

ORIGINAL RESEARCH

OBSTETRIC ANESTHESIA

Sphenopalatine ganglion block vs greater occipital nerve block in the management of post dural puncture headache in obstetric patients: a randomized clinical trial

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ABSTRACT

Background: With the increased popularity of spinal anesthesia for a variety of surgeries, the anesthesiologists have to face the increased incidence of post dural puncture headache (PDPH). It is especially cumbersome to the obstetric patients. A variety of management techniques have been used. We compared the efficacy of sphenopalatine ganglion block (SPGB) versus greater occipital nerve block (GONB) for the management of PDPH in obstetric cases.

Methodology: This prospective, randomized trial, enrolled 120 PDPH cases into two groups. The SPGB group received bilateral SPGB with a 3 ml mixture of 2% lidocaine and 4 mg dexamethasone (in each nostril). In the GONB group, the greater occipital nerves were blocked utilizing a solution of 3 ml mixture of 2% lidocaine and 4 mg dexamethasone on each side. Prior to the procedure, a pain score on numerical pain scale (NPS) was reported. Pain scores were noted at 15 and 30 min, then at 2, 4, 8, 16, and 24 h after the intervention. Need for and cumulative dose of analgesics used were recorded. Complications, patient satisfaction, hospital stay for epidural blood patch (EBP), and hospital discharges were also recorded.

Results: Pain perception in upright position at 30 min and at 2, 16, and 24 h, the need for rescue analgesia and the cumulative analgesic dose within 24 h were significantly lower in SPGB group. Bitter taste was significantly more frequently complained by the patients of SPGB group. In the SPGB group, the EBP was not significantly less prevalent. In the SPGB group, patient satisfaction was noticeably greater.

Conclusion: The sphenopalatine ganglion block is more effective in relieving PDPH and its associated symptoms than the greater occipital nerve block. Both procedures are easy, safe, more conservative than EBP, and without serious adverse effects. The sphenopalatine ganglion block can be recommended as a first line treatment for PDPH.

Abbreviations: ASA: American Association of Anesthesiologists; CI: Confidence Interval; CSF: Cerebral Spinal Fluid; EBP: Epidural Blood Patch; GON: Greater Occipital Nerve; GONB: Greater Occipital Nerve Block; PDPH: Post-Dural Puncture Headache; RR: Relative Risk; SPGB: Sphenopalatine Ganglion Block; NPS: Numerical Pain Scale

Key words: Nerve Block; Obstetrical Analgesia; Post-Dural Puncture Headache; Sphenopalatine Ganglion Block

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1. INTRODUCTION

Postdural puncture headache (PDPH) following neuraxial anesthesia is very common in obstetric population. The reported incidence of PDPH after unintentional dural puncture (UDP) with an epidural needle for labor analgesia is between 81-88%.¹ Unintentional dural puncture occurs in up to 6% of epidural placements, with 11-33% of UDP going unrecognized until the patient presents with PDPH.² While the incidence of headache following spinal anesthesia is similar in all populations, ranging from 0.1-36% depending upon the type and gauge of the needle used, pregnancy, female gender, and young age have always been considered major risk factors for developing PDPH.³

Leakage of the cerebral spinal fluid (CSF) has been considered as the leading cause of PDPH. It is a dull-throbbing, severe fronto-occipital headache that is worsened usually by standing, walking, and sitting, due to the stretch of the pain-sensitive meningeal structures.⁴ PDPH can have another explanation theory, which is the Monro-Kellie doctrine, it notes that reduced CSF volume is compensated by venodilatation, that causes migraine-like headache.⁵

PDPH management is often referred to the anesthesiologists. It does not only make the patient suffer worse, but also, prolongs the hospital stay and raises overall healthcare costs. While the epidural blood patch (EBP) is a successful treatment for the issue, the procedure itself may lead to another unintended dural puncture. Moreover, if the first EBP is not fully effective, patients may occasionally require a second one. For a patient who had already endured a great deal of suffering, this might be hard to explain.⁶

