Pain Medicine Case Reports

ISSN 2768-5152
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Volume 10, Number 2, pp. 101-106

Efficacy of Nerve Blocks for Posttraumatic Trigeminal Autonomic Cephalalgias: A Case Series

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Background: Posttraumatic headaches (PTHs) frequently occur following mild traumatic brain injury and may occasionally present with features of trigeminal autonomic cephalalgias (TACs). PTH-TAC is characterized by unilateral craniofacial pain and autonomic symptoms and can be significantly debilitating. Management of this headache subtype can be particularly challenging as it can be refractory to medical therapies. Currently, there is a paucity of evidence on the optimum medical management for this condition.

Objectives: This case series evaluated the effectiveness of nerve blocks in managing PTH with TAC features, highlighting their therapeutic potential for this debilitating headache phenotype.

Setting: In this retrospective study, we identified 4 patients seen at St. Michael's clinic from January 2021 to December 2023.

Methods: We identified 4 patients meeting the International Classification of Headache Disorders diagnostic criteria for PTH, presenting with TAC features. They initially failed medical management and later underwent anesthetic nerve block procedures, including occipital, supraorbital, and supratrochlear nerve blocks. Clinical outcomes, including changes in headache frequency, pain intensity using a standard 11-point Numeric Rating Scale (NRS-11), where 0 indicates no pain, and 10 indicates the worst pain imaginable., and autonomic symptoms, were documented over a 2 month follow-up period.

Results: All patients demonstrated significant improvement, with reductions in headache intensity and frequency > 50% in 2 cases and near-complete resolution in 2 cases recorded at the 2 month follow-up. Associated autonomic symptoms, including nasal congestion, tearing, and periorbital pain, also showed marked improvement. No significant adverse effects were reported during or after the procedure.

Limitations: This is a small case series with a limited follow-up period (2 months).

Conclusions: Nerve blocks represent a potentially safe and effective intervention for PTH with TAC-like features, providing both rapid and sustained relief for patients with refractory symptoms. However, we need larger prospective cohort studies with extended follow-up periods to confirm the findings of this small case series. Such studies will help standardize evidence-based treatment protocols for this challenging subset of headaches.

Key words: mTBI, mild traumatic brain injury, TAC, trigeminal autonomic cephalalgia, PTH, posttraumatic headache, PT-TAC, posttraumatic trigeminal autonomic cephalalgia, ICHD-3, International Classification of Headache Disorders 3 criteria

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Disclaimer: There was no external funding in the preparation of this manuscript.
Conflict of interest: Each author certifies that he or she, or a member of his or her immediate family, has no commercial association (i.e., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted manuscript.
Patient consent for publication: this study represents a retrospective case series of four fully anonymized patients, with no identifiable information included. In accordance with applicable regulations for de-identified data, this work does not constitute human subjects research requiring informed consent.
This case report adheres to CARE Guidelines and the CARE Checklist has been provided to the journal editor.
Accepted: 2025-12-14, Published: 2026-04-30

BACKGROUND

Posttraumatic headache (PTH) occurs in approximately one-half to two-thirds of patients with mild traumatic brain injury (mTBI). According to the Third Edition of the International Classification of Headache Disorders (ICHD-3) criteria, PTHs are classified as a secondary headache that must develop within 7 days following trauma or injury to the head (1,2). The most common headache phenotypes following mTBI are migraine and tension-type headaches. Less frequently, however, PTH can present with features of trigeminal autonomic cephalalgias (TACs), a group of rare but disabling headache disorders that include cluster headache, paroxysmal hemicrania, hemicrania continua, short-lasting unilateral neuralgiform headache attacks with conjunctival injection and tearing (SUNCT), and short-lasting unilateral neuralgiform headache attacks with cranial autonomic symptoms (SUNA) (1,2).

