



Original Article

A Prospective Observational Study of Ultrasound-Guided Sphenopalatine Ganglion Block for Post-Dural Puncture Headache

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ABSTRACT

Background: Post-dural puncture headache (PDPH) is a common complication following neuraxial anesthesia, resulting from cerebrospinal fluid leakage and intracranial hypotension. Conventional management includes hydration, analgesics, and epidural blood patch. Recently, sphenopalatine ganglion (SPG) block has emerged as a minimally invasive alternative.

Objective: To evaluate the effectiveness of ultrasound-guided sphenopalatine ganglion block in relieving pain associated with PDPH.

Methods: In this prospective observational study, patients diagnosed with PDPH received ultrasound-guided SPG block. Pain scores were recorded before and after the procedure at predefined intervals. Time to pain relief, need for repeat block, requirement of rescue analgesia, and complications were noted.

Results: Ultrasound-guided SPG block resulted in a significant reduction in pain scores with rapid onset of relief. Most patients experienced sustained analgesia, with minimal need for rescue analgesics and negligible complications.

Conclusion: Ultrasound-guided SPG block is an effective, safe, and minimally invasive option for managing PDPH.

Keywords: Post-dural puncture headache, sphenopalatine ganglion block, ultrasound-guided, neuraxial anaesthesia, headache management.

INTRODUCTION

Post-dural puncture headache (PDPH) is a well-recognized and potentially debilitating complication following neuraxial anesthesia techniques, including spinal anesthesia, epidural anesthesia, and inadvertent dural puncture during epidural placement. Despite advances in needle design and technique, the incidence of PDPH remains significant, particularly in young adults, obstetric patients, and females. The reported incidence varies widely, ranging from 1% to as high as 30%, depending on patient characteristics and procedural factors.¹

PDPH is classically described as a postural headache that worsens in the upright position and improves upon lying supine. It is often associated with other symptoms such as nausea, vomiting, neck stiffness, photophobia, tinnitus, and visual disturbances. These symptoms can significantly impair functional recovery, delay mobilization, prolong hospital stay, and reduce overall patient satisfaction.¹

The underlying pathophysiology of PDPH is primarily attributed to persistent cerebrospinal fluid (CSF) leakage through the dural defect, resulting in decreased intracranial CSF volume and pressure. This leads to downward traction on pain-sensitive intracranial structures. Additionally, compensatory cerebral vasodilation occurs as per the Monro-Kellie doctrine to maintain intracranial volume homeostasis. This vasodilation is mediated, in part, by parasympathetic pathways involving the sphenopalatine ganglion (SPG), which plays a key role in cranial autonomic regulation and nociceptive transmission.²

Conventional management strategies for PDPH include conservative measures such as bed rest, adequate hydration, caffeine administration, and oral or intravenous analgesics. While these approaches may provide symptomatic relief, they

are often insufficient in moderate to severe cases. The epidural blood patch (EBP) is widely regarded as the gold standard treatment, with high success rates. However, it is an invasive procedure and carries risks such as back pain, infection, nerve injury, repeat dural puncture, and, rarely, neurological complications. Furthermore, not all patients are suitable candidates for EBP, and some may refuse the procedure.³

In recent years, the sphenopalatine ganglion block has emerged as a promising, minimally invasive alternative for the management of PDPH. The SPG, located in the pterygopalatine fossa posterior to the middle nasal turbinate, contains parasympathetic fibers that contribute to cerebral vasodilation. Blocking this ganglion is thought to attenuate vasodilation and thereby alleviate headache symptoms.

Traditionally, SPG block has been performed using transnasal approaches with cotton-tipped applicators soaked in local anesthetic. Although simple and non-invasive, this method may result in inconsistent drug delivery and variable efficacy. Advances in regional anesthesia have led to the development of ultrasound-guided techniques, allowing more precise localization of the pterygopalatine fossa via an infrazygomatic approach. Ultrasound guidance enhances accuracy, improves safety by visualizing surrounding structures, and may provide more reliable and prolonged analgesia.⁴

Given these considerations, ultrasound-guided SPG block represents an attractive alternative in the management of PDPH, combining efficacy with a favorable safety profile. However, there remains limited prospective data evaluating its effectiveness, especially in comparison to conventional treatment modalities.

