



# Postdural puncture headache in the obstetric population: a new approach?

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## ABSTRACT

**Background and objectives** The gold standard for the treatment of postdural puncture headache (PDPH) is the epidural blood patch (EBP). Regional techniques—sphenopalatine ganglion block (SPGB), greater occipital nerve block (GONB) and trigger point infiltration (TPI)—can also be used for the treatment of PDPH. Our objective was to evaluate the efficacy of these peripheral nerve blocks (PNBs) in the treatment of PDPH.

**Methods** A retrospective study was conducted including all patients with PDPH in the obstetrics department of our institution between April 2016 and December 2017. Data were retrieved from clinical records regarding anesthetic technique, symptoms, treatment, Numeric Pain Score (NPS) before and after treatment, among others.

**Results** We observed 50 cases of PDPH: 25 following spinal anesthesia, 19 following epidural block and 6 following combined spinal-epidural. Of these, seven were managed conservatively and one received EBP as first-line treatment. The remaining 42 patients received PNB as first-line treatment. Of these, 27 received only 1 course of PNB, while 15 received 2 courses. We observed a statistically significant improvement in the NPS after the first course of blocks (n=42), with a reduction of the median NPS by 6.0 (IQR 4.0–7.5; p<0.001). Improvement was also observed after the second course of blocks (n=15), with a reduction of the median NPS of 3.5 (IQR 1.5–5.0; p=0.02). Due to treatment failure, 9 of the 42 patients treated with PNB required EBP. None of these were cases following spinal anesthesia.

**Conclusion** SPGB, GONB and TPI can be safe and effective options for treatment of PDPH, but do not completely eliminate the need for EBP. Prospective studies designed to identify factors associated with unsuccessful treatment are required.

## INTRODUCTION

Postdural puncture headache (PDPH) is a common complication, following neuraxial techniques. It is purported to be caused by a cerebrospinal fluid (CSF) leak through an opening in the dura mater, leading to low CSF pressure, meningeal traction and exaggerated compensatory cerebral vasodilation.<sup>1</sup> PDPH can occur after intentional puncture of the dura mater for spinal anesthesia or after accidental puncture (ADP) during epidural block. The incidence of PDPH is related to several factors, most important of which are the caliber and type of needle used—70% for 16G Tuohy needles and <2% for 29G Quincke needles.<sup>2</sup>

PDPH is defined as a headache caused by low CSF pressure that is usually, but not invariably, orthostatic, occurring within 5 days of a confirmed or presumed dural puncture. Neck stiffness and/or pain, tinnitus, subjective hearing symptoms, photophobia and nausea may also be present.<sup>3</sup> Up to 90% remit spontaneously within 2 weeks; the remaining cases are treated as CSF fistulae. The obstetric population is particularly prone to PDPH—there is a higher incidence of ADP in parturients than the general population, and young women are at higher risk of developing PDPH. Moreover, symptoms of PDPH are particularly relevant in the postpartum period, during which they cause significant short-term disability, prevent ambulation and care of the newborn and result in a longer hospital stay.<sup>4</sup> Thus, management of PDPH is a major issue in obstetric anesthesia.

Conservative treatment for PDPH includes adequate hydration, systemic analgesia with paracetamol and non-steroidal anti-inflammatories and increased caffeine intake, as well as bed rest if these measures are unsuccessful. The gold standard for the treatment of PDPH is the epidural blood patch (EBP). EBP has a high success rate (70%–80%) but is an invasive technique with potential complications.<sup>4</sup> There has been increased interest in regional analgesic techniques for treatment of PDPH, due to their success in the treatment of other headache syndromes. Several case reports and case series have been published regarding the use of peripheral nerve blocks (PNBs) for PDPH, most of which report the use of sphenopalatine ganglion block (SPGB), greater occipital nerve block (GONB) and trigger point infiltration (TPI).<sup>5–12</sup>

Blockade of the sphenopalatine ganglion interrupts parasympathetic flow to the cerebral vasculature. This opposes the excessive vasodilation induced by the CSF leak, allowing the vessels to return to their normal diameter and thus alleviating symptoms.<sup>5</sup> Blockade of the greater occipital nerve interrupts the afferent somatic innervation of most of the occipital region.<sup>12</sup> Infiltration of trigger points in the occipital and cervical regions supplements analgesia. These techniques allow a topographic and symptom-oriented approach to the treatment of PDPH.

The aim of the study was to describe our experience with the analgesic efficacy of these PNBs in the treatment of PDPH. We also aimed to identify factors associated with the need for EBP and the effect of treatment on discharge delay due to PDPH.



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## METHODS

A retrospective study was conducted including all patients with PDPH at our institution between April 2016 and December 2017.

