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# Efficacy and efficiency of sphenopalatine ganglion block for management of post-dural puncture headache in obstetric patients: a randomized clinical trial

Marwa M. Mowafi* and Rehab A. Abdelrazik

## Abstract

**Background:** This clinical trial aimed to study the efficacy and efficiency of sphenopalatine ganglion block (SPGB) for the management of post-dural puncture headache (PDPH) in obstetric patients. A prospective randomized clinical trial was carried out on 40 patients with PDPH divided randomly into two equal groups. Paracetamol group (PG): The patients received 1 g of paracetamol three times per day intravenously for 1 day. If adequate pain relief was not achieved, rescue analgesia in the form of intravenous ketorolac was given. Block group (SPGBG): The patients received bilateral SPGB using 3 ml mixture of lignocaine with dexamethasone in each nostril. The pain score, heart rate, and mean arterial pressure were recorded. The onset of analgesia, duration of analgesia, adverse effects, total dose of ketorolac, patient satisfaction, and hospital stay for epidural blood patch (EBP) or hospital discharge after 24 h were also documented.

**Results:** The pain perception (numeric rating scale [NRS]) in the block group was generally lower throughout the study showing only highly significant difference till the first 2 h after the block with more rapid onset and longer duration of analgesia. The total dose of rescue analgesic in mg was significantly lower in the block group and hospital stay for EBP was significantly less in the block group with higher patient satisfaction.

**Conclusions:** PDPH can be treated effectively and rapidly with transnasal SPGB, which is a noninvasive, safe, and easy method with a low complication rate.

**Trial registration:** ClinicalTrials.gov, NCT04793490. Registered on March 11, 2021; https://clinicaltrials.gov/ct2/show/NCT04793490).

**Keywords:** Post dural puncture headache, Sphenopalatine ganglion block, Analgesia, Obstetrical

## Background

When comparing with other patients' categories, both incidence and severity of post-dural puncture headache (PDPH) in obstetric population are remarkably higher in accidental dural puncture (Darvish et al. 2011). It can reach up to 86% (Darvish et al. 2011), instead of 25% in non-obstetric population (Bakshi and Gehdoo 2018). Although there is an equal incidence of headache following spinal anesthesia in both populations ranging from 0.1 to 36% depending upon the type and gauge of needle used, pregnancy, female gender, and young age have always been considered as major risk factors for PDPH (Oberhofer et al. 2013). It is often exhausting, hindering the mother from taking care of the newborn baby. This causes raised healthcare costs, extended stay in the hospital, and frequent visits to the emergency department

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for evaluating and treating the headache (Angle et al. 2005). Also, one small study found out that patients who complained of PDPH were significantly more potential to acquire chronic headache (Webb et al. 2012).

Controlling PDPH is not easy and cannot be accomplished by conservative measures as bed rest, analgesics, hydration, and caffeine alone (Turnbull and Shepherd 2003). While epidural blood patch (EBP) is considered the gold standard method in the management of PDPH (Chestnut et al. 2014), it is invasive leading to serious complications such as infection, bleeding, and or neurological insult. It might raise the risk of multiple dural punctures (Bradbury et al. 2013). Cosyntropin is a synthetic equivalent of adrenocorticotropic hormone (ACTH) that stimulates the adrenal cortex to release aldosterone (Rossi et al. 2019). It may increase the production of CSF through the active transport of sodium ions. There is also an increase in beta-endorphin that may reduce pain perception (Hanling et al. 2016). However, it is not known whether this drug (CORTROSYN®) is excreted in human milk. So, caution must be taken if cosyntropin for injection is prescribed for a nursing woman.