Therefore, this prospective observational study was undertaken to evaluate the efficacy of ultrasound-guided sphenopalatine ganglion block in patients with post-dural puncture headache, with particular emphasis on pain relief, duration of analgesia, and need for additional interventions.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Anesthesiology at a tertiary care teaching hospital after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to inclusion in the study. The study was carried out over a period of 18 months.

A total of 60 patients aged between 18 and 65 years who developed post-dural puncture headache (PDPH) following spinal anesthesia, epidural anesthesia, or accidental dural puncture were included in the study. PDPH was diagnosed clinically based on the presence of a postural headache that worsened in the sitting or standing position and improved on lying down. Patients with a Visual Analog Scale (VAS) score of 4 or more were considered eligible. Patients who refused consent, had a known allergy to local anesthetics, coagulopathy, infection at the injection site, pre-existing chronic headache disorders such as migraine, neurological deficits, intracranial pathology, or those who had already received an epidural blood patch were excluded from the study.

All patients underwent a thorough pre-procedural evaluation, including detailed history, physical examination, and confirmation of PDPH diagnosis. Baseline vital parameters such as heart rate, blood pressure, and oxygen saturation were recorded. Pain intensity was assessed using the Visual Analog Scale (VAS), where 0 represented no pain and 10 represented the worst imaginable pain. Routine investigations were performed as per institutional protocol.

Prior to performing the sphenopalatine ganglion (SPG) block, all patients received standard conservative management, including adequate hydration, bed rest, and administration of oral or intravenous analgesics such as paracetamol with or without non-steroidal anti-inflammatory drugs. Patients who continued to have significant symptoms despite these measures were taken up for ultrasound-guided SPG block.

The procedure was performed under strict aseptic precautions with the patient in the supine position and the head slightly extended. Standard ASA monitors, including electrocardiography, non-invasive blood pressure, and pulse oximetry, were applied, and intravenous access was secured. A high-frequency linear ultrasound probe (6–13 MHz) was placed inferior to the zygomatic arch in a transverse orientation to identify the relevant anatomical landmarks, including the maxilla, lateral pterygoid muscle, and pterygopalatine fossa.

Using an in-plane infrazygomatic approach, a 22–25 gauge needle was advanced under real-time ultrasound guidance toward the pterygopalatine fossa. After careful negative aspiration to rule out intravascular placement, 3–5 mL of 0.25% bupivacaine was injected. The procedure was then repeated on the contralateral side. Following the block, patients were monitored for at least 30 to 60 minutes for hemodynamic stability and any immediate complications, including signs of local anesthetic systemic toxicity.

Pain intensity was assessed using the VAS score at baseline (prior to the block) and subsequently at 15 minutes, 30 minutes, 1 hour, 4 hours, 12 hours, and 24 hours following the procedure. The primary outcome of the study was the

reduction in VAS score following the SPG block. Secondary outcomes included the time to onset of analgesia, defined as the time taken to achieve a reduction of at least 50% in VAS score, duration of analgesia, requirement of repeat SPG block, need for rescue analgesia, and patient satisfaction.

Rescue analgesia was administered when the VAS score was 4 or greater, in the form of intravenous paracetamol 1 gram, followed by additional analgesics such as non-steroidal anti-inflammatory drugs or opioids if required, as per institutional protocol. The total consumption of rescue analgesics within the first 24 hours was recorded.

Patients were also observed for any adverse events, including bleeding, hematoma, infection, nasal or facial discomfort, and features suggestive of local anesthetic toxicity such as tinnitus, perioral numbness, metallic taste, seizures, or cardiac arrhythmias. All relevant data, including demographic details, clinical findings, pain scores, analgesic requirements, and complications, were documented in a predesigned case record form.