Records from all patients on whom neuraxial anesthesia was performed were reviewed to identify those diagnosed with PDPH as described below. Data collected included: demographic data, American Society of Anesthesiologists physical status, anesthetic technique, mode of diagnosis of ADP, location of pain, treatment, timing between neuraxial technique, symptom onset and intervention, resting verbal Numeric Pain Score (NPS) immediately before and 30 min after treatment, subjective impression of overall improvement in pain score (whether the patient believed their pain had improved more or less than 50%), complications, duration of hospital stay, delay after expected discharge (expected discharge is 2 days after vaginal delivery and 3 day after cesarean section), need for readmission after discharge. Exclusion criteria included losses in follow-up and inadequate documentation of medical records.

## Hospital protocol for PDPH management

Our institution's obstetrics department has between 3000 and 3500 births per year, with a cesarean section rate of 25%–30%. Up to 85%–95% of parturients receive neuraxial analgesia for labor and approximately 70% of cesarean sections are carried out under regional anesthesia. The rate of ADP during epidural catheter placement in the obstetric population is 1%–1.5%.

The technique of choice for labor analgesia is epidural analgesia via a catheter inserted with an 18G Tuohy needle. Subarachnoid block with a 25–27G Quincke or Whitacre needle is used sporadically for labor analgesia in a minority of selected cases. Cesarean section under regional anesthesia is carried out preferentially under combined spinal-epidural (CSE) with a needle-through-needle technique (18G Tuohy and 27G Whitacre) or spinal anesthesia (25–27G Quincke or Whitacre). Epidural anesthesia is used if a catheter has already been sited.

At our institution, patients with suspected PDPH are generally identified in one of two ways: patients with confirmed ADP with a Tuohy needle (during performance of epidural block or CSE) are referred to the department of anesthesiology's acute pain service and monitored for the occurrence of symptoms of PDPH; patients presenting later with symptoms of PDPH (after undetected ADP or following spinal anesthesia) are referenced to the acute pain service by ward nursing staff. In both circumstances, the diagnosis is confirmed by an anesthesiologist, according to the International Classification of Headache Disorders.

On diagnosis, treatment for PDPH is initiated according to local protocols. Until 2016, these recommended the use of conservative treatment (oral hydration, caffeine citrate 300 mg two times per day and oral analgesia with paracetamol 1 g three times per day, ibuprofen 400 mg three times per day, tramadol 100 mg three times per day). EBP was proposed to the patient after 48 hours of unsatisfactory symptom relief with conservative treatment or as first-line treatment for severe and disabling headache with associated symptoms (vestibular, cochlear and ocular dysfunction).

In 2016, local protocols were altered to include SPGB as first-line treatment. In 2017, GONB with or without TPI was added to the first-line treatment for patients with symptoms located to the occipital or cervical regions. All patients were started on conservative treatment on diagnosis of PDPH. EBP was still proposed to patients as first-line treatment for severe symptoms and as second-line treatment if two courses of PNB are

unsuccessful. Patients who refused PNB or EBP were managed with conservative treatment only.

**SPGB technique:** With the patient in the supine position, an epidural catheter or a cotton-tipped applicator is introduced transnasally to reach the SPG in the pterygopalatine fossa. Local anesthetic (1–2 mL of 1% ropivacaine) is administered; this is repeated 10 min later. Patients remain in the supine position for 20 min, after which the catheter or applicator is removed.

**GONB/TPI technique:** With the patient either prone or sitting with the neck flexed, the external occipital protuberance is palpated and a needle inserted between 15 mm and 25 mm lateral to it, parallel to the superior nuchal line. Between 2 and 3 mL of 1% ropivacaine is injected on each side. Trigger points in the occipital and cervical regions are identified, if present, and small volumes of the local anesthetic are injected here.

Blocks are carried out with standard monitoring. After the blocks are performed, patients are evaluated in the upright position in the presence of the anesthesiologist. Pain is evaluated using the NPS, and scores before and after treatment recorded.

## Statistical analysis

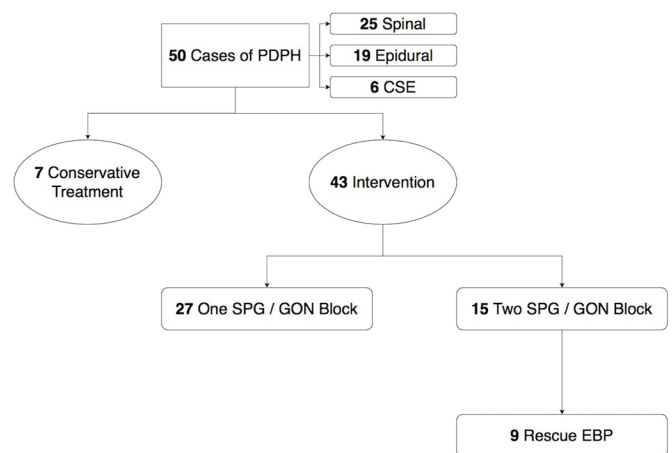
Continuous variables are presented as median with IQR (25–75). All discrete variables are presented as numbers and/or percentages.

