blocks reported.

Prospective Cohort

Juškys and Šustickas (2018) conducted a prospective study from March 2014 to February 2018 of 44 patients, ages 28 to 84 years (mean age 56.3 ± 14.71 years) of which 79.55% were female (n=35), diagnosed with medically refractory occipital neuralgia and treated with local anesthetic and corticosteroids injected into the GON or GON plus LON (n=29 and n=15, respectively).

Analysis of the outcomes of those patients was done by comparing the Visual Analog Scale (VAS) and Barrow Neurological Institute Pain Intensity Score (BNIPIS) prior to treatment, 24 hours after the block, and at a follow-up 6 months later. Also, patients were assigned to two distinct groups based on the time from onset of the disease: patients experiencing pain for < 6 months fell into the acute pain category, while those experiencing pain for > 6 months were already considered as a chronic pain group. The authors assessed whether there was any difference between the VAS score of the two groups before the procedure, 24 hours after the ONB, and, finally, at the follow-up after 6 months. Analgesic medication consumption before and after 6 months was recorded. A comparison of procedure efficacy in lidocaine and bupivacaine groups was made. Evaluation of block potency for acute and chronic pain categories was conducted as well. The success criteria were defined as patient satisfaction with own condition for at least 6 months, not requiring another block in order to stay comfortable. At least 6 months of condition improvement was achieved in 95.45% of patients (n = 42), while other two required another occipital nerve block before the follow-up after 6 months. In 75% of cases (n = 33), the anaesthetizing agent used was 2% 5 ml of lidocaine, while the rest of 25% (n = 11) of injections were made with 0.5% 5ml of bupivacaine; regardless of the anesthetic, all of the solutions contained 4 mg of dexamethasone. Mean headache VAS scores decreased from 7.23 ± 0.93 (pre-treatment) to 1.95 ± 1.59 (24 hours after, $p < 0.0001$) and increased to 2.21 ± 1.73 at the follow-up after 6 months, showing no statistically significant difference between post-interventional and six-month VAS scores ($p = 0.07$). In all patients the necessity of medication to control pain decreased to 16.67% (n = 7) during the check-up after 6 months. There was no statistically significant difference in the effectiveness of ONB with regard to the local anesthetic used or the pain group targeted. The authors failed to get any statistically significant differences in VAS scores while comparing the groups according to the usage of lidocaine or bupivacaine as a substrate for injection and, similarly, there was not enough evidence to conclude that the efficacy of occipital neuralgia treatment using block technique depends on whether the patient was in the acute or chronic setting of the disease. These findings suggest that effectiveness of occipital nerve block might not depend on local anesthetic used or the duration of occipital neuralgia prior to treatment.

Systematic Review

Evans and colleagues (2023) conducted a systematic review of randomized controlled trials utilizing injection treatments for headaches with pain or tenderness in the occipital region published up to June 11, 2020 in multiple databases. For studies reporting on multiple types of headaches, data were analyzed for the occipital pain pathology (i.e. occipital migraine, occipital headache, cervicogenic headache, occipital neuralgia) and data were excluded from other pathologies including tension-type headache, unspecified migraines, or general headache. Twelve studies met inclusion criteria. All 12 studies included were randomized controlled trials (RCTs) published between 2002 and 2019. Five studies treated cervicogenic headache, three treated migraine with occipital tenderness, one treated cervicogenic headache with occipital neuralgia (Na et al., 2010), one treated occipital neuralgia or migraine with occipital tenderness (Cohen et al., 2015), one treated cervicogenic headache or migraine without aura or tension-type headache, and one treated primary occipital headaches including tension-type, migraine, cluster, or new daily persistent headache. A total of 586 patients, including 178 males and 400 females, were included. The mean age of included patients for each study ranged from 33.7 to 55.8 years. This meta-analysis showed that anesthetic injections provide a statistically significant reduction in the frequency of headaches which persisted to at least until 6 weeks post-injection, and pain severity which persisted to at least 6 months postinjection. Headache pain severity improvements remain statistically significant up to 6 months after treatment, although the mean pooled reduction diminished to 1.07 points at which point management with botulinum toxin type A injection, pulsed radiofrequency, or cryoneurolysis provided statistically significant superiority to the injected anesthetic with corticosteroid. This review is limited by a small number of RCTs with comparable data for meta-analysis. In addition, multiple different headache diagnoses were included, however, a strength of this study is that all included studies described occipital pain. Future studies with longer-term follow-up are needed to investigate the reduction in headache frequency beyond 6 weeks. The authors conclude that occipital pain is a common debilitating disorder that

leads to profound decreases in quality of life. Before occipital nerve surgery, anesthetic injections are utilized to confirm occipital trigger site presence. These diagnostic injections should be repeated to confirm an absence of response to injection.