The collected data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS). Continuous variables were expressed as mean \pm standard deviation, while categorical variables were presented as frequencies and percentages. Comparison of VAS scores before and after the block was performed using the paired t-test, and repeated measures analysis of variance (ANOVA) was used for comparison across multiple time intervals. A p-value of less than 0.05 was considered statistically significant.

Efforts were made to minimize bias by standardizing the block technique, drug concentration, and volume administered. All procedures were performed by experienced anesthesiologists, and a uniform protocol was followed for pain assessment and administration of rescue analgesia.

RESULTS

A total of 60 patients with post-dural puncture headache were included, with a mean age of 32.4 ± 8.6 years and a female predominance (63.3%). Most cases followed spinal anesthesia. Ultrasound-guided sphenopalatine ganglion block resulted in a significant reduction in pain scores, with mean VAS decreasing from 7.6 ± 1.1 at baseline to 1.9 ± 0.8 at 1 hour ($p < 0.001$), and sustained relief up to 24 hours.

The mean onset of analgesia was 18.5 minutes, and the average duration of pain relief was 14.6 hours. The majority of patients (80%) did not require a repeat block, and only 26.7% required rescue analgesia. Patient satisfaction was high, with over 90% reporting good to excellent relief. No major complications were observed, and only minor, self-limiting side effects occurred in a small number of patients.

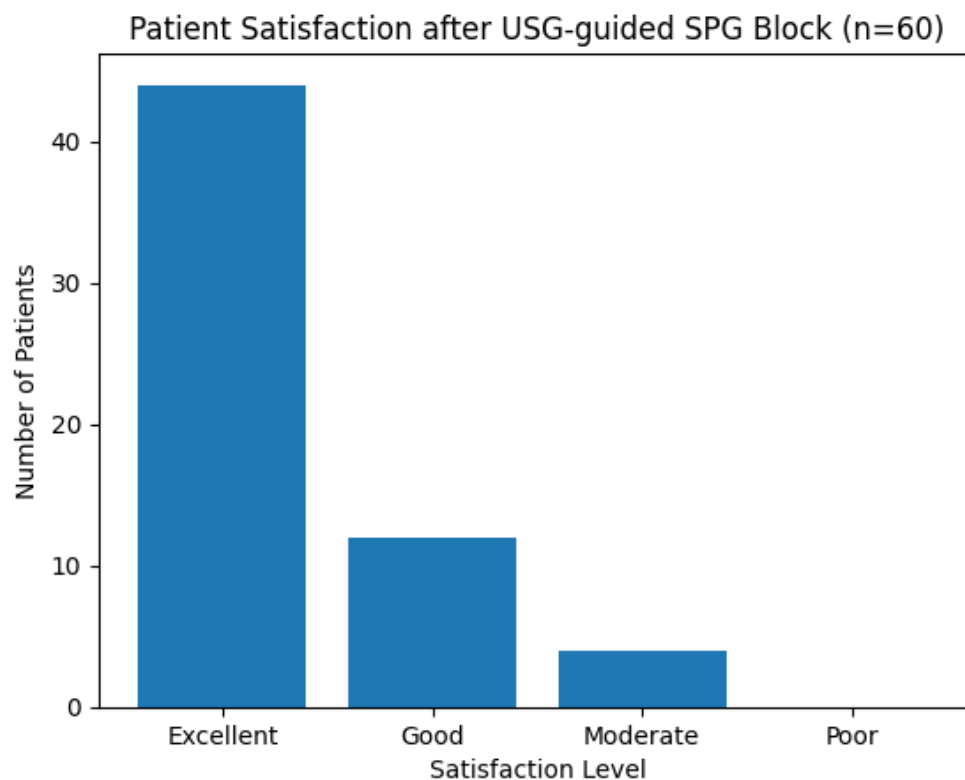


Figure 1: Patient satisfaction after USG guided SPG block.