To evaluate the success of SPGB, GONB and TPI in alleviating symptoms, pain scores before and after treatment were analyzed in the patients treated with PNB only. Given the paired nature of the data, a Wilcoxon signed-rank test was used to evaluate for statistical significance. A p value of 0.05 was considered significant. The Hodges-Lehmann median difference was used to calculate effect size for pain scores. For the secondary outcomes, comparative analysis was not performed due to the small sample size of patients per treatment group. Descriptive analysis is presented for this data. SPSS Statistics V.22.0 (IBM) was used for data analysis.

## RESULTS

## Patient characteristics

Over the course of 21 months, 50 patients were diagnosed with PDPH and were included in the study. Figure 1 shows data regarding the anesthetic technique, diagnosis and treatment of the 50 cases of PDPH. PDPH was observed following 25 cases of spinal anesthesia, 19 cases of epidural block and 6 cases of CSE.



**Figure 1** PDPH cases and approach to treatment. CSE, combined spinal-epidural; EBP, epidural blood patch; GON, greater occipital nerve; PDPH, postdural puncture headache; SPG, sphenopalatine ganglion.

**Table 1** Patient characteristics

Patient characteristics	PNB or EBP (n=43)	Conservative treatment (n=7)
Median age (IQR) in years	34 (29–36)	33 (27–35)
ASA classification, n (%)		
II	43 (100.0)	6 (85.7)
III	0 (0.0)	1 (14.3)
Technique, n (%)		
Spinal	20 (46.5)	5 (71.4)
Epidural	18 (41.9)	1 (14.3)
CSE	5 (11.6)	1 (14.3)

ASA, American Society of Anesthesiologists; CSE, combined spinal-epidural; EBP, epidural blood patch; PNB, peripheral nerve blocks.

Seven of the 50 patients were treated with conservative management only. Thus, 43 patients were treated with PNB or EBP or a combination of these techniques.

Table 1 shows data regarding patient characteristics and analgesic/anesthetic technique used. No complications of the aforementioned techniques used for treatment of PDPH were observed.

### Effect of PNBs on pain score

Of the 50 cases of PDPH observed over the 21 months this study lasted, 42 were given SPGB with or without GONB/TPI (in addition to conservative measures) as first-line treatment. Of these, 27 patients received only 1 course of PNB, while 15 received 2 courses. We aimed to evaluate the effect of PNB on the symptoms of PDPH, namely intensity of pain. To do this, we compared the NPS before and after treatment. Table 2 shows this data.

NPSs after the first course of blocks were improved, with a reduction of the median NPS by 6.0 (IQR 4.0–7.5;  $p < 0.001$ ). Improvement was also observed after the second course of blocks, with a reduction of the median NPS of 3.5 (IQR 1.5–5.0;  $p = 0.02$ ).

A greater than 50% improvement in pain scores was observed in 86% (95% CI 75% to 97%) of patients after the first course of blocks, but in only 69% (95% CI 40% to 98%) of patients after the second course of blocks.

A discharge delay due to PDPH was observed in 38% (95% CI 23% to 53%) of patients. This improved as the protocol was implemented: a delay in discharge due to PDPH occurred in 21% (95% CI 5% to 36%) of patients in 2017, compared with 69% (95% CI 43% to 94%) in 2016. A shorter hospital stay has obvious economic advantages, while also being important in the obstetric population.

PNBs were performed in the first 24 hours after diagnosis of PDPH in 71.4% of the 42 patients. There was a slight improvement in the timing of intervention with progressive widespread implementation of the new treatment protocols in our department: 76.0% of patients received treatment with PNB within 24 hours of diagnosis in 2017, compared with 64.7% in 2016.

**Table 2** Effect of peripheral nerve blocks on pain scores

Intervention	No of patients	NPS before treatment (median, IQR)	NPS after treatment (median, IQR)	P value
1 <sup>st</sup> PNB	42	8.0 (6.0–9.0)	1 (0.0–3.0)	<0.001*
2 <sup>nd</sup> PNB	15	5.5 (4.0–7.3)	2 (0.0–3.0)	0.02*

\*Wilcoxon signed-rank test and Hodges-Lehmann median difference. NPS, Numeric Pain Score; PNB, peripheral nerve block.

**Table 3** Anesthetic technique and epidural blood patch

Technique	EBP (n=10)	No EBP (n=40)
Spinal, n (%)	0 (0.0)	25 (62.5)
Epidural, n (%)	8 (80.0)	11 (27.5)
CSE, n (%)	2 (20.0)	4 (10.0)

CSE, combined spinal-epidural; EBP, epidural blood patch.