Other Treatment Options for Occipital Neuralgia

Pulsed radiofrequency has generated substantial interest in the pain medicine and neuroscience communities as a possible treatment for neuropathic pain. The conceptual appeal of pulsed radiofrequency is that it exerts analgesic effects without damaging neural architecture. Cohen et al., 2015, conducted a randomized, double-blind, comparative-effectiveness study comparing pulsed radiofrequency to steroid injections for occipital neuralgia or migraine with occipital nerve tenderness. The study sites consisted of 5 military academic treatment facilities, 2 VA hospitals, and 2 civilian teaching hospitals. Participants were treated and followed between August 2012 and February 2015. Inclusion criteria were age ≥18 years; a diagnosis of occipital neuralgia including paroxysmal stabbing pain in the distribution of the greater or lesser occipital nerve(s), tenderness over the affected nerve(s), and relief of pain for at least 3 hours after bupivacaine local anesthetic block of the affected nerve(s), or a diagnosis of migraine with a predominance of occipital pain and occipital nerve tenderness that responded to local anesthetic blockade; ≥4/10 pain; failure to respond to previous therapy to include non-opioid analgesics; and headache frequency ≥10 days/month. Eighty-one participants were randomized 1:1. Group 1 received an injection containing 1 mL 0.5% bupivacaine, 1 mL 2% lidocaine, and 0.75 mL normal saline at each targeted nerve (up to 4). After 4 minutes, pulsed radiofrequency treatment was initiated with a radiofrequency generator. Group 2 received the same injection and sham pulsed radiofrequency treatment. This study was powered to determine whether pulsed radiofrequency was superior to steroid injections. For the primary outcome measure, average occipital pain at 6 weeks, pulsed radiofrequency participants experienced a mean change from baseline of −2.743 ± 2.487, which favorably compared with those who received steroid injections (−1.377 ± 1.970; P = 0.008). The differences in average occipital pain (mean change from baseline −3.273 ± 2.368 in pulsed radiofrequency participants vs −1.421 ± 2.062 in those who received steroids; P < 0.001) and worst occipital pain (−3.095 ± 2.701 vs −1.833 ± 2.540; P = 0.033) were present at 2 weeks and persisted through 6 months for average occipital pain (mean change from baseline for the PRF group −1.413 ± 2.352 vs −0.33 ± 1.382; P = 0.017 in steroid participants). The difference in worst occipital pain favoring the pulsed radiofrequency group was significant at 3 months (mean change from baseline −1.925 ± 3.204 vs −0.541 ± 2.644; P = 0.043), but not at 6 months (−1.263 ± 2.976 vs −0.149 ± 1.972; P = 0.083). There are several possible explanations for our findings including greater efficacy for pulsed radiofrequency than for steroids, or similar efficacy but more sustained benefit, as previous studies evaluating steroid injections for other conditions have generally shown benefit for several weeks, after which the effects quickly dissipate. Another explanation is that both treatments would have comparable benefit in a treatment-naive population, but these participants were more likely to experience better relief with pulsed radiofrequency, because most had already failed steroid injections. The observation that the relief of pain did not translate to improved secondary outcome measures implies that the affective-motivational aspect of pain may be greater than the sensory-discriminative component in occipital neuralgia and highlights the complexity of treating neuropathic pain in individuals with psychosocial overlay. Although the study was not powered to detect any subgroup differences, the authors separately analyzed the results in those participants with occipital neuralgia (n = 36) or migraine with occipital nerve tenderness (n = 45). In patients with occipital neuralgia without migraines, no significant differences were found between groups at any time point (mean change from baseline for average occipital pain at 6 weeks in the pulsed radiofrequency group −1.779 ± 2.186 vs −1.667 ± 2.813 in the steroid group; P = 0.508). Similar to the largest study evaluating pulsed radiofrequency for occipital neuralgia (Huang et al., 2012 discussed below), participants in this study had failed less invasive treatments, including in most cases steroid injections.

Huang et al., 2012 report results for 102 consecutive patients with a primary diagnosis of occipital neuralgia. All data were acquired from a review of medical records. All patients were treated with pulsed radiofrequency of the GON and/or LON for a primary diagnosis of ON or migraine headache with occipital nerve tenderness and a positive response to diagnostic blocks. Diagnostic criteria for ON were based on the IHS definition of ON. Clinical symptoms typically

involved paroxysmal shooting or stabbing pain in the distribution of the affected nerve(s), often with hypo- or dysesthesias in the affected area(s). Physical exam findings included pain elicited with pressure over the GON or LON, or a positive Tinel's sign. In all cases, temporary improvement with a local anesthetic diagnostic block confirmed the diagnosis. Pain scores were measured via 0–10 numerical rating scales. A positive primary outcome measure was predefined as 50% pain relief lasting at least 3 months after treatment. The secondary outcome measure, procedural satisfaction, was garnered from specific questions designed to assess benefit (i.e., the treatment or medication I received at my last visit: 1) helped my pain; 2) did not change my pain; and 3) worsened my pain). The mean age of the study subjects was 51.2 years (standard deviation [SD]: 14.5; range: 22–83 years), with 73.5% being female. The average duration of pain was 6.9 years (SD: 8.6; range: 1–44 years). Just over one-third reported a traumatic inciting event, with the most common being motor vehicle accidents, sports injury, and falls. Over one-half had a co-existing chronic pain condition, and the most frequent chronic pain conditions in the patients were arthalgias or low back pain. Thirty-eight percent were receiving opioid therapy and one-third were either receiving or seeking disability or pursuing a worker's compensation complaint. Subjects were nearly equally divided between obtaining 80% pain relief (45%) and between 50% and 79% relief (41%) during their diagnostic blocks, with 10% proceeding to pulsed radiofrequency despite experiencing <50% relief. Almost 40% had an active or recent history of a psychiatric condition. Overall, 51.0% of subjects experienced a positive outcome. Characteristics associated with procedural success include a history of a previous inciting event (65.7% success rate; P = 0.03), the presence of greater occipital neuralgia by itself (71.4% success rate vs 43.2% for lesser or combination occipital neuralgia; P = 0.01), lower injectate volumes during diagnostic blocks (mean: 3.4 mL [SD 1.2] for a positive outcome vs 4.1 mL [SD 1.3] for an unsuccessful procedure; P = 0.01) and multiple cycles of pulsed radiofrequency (62.3% success rate vs 34.2% for a single cycle; P = 0.005) were all found to correlate with a successful outcome in univariable analysis. Variables for which a trend was observed to be associated with a negative result included the presence of a co-existing pain condition (45.8% success rate vs 59.5%), opioid use (38.5% vs 58.7%), co-existing psychopathology (41.8% vs 53.2%), receiving multiple diagnostic blocks before pulsed radiofrequency (44.6% vs 58.7%), receiving no local anesthetic during the procedure (28.6% vs 50.0%), and the presence of ongoing financial secondary gain issues (26.5% success rate vs 63.2% in patients without secondary gain; P < 0.0001). Overall, slightly more than half of subjects experienced a positive outcome. Although this success rate may be viewed by some as inadequate, the results should be viewed from the perspective that these individuals had already failed multiple conservative and interventional treatment modalities and therefore were at high-risk for treatment failure. In summary, results of this study demonstrate that pulsed radiofrequency may provide significant intermediate-term pain relief to a substantial percentage of patients with refractory occipital neuralgia. Selecting appropriate candidates based on clinical characteristics (i.e., neuropathic pain limited to the distribution of the occipital nerves), and optimizing diagnostic accuracy (i.e., maximizing the specificity of diagnostic occipital nerve blocks by reducing injectate volume) and treatment considerations (i.e., utilizing >1 cycle of PRF) may further improve success rates.