Posttraumatic trigeminal autonomic cephalalgias (PT-TACs) have been reported in approximately 24% of patients following mTBI (3). These headaches can present phenotypically with mixed features of both TACs and migraines. Common characteristics include fixed unilateral temporoparietal "ice-pick" pain, often accompanied by autonomic symptoms, such as nasal congestion, rhinorrhea, facial sweating, conjunctival injection, or lacrimation (4). PT-TACs are particularly challenging to manage, as they are frequently refractory to analgesics and prophylactic therapies. This treatment resistance often results in substantial disability and impaired quality of life for affected patients.

The current literature on PTH management suggests adapting the treatment to the headache phenotype, but definitive guidelines for PT-TAC are lacking. Consequently, evidence-based options for PT-TAC are limited, leaving patients vulnerable to prolonged illness and significant functional impairment. Peripheral nerve blocks have been used as a promising alternative for the management of PTHs refractory to medications (5,6). However, their use in PT-TAC has not been documented.

The purpose of this case series is to highlight the potential of nerve blocks as an effective and simple therapeutic option for managing PT-TAC, aiming to encourage timely and efficacious interventions for this headache subtype.

METHODS

Our case series includes 4 patients who met the diagnostic criteria for mTBI based on the Department of Veterans Affairs/Department of Defense guidelines. Researchers have defined mTBI as a traumatically induced injury and/or physiological disruption of brain function resulting from an external force and followed by one or more of the following: (1) any period of loss of or decreased consciousness; (2) any loss of memory for events immediately before or after the injury (posttraumatic amnesia); (3) any alteration in mental state at the time of injury (e.g., confusion, disorientation, slowed thinking); (4) neurological deficits (e.g., weakness, balance loss, sensory changes) that may be transient; or (5) an intracranial lesion.

The diagnosis of PTH was established using the ICHD-3, which defines it as a secondary headache developing within 7 days of head trauma. All patients in this series developed PTH with TAC-like features, including unilateral headache with "ice-pick" stabbing pain, nasal congestion, conjunctival injection, or lacrimation (Table 1). Each patient underwent a combination of nerve block procedures chosen based on their symptom patterns, including greater and lesser occipital (GO, LO), third occipital (TO), supraorbital (SO), and supratrochlear (ST) nerve blocks, following previously described protocols (6). A combination of corticosteroids and lidocaine was used in GO, LO nerve blocks, but only lidocaine was used in SO and ST nerve blocks due to the proximity of these nerves to the dermis, where steroids can cause noticeable dermal atrophy. Clinical outcomes were evaluated through patient-reported headache diaries documenting changes in headache intensity and frequency during follow-up.

Outcomes were evaluated based on patient-reported changes in a headache diary (intensity and frequency) during follow-up visits. Headache intensity was recorded using a standard Numeric Rating Scale (NRS-11) where 0 was no headache, and 10 was the worst headache imaginable. Adverse events and complications were monitored and recorded.

Case 1

A 37-year-old woman presented with recurrent, fixed, right-sided headaches that developed after a traumatic brain injury sustained 2 years earlier. The headaches were described as debilitating bouts of short-lasting, stabbing pain occurring once weekly and lasting approximately 15 minutes. The most severe headaches were ranked at 9 out of 10 on the NRS-11. The pain was localized to the right temporoparietal and periorbital areas and was associated with nasal congestion and ip-

silateral scalp numbness. Prodromal symptoms included scalp paresthesia and lightheadedness preceding the headaches.

The headaches began immediately after she was struck on the right side of the head by a heavy object, an event that resulted in loss of consciousness (LOC) for an undetermined duration, followed by partial short-term anterograde amnesia. Initial head imaging was normal. In the early postinjury period, she experienced daily right-sided headaches that progressively worsened into severe stabbing pain accompanied by autonomic symptoms, including nasal congestion and scalp numbness. The headaches occurred spontaneously without identifiable triggers or consistent aggravating or relieving factors. They were refractory to analgesic agents.

Her clinical history was further complicated by a postconcussive syndrome, characterized by dizziness, sleep disturbances, fatigue, and slowed cognitive processing. She also experienced infrequent posttraumatic nonconvulsive seizures, preceded by scalp paresthesias, whole-body weakness, and brief LOC lasting about a minute, followed by postictal confusion.