A parasympathetic ganglion, known as the sphenopalatine ganglion, is situated in the pterygopalatine fossa. Transnasal sphenopalatine ganglion block (SPGB) has been successfully used to treat a variety of chronic headaches, including cluster headaches, migraine, and trigeminal neuralgia, and it may be a safer option for treating PDPH. It doesn't require imaging and is performed at the patient's bedside. In addition, it appears to have a faster onset than EBP and a higher safety profile.⁷ Leakage of CSF stimulates this ganglion and causes cerebrovascular vasodilation by releasing nitric oxide, vasoactive intestinal peptide, and acetylcholine into the dural blood vessels. These chemicals can also stimulate the trigeminal nociceptors causing headache that needs increased analgesic intake.⁸ Administration of intranasal lidocaine 2% anesthetizes the SPG and prevents the parasympathetic triggered cerebral

vasodilation by the neurons synapsing in SPG and reduce signaling, that relieves the PDPH.⁸

Greater occipital nerve block (GONB) is another minimally invasive peripheral nerve block that has been employed with good results. It has been used for more than ten years to treat complex headache conditions caused by a variety of etiologies, including cluster headache, migraine, and chronic daily headache.⁹ The greater occipital nerve (GON) emerges from the C2-3 segments, and its proximal portion is located close to the spinous process between the semispinalis and obliquus capitis inferior. The GON then passes through the semispinalis and enters the trapezius muscle after the exit. The nerve eventually leaves the insertion into the nuchal line, about 5 cm lateral to the midline. The GON serves as the primary sensory supply for the occipital region. It also supplies the major rectus capitis posterior muscle as well as the muscles, skin, and arteries of the scalp.¹⁰ There is an assumption that good pain relief and quick recovery after PDPH could be achieved through occipital blockade. This counts on the resemblance between the associated symptoms of PDPH and those of cervicogenic headache, which can be efficiently managed with occipital blockade. The block decreases convergence of the nociceptive afferent fibers and sensitization of the trigemino-cervical neurons and the mechanical hyperalgesia aroused by sitting in various positions and walking, which may start the pain by triggering the upper cervical nerves supplying the adjacent muscle.¹¹

Since dexamethasone has potent anti-inflammatory and immunosuppressive effects by inhibiting cytokine-mediated pathways. Many healthcare providers think that local anesthetics quickly relieve headaches, like abortive agents, while locally acting steroids have preventive effects for up to 6 weeks.¹²

We aimed to compare the impact of greater occipital nerve block vs. sphenopalatine ganglion block for the management of PDPH in obstetric patients regarding efficacy, the need for rescue analgesia, and the total analgesic consumption in the first 24 h following the block. We also aimed to document block related complications, the need for EBP, and to assess the overall patient satisfaction following both blocks.

2. METHODOLOGY

Study design

This study is a prospective, randomized clinical trial, at our University Maternity Hospital from March 2021 till October 2022. The usage of the visual analogue scale (VAS), ranged from 0 to 100, to judge the intensity of the pain (0 = no pain, 100 = most severe pain), was explained to the patients.

Randomization was accomplished via the usage of a computer-generated randomization sequence, and allocation secrecy was preserved throughout the approach by using numbered, opaque, and sealed envelopes.

Inclusion criteria

We included obstetric patients with ASA physical status I & II, body weight 60-100 kg, expressing PDPH (VAS > 40) following spinal anesthesia, despite conventional treatment with bed rest, abdominal binders, intravenous fluids and caffeine.

Exclusion criteria

We excluded cases with history of migraine or chronic headache, chronic hypertension, inability to follow the VAS, infection at the block's location, a known coagulation defect, polyp, nasal septal deviation, prior nasal hemorrhage, or local anesthetic allergy.

Enrolled patients were divided into one of the two groups:

SPGB group: Patients received bilateral sphenopalatine ganglion block with 1 ml dexamethasone (4 mg) plus 2 ml lidocaine 2% in each nostril. A few drops of 2% lidocaine were injected into each anterior nares. The patient was then placed in the supine position, and a cotton-tipped applicator soaked with a mixture of lignocaine and dexamethasone was positioned in both nares, just anterior to the sphenopalatine ganglion and pterygopalatine fossa and superior to the middle turbinate for 5 min.

GONB group: Cases received bilateral greater occipital nerve block with 1 ml dexamethasone (4 mg) plus 2 ml lidocaine 2% on each side with a 3-ml syringe with a 25-30 gauge needle. While the patient was in neck flexed setting position, the occipital artery was located at the intersection of the lateral two-thirds and medial third of a line drawn between the mastoid process and the external occipital protuberance, and the GON was localized immediately medial to the artery in an area where there is no muscle. A slight tenderness is felt on palpating this region which confirms the correct site for the block, the anesthetic mixture was injected. Then, the technique was repeated on the other side for a bilateral block.