Pietramaggiori and Scherer (2023) report results of a retrospective chart review of 87 patients who underwent nerve and muscle sparing surgical decompression for occipital neuralgia and were followed for at least 12 months. Patients were either self-referred, or referred by a neurologist, pain specialist, or general practitioner after failing to respond in a satisfactory manner to disease-modifying medications for at least 1 year. Diagnosis was confirmed by a constellation of symptoms consistent with occipital neuralgia and selective blocks of the occipital nerves. Positive response was considered when symptoms temporarily improved (at least >50% improvement). The block (2.5 cc of a mixture of 1% lidocaine and 10 mg of triamcinolone) was administered through a 30-gauge needle in the area between the lateral edge of the trapezius and the medial edge of the sternocleidomastoid muscle, just below the nuchal line. Average age was 45.5 years (range, 20 to 86 years), and the female-to-male ratio was 2.5:1. Thirty-two patients had unilateral occipital neuralgia, and 55 were affected bilaterally. Most of the patients included in this study had some type of previous trauma, such as a whiplash or direct contusion on the occipital region, with preservation of sensation. First, the authors quantified whether

occipital decompression surgery as described above had an impact on headaches days. Patients with occipital neuralgia typically have chronic background pain and crisis of more intense pain and shorter duration. The chronic pain days decreased from an average of 25 to 4.3 ($P < 0.01$), exhibiting a significant 80.5% reduction (5.8-fold). The pain crisis days per month passed from 19 to 3.7 ($P < 0.01$), corresponding to an 82.8% reduction (5.1-fold). Second, the authors evaluated pain intensity. Patients felt on average a background pain intensity of 3.7 of 10, whereas after surgery, the pain decreased to 0.7 of 10 ($P < 0.01$), corresponding to a 76.1% reduction (5.2-fold). Pain intensity peaks during crises passed from 8.8 of 10 to 2.1 of 10 after surgery ($P < 0.01$), corresponding to a significant reduction by 81.1% (4.2-fold). The decrease in headache days and intensity mirrored the decreased drug use. The use of nonsteroidal anti-inflammatory drugs decreased from 25.3 to 7.7 pills per month (main drug used ibuprofen and equivalents, 69.7% reduction, 3.3-fold, $P < 0.01$, not shown). Patients with occipital neuralgia may have other forms of headaches such as chronic migraines. These patients most often use triptans to improve their global pain. The use of triptans among our patient population decreased from 14 pills per month to 2.7 pills per month ($P < 0.01$) (80.6% reduction, 5.2-fold, not shown). Patients are also often given disease-modifying drugs (including antiepileptics, antidepressants, beta-blockers, and anti–calcitonin gene-related peptide antibodies to decrease the general burden of the headaches). Fifteen of the 46 patients using disease-modifying drugs could stop 1 year after surgery, and among the other 31 patients, 15 could reduce the doses by more than 50%. Seven of 87 patients were on morphine derivatives before surgery, of which five could completely stop and two could reduce more than 50% the intake after surgery. The overall improvement in Migraine Headache Index after surgery was divided into global and occipital. Global is the general evaluation of patients with other triggers or types of headaches in addition to occipital neuralgia. The analysis of the global improvement showed 81.5% of patients exhibiting more than 50% improvement, with 17.3% of patients exhibiting complete remission of all headaches, 42% of the patients showing 80% to 99% improvement, and 22.2% showing 50% to 79% improvement. 18.5% of patients did not show any significant global improvement. No patients reported a worsening of the symptoms. The impact on occipital pain relief was higher than the global improvement. The significant occipital pain improvement was 91%, with 45% of patients showing a complete remission of occipital symptoms; 28% showing significant, major improvement; and 18% showing significant, moderate improvement. Nine percent of the patients did not show any improvement. No patients reported a worsening of the symptoms. Only minor complications occurred. Four patients required post-surgery scar revision, all under local anesthesia. One patient had partial wound dehiscence, probably because of reaction to resorbable suture; and three patients developed pain around the surgical incision, probably because of excessive scarring. Interestingly, the authors noted that most patients with occipital neuralgia can point with one fingertip to the pit between the trapezius and the sternocleidomastoid muscles to indicate the origin of pain. This zone is known as the occipital triangle, where the greater and lesser occipital nerve neurovascular bundle is compressed by fascial and tendinous structures and directly accessible. Compression and neuropathy of the greater and lesser occipital nerve are considered responsible for most of the occipital neuralgia symptoms.

From the review of the scientific literature about the results of invasive options available for occipital neuralgia, Pietramaggiori and Scherer (2023) conclude that surgical decompression seems to be the most effective, with a greater than 80% long-term success rate, as indicated by at least 50% improvement in migraine days, intensity, and duration calculated by the Migraine Headache Index. The two largest case series to date about surgical decompression of the occipital nerves (Ducic et al., 2009, who followed 209 patients; and Ascha et al., who followed 176 patients) report 80.5% and 86.2%, respectively, having more than 50% improvement, with a significant 43.5% and 52%, respectively, among those with complete remission.

Several studies on pulsed radiofrequency, a nondestructive form of radiofrequency therapy for the treatment of occipital neuralgia have shown statistically significant improvements in pain scores and quality of life and reductions in pain medication use. Cohen et al., 2015 (described above) compared the effects of pulsed radiofrequency to occipital nerve blocks with steroids in a randomized, double-blind study and found pulsed radiofrequency to be superior in terms of

average pain score reductions at 6 weeks through 6 months. Given these findings, Cohen et al. suggest that pulsed radiofrequency should be considered as a treatment modality for prolonged benefit beyond occipital nerve blocks utilizing steroids.

Depending on how radiofrequency energy is applied to neural tissues, radiofrequency therapy can be defined as thermal or pulsed. Thermal radiofrequency produces more heat that results in neural disruption via the creation of a destructive lesion. Pulse radiofrequency, in comparison, delivers short bursts of high-amplitude current between comparatively long pauses that allow for the dissipation of heat. Neural tissue is preserved by allowing this heat to dissipate as proven in histologic studies. Although no studies have specifically compared the outcomes of thermal radiofrequency vs pulsed radiofrequency for the treatment of occipital neuralgia, studies have compared these two radiofrequency modalities for trigeminal neuralgia, a similar neuropathic type–mediated headache disorder (Hoffman et al., 2018).

