Pain Medicine Case Reports

Bilateral Sphenopalatine Ganglion Block in the Management of Headache Associated with Subarachnoid Hemorrhage: Case Report

--Manuscript Draft--

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Corresponding Author:	Harold Acosta, M.D. Instituto Nacional de Cancerología: Instituto Nacional de Cancerologia COLOMBIA
Corresponding Author Secondary Information:	
Corresponding Author's Institution:	Instituto Nacional de Cancerología: Instituto Nacional de Cancerologia
Corresponding Author's Secondary Institution:	
First Author:	Bilena Molina Arteta, M.D., FIPP, MSc
First Author Secondary Information:	
Order of Authors:	Bilena Molina Arteta, M.D., FIPP, MSc
	Harold Acosta Gutiérrez, M.D.
	Natalia Botero Jaramillo, M.D.
Order of Authors Secondary Information:	
Abstract:	Background The sphenopalatine ganglion (SPG) is pivotal in craniofacial pain modulation. SPG blocks have been explored for various headache types, but their efficacy in subarachnoid hemorrhage (SAH)-associated headaches is underreported. Case Presentation A 26-year-old female with chronic migraine and B-cell acute lymphoblastic leukemia experienced severe holocranial headache and focal seizures following a CNS relapse and thrombocytopenia-induced bihemispheric subarachnoid hemorrhage. Initial pharmacological management included hydromorphone, pregabalin, and amitriptyline. A bilateral transnasal SPG block was performed, followed by fluoroscopic-guided SPG block, resulting in significant pain reduction from a numeric analog scale (NAS) score of 10/10 to 3/10. Conclusion SPG blocks demonstrate promising potential for managing persistent headaches post-SAH. The initial non-invasive transnasal approach, followed by more invasive techniques if needed, can provide substantial pain relief and improve patient quality of life. Further research is warranted to establish these findings and optimize treatment protocols.

Bilateral Sphenopalatine Ganglion Block in the Management of Headache Associated with Subarachnoid Hemorrhage: Case Report

Abstract

Background

The sphenopalatine ganglion (SPG) plays a pivotal role in the modulation of craniofacial pain. SPG blocks have been explored for various headache types; however, their efficacy in subarachnoid hemorrhage (SAH)-associated headaches remains underreported.

Case Presentation

A 26-year-old female with a history of chronic migraine and B-cell acute lymphoblastic leukemia presented with severe holocranial headache and focal seizures following a central nervous system (CNS) relapse and thrombocytopenia-induced bihemispheric subarachnoid hemorrhage. Initial pharmacological management included hydromorphone, pregabalin, and amitriptyline. A bilateral transnasal SPG block was performed, followed by a fluoroscopy-guided SPG block, resulting in a significant reduction in pain intensity, from a numeric analog scale (NAS) score of 10/10 to 3/10.

Conclusion

SPG blocks show promising potential in the management of persistent headaches following SAH. An initial non-invasive transnasal approach, followed by more invasive techniques, when necessary, may provide substantial pain relief and improve patient quality of life. Further research is needed to validate these findings and optimize treatment protocols.

Key Words: sphenopalatine ganglion block, secondary headaches, subarachnoid hemorrhage, pain management

Introduction

The sphenopalatine ganglion (SPG) is the primary extracranial parasympathetic ganglion involved in the modulation of craniofacial pain syndromes. It comprises parasympathetic and sensory nerve cells, but also contains sympathetic and motor fibers, although its parasympathetic function is the most clinically relevant (1). Irritation of the SPG can produce neuralgias in the face and neck due to its connections with the facial nerve, occipital nerves, and cervical cutaneous nerves. It may also generate ocular and mandibular pain through its connections with the ciliary and otic ganglia, as well as visceral symptoms such as hiccups and digestive disturbances via its connection with the vagus nerve. Additionally, it can cause referred otalgia due to its association with the sympathetic plexus (2).

The clinical significance of the SPG was first described by Greenfield Sluder in 1908 (3), who identified its role in nasal headaches through clinical observations. He reported that patients experienced unilateral pain involving the root of the nose, the eyes, the upper jaw, the mastoid region, and the occiput. These symptoms were successfully relieved by the

application of cocaine to the posterior end of the middle turbinate, suggesting that the SPG played a key role in the pathogenesis of these headaches.