Patients in both groups received the block in the ward while hemodynamic parameters were being monitored. SPGB was carried out using a trans-nasal technique.

The intensity of headache was assessed just before the block, then after 15 min and 30 min using VAS. If the pain score remained > 40, the block was repeated with the same drugs after 30 min.

Intensity of the block was assessed using VAS at 2, 4, 8, 16 and 24 h after the block. If VAS > 40 at any time during the study period intravenous ketorolac 30 mg was given as rescue analgesic. Patients with inadequate pain relief even after 24 h were advised for EBP. Need for analgesia and total consumption of rescue analgesic were recorded. Patient satisfaction and any complications were recorded.

Sample size calculation

11 PASS Program was used for sample size calculation based upon the previous literature. The expected success rate of GONB to relieve headache after 1-2 blocks is known to be about 70%.¹³ Assuming a difference of about 20% in success rate between the two study groups, sample size of 60 patient per group was needed to detect difference between two groups with power of 80% and alpha error of 0.05.

Statistical analysis

Statistical Package for Social Sciences, version 22.0 (IBM Corp., Chicago, USA, 2013) was used to code, tabulate, and statistically analyze the obtained data. The Shapiro-Wilk test was used to determine the normality of descriptive statistics, after which the mean \pm SD and 95% confidence interval were used to define relative impacts and compare them. For variables with small, expected numbers in qualitative data, inferential analyses for independent variables were performed utilizing Chi square test and Fisher's Exact test, while relative impacts were characterized as relative risk and its 95% confidence interval. If $P < 0.050$, it was considered significant.

4. RESULTS

A total of 143 participants were evaluated to see if they were eligible for this research, 23 individuals were excluded; 5 refused to take part, and 18 did not fulfill the

Table 1: Comparative demographic characteristics

| Variables | SPGB Group (n = 60) | GONB Group (n = 60) | p-value |
|--------------------------------------|---------------------|---------------------|----------------|
| Age (y) | 31.5 \pm 2.7 | 32.1 \pm 2.9 | \wedge 0.193 |
| Body mass index (kg/m ²) | 29.5 \pm 2.7 | 28.8 \pm 2.3 | \wedge 0.134 |
| ASA | I | 49 (81.7) | 53 (88.3) |
| | II | 11 (18.3) | 7 (11.7) |
| | | | #0.306 |

SPGB: sphenopalatine ganglion block; GONB: greater occipital nerve block; \wedge Independent t-test; #Chi square test. Data presented as mean \pm SD or n (%)

Table 2: Comparison regarding pain perception and analgesia

| Variables | SPGB Group (Total=60) | GONB Group (Total=60) | P-value | Effect in SPGB relative to that in GONB Mean \pm SE (95% CI) |
|---|--------------------------|--------------------------|----------------------------------|--|
| Pain perception in up-right position (NRS) | | | | |
| Baseline | 61.9 \pm 8.4 | 63.0 \pm 8.3 | \wedge 0.478 | -1.1 \pm 1.5 (-4.1-1.9) |
| Min-15 | 43.8 \pm 5.8 | 45.2 \pm 5.2 | \wedge 0.187 | -1.3 \pm 1.0 (-3.3-0.7) |
| Min-30 | 36.5 \pm 5.2 | 38.5 \pm 5.2 | \wedge0.037* | -2.0 \pm 0.9 (-3.9-0.1) |
| H-2 | 11.9 \pm 7.3 | 15.0 \pm 7.2 | \wedge0.022* | -3.1 \pm 1.3 (-5.7-0.5) |
| H-4 | 11.7 \pm 8.0 | 14.0 \pm 9.1 | \wedge 0.138 | -2.3 \pm 1.6 (-5.4-0.8) |
| H-8 | 20.7 \pm 7.8 | 23.1 \pm 8.5 | \wedge 0.109 | -2.4 \pm 1.5 (-5.4-0.5) |
| H-16 | 21.4 \pm 7.5 | 25.3 \pm 11.0 | \wedge0.028* | -3.8 \pm 1.7 (-7.2-0.4) |
| H-24 | 23.3 \pm 7.4 | 26.7 \pm 9.1 | \wedge0.029* | -3.3 \pm 1.5 (-6.3-0.3) |
| Rescue analgesia | | | | |
| Need to rescue analgesia | 25 (41.7) | 37 (61.7) | #0.028* | RR: 0.68 (0.47-0.97) |
| Cumulative dose /24 h (mg) | 28.0 \pm 34.4 | 45.5 \pm 40.0 | \wedge0.011* | -17.5 \pm 6.8 (-31.0-4.0) |
| <i>SPGB: sphenopalatine ganglion block; GONB: greater occipital nerve block; RR: relative risk; CI: confidence interval; \wedgeIndependent t-test; #Chi square test; *Significant; Data presented as mean \pm SD or n (%)</i> | | | | |