On examination, the patient had myofascial pain in the shoulder girdle muscles bilaterally, and the range of motion in the head rotation was restricted to the right due to mid and upper cervical spine pain. Digital pressure over the right cervical facets elicited tenderness.

The patient was initiated on levetiracetam for seizure prophylaxis. After a failed trial of amitriptyline, she underwent bilateral third, greater, and lesser occipital nerve blocks. Following the procedure, she reported 0 to 1 out of 10 pain on the NRS-11, which was around a 90% reduction in headache intensity.

On a 2-month follow-up, she reported a significant and sustained decrease in both headache intensity and frequency, with near-complete resolution of symptoms.

Case 2

A 57-year-old man presented with new-onset headaches following a mTBI sustained 2 months earlier. The injury occurred when a tree trunk broke through his car's windshield and struck him in the face. Immediately postinjury, he developed a confusional state lasting approximately 6 hours, though he denied complete LOC. He was evaluated in an emergency room and discharged in stable condition. Imaging showed no evidence of intracranial bleeding, structural brain pathology, or cranial fractures.

Within the first week following the injury, the patient reported left-sided occipitotemporal headaches characterized by severe "ice-pick" stabbing pain lasting 5-10 minutes, occurring intermittently, primarily at night. The pain intensity was rated at 8 out of 10 on the NRS-11 at its worst, often waking him from sleep. Associated autonomic symptoms included ipsilateral eye tearing during attacks and a foreign body sensation in the left eye at the onset of each headache. He had no prior history of headaches and no family history of headaches.

Table 1. Summary of clinical characteristics, interventions, and outcomes for patients with PT-TACs

Case	Age/ Gender	Mechanism of Injury	Headache Features	Associated Symptoms	Initial Treatment	Nerve Blocks Performed	Outcome at 2 Mo
1	37/W	Blunt trauma to right temporal region; LOC + amnesia	Unilateral right-sided stabbing pain (9/10); temporoparietal and periorbital	Nasal congestion, scalp numbness	Amitriptyline (failed)	Right GO, LO, TO, nerve blocks	Ninety percent reduction in pain; complete resolution of TAC symptoms
2	57/M	Facial trauma by tree trunk; altered mental state	Left occipitotemporal stabbing pain (8/10); nocturnal attacks	Eye tearing, foreign body eye sensation	Amitriptyline (failed)	Left GO, LO, SO, ST, TO + C3/C4 medial branch blocks	Fifty-percent reduction in headache and cervical pain, and TAC symptoms
3	50/W	Head trauma from golf ball; no LOC	Alternating then left-sided stabbing periorbital pain (9/10)	Conjunctival injection, lacrimation	Amitriptyline (partial response)	Bilateral GO, LO, TO, SO, ST nerve blocks	Near-complete resolution of pain and TAC symptoms
4	77/W	MVA with brief LOC; post-concussive symptoms	Left retroorbital stabbing pain (8/10); also, daily holocranial migrainous headaches	Nasal congestion, nausea, photophobia, visual aura	Venlafaxine (failed)	Bilateral GO, LO, TO, SO, ST nerve blocks	Seventy-percent reduction in TAC and daily headache intensity

His medical history was significant for a postconcussion syndrome exhibiting mainly language problems (i.e., word-finding difficulties), and nonspecific dizziness. He also complained of unrelated spinal pain and a history of prior spine surgery. On examination, myofascial pain was noted in the left posterolateral cervical region, with tenderness on digital palpation of the left C2-C4 cervical facets. The range of motion in left head rotation was limited.

The patient was diagnosed with PT-TAC with features of hemicrania continua (e.g., foreign body sensation in the ipsilateral eye). Additionally, his left-sided cervicalgia was attributed to posttraumatic cervical facet arthropathy.

Initial treatment with amitriptyline 10 mg daily was ineffective. He subsequently underwent GO, LO, SO, and ST nerve blocks on the left side, which completely resolved his headaches. For cervicalgia, he received TO and medial branch nerve blocks at C3 and C4 levels, under fluoroscopy, which resolved the cervical and myofascial pain.