Hoffman et al., 2018, report on 46 patients who underwent thermal radiofrequency. The average patient age was 46.5 ± 13.6 years, and the majority of patients were female (82.6% female vs 17.4% male). In this patient population, 54.3% were diagnosed with bilateral occipital neuralgia, and 45.7% had unilateral occipital neuralgia. These patients underwent bilateral thermal radiofrequency ablation and unilateral thermal radiofrequency ablation, respectively. There was a significant difference between preprocedural and 1-month postprocedural patient-reported VAS scores (6.7 vs 2.7, $P < 0.001$), a mean reduction of 4.0 ± 3.3. The patient-reported length of relief following thermal radiofrequency ablation varied among patients, but the mean was 6.5 ± 5.1 months. This mean was calculated from the data for 39 patients. Results from the remaining 7 patients were excluded because the clinical documentation failed to specifically define the length of relief. Based on data from 44 patients, the mean percent of pain relief reported by patients at the 1-month follow-up visit was 76.3% ± 25.0%. Thermal radiofrequency is a relatively low-risk option for headache management; it has no medication side effects and a low incidence of complications.

Abd-Elsayed et al., retrospectively assessed the efficacy of radiofrequency ablation (RFA) therapy as a treatment for occipital neuralgia. Data was collected from 277 occipital nerve RFA patients who had adequate pre-procedure and post-procedure follow-up for data analysis. Data collected includes the patient's age, biological sex, BMI, headache diagnosis, pre-procedure, and post-procedure pain score using the visual analog scale (VAS), subjective percent improvement in symptom(s), and duration of symptom relief. The mean pre-procedure pain score before RFA therapy for patients who completed at least 6 months of follow-up was 5.57 (SD = 1.87) and the mean post-procedure pain score after RFA therapy was 2.39 (SD = 2.42). The improvement in pain scores between pre-procedure and post-procedure was statistically significant with a p-value < 0.001. The mean patient-reported percent improvement in pain following RFA therapy was 63.53% (SD = 36.37). The mean duration of pain improvement was 253.9 days after the initiation of therapy (SD = 300.5). When excluding patients who did not have any relief following their RFA procedure, the average pre-procedure pain score was 5.54 (SD = 1.81) and post-procedure pain score was 1.71 (SD = 1.81) with a p-value < 0.001. This study demonstrates the minimally invasive, safe, and effective treatment of RFA in patients with refractory occipital neuralgias and headaches. Additional studies are necessary to illuminate ideal patient characteristics for RFA treatment and the potential for procedural complications and long-term side effects associated with occipital nerve RFA therapy.

Analysis of Evidence

Complex regional pain syndrome (CRPS) is an umbrella term for a variety of clinical presentations characterized by chronic persistent pain that is disproportionate to any preceding injury (if any) and that is not restricted anatomically to the distribution of a specific peripheral nerve (Bruehl 2010). The available evidence relating to the effectiveness of peripheral nerve blocks for CRPS is not compelling. While there is substantial uncertainty regarding the effectiveness of alternative therapeutic options, it is not clear that this procedure provides clinical value. If peripheral nerve block is to continue to be offered to people with CRPS, there is a clear need for further, better quality research into its efficacy (O'Connell et al., 2016).

Occipital neuralgia is a challenging condition for which there is no reference standard for treatment. Well-designed studies have rarely been reported. Small, mainly retrospective studies report that occipital nerve block with or without corticosteroids may be an effective treatment modality for occipital neuralgia that is refractory to conventional medical therapies. Duration of pain relief from occipital nerve blocks is usually transient, ranging from less than 1 week to more than 6 months. There is some evidence that repeated injections might produce a tolerance. Evidence for the use of occipital nerve block for therapeutic purposes is lacking. Studies that address patient selection and optimal use of occipital nerve block for occipital neuralgia are needed. There is widespread agreement that efforts to develop improved treatments for patients with chronic pain are a research priority. Randomized controlled trials establishing the difference in the magnitude of response between the treatment and control groups that will be considered large enough to establish the scientific or therapeutic importance of the results are needed (Dworkin et al., 2008).

Coding

The following codes are included below for informational purposes only; inclusion of a code does not constitute or imply coverage or reimbursement.

Refer to the National Correct Coding Initiative Policy Manual for Medicare Services, Chapter 2 and Chapter 8 for CPT codes 64400-64530 coding instructions.

CPT Codes

CPT Code	Code Description
64400	Injection(s), anesthetic agent(s) and/or steroid; trigeminal nerve, each branch (ie, ophthalmic, maxillary, mandibular)
64405	Injection(s), anesthetic agent(s) and/or steroid; greater occipital nerve
64408	Injection(s), anesthetic agent(s) and/or steroid; vagus nerve
64415	Injection(s), anesthetic agent(s) and/or steroid; brachial plexus, including imaging guidance, when performed
64416	Injection(s), anesthetic agent(s) and/or steroid; brachial plexus, continuous infusion by catheter (including catheter placement), including imaging guidance, when performed
64417	Injection(s), anesthetic agent(s) and/or steroid; axillary nerve, including imaging guidance, when performed
64418	Injection(s), anesthetic agent(s) and/or steroid; suprascapular nerve
64420	Injection(s), anesthetic agent(s) and/or steroid; intercostal nerve, single level
64421	Injection(s), anesthetic agent(s) and/or steroid; intercostal nerve, each additional level
64425	Injection(s), anesthetic agent(s) and/or steroid; ilioinguinal, iliohypogastric nerves
64430	Injection(s), anesthetic agent(s) and/or steroid; pudendal nerve
64435	Injection(s), anesthetic agent(s) and/or steroid; paracervical (uterine) nerve
64445	Injection(s), anesthetic agent(s) and/or steroid; sciatic nerve, including imaging guidance, when performed
64446	Injection(s), anesthetic agent(s) and/or steroid; sciatic nerve, continuous infusion by catheter (including catheter placement), including imaging guidance, when performed
64447	Injection(s), anesthetic agent(s); femoral nerve, including imaging guidance, when performed
64448	Injection(s), anesthetic agent(s); femoral nerve, continuous infusion by catheter (including catheter placement), including imaging guidance, when performed
64449	Injection(s), anesthetic agent(s) and/or steroid; lumbar plexus, posterior approach, continuous infusion by catheter (including catheter placement), including imaging guidance, when performed
64450	Injection(s), anesthetic agent(s) and/or steroid; other peripheral nerve or

	branch
64454	Injection(s), anesthetic agent(s) and/or steroid; genicular nerve branches, including imaging guidance, when performed
64455	Injection(s), anesthetic agent(s) and/or steroid; plantar common digital nerve(s) (eg Morton's neuroma)