Table 3: Comparison regarding complications, epidural blood patch and patients' satisfaction

| Variables | SPGB Group (Total=60) | GONB Group (Total=60) | P-value | Effect in SPGB relative to that in GONB | |
|--|--------------------------|--------------------------|------------------------------|---|------------------|
| | | | | RR | 95% CI |
| Complications [n (%)] | | | | | |
| Pain at the site of injection | 6 (10.0) | 8 (13.3) | #0.570 | 0.75 | 0.28-2.03 |
| Bleeding | 6 (10.0) | 4 (6.7) | #0.509 | 1.50 | 0.45-5.05 |
| Vasovagal syncope | 3 (5.0) | 4 (6.7) | \S 0.999 | 0.75 | 0.18-3.21 |
| Photophobia | 2 (3.3) | 3 (5.0) | \S 0.999 | 0.67 | 0.12-3.85 |
| Tinnitus | 2 (3.3) | 4 (6.7) | \S 0.679 | 0.50 | 0.10-2.63 |
| Dizziness | 3 (5.0) | 6 (10.0) | \S 0.491 | 0.50 | 0.13-1.91 |
| Bitter taste | 6 (10.0) | 0 (0.0) | \S0.027* | NA | NA |
| Epidural blood patch [n (%)] | | | | | |
| Epidural blood patch | 3 (5.0) | 4 (6.7) | \S 0.999 | 0.75 | 0.18-3.21 |
| Patients' satisfaction [n (%)] | | | | | |
| Satisfied | 39 (65.0) | 34 (56.7) | #0.683 | 1.15 | 0.86-1.53 |
| Borderline | 18 (30.0) | 22 (36.7) | | | |
| Unsatisfied | 3 (5.0) | 4 (6.7) | | | Reference |
| <i>SPGB: sphenopalatine ganglion block; GONB: greater occipital nerve block; RR: relative risk; CI: confidence interval; \wedgeIndependent t-test; #Chi square test; \S Fisher's Exact test; * Significant</i> | | | | | |

criteria for inclusion. SPGB or GONB were randomly administered to 60 participants in each group.

Table 1 reveals that there were no significant differences between the two groups regarding age, body mass index, and ASA.

Rescue analgesia was required significantly less frequently by the patients in SPGB group ($P = 0.028$); also the cumulative dose of analgesic within 24 h was significantly less ($P = 0.011$) in this group (Table 2).

The block complications, including vasovagal syncope, photophobia, tinnitus, dizziness and pain at the site of injection, were non-significantly less frequent in SPGB group. Bitter taste and bleeding were more frequent in SPGB group. The difference was more marked in case of bitter taste. EBP was non-significantly less frequent in SPGB group ($P = 0.999$). Patients' satisfaction level was significantly higher ($P = 0.683$) in SPGB group (Table 3).

4. DISCUSSION

Although PDPH usually resolves spontaneously, it has the potential to cause significant morbidity in obstetric patients. It can also interfere with the mother's ability to take care of herself or her baby and may extend the length of hospital stay or evolve into chronic headache.¹⁴ Aggressive hydration and bed rest are frequently used to compensate for CSF leak and decrease its loss.¹⁵ These methods are simple and safe, but their role for the management of PDPH has no conclusive evidence.¹⁶

Autologous blood injection in the epidural space by EBP to seal the dural puncture is usually counted as the final solution after failure of the standard pharmacological and conservative measures. Reported complications from EBP include secondary low back pain, sub-acute subdural hematoma, lumbar vertebral syndrome and adhesive arachnoiditis. Sometimes, patients are not fit for EBP as in case of local infection or refuse this invasive procedure.¹⁷