The first topical transnasal sphenopalatine ganglion block (SPGB) was described by Sluder in 1908 as a non-invasive technique (Bradbury et al. 2013). After that, it has been used effectively for the management of headaches of variable etiologies including but not limited to chronic migraine, cluster headaches, refractory trigeminal neuralgia, and postoperative analgesia for endoscopic sinus surgery (Tolba et al. 2019). The pathophysiology of migraine is complex, involving activation of the trigemino-vascular system that leads to inflammatory changes in the pain-sensitive meninges and alters the permeability of the blood–brain barrier (Goadsby 2009). Mechanical stimulation of parasympathetic synapses within the SPG releases vaso-active peptides which in addition to the blockage of parasympathetic activity by the local anesthetic contribute to the control of neurogenic inflammation, vasodilatation, and the symptoms of migraine (Mojica et al. 2017). Similarly, continuous leakage of cerebrospinal fluid after dural puncture leads to compensatory vasodilatation that causes headache. SPGB inhibits the uncontrolled vasodilatation and the symptoms are attenuated (Piagkou et al. 2012). This procedure is safe and feasible and can be readily done in the emergency department (Nair and Rayani 2017).

Administration of lignocaine 2% intranasally anesthetizes the SPG and reduces signaling and can decrease the PDPH. The mechanism of action of short-acting drugs as lignocaine to give continuous relief of PDPH symptoms after its duration of action is still unexplained (Tolba et al. 2019). While local anesthetics are usually used as abortive agents that give a quick onset for relieving the headache, corticosteroids used as adjuvants to the local anesthetic agent may produce a long-lasting inhibitory effect (up to 6 weeks) in case of chronic headache (Pehora et al. 2017).

Only few studies have investigated the efficacy and safety of SPGB for treating the PDPH. Earlier studies showed that SPGB was a safe procedure, provided good pain relief after the block, and showed reduction in the need for EBP with overall high patient satisfaction (Candido et al. 2013; Cohen et al. 2018, 2009, 2001; Jespersen et al. 2020; Kent and Mehaffey 2015, 2016; Patel et al. 2016; Puthenveettil et al. 2018; Santos et al. 2021; Takmaz et al. 2021). All these studies were suggestive that the block could be useful.

Our study aimed to emphasize the efficacy and efficiency of SPGB for the management of PDPH in obstetric patients using lignocaine dexamethasone mixture.

## Methods

This study was a prospective, randomized, parallel-group (allocation ratio 1:1), clinical trial, at Ain Shams University Hospitals (Maternity Hospital), Cairo, Egypt. The study adheres to CONSORT guidelines.

All patients signed a written informed consent before inclusion. Patients were informed about the use of numeric rating scale (NRS) to assess the severity of pain with a score from 0 to 10 (0 = no pain, 10 = most severe pain).

An investigator performed simple randomization using a computer-generated number table of random numbers in opaque and sealed envelope (SNOSE). Another investigator (not involved in sequence generation and allocation concealment) assessed patients for eligibility and assigned eligible patients to one of the studied groups. The assigned treatment was written on a card and sealed in opaque envelopes consecutively numbered. These envelopes were opened just immediately before administering the medication.

Sample size was calculated using PASS 11$^{th}$ release program, setting power at 90%, the alpha error at 5%. Result from a previous study (Puthenveettil et al. 2018) showed that the mean pain score at 2 h was $1.7 \pm 2.3$ in group B cases compared to $4.1 \pm 1.4$ in group A cases. Based on these results, a sample size of 20 patients in each group (40 total) will be needed, taking into account 20% drop-out rate.

### Inclusion criteria

We included a total of 40 patients post-cesarean section who had spinal anesthesia with 25G spinal needle, ASA I or II status, BMI < 35 kg/m$^2$, and with active PDPH

within 7 days after subarachnoid block and not relieved (NRS > 4) with standard treatment.

#### Exclusion criteria

We excluded patients who refuse to take part in the study, patients with BMI > 35 kg/m$^2$ and ASA above II, patients with chronic headache or migraine, and patients with known coagulopathy, nasal septal deviation, polyp, history of nasal bleeding, and allergy to local anesthetics.