The SPG plays a fundamental role in autonomic balance and the regulation of cerebral vascular tone, supporting its involvement in headache disorders. Several techniques have been described for accessing the SPG: transnasal, infratemporal, and transoral. The transnasal approach involves the insertion of cotton applicators soaked in local anesthetic through the nasal floor until they reach the posterior wall, where additional anesthetic is applied and left in place for 15 to 30 minutes to allow mucosal absorption into the ganglion (4). Other methods and commercial devices for transnasal delivery—such as atomizers, sprays, and dedicated catheter systems—have been developed to improve anesthetic dispersion and enhance patient comfort. This technique is primarily used for headache management, although it has also been applied in cases of trigeminal neuralgia and other facial pain syndromes. However, drug absorption can be erratic and unpredictable, and side effects may include epistaxis, unpleasant taste, and motor or sensory disturbances in the palate and oropharynx (5).

The transoral technique is considered the most challenging due to the complexity of the approach. It requires the use of a curved needle inserted through the greater palatine foramen, traversing the maxillary nerve, which may induce paresthesia. Complications such as hematomas and infraorbital nerve injury may occur. The infratemporal approach is most commonly used for neurolytic and radiofrequency techniques and is performed under fluoroscopic guidance to insert a needle along the inferior lateral orbital wall to access the pterygopalatine fossa. Adverse events associated with this approach include accidental entry into the orbit or nasal cavity, severe hemorrhagic complications (2, 5), and reflex bradycardia known as the "Konen reflex" (6).

According to the available evidence, the most strongly supported indication (Grade B), based on randomized clinical trials, is for reducing analgesic requirements following endoscopic sinus surgery. Other Grade B indications, supported by observational studies, include cluster headache, trigeminal neuralgia (second division), and migraine. Grade C recommendations, based on case series, suggest potential benefits in post-dural puncture headache, sphenopalatine neuralgia, atypical facial pain secondary to trauma, hemifacial headache, nasal pain, cancer-related pain, persistent hiccups, among others (4, 7). In clinical practice, a study by Burkett reported that its most common use among specialists was for chronic migraine (8). It has also been frequently employed in facial pain management, due to the SPG’s connections with the maxillary nerve (a branch of the trigeminal nerve) and the otic ganglion, which are involved in the sensory innervation of the face (9).

Clinical Case

A 26-year-old patient with a history of chronic migraine and Philadelphia-like high-risk B-cell acute lymphoblastic leukemia under treatment was receiving inotuzumab-based therapy during hospitalization when she developed a severe holocranial headache, loss of consciousness, and focal seizures, in the context of bihemispheric subarachnoid hemorrhage and thrombocytopenia. Cerebral angiography did not reveal any arteriovenous or aneurysmal

malformations. The hemato-oncology team concluded that the bleeding was likely secondary to inotuzumab immunotherapy-induced thrombocytopenia. Following the initial seizure episode, the patient was admitted to the Intensive Care Unit.

The pain medicine and palliative care team initiated pharmacological management with hydromorphone, pregabalin, and amitriptyline. As part of the interventional approach, bilateral transnasal sphenopalatine ganglion (SPG) blocks were initially performed for both therapeutic and diagnostic purposes. Concurrently, correction of thrombocytopenia was undertaken to allow for a safer subsequent intervention. Once platelet counts were stabilized, a fluoroscopy-guided bilateral SPG block was performed using bupivacaine and methylprednisolone. The decision to proceed with a fluoroscopy-guided technique was based on the need for a deeper, more precise, and longer-lasting block, given the limited and short-duration relief obtained with the transnasal approach. Additionally, the unavailability of ultrasound-guided SPG techniques within the institution restricted the choice of image-guided methods.

The patient tolerated the intervention well. Following the fluoroscopy-guided procedure, she experienced a marked improvement in headache symptoms, with pain intensity decreasing from 10/10 to 3/10 on the Numeric Analog Scale (NAS) within the first hour post-intervention. This significant reduction was maintained at the seven-day follow-up, without recurrence of seizures or neurological deterioration, and with notable improvement in sleep quality, as reported by the patient. Follow-up could not be extended beyond seven days due to the patient's hospital discharge. During the post-procedural period, no adverse effects were reported, and the patient expressed satisfaction with the outcomes.