For many incapacitating headache disorders, Peripheral nerve blocks are effective and safe like an additional management strategy.¹⁸

In 2001, Cohen et al. released the first publication that outlined the SPGB applied for the treatment of PDPH.¹⁹ They selected 22 pregnant women who complained of neck pain, migraines, low backaches, and tension headaches to receive the block. The block succeeded in relieving their headache and none of the patients experienced difficulties. In another study, 13 parturients with mild to severe PDPH were enrolled by Cohen et al.²⁰ Potent pain control was reported by 11 out of 13 patients, and they did not need EBP; the remaining 2 cases required EBP to find relief. Three PDPH patients were treated in the emergency room using SPGB by Kent and Mehaffey.²¹ After the block, the discomfort was effectively managed for all patients. None of the cases required EBP, and all of them reported experiencing quick and adequate pain alleviation. The retrospective

data of 72 cases that complained of PDPH, were gathered over a 17-years period and described by Patel et al.²² The patients received either SPGB or EBP. After one hour, the block group patients showed greater pain relief. Yet, the difference between groups became non-significant after 24 h following the block. But the side effects were more noted in the EBP group. Puthenveetil et al. evaluated the efficacy of the block therapy for PDPH compared to the conservative approach.²³ They declared that SPGB provided good, continuous pain control over the course of the study, whereas effective pain control in the conservative group started after 4 h.²⁴ The trans-nasal SPGB can control PDPH quickly and successfully.²⁵

The GONB for managing PDPH was first mentioned in 2008 by Matute et al.²⁶ Naja et al. treated PDPH following cesarean and lower limb surgeries by blocking the lesser and greater occipital nerves, and compared with conservative treatment.²⁷ After getting 1-2 blocks in the block group, 68.4% of patients experienced total pain relief, while the remaining 31.6% required up to 4 blocks. Other researchers also performed bilateral GONB for the treatment of PDPH with complete satisfaction.^{28,29,30} Following a single injection, the patients experience marked pain relief that may last for more than 24 h.

In our randomized clinical trial, pain perception in upright position was lower in SPGB group at all the time points indicated by lower VAS scores, the differences were statistically significant only at 30 min and at 2, 16, and 24 h. Rescue analgesia was required much less frequently in SPGB group with a significantly lower cumulative analgesic dose in 24 h, indicating better quality of analgesia. Regarding complications, there were no differences between the two groups except for bitter taste and bleeding, being more frequent in SPGB group. The difference was significant only for bitter taste. EBP was non-significantly less frequent in SPGB group while in the SPGB group, patient satisfaction was non-significantly greater.

Youssef et al. compared the efficacy of SPGB and GONB to improve PDPH and its symptoms after spinal anesthesia for elective cesarean section.³¹ they concluded that both the SPGB and GONB were efficient equally in improving the PDPH and its related symptoms. Both blocks are safe, easily performed, and less invasive than EBP, without any serious side effects and that both GONB and SPGB can be recommended as a first option therapy for PDPH. In their study, contrary to our results, total analgesic consumption was higher in SPGB group than in GONB group. They attributed this to the fact that GONB is a regional anesthesia technique that can cause a central neuro-modulatory effect leading to diminished central sensitization because of the

transient reduction in afferent input to the trigeminal nucleus and dorsal roots.

5. LIMITATIONS

This work was performed only on a small sample size. Further studies with larger sample size of both genders are needed to validate our results.

6. CONCLUSION

Sphenopalatine ganglion block is more effective in relieving post dural puncture headache and its associated symptoms than greater occipital nerve block. Both approaches are easy to perform, safe, well tolerated and with no serious side effects. Sphenopalatine ganglion block may be recommended as a first option for the treatment of post dural puncture headache.

7. Data availability

The numerical data generated in this study is available with the corresponding author for the researchers

8. Ethical considerations

The trial was approved by the Ethics Committee of our University (No. FMASU R 80/2021), and it was registered at the clinicaltrials.gov (No. NCT05235256). Before being enrolled in the study, each patient signed a written informed consent.

9. Disclosure of interest

The authors report no conflict of interest.

10. Funding

No external or industry funding was involved in the conduct of this study.

11. Authors' contribution

RA: Concept, conduction of the study work, data analysis and manuscript editing

HT: Concept, conduction of the study work and manuscript drafting

SA: Design, data interpretation and manuscript editing

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