### Neuraxial technique and EBP

Table 3 shows data regarding the analgesic/anesthetic technique causing the 50 cases of PDPH in the patients that required EBP for successful treatment and in those that did not. Due to treatment failure with PNB, 9 of the 42 patients initially treated with PNB required EBP. None of these were cases following spinal anesthesia.

### DISCUSSION

Our results demonstrate that PNBs may be an attractive option to help with pain associated with PDPH. Previous studies show similar effectiveness of these techniques in pain relief, mostly regarding SPGB in isolation.<sup>5 7 13 14</sup> Our results also suggest that the effect is less pronounced after the second course of PNB, possibly indicating a more refractory headache. Although some (n=9) of these patients needed a rescue EBP, over two-thirds of these patients achieved at least temporary satisfactory pain relief with PNBs.

It would also be helpful to compare patients treated with PNB only with those treated with EBP block only (ie, as first-line treatment), in order to compare the relative effectiveness of the two treatment modalities. We are unable to do this in this study as only one patient received EBP as first-line treatment—EBP was used as rescue therapy after treatment failure in the other nine cases. Another study has compared SPGB and EBP as separate treatment options and concluded that SPGB provides faster and sustained symptom relief.<sup>14</sup> This agrees with our findings.

In this population, all cases of PDPH requiring EBP followed epidural block or CSE. Dural puncture with a Tuohy needle is the most likely culprit of PDPH with severe symptoms requiring EBP, either as first-line treatment or as rescue therapy after failure of less invasive treatment.<sup>2</sup> None of the cases of PDPH due to spinal anesthesia required EBP for satisfactory treatment, which was achieved with conservative treatment with or without PNB. This is, in itself, an important conclusion to draw—EBP might be avoidable in cases of PDPH after subarachnoid block, in favor of less invasive techniques such as PNB, in addition to standard conservative treatment. We lack data regarding the need for EBP in PDPH following spinal anesthesia in previous years at our institution, but the published literature on this topic reports that, while the incidence is lower than after ADP with a Tuohy needle, EBP is still sometimes needed for PDPH after spinal anesthesia.<sup>2 15</sup> With this management protocol, we have avoided the need for EBP in all cases of PDPH due to spinal anesthesia. On the other hand, PDPH following ADP may be successfully treated with PNB, but some cases will still require EBP.

Expectant management of PDPH tends to increase hospital length of stay and emergency room visits.<sup>16</sup> In the past, our department has tended to favor expectant management of PDPH. One of the objectives of the implementation of this management protocol was to reduce delay to discharge due to PDPH. The available data from this study are insufficient to draw conclusions on the effect of the new management protocol on this parameter. The incidence of discharge delay due to

PDPH in patients diagnosed with PDPH was 38%, a much higher figure than that observed in the literature.<sup>17</sup> This may be due to a small sample size and a more conservative treatment approach, as well as differing hospital practices. Also, we do not have previous data (from before implementation of the new treatment protocol) for comparison. Nevertheless, there appears to be a progressive improvement, such that the figure is much lower for patients treated for PDPH in 2017, after widespread application of the treatment protocol, as described.

## LIMITATIONS

Our study has several limitations. Consistent with a retrospective study, significant confounders may exist that partially explain the relationship we observed. Thus, our findings should be interpreted as exploratory. Additionally, there was no standardized form used for the recording of the data. This resulted in missing data for some variables in an already small population, which may have prevented other significant conclusions being drawn from the statistical analysis performed. Finally, an important limitation of this study is that referral of potential PDPH cases (if ADP did not occur) to the anesthesia department is dependent on recognition of symptoms by nursing staff, as patients who received neuraxial analgesia or anesthesia are not evaluated regularly unless an epidural catheter remains in place or complications of the technique occur. This may have resulted in some cases of undiagnosed PDPH that were not assessed by an anesthesiologist and where the treatment protocol was not applied.

## CONCLUSIONS

In conclusion, we have described our experience with the management of PDPH in a busy obstetrical practice. SPGB, GONB and TPI can be considered as analgesic options in the management of PDPH, as not all cases of PDPH require EBP for successful treatment. This enables a topographic and symptom-oriented approach to the treatment of PDPH.

**Contributors** JX designed the study, performed data collection, analysis and interpretation and drafted and revised the paper. SP designed the study, performed data collection and drafted and revised the paper. JS performed statistical analysis and participated in drafting the paper. CSN performed statistical analysis. HC and RF devised the treatment protocols studied and participated in data collection and revision of the draft paper. RA devised the treatment protocols studied, initiated the project, monitored data collection and revised the draft paper. PL devised the treatment protocols studied, participated in data collection and revision of the draft paper. HM revised the draft paper.

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**Data availability statement** Data are available on reasonable request. Data are deidentified participant data. Data are available from the corresponding author (ORCID id: 0000-0003-2483-2146).

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