Discussion

Approximately 80% of spontaneous subarachnoid hemorrhages (SAH) result from aneurysmal rupture. These cases are commonly associated with intense and recurrent headaches, which are classified as persistent when they last for more than three months. In the immediate post-SAH period, it is essential to evaluate potentially life-threatening complications such as rebleeding, hydrocephalus, vasospasm, and delayed cerebral ischemia (10).

Post-SAH headaches typically present with a diffuse, diurnal pain pattern and have a slower onset than the initial ictal headache. These may manifest as sensations of pressure, throbbing, or pulling. Patients generally follow one of two trajectories: some experience rapid resolution of headaches within a few days, while others report persistent daily headaches of high intensity, which increases the risk of chronic pain and related sequelae (10).

The pathophysiological mechanisms underlying persistent headache after SAH are not well established. Proposed factors include direct meningeal stretching and chemical irritation by blood products, neuroinflammatory responses, and vascular hyperreactivity such as

vasospasm. Additionally, cortical spreading depression—associated with migraine aura—has also been observed post-SAH (11). Currently, there are no specific guidelines for the medical management of post-SAH headache. Furthermore, many therapies commonly used for other headache types present challenges in this setting. Opioids remain the most frequently used medications for this indication (10).

Given the patient's significant thrombocytopenia and recent intracranial hemorrhage, neuraxial or more invasive cranial interventions were contraindicated. The SPG block presented a minimally invasive, low-risk alternative. After an initial favorable response and correction of platelet levels, a fluoroscopy-guided approach was chosen to improve both accuracy and duration of the therapeutic effect.

The SPG block carries a Grade B recommendation for the treatment of cluster headache, second-division trigeminal neuralgia, migraine, reduction of pain associated with nasal packing removal post-surgery, and decreased analgesic requirements following endoscopic sinus surgery. Among these, the best evidence supports its use in reducing postoperative analgesic needs after endoscopic sinus surgery. For other pain syndromes, the level of recommendation is lower due to limited data from controlled studies. These include post-dural puncture headache, sphenopalatine neuralgia, maxillary neuralgia, facial neuralgia, sympathetic neuralgia, atypical post-traumatic facial pain, atypical odontalgia, granuloma-related pain, herpes keratitis, hemifacial headache, paroxysmal hemicrania, nasal pain, continuous hemicrania, trigeminal neuropathy, oncologic pain, and seizures associated with nasal pathology (7).

Several case reports have described the use of SPG blocks in the management of post-SAH headache. Melinosky and Mehta (12) reported five cases: two patients received a transnasal block and three received a transcutaneous block. All patients experienced complete pain relief within 30 minutes, except one who reported a 30% reduction. The transcutaneous approach yielded complete relief in all treated patients.

Smith et al. (13) published a case series of seven adult patients who received fluoroscopy-guided SPG blocks for spontaneous post-SAH headache. Each patient underwent a single bilateral suprazygomatic SPG block with ropivacaine and dexamethasone between 6 and 11 days post-hemorrhage, resulting in significant headache relief.

Singh et al. (14) described a patient treated with transnasal SPG block using a cotton swab soaked in 1 to 2 mL of 4% lidocaine combined with 5 µg of dexmedetomidine. The patient

reported immediate relief; the block was repeated four times at 12-hour intervals on days 2 and 3 of treatment, after which the headache did not recur.

Although the transnasal SPG block provides effective relief, its duration typically does not exceed six hours, as demonstrated in post-dural puncture headache (15). In a cohort study, Bussmann et al. (1) showed a 48.85% total pain reduction in emergency settings, with a number needed to treat (NNT) of 2 and a partial relief rate of 33.3%. It has been proposed that the use of a needle in percutaneous approaches may enhance the effectiveness of SPG blockade (16).

The proposed mechanism of action of SPG block involves modulation of autonomic input in the head, neck, and shoulder regions, which may account for its efficacy in headaches with an autonomic component. It is also suggested that SPG block reduces the local release of vasoactive substances in the pterygopalatine fossa, including calcitonin gene-related peptide (CGRP) (17). These mechanisms may alter the trajectory of post-SAH headache and reduce the risk of chronicity (13).