References

Peripheral neuropathy

1. Bril V, England J, Franklin GM, et al.; American Academy of Neurology; American Association of Neuromuscular and Electrodiagnostic Medicine; American Academy of Physical Medicine and Rehabilitation. Evidence-based guideline: Treatment of painful diabetic neuropathy: report of the American Academy of Neurology, the American Association of Neuromuscular and Electrodiagnostic Medicine, and the American Academy of Physical Medicine and Rehabilitation. *Neurology*. 2011 May 17;76(20):1758-65.
2. American Society of Anesthesiologists Task Force on Chronic Pain Management American Society of Regional Anesthesia and Pain Medicine. Practice guidelines for chronic pain management: an updated report by the American Society of Anesthesiologists Task Force on Chronic Pain Management and the American Society of Regional Anesthesia and Pain Medicine. Anesthesiology. 2010; 112(4):810-833.
3. Xu L, Sun Z, Casserly E, Nasr C, Cheng J, Xu J. Advances in Interventional Therapies for Painful Diabetic Neuropathy: A Systematic Review. *Anesth Analg*. 2022 Jun 1;134(6):1215-1228.
4. Lai HY, Foo LL, Lim SM, Yong CF, Loh PS, Chaw SH, Hasan MS, Wang CY. The hemodynamic and pain impact of peripheral nerve block versus spinal anesthesia in diabetic patients undergoing diabetic foot surgery. Clin Auton Res. 2020 Feb;30(1):53-60.
5. Poncelet AN. An algorithm for the evaluation of peripheral neuropathy. *Am Fam Physician*. 1998 Feb 15;57(4):755-64.
6. Candido K, Kusper T. Regional Anesthesia and the Patient with Preexisting Neuropathy. Anesthesiology News Special Edition 2018. November 2, 2018. Available at: https://www.anesthesiologynews.com/. Accessed 03/18/2024.
7. England JD, Asbury AK. Peripheral neuropathy. Lancet. 2004 Jun 26;363(9427):2151-61.
8. Collins MP. The vasculitic neuropathies: an update. *Curr Opin Neurol*. 2012 Oct;25(5):573-85.

Mononeuritis multiplex

9. Kedlaya D. Mononeuritis Multiplex. Medscape January 6, 2021. Available at: https://emedicine.medscape.com/article/316024-overview?form=fpf . Accessed 03/18/2024.
10. Zhang YS, Sun AP, Chen L, Dong RF, Zhong YF, Zhang J. Nerve biopsy findings contribute to diagnosis of multiple mononeuropathy: 78% of findings support clinical diagnosis. Neural Regen Res. 2015 Jan;10(1):112-8.
11. Sheikh AAE, Sheikh AB, Tariq U, Siddiqui FS, Malik WT, Rajput HM, Ahmad I. Paraneoplastic Mononeuritis Multiplex: A Unique Presentation of Non-Hodgkin Lymphoma. *Cureus*. 2018 Jun 26;10(6):e2885.
12. Blaes F. Diagnosis and therapeutic options for peripheral vasculitic neuropathy. Ther Adv *Musculoskelet Dis*. 2015 Apr;7(2):45-55.
13. Collins MP, Dyck PJ, Gronseth GS, et al.; Peripheral Nerve Society. Peripheral Nerve Society Guideline on the classification, diagnosis, investigation, and immunosuppressive therapy of non-systemic vasculitic neuropathy: executive summary. *J Peripher Nerv Syst*. 2010 Sep;15(3):176-84.
14. Robinson-Papp J, Simpson DM. Neuromuscular diseases associated with HIV-1 infection. *Muscle Nerve*. 2009 Dec;40(6):1043-53.
15. Palma P, Costa A, Duro R, et al. Mononeuritis multiplex: an uncommon neurological manifestation of cytomegalovirus reactivation in an HIV-infected patient. *BMC Infect Dis*. 2018 Nov 12. 18 (1):554.
16. Gorson KC. Vasculitic neuropathies: an update. *Neurologist*. 2007 Jan. 13(1):12-9.

17. Zachary Simmons, 14 - Treatment and Management of Autoimmune Neuropathies, Editor(s): Tulio E. Bertorini, Neuromuscular Disorders: Treatment and Management, W.B. Saunders, 2011, Pages 215-235, ISBN 9781437703726, https://doi.org/10.1016/B978-1-4377-0372-6.00014-1.