After obtaining the informed consent, patients were randomly divided into 2 equal groups, there was no blinding for the anesthetist and the patients, but the data collector was blind:

Paracetamol group (PG): ($n = 20$) Patients received 1 g paracetamol three times daily intravenously for 1 day. If adequate analgesia was not achieved (NRS > 4) after 2 h, rescue analgesia in the form of intravenous ketorolac 30 mg was given with a maximum dose of 120 mg/day.

Block group (SPGBG): ($n = 20$) Patients received bilateral SPGB, using 3-ml mixture of 2 ml of lignocaine 2% plus 1 ml (4 mg) dexamethasone in each nostril. All blocks were performed by the same anesthetist.

Bilateral SPGB was done with cotton-tipped applicator in the ward under monitoring where non-invasive blood pressure and $O_2$ saturation probe were attached to the patient. The patient was in supine position with the neck extended. The anterior nares were inspected for polyps, tumors, or significant septal deviation. SPGB was done using transnasal approach. Few drops of lidocaine 2% was instilled into both anterior nares. Then, a long applicator with a cotton swab at the tip saturated with a 3-mL mixture of 2 mL lidocaine 2% plus 1 mL dexamethasone (4 mg) is then inserted parallel to the floor of the nose until resistance is encountered. The swab should be at the posterior pharyngeal wall superior to the middle turbinate. The applicator was kept in the nostril for 5 min and then removed. Similarly, the procedure is repeated in the other nostril.

The connective tissue and mucous membrane covering helps the diffusion and penetration of the drug. After 5 min, the patients in group B were asked to sit up to assess the presence of headache using numeric pain score (NRS). If adequate pain relief was not achieved after 2 h from a successful block (NRS > 4), the rescue analgesia in the form of intravenous ketorolac 30 mg with a maximum dose of 120 mg/day was given. Patients in both groups without adequate pain relief after 24 h from the beginning of the study were considered for EBP.

Standard monitoring of the patients such as mean arterial blood pressure and heart rate were recorded. Pain score was recorded before the procedure, 5 min, 15 min, 30 min, 1, 2, 4, 6, 8, 12, and 24 h after the procedure. Onset of analgesia (NRS less than 4), duration of analgesia (time to first rescue analgesic in min), adverse effects associated with the block, the total dose of ketorolac in (mg) during the study period, patient satisfaction, hospital stay for EBP, or hospital discharge after 24 h were also documented. Our study ended 24 h after recruiting patients for the trial.

#### Study endpoint

Failure to control PDPH with the suggested management.

#### Study outcomes

The primary outcome was to study the efficacy of SPGB for the treatment of PDPH assessed by reduction in pain score to < 4.

The secondary outcomes were to study the efficiency of the block by the assessment of onset and duration of analgesia, as well as the development of any side effects associated with the block, total dose of ketorolac, and hospital stay for EBP or hospital discharge after 24 h and patient satisfaction.

#### Statistical methods

The collected data were coded, tabulated, and statistically analyzed using IBM SPSS statistics (Statistical Package for Social Sciences) software version 22.0, IBM Corp., Chicago, USA, 2013. Quantitative variables tested for normality using Shapiro–Wilk test, then if normally distributed described as mean and standard deviation (SD) and compared using independent *t*-test, while if not normally distributed described as median and interquartile range (IQR) (1st − 3rd IQ) and compared using Mann–Whitney test. Qualitative data was described as number and percentage and compared using chi-square test and Fisher's exact test for variables with small, expected numbers, while linear by linear associations used for ordinal variable. Long rank test was used to compare rate of morphine analgesia. The level of significance was taken at *P* value < 0.050 was significant, otherwise is non-significant.

## Results

This is a prospective clinical trial aimed to study both the efficiency and efficacy of SPGB in managing PDPH in obstetric patients who underwent a cesarean section with spinal anesthesia as compared to IV analgesia by paracetamol with or without ketorolac.