Conclusion

SPG blocks show promising potential as a therapeutic option for persistent headache following subarachnoid hemorrhage. An initial diagnostic attempt using the transnasal technique may be appropriate, with subsequent use of more invasive techniques if necessary. Bilateral SPG block is recommended for holocranial headaches. The main limitation of this case is the lack of long-term follow-up to assess recurrence or the need for additional interventions. While current studies support the use of SPG block for secondary headaches, evidence in the context of SAH remains limited, and randomized controlled trials are required to validate its efficacy.

Case reports are exempt from institutional review board approval at our institution. The patient provided informed consent.

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:

Consent obtained directly from patient(s).

This case report adheres to CARE Guidelines and the CARE Checklist has been provided to the journal editor.

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Figure 1. Timeline with the main clinical events and pain interventions.

Figure 2. A y B. Percutaneous sphenopalatine ganglion block technique guided by fluoroscopy.

Dear Editor and Reviewers,

We would like to express our sincere gratitude for the thoughtful and constructive comments provided during the review process. We appreciate the time and effort dedicated by the reviewers to improve the quality and clarity of our manuscript titled *"Bilateral Sphenopalatine Ganglion Block in the Management of Headache Associated with Subarachnoid Hemorrhage: Case Report."*

We have carefully considered each suggestion and made the appropriate revisions accordingly. Below, we provide a detailed point-by-point response to each reviewer's comments.

Response to Reviewer #1:

1. Rationale for fluoroscopy-guided SPG block vs. other approaches:

We thank the reviewer for this important question. In the presented case, the initial approach was a transnasal SPG block, selected for its non-invasive nature and suitability in a thrombocytopenic patient with recent intracranial hemorrhage, where more invasive techniques would carry significant risk. However, the analgesic benefit from the transnasal block was limited in duration, consistent with previously reported data on short-lived effects in post-dural puncture headache and post-SAH contexts.

Once platelet levels stabilized, we proceeded with a fluoroscopy-guided percutaneous SPG block, as it allowed for greater anatomical precision, longer duration of analgesia, and targeted delivery of local anesthetic and corticosteroids into the pterygopalatine fossa. This decision was made given the unavailability of ultrasound-guided SPG techniques at our institution and the technical challenges and risk profile of the transoral approach. Thus, the fluoroscopic approach represented the most viable and effective image-guided intervention under the clinical circumstances.

2. Why was follow-up (FU) limited to 7 days?

The 7-day follow-up period was limited due to the patient's hospital discharge, which occurred shortly after the procedure. As this was a hospitalized leukemia patient under ongoing hematologic management, follow-up was constrained to the inpatient setting, and we were unable to secure structured outpatient pain assessments post-discharge. However, during this period, the patient reported sustained improvement in pain, no recurrence of seizures, and enhanced sleep quality. We acknowledge this as a limitation of the report and have added a comment to this effect in the conclusion to emphasize the need for longer-term data in future cases or prospective studies.

3. Clarification regarding outcome description in the paragraph before the Discussion:

We appreciate the reviewer's comment and agree that the original paragraph could benefit from clarification. The paragraph has been revised to reflect the following:

"The patient tolerated the intervention well. Following the fluoroscopy-guided procedure, she experienced a marked improvement in headache symptoms, with pain intensity decreasing from 10/10 to 3/10 on the Numeric Analog Scale (NAS) within the first hour post-intervention. This significant reduction was maintained at the seven-day follow-up, without recurrence of seizures or neurological deterioration, and with notable improvement in sleep quality, as reported by the patient. During the post-procedural period, no adverse effects were reported, and the patient expressed satisfaction with the outcomes."

Response to Reviewer #2:

1. Please review the article for English syntax. There are several run-on sentences that need correcting.

We appreciate this observation. The manuscript has undergone thorough revision for grammar and syntax, including correction of run-on sentences and improvement of overall clarity. We believe the current version reflects these refinements appropriately.