Complex regional pain syndrome

18. Misidou C, Papagoras C. Complex Regional Pain Syndrome: An update. *Mediterr J Rheumatol*. 2019 Mar 28;30(1):16-25.
19. Merskey H, Addison RG, Beric A, et al. Detailed descriptions of pain syndromes. In: Merskey H, Bogduk N, editors. *Classification of Chronic Pain: Descriptions of Chronic Pain Syndromes and Definitions of Pain Terms*, 2nd edn Seattle: IASP Press: 1994.
20. Merskey H, Bogduk K: Classification of chronic pain: definitions of chronic pain syndromes and definition of pain terms. Seattle: IASP Press; 1994.
21. Elsharydah A, Loo N, Minhajuddin A, Kandil E. Complex regional pain syndrome type 1 predictors- Epidemiological perspective from a national database analysis. *J Clin Anesth.* 2017;39:34-7.
22. Goh EL, Chidambaram S, Ma D. Complex regional pain syndrome: a recent update. *Burns Trauma*. 2017 Jan 19;5:2.
23. Bussa M, Mascaro A, Cuffaro L, Rinaldi S. Adult complex regional pain syndrome type I: A narrative review. *PMR.* 2017;9:707–19.
24. Brunner F, Lienhardt SB, Kissling RO, Bachmann LM, Weber U. Diagnostic criteria and follow-up parameters in complex regional pain syndrome type I--a Delphi survey. *Eur J Pain*. 2008 Jan. 12(1):48-52.
25. Harden R, Bruehl S. Diagnosis of complex regional pain syndrome: signs, symptoms, and new empirically derived diagnostic criteria. *Clin J Pain* 2006;22:415–9.
26. Manchikanti L, Singh V, Kloth D, et al. Interventional techniques in the management of chronic pain: Part 2.0. *Pain Physician*. 2001 Jan;4(1):24-96.
27. Harden R, Bruehl S, Stanton-Hicks M, Wilson P. Proposed new diagnostic criteria for complex regional pain syndrome. *Pain Med* 2007;8:326–31.
28. Sandroni P, Benrud-Larson L, McClelland R, Low P. Complex regional pain syndrome type I: incidence and prevalence in Olmsted county, a population-based study. *Pain* 2003;103:199–207.
29. De Mos M, de Bruijn AG, Huygen FJ, et al. The incidence of complex regional pain syndrome: a population-based study. *Pain* 2007;129:12–20.
30. Elsharydah A, Loo N, Minhajuddin A, Kandil E. Complex regional pain syndrome type 1 predictors-Epidemiological perspective from a national database analysis. *J Clin Anesth* 2017;39:34–7.
31. Van de Vusse A, Stomp-van den Berg S, Kessels A, Weber W. Randomised controlled trial of gabapentin in complex regional pain syndrome type 1. *BMC Neurol.* 2004;4:13.
32. Wertli M, Kessels A, Perez R, Bachmann L, Brunner F. Rational pain management in complex regional pain syndrome 1 (CRPS 1)—A network meta-analysis. *Pain Med* 2014;15:1575–89.
33. Perez R, Zollinger P, Dijkstra P, et al. Evidence based guidelines for complex regional pain syndrome type 1. *BMC Neurol.* 2010;10:20.
34. Cepeda MS, Lau J, Carr DB: Defining the therapeutic role of local anesthetic sympathetic blockade in complex regional pain syndrome: a narrative and systematic review. *Clin J Pain.* 2002, 18:216-233.
35. Brunner F, Lienhardt SB, Kissling RO, Bachmann LM, Weber U. Diagnostic criteria and follow-up parameters in complex regional pain syndrome type I--a Delphi survey. *Eur J Pain*. 2008 Jan;12(1):48-52.
36. Harden, R.N.; Oaklander, A.L.; Burton, et al. Complex regional pain syndrome: Practical diagnostic and treatment guidelines, 4th edition. *Pain Med*. 2013, 14, 180–229.
37. Harden RN, McCabe CS, et al. Complex Regional Pain Syndrome: Practical Diagnostic and Treatment Guidelines, 5th Edition. *Pain Med*. 2022 Jun 10;23(Suppl 1):S1-S53.

38. Bruehl S, Maihöfner C, Stanton-Hicks M, et al. Complex regional pain syndrome: evidence for warm and cold subtypes in a large prospective clinical sample. *Pain*. 2016 Aug;157(8):1674-81.
39. O'Connell NE, Wand BM, Gibson W, Carr DB, et al. Local anaesthetic sympathetic blockade for complex regional pain syndrome. Cochrane Database Syst Rev. 2016 Jul 28;7(7):CD004598.
40. Bruehl S. An update on the pathophysiology of complex regional pain syndrome. *Anesthesiology*. 2010 Sep;113(3):713-25.
41. Nelson DV, Stacey BR. Interventional therapies in the management of complex regional pain syndrome. Clin J Pain. 2006 Jun;22(5):438-42.
42. Ghaly L, Bargnes V, Rahman S, et al. Interventional Treatment of Complex Regional Pain Syndrome. *Biomedicines*. 2023 Aug 14;11(8):2263.
43. Yucel, I, Demiraran Y, Ozturan, K., et al. Complex regional pain syndrome type I: Efficacy of stellate ganglion blockade. *J. Orthop. Traumatol*. 2009;(10):179–183.
44. Cheng J, Salmasi V, You J, et al. Outcomes of Sympathetic Blocks in the Management of Complex Regional Pain Syndrome: A Retrospective Cohort Study. *Anesthesiology.* 2019, 131, 883–893.
45. Deer TR, Levy RM, Kramer J, et al. Dorsal root ganglion stimulation yielded higher treatment success rate for complex regional pain syndrome and causalgia at 3 and 12 months: A randomized comparative trial. *Pain*. 2017;158(4):669–81.
46. Deer TR, Pope JE, Lamer TJ, et al. The Neuromodulation Appropriateness Consensus Committee on Best Practices for Dorsal Root Ganglion Stimulation. *Neuromodulation*. 2019;22(1):1–35.
47. Piraccini E, Munakomi S, Chang KV. Stellate Ganglion Blocks. [Updated 2023 Aug 13]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK507798/.
48. Alexander CE, De Jesus O, Varacallo M. Lumbar Sympathetic Block. [Updated 2023 Aug 23]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK431107/.
49. Cepeda MS, Lau J, Carr DB: Defining the therapeutic role of local anesthetic sympathetic blockade in complex regional pain syndrome: a narrative and systematic review. *Clin J Pain*. 2002, 18:216-233.
50. Cepeda MS, Carr DB, Lau J. Local anesthetic sympathetic blockade for complex regional pain syndrome. Cochrane Database Syst Rev. 2005 Oct 19;(4):CD004598. Update in: Cochrane Database Syst Rev. 2013;8:CD004598.
51. Stanton TR, Wand BM, Carr DB, et al. Local anaesthetic sympathetic blockade for complex regional pain syndrome. Cochrane Database Syst Rev. 2013 Aug 19;(8):CD004598. Update in: Cochrane Database Syst Rev. 2016;7:CD004598. PMID: 23959684.
52. O'Connell NE, Wand BM, Gibson W, et al. Local anaesthetic sympathetic blockade for complex regional pain syndrome. Cochrane Database Syst Rev. 2016 Jul 28;7(7):CD004598.