In this study, 69 patients were assessed for eligibility. Twenty-nine were excluded (three refused to participate and 26 did not meet the inclusion criteria). Forty patients were randomized and allocated to receive either paracetamol (PG, $n = 20$) or sphenopalatine ganglion block (SPGBG, $n = 20$) between March 2021 and December 2021 (Fig. 1).

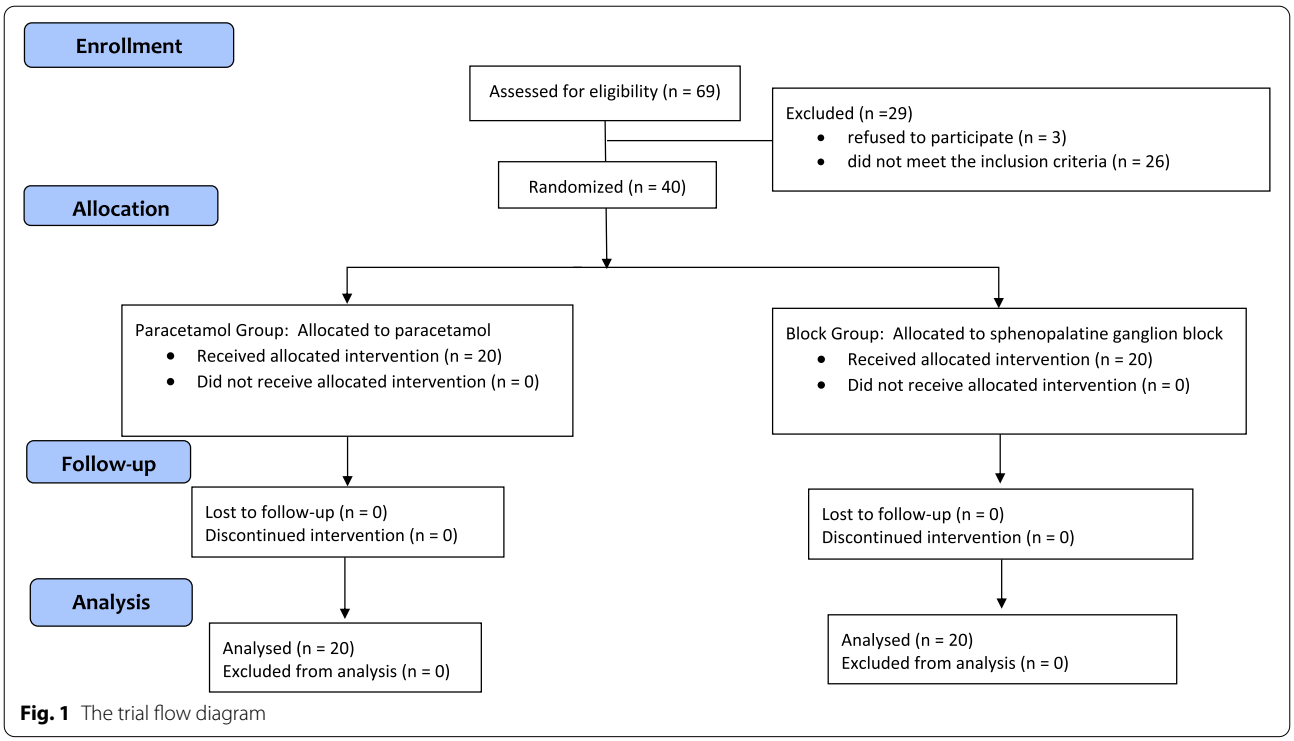


**Fig. 1** The trial flow diagram

The results of the study suggest that SPGB could be effectively used in the management and rapid control of PDPH. It was found that SPGB can offer adequate pain control throughout the study period with faster onset and longer duration of analgesia with less analgesic consumption. No patients in the SPGB group had serious side effects associated with the block. The need for hospital stay for EBP was much less in the block group and patient satisfaction was significantly higher in the SPGB group.