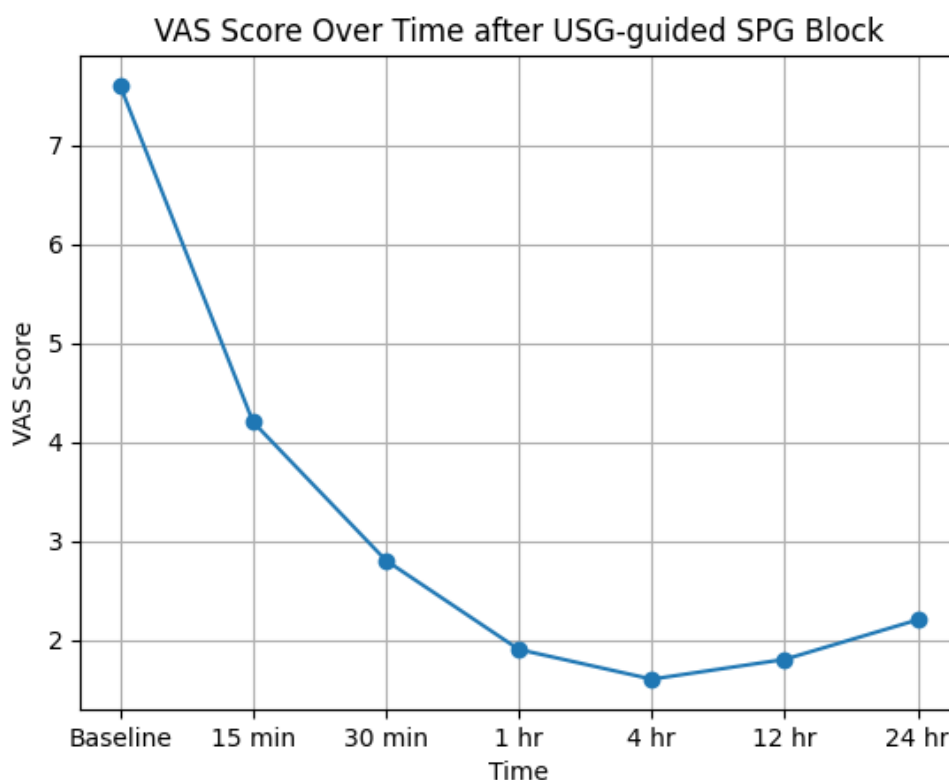


Figure 2: VAS score over time after USG guided SPG block

DISCUSSION

Post-dural puncture headache (PDPH) remains a common and distressing complication following neuraxial anesthesia, often leading to delayed recovery, prolonged hospital stay, and reduced patient satisfaction. The present study demonstrates that ultrasound-guided sphenopalatine ganglion (SPG) block provides rapid, effective, and sustained analgesia in patients with PDPH, with minimal adverse effects and high patient satisfaction.

In our study, the majority of patients developed PDPH following spinal anesthesia (76.7%), which is consistent with existing literature, where spinal anesthesia is identified as the most common cause due to intentional dural puncture. The predominance of female patients (63.3%) also aligns with prior reports suggesting a higher incidence of PDPH in females, possibly due to hormonal influences, lower body mass index, and differences in pain perception.

The baseline VAS score in our cohort (7.6 ± 1.1) indicates that most patients experienced moderate to severe headache prior to intervention. Following SPG block, there was a rapid and statistically significant reduction in pain scores as early as 15 minutes, with continued improvement over time. This rapid onset of analgesia (mean 18.5 ± 6.2 minutes) is comparable to findings from previous studies. For instance, Cohen et al¹ reported meaningful pain relief within 10–20 minutes following transnasal SPG block, while Kent and Mehaffey² also demonstrated early pain reduction within 30 minutes. The prompt analgesic effect observed in our study reinforces the role of SPG block as a fast-acting, minimally invasive alternative to more invasive procedures such as epidural blood patch (EBP).