Occipital Neuralgia

53. The International Classification of Headache Disorders. 3rd edition. 9. Vol. 33. Cephalalgia: An International J Headache; 2013. pp. 629–808. (beta version).
54. Dworkin RH, Turk DC, Wyrwich KW, et al. Interpreting the clinical importance of treatment outcomes in chronic pain clinical trials: IMMPACT recommendations. *J Pain*. 2008 Feb;9(2):105-21.
55. Choi I, Jeon SR. Neuralgias of the Head: Occipital Neuralgia. *J Korean Med Sci*. 2016 Apr;31(4):479-88.
56. Bond BM, Kinslow C. Improvement in clinical outcomes after dry needling in a patient with occipital neuralgia. *J Can Chiropr Assoc*. 2015 Jun;59(2):101-10.
57. Dougherty C. Occipital neuralgia. *Current Pain and Headache Reports*. 2014;18(5):411.
58. Djavaherian DM, Guthmiller KB. Occipital Neuralgia. [Updated 2023 Mar 6]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK538281/.

59. Swanson D, Guedry R, Boudreaux Met al. An Update on the Diagnosis, Treatment, and Management of Occipital Neuralgia. *J Craniofac Surg*. 2022 May 1;33(3):779-783.
60. Vanelderen P, Lataster A, Levy R, et al. Occipital neuralgia: Evidence-based medicine. *Pain Prac.* 2010; 10(2):137-144.
61. Kuhn WF, Kuhn SC, Gilberstadt H. Occipital neuralgias: clinical recognition of a complicated headache. A case series and literature review. *J Orofac Pain.* 1997;11:158–165.
62. American Association of Neurological Surgeons (AANS). Occipital Neuralgia. © 2024 American Association of Neurological Surgeons. Available at: https://www.aans.org/en/Patients/Neurosurgical-Conditions-and-Treatments/Occipital-Neuralgia. Accessed 03/27/2024.
63. Mathew PG, Najib U, Khaled S, Krel R. Prevalence of Occipital Neuralgia at a Community Hospital-based Headache Clinic. *Neurol Clin Pract*. 2021 Feb;11(1):6-12.
64. Sahai-Srivastava S, Zheng L. Occipital neuralgia with and without migraine: difference in pain characteristics and risk factors. *Headache*. 2011 Jan;51(1):124-8.
65. Lavin PJ, Workman R. Cushing syndrome induced by serial occipital nerve blocks containing corticosteroids. *Headache*. 2001 Oct;41(9):902-4.
66. Koopman JS, Dieleman JP, Huygen FJ, et al. Incidence of facial pain in the general population. *Pain*. 2009;147(1–3):122–127.
67. Yun JM, Lee SH, Cho JH, Kim KW, Ha IH. The effects of acupuncture on occipital neuralgia: a systematic review and meta-analysis. *BMC Complement Med Ther*. 2020 Jun 3;20(1):171.
68. Hoffman LM, Abd-Elsayed A, Burroughs TJ, Sachdeva H. Treatment of Occipital Neuralgia by Thermal Radiofrequency Ablation. *Ochsner J*. 2018 Fall;18(3):209-214.
69. Wang S, Han X, Zhao C, Luo F. Occipital Nerve Blockade for the Treatment of Occipital Neuralgia-Like Acute Postcraniotomy Headache: A Retrospective Study. *Pain Res Manag*. 2021 Apr 19;2021:5572121.
70. Keifer OP Jr, Diaz A, Campbell M, et al. Occipital Nerve Stimulation for the Treatment of Refractory Occipital Neuralgia: A Case Series. *World Neurosurg*. 2017 Sep;105:599-604.
71. Sakharpe AK, Cascella M. Occipital Nerve Stimulation. [Updated 2023 Jul 3]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK553129/
72. Liu AJ, Ji HJ, Jiao YC, Zhang ZW. Peripheral Nerve Stimulation for Occipital Neuralgia. Chin Med J (Engl). 2015 Sep 20;128(18):2553-4.
73. Williams V. Occipital Neuralgia. *US Pharm*. 2020;45(1):30-33.
74. Ashkenazi A, Blumenfeld A, Napchan U, et al. Peripheral nerve blocks and trigger point injections in headache management –A systematic review and suggestions for future research. *Headache*. 2010;50: 943-952.
75. Ashkenazi A, Blumenfeld A, Napchan U, et al.; Interventional Procedures Special Interest Section of the American. Peripheral nerve blocks and trigger point injections in headache management - a systematic review and suggestions for future research. *Headache*. 2010 Jun;50(6):943-52.
76. Blumenfeld A, Ashkenazi A, Grosberg B, et al. Patterns of use of peripheral nerve blocks and trigger point injections among headache practitioners in the USA: Results of the American Headache Society Interventional Procedure Survey (AHS-IPS). *Headache*. 2010 Jun;50(6):937-42.
77. Szperka CL, Gelfand AA, Hershey AD. Patterns of Use of Peripheral Nerve Blocks and Trigger Point Injections for Pediatric Headache: Results of a Survey of the American Headache Society Pediatric and Adolescent Section. *Headache*. 2016 Nov;56(10):1597-1607.
78. Blumenfeld A, Ashkenazi A, Napchan U, et al. Expert consensus recommendations for the performance of peripheral nerve blocks for headaches--a narrative review. *Headache*. 2013 Mar;53(3):437-46.
79. Shanthanna H, Busse JW, Thabane L, Paul J, Couban R, Choudhary H, Kaushal A, Suzumura E, Kim I, Harsha P. Local anesthetic injections with or without steroid for chronic non-cancer pain: a protocol for a systematic review and meta-analysis of randomized controlled trials. *Syst Rev*. 2016 Feb 1;5:18.