2. In the introduction, please cite the original reference of sphenopalatine neuralgia by Greenfield Sluder. Sluder G. Role of the sphenopalatine (Meckel's) ganglion in nasal headaches. N Y State J Med 1908; 87: 989-90.

Thank you for this recommendation. The historical reference by Greenfield Sluder (1908) is cited in the Introduction section and included in the references list as:

Sluder G. Role of the sphenopalatine (Meckel's) ganglion in nasal headaches. *N Y State J Med*. 1908;87:989–990.

3. Please cite the reference for the Konen reflex: Konen A. Unexpected effects due to radiofrequency thermocoagulation of the sphenopalatine ganglion: two case reports. *Pain Digest.* 2000;10:30-33.

This reference is already cited in the section describing the infratemporal approach and potential complications. It is also appropriately listed in the references section:

Konen A. Unexpected effects due to radiofrequency thermocoagulation of the sphenopalatine ganglion: two case reports. *Pain Digest*. 2000;10:30–33.

4. In the clinical case, the description of all the chemotherapy regimens and reactions is not necessary except for the mention of inotuzumab. Please consider shortening.

We appreciate this suggestion. In the revised version, the clinical case description has been substantially shortened. Only relevant details are retained, specifically the mention of

inotuzumab as the agent associated with thrombocytopenia and hemorrhage. The full list of chemotherapy regimens has been omitted to maintain focus and conciseness.

5. Please elaborate on the rationale for choosing the SPG block for treatment of the headache. Were any other interventional therapies considered?

The rationale for selecting an SPG block is described in both the clinical case and discussion sections. In brief, due to the patient's severe thrombocytopenia and recent intracranial hemorrhage, more invasive cranial or neuraxial procedures were contraindicated. The SPG block was chosen as a minimally invasive, low-risk option that offered the potential for effective pain relief. The clinical decision-making was guided by safety concerns in a thrombocytopenic, post-hemorrhagic setting, which significantly limited the therapeutic window.

6. In the discussion, I am almost certain that Sluder was not describing a cluster headache in his original papers since what he was describing is called sphenopalatine neuralgia. Sluder G. *Etiology, diagnosis, prognosis and treatment of sphenopalatine ganglion neuralgia. JAMA*. 1913;16:1202–6. I have enclosed a paper delineating the two diagnosis.

We thank the reviewer for this important clarification. In the current version of the manuscript, no claim is made that Sluder was describing cluster headache. Rather, the discussion remains faithful to the historical context, referencing Sluder's description of nasal headaches associated with SPG dysfunction in 1908. The statement has been carefully phrased to avoid mischaracterization.

Response to Reviewer #3:

1. Can the authors briefly mention that there are different techniques (different devices) for the transnasal approach, not just cotton applicators.

Thank you for this valuable suggestion. We have included a sentence in the *Introduction* section acknowledging the availability of various commercial devices for transnasal SPG block, beyond the use of cotton applicators. The revised paragraph reads:

"Other methods and commercial devices for transnasal delivery—such as atomizers, sprays, and dedicated catheter systems—have been developed to improve anesthetic dispersion and enhance patient comfort."

This addition aims to reflect current practice more accurately.

2. Discussion (Page 8, lines 4–16): I am not necessarily sure that you need to repeat this in the discussion since you also have similar information in the introduction. I would suggest considering consolidating it.

We appreciate this editorial observation. While we recognize that portions of the information regarding SPG block indications appear both in the *Introduction* and *Discussion*, we chose to retain the brief reiteration in the *Discussion* for two reasons:

- It provides clinical context when comparing our case with the broader evidence base.
- It helps reinforce the rationale for use of SPG block in secondary headache conditions like post-SAH pain.

However, to reduce redundancy, the discussion paragraph has been **condensed** and edited for brevity to avoid full repetition.

3. Page 8, line 25: Please spell out abbreviation for FPP since it is the first time it appears.

Thank you for identifying this oversight. We have corrected the text by spelling out the abbreviation as follows:

"...received a single bilateral suprazygomatic pterygopalatine fossa (PPF) block with ropivacaine and dexamethasone…"

We hope that the revisions and clarifications provided satisfactorily address all concerns raised. We believe these improvements have strengthened the manuscript and we remain grateful for the opportunity to share this case report.

Thank you for your consideration.