At the 2-month follow-up visit, the patient reported a 50% reduction in headache frequency and intensity, with pain levels decreasing to 3 out of 10 on the NRS-11 His cervical pain intensity was also reduced by 50%. He was recommended to undergo radiofrequency ablation (RFA) but declined this suggestion.

Case 3

A 50-year-old woman presented with severe refractory headaches that began following head trauma 3 months earlier. The injury occurred when she was struck on the head by a golf ball. Computed tomography (CT) head done right after was normal. She immediately developed unilateral headaches, which initially alternated sides but later localized to the left frontal and periorbital regions. The pain, initially throbbing, evolved into stabbing episodes occurring several times daily and lasting for a few minutes. These episodes were associated with conjunctival injection and tearing in the ipsilateral eye. The pain at its worst intensity was described as 9 out of 10 on the NRS-11.

The patient also exhibited symptoms of postconcussive syndrome, including cognitive impairment, dizziness, noise sensitivity, fatigue, irritability, mood changes, blurred vision, and difficulties with memory and concentration. Her medical history was significant for end-stage renal disease requiring hemodialysis. She reported daily ibuprofen use, which may have contributed to the intensity of her headaches, and it was discontinued.

On evaluation, she appeared somnolent and sluggish in her responses. Posttraumatic amnesia limited her ability to recall details of the trauma. Physical examination revealed bilateral myofascial pain involving the paraspinal muscles in the cervical and thoracic regions, as well as the shoulder girdle muscles.

Initial treatment with amitriptyline alleviated the migrainous component of her daily headaches, but the TAC component of severe unilateral pain attacks with autonomic symptoms persisted. Further management involved bilateral GO, LO, and TO nerve blocks, along with bilateral SO and ST nerve blocks. Following the procedure, the patient reported an immediate reduction in pain intensity from 7 out of 10 to 1 out of 10 on the NRS-11.

At a 2-month follow-up visit, the patient reported a near-complete resolution of her TAC headaches.

Case 4

A 77-year-old woman presented with severe headaches and spinal pain following a high-speed motor vehicle accident that resulted in mTBI with a brief LOC and CT head negative. She described excruciating unilateral left retroorbital stabbing pain occurring 3 times per week, often accompanied by nasal congestion, nausea, and photophobia. Visual auras, characterized as "visual fortifications," preceded the pain. In addition, she reported holocephalic daily migrainous headaches. Her pain was ranked at 8 out of 10 on the NRS-11 at its worst.

She also developed cognitive problems in temporal association with her injury, which were consistent with a postconcussion syndrome. These included mental fogginess, slowed thinking, concentration difficulties, and short-term memory deficits. Her headaches were exacerbated by positional changes and loud sounds. Her postinjury symptoms were further complicated by cervical spinal pain and radicular pain affecting both upper extremities.

On evaluation, the patient exhibited impaired smooth pursuits, convergence insufficiency, and bilateral hearing loss. Cervical pain was noted with movement, and sensory deficits were present in the right upper extremity.

Initial treatment with venlafaxine, followed by trazodone, failed to alleviate her symptoms. Headache management was subsequently pursued with bilateral

GO, LO, and TO nerve blocks, as well as bilateral SO and ST nerve blocks. The patient reported immediate relief postprocedure.

A follow-up at 2 months revealed a 70% reduction in headache pain. Both the daily migrainous headaches and PT-TAC components showed significant improvement.

DISCUSSION

PTHs are a frequent and debilitating consequence of mTBI. In the United States alone, approximately one million individuals sustain mTBIs annually, with 30% to 90% of patients developing PTHs (7). All 4 patients in this series met the ICHD-3 criteria for PTH. Studies have reported significant overlap between headache phenotypes in many patients. The most commonly reported PTH phenotypes are migraine and tension-type headaches, accounting for nearly 80% of the PTHs (7,8). In a couple of military cohorts reported by Lyons et al (8), TACs comprised as much as one-third of personnel with blast injuries and postconcussions. In our experience, the incidence of TAC among PTH cases is much smaller.