The sustained reduction in VAS scores over 24 hours in our study is noteworthy. Similar trends have been reported in studies by Nair et al.³ and Jespersen et al.⁴, where SPG block provided prolonged analgesia, although some variability in duration was noted. The mean duration of analgesia in our study (14.6 ± 4.3 hours) is comparable to or slightly longer than that reported in earlier studies, which typically range between 8 to 12 hours. This extended duration may be attributed to the use of ultrasound guidance, which potentially improves the accuracy of drug delivery and enhances block efficacy.

A key finding in our study is that 80% of patients did not require a repeat block, and only 26.7% required rescue analgesia within 24 hours. These results are consistent with prior observational studies where the majority of patients achieved adequate relief with a single SPG block. In contrast, some studies have reported higher rates of repeat interventions, possibly due to differences in technique (blind vs. ultrasound-guided), local anesthetic concentration, or patient selection. Compared to epidural blood patch, which is considered the gold standard for refractory PDPH, SPG block offers the advantage of being less invasive, easier to perform, and associated with fewer complications, although its duration of action may be shorter.⁵

The requirement for rescue analgesia in our study was relatively low, and most patients responded to simple analgesics such as intravenous paracetamol. This finding is in agreement with previous reports where SPG block significantly reduced the need for additional analgesics. Only a small proportion of patients required non-steroidal anti-inflammatory drugs, and none required escalation to invasive interventions such as epidural blood patch within the study period.⁶

Patient satisfaction in our study was notably high, with over 90% of patients reporting excellent or good relief. This is comparable to studies by Kent et al.² and Cohen et al.¹, where patient satisfaction rates exceeded 85%. High satisfaction scores likely reflect the rapid onset of relief, non-invasive nature of the procedure, and minimal side effects.

The safety profile of SPG block in our study was favourable, with no major complications observed. Minor adverse effects such as transient nasal discomfort (10%) and mild dizziness (5%) were self-limiting and required no intervention. These findings are consistent with the existing literature, which reports a low incidence of complications associated with SPG block. Importantly, no cases of epistaxis, infection, or local anesthetic systemic toxicity were observed, further supporting the safety of the technique.^{7,8}

The use of ultrasound guidance in our study represents an important methodological advantage. While many earlier studies have employed blind transnasal techniques, ultrasound guidance allows for better visualization of anatomical landmarks and may improve the precision and effectiveness of the block. Although comparative data are limited, our findings suggest that ultrasound-guided SPG block may offer enhanced efficacy and consistency, warranting further investigation.⁷

Despite these encouraging results, certain limitations must be acknowledged. The study lacked a control group or comparison with standard treatments such as epidural blood patch, which limits the ability to draw definitive conclusions regarding relative efficacy. The sample size was modest, and the follow-up period was limited to 24 hours, which may not fully capture late recurrences of PDPH. Additionally, the study was not blinded, introducing the possibility of observer bias.

CONCLUSION

In summary, the findings of this study support the use of ultrasound-guided SPG block as an effective, safe, and minimally invasive modality for the management of PDPH. It provides rapid and sustained analgesia, reduces the need for rescue medications, and is associated with high patient satisfaction. Further randomized controlled trials comparing SPG block with epidural blood patch and other standard therapies are warranted to establish its definitive role in clinical practice.

Limitations

This study has several limitations. The absence of a control group limits comparison with standard treatments such as epidural blood patch. The sample size was relatively small, and follow-up was limited to 24 hours, preventing assessment of long-term outcomes and recurrence. The lack of blinding may have introduced bias in subjective measures such as VAS scores and patient satisfaction. Additionally, no comparison was made with blind SPG block techniques or different local anesthetic regimens.

Future Directions

Future studies should include larger, randomized controlled trials comparing SPG block with standard therapies. Longer follow-up is needed to evaluate sustained efficacy and recurrence. Further research should also explore optimal drug regimens and compare ultrasound-guided versus conventional techniques.

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Conflict of interest: Nil

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