80. Afridi SK, Shields KG, Bhola R, Goadsby PJ. Greater occipital nerve injection in primary headache syndromes--prolonged effects from a single injection. *Pain*. 2006 May;122(1-2):126-9.
81. Chowdhury D, Datta D, Mundra A. Role of Greater Occipital Nerve Block in Headache Disorders; A Narrative Review. *Neurol India*. 2021;69:S228-56.
82. Madore S, Ross MK, Hayden A. The Use of Occipital Nerve Blocks & Trigger Point Injections in Headaches with Occipital Tenderness. *Osteopathic Family Physician*. 2017 Jan-Feb;9(1):12-16.
83. Seeger TA, Orr S, Bodell L, Lockyer L, Rajapakse T, Barlow KM. Occipital nerve blocks for pediatric posttraumatic headache. J Child Neurol. 2015;30(9):1142–6.
84. Hascalovici JR, Robbins MS. Peripheral Nerve Blocks for the Treatment of Headache in Older Adults: A Retrospective Study. Headache. 2017 Jan;57(1):80-86.
85. Vanderhoek MD, Hoang HT, Goff B. Ultrasound-guided greater occipital nerve blocks and pulsed radiofrequency ablation for diagnosis and treatment of occipital neuralgia. Anesth Pain Med. 2013 Sep;3(2):256-9.
86. Kastler A, Onana Y, Comte A, et al. A simplified CT-guided approach for greater occipital nerve infiltration in the management of occipital neuralgia. *Eur Radiol*. 2015 Aug;25(8):2512-8.
87. Kuhn WF, Kuhn SC, Gilberstadt H. Occipital neuralgias: clinical recognition of a complicated headache. A case series and literature review. *J Orofac Pain*. 1997;11:158–165.
88. Kissoon NR, O'Brien TG, Bendel MA, et al. Comparative Effectiveness of Landmark-guided Greater Occipital Nerve (GON) Block at the Superior Nuchal Line Versus Ultrasound-guided GON Block at the Level of C2: A Randomized Clinical Trial (RCT). *Clin J Pain*. 2022 Feb 7;38(4):271-278.
89. Choi HJ, Oh IH, Choi SK, Lim YJ. Clinical outcomes of pulsed radiofrequency neuromodulation for the treatment of occipital neuralgia. *J Korean Neurosurg Soc*. 2012 May;51(5):281-5.
90. Urits I, Schwartz RH, Patel P, et al. A Review of the Recent Findings in Minimally Invasive Treatment Options for the Management of Occipital Neuralgia. *Neurol Ther*. 2020 Dec;9(2):229-241.
91. Juškys R, Šustickas G. Effectiveness of treatment of occipital neuralgia using the nerve block technique: a prospective analysis of 44 patients. *Acta Med Litu*. 2018;25(2):53–60.
92. Tobin J, Flitman S. Occipital nerve blocks: when and what to inject? *Headach*e. 2009 Nov-Dec;49(10):1521-33.
93. Evans AG, Joseph KS, Samouil MM, et al. Nerve blocks for occipital headaches: A systematic review and meta-analysis. *J Anaesthesiol Clin Pharmacol*. 2023 Apr-Jun;39(2):170-180.
94. Na SH, Kim TW, Oh S-Y, Kweon TD, Yoon KB, Yoon DM. Ultrasonic doppler flowmeter-guided occipital nerve block. *Korean J Anesthesiol.* 2010;59:394-7.
95. Cohen SP, Peterlin BL, Fulton L, et al. Randomized, double-blind, comparative-effectiveness study comparing pulsed radiofrequency to steroid injections for occipital neuralgia or migraine with occipital nerve tenderness. *Pain*. 2015 Dec;156(12):2585-2594.
96. Huang JH, Galvagno SM Jr, Hameed M, et al. Occipital nerve pulsed radiofrequency treatment: a multi-center study evaluating predictors of outcome. *Pain Med*. 2012 Apr;13(4):489-97.
97. Pietramaggiori G, Scherer S. Minimally Invasive Nerve- and Muscle-Sparing Surgical Decompression for Occipital Neuralgia. *Plast Reconstr Surg*. 2023 Jan 1;151(1):169-177.
98. Ducic I, Hartmann EC, Larson EE. Indications and outcomes for surgical treatment of patients with chronic migraine headaches caused by occipital neuralgia. *Plast Reconstr Surg*. 2009;123:1453–1461.
99. Ascha M, Kurlander DE, Sattar A, et al. In-depth review of symptoms, triggers, and treatment of occipital migraine headaches (site IV). *Plast Reconstr Surg*. 2017;139:1333e–1342e.
100. Remy K, Hazewinkel MH, Mullen C, et al. Reoperation Following Primary Greater Occipital Nerve Decompression Surgery: Incidence, Risk Factors and Outcomes. *Plast Reconstr Surg*. 2024 Apr 9.

101. Martelletti P, Giamberardino MA, Mitsikostas DD. Greater occipital nerve as target for refractory chronic headaches: from corticosteroid block to invasive neurostimulation and back. *Expert Rev Neurother*. 2016;16:865–6.
102. Hoffman LM, Abd-Elsayed A, Burroughs TJ, Sachdeva H. Treatment of Occipital Neuralgia by Thermal Radiofrequency Ablation. *Ochsner J*. 2018 Fall;18(3):209-214.
103. Erdine S, Ozyalcin NS, Cimen A, et al. Comparison of pulsed radiofrequency with conventional radiofrequency in the treatment of idiopathic trigeminal neuralgia. *Eur J Pain*. 2007. April;11(3):309-313.
104. Abd-Elsayed A, Yapo SA, Cao NN, Keith MK, Fiala KJ. Radiofrequency ablation of the occipital nerves for treatment of neuralgias and headache. *Pain Pract*. 2024 Jan;24(1):18-2.

Policy history

Origination date: 06/01/2024
Review/Approval(s): Technology Assessment Committee: 03/26/2024 (policy origination)

Not all services mentioned in this policy are covered for all products or employer groups. Coverage is based upon the terms of a member's particular benefit plan which may contain its own specific provisions for coverage and exclusions regardless of medical necessity. Please consult the product's Evidence of Coverage for exclusions or other benefit limitations applicable to this service or supply. If there is any discrepancy between this policy and a member's benefit plan, the provisions of the benefit plan will govern. However, applicable state mandates take precedence with respect to fully insured plans and self-funded non-ERISA (e.g., government, school boards, church) plans. Unless otherwise specifically excluded, federal mandates will apply to all plans.