TACs are characterized by unilateral pain, most often "ice-pick" in character, localized to the orbital, SO, or temporal areas, and accompanied by autonomic features, such as lacrimation, nasal congestion, rhinorrhea, or conjunctival injection (1). This group of disorders includes cluster headache, paroxysmal hemicrania, hemicrania continua, and SUNCT or SUNA. TACs are among the most severe and disabling pain disorders due to their excruciating pain intensity (9).

The mechanisms underlying PTH, particularly those with TAC-like features, remain incompletely understood. Proposed mechanisms include central sensitization, impaired synaptic remodeling, wind-up, and functional disruption of descending inhibitory pain pathways within the trigeminal-cervical complex (10). These mechanisms may involve axonal injury, oxidative stress, and neuroinflammation, leading to persistent sensitization of nociceptive pathways and hyperexcitability involving the trigeminal system (11). Evidence from recent studies (11,12) suggests that the convergence of cervical and trigeminal sensory pathways may also play a role in perpetuating headache symptoms in PTH.

Despite increasing recognition of PTH with TAC features, effective treatment options remain limited, particularly for refractory cases. Indomethacin, a potent nonsteroidal anti-inflammatory drug, is effective in some cases, particularly those resembling hemicrania continua or paroxysmal hemicrania (13). However, its clinical utility is often limited by significant gastrointestinal and renal side effects, requiring cautious use for only short periods.

In addition to indomethacin, various pharmacological therapies are available for managing TACs. Acute treatments include subcutaneous sumatriptan and high-flow oxygen, both of which are effective in cluster headaches. Preventive therapies for cluster headaches often rely on verapamil, a calcium channel blocker requiring careful monitoring due to potential cardiac side effects, and lithium, which is effective in chronic cluster headache forms. Emerging therapies include monoclonal antibodies targeting calcitonin gene-related peptide pathways, such as galcanezumab, which have shown promise in cluster headache prevention (14). However, it is important to mention that there are no therapeutic studies dedicated to PT-TACs, and therapeutic decisions rely primarily on extrapolating outcomes from nontraumatic cases.

Other interventional approaches for TACs include sphenopalatine ganglion (SPG) blocks, which have demonstrated partial efficacy in reducing autonomic symptoms and headache frequency in refractory cases of cluster headaches, with a reduction in attack frequency and severity (15). However, no studies are available for posttraumatic cases. SPG blocks have also been used to treat trigeminal neuralgia, migraines, and postdural puncture headaches, with varying degrees of success. While SPG blocks are generally considered safe, they require interventional training. Simpler nerve blocks, targeting GO, LO, and TO nerves, as well as SO and ST nerves, have emerged as promising interventions for PTHs (6). However, we are not aware of any reports using them for TACs.

Additionally, RFA has shown promise in treating refractory headache conditions involving the GO nerve, TO nerve, and other pericranial nerves (16-18). Abd-Elsayed et al (18) demonstrated significant pain reduction in patients with RFA for pericranial nerves and achieved a 90.3% success rate in relieving chronic headaches, including migraines, with significant reductions in pain scores (from 6.6 to 1.9 on the NRS-11) and associated symptoms, while reporting minimal side effects. These findings suggest the potential of RFA as a minimally invasive treatment and also warrant its exploration in PTH subtypes due to its prolonged pain relief and minimal adverse effects when performed by trained specialists (18).

CONCLUSIONS

Our case series highlights the potential role of peripheral nerve blocks as a safe, effective, and well-tolerated intervention for managing PT-TAC, a rare and disabling headache subtype following mTBI. All 4 patients, previously refractory to standard medical therapies, experienced clinically significant reductions in headache intensity and frequency following targeted nerve block procedures, with some achieving near-complete resolution of symptoms. The improvements extended to associated cranial autonomic features, further supporting the utility of this approach. While our findings are limited by the small sample size and short follow-up period, they underscore the need for prospective studies to validate the efficacy, durability, and optimal protocols for nerve blocks in PT-TAC. Broader recognition and early interventional management of this challenging headache phenotype may substantially improve quality of life and reduce long-term disability in affected individuals.

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