In our trial, very minimal self-limited side effects as bitter taste, nasal congestion, lacrimation, epistaxis, and dizziness were recorded in the SPGB group. So, it is considered a safe technique. Only one patient in our block group versus 7 patients in the control group needed EBP.

The analysis was done by the original assigned group (each had 20 patients). Table 1 shows no statistically significant difference between the studied groups regarding age, weight, BMI, and ASA.

Table 2 shows no statistically significant difference between the studied groups regarding mean blood pressure and heart rate.

Table 3 shows that the pain perception (NRS) in the SPGBG was generally lower throughout the study showing only highly significant difference from 15 min till the first 2 h after the block, while other measures showed a non-significant difference.

**Table 1** Comparison regarding demographic characteristics

| Variables | SPGBG (*N* = 20) | PG (*N* = 20) | *p*-value^ |
|---|---|---|---|
| Age (year), mean ± SD | 28.7 ± 3.7 | 27.5 ± 3.0 | 0.250 |
| Weight (kg), mean ± SD | 82.9 ± 5.0 | 80.5 ± 6.8 | 0.199 |
| BMI (kg/m$^2$), mean ± SD | 29.4 ± 1.8 | 28.7 ± 1.6 | 0.198 |
| ASA (*n*, %) I | 20 (100.0%) | 20 (100.0%) | Not applicable |

*SD* Standard deviation, *BMI* Body mass index, *ASA* American Society of Anesthesiologists, *SPGBG* Sphenopalatine ganglion block group, *PG* Paracetamol group

^Independent *t*-test

Table 4 shows that SPGBG had more rapid onset, longer duration of analgesia with highly significant difference, as well as less consumption of rescue analgesic.

Table 5 shows that SPGBG had significantly lower hospital stay with significantly higher patient satisfaction and minimal side effects with a significant difference only regarding the bitter taste.

## Discussion

The first paper described the SPGB block use for managing PDPH which was published by Cohen et al. (Cohen et al. 2001). The block was used in 22 parturient who suffered from migraines, tension headaches, neck pain, and low backaches. They inserted cotton-tipped applicators

**Table 2** Comparison regarding mean blood pressure and heart rate

| Time | SPGBG (*N* = 20) | PG (*N* = 20) | *p*-value^ | Effect of SPGB relative to PG | |
|---|---|---|---|---|---|
| | | | | Mean ± SE | 95% CI |
| Mean arterial blood pressure (mmHg) | | | | | |
| Baseline | 97.1 ± 5.5 | 96.0 ± 5.0 | 0.513 | 1.1 ± 1.7 | − 2.3 to 4.5 |
| Minute-5 | 92.2 ± 5.6 | 94.9 ± 5.2 | 0.121 | − 2.7 ± 1.7 | − 6.1 to 0.7 |
| Minute-15 | 91.3 ± 4.9 | 94.4 ± 5.0 | 0.052 | − 3.2 ± 1.6 | − 6.3 to 0.0 |
| Minute-30 | 90.1 ± 5.6 | 93.2 ± 5.1 | 0.076 | − 3.1 ± 1.7 | − 6.5 to 0.3 |
| Hour-1 | 88.2 ± 5.7 | 91.3 ± 5.3 | 0.087 | − 3.1 ± 1.7 | − 6.6 to 0.5 |
| Hour-2 | 86.2 ± 5.4 | 89.3 ± 5.3 | 0.075 | − 3.1 ± 1.7 | − 6.5 to 0.3 |
| Hour-4 | 85.7 ± 5.4 | 88.2 ± 5.2 | 0.143 | − 2.5 ± 1.7 | − 5.9 to 0.9 |
| Hour-6 | 83.9 ± 5.5 | 86.1 ± 3.7 | 0.148 | − 2.2 ± 1.5 | − 5.2 to 0.8 |
| Hour-8 | 82.9 ± 5.7 | 85.0 ± 4.0 | 0.192 | − 2.1 ± 1.5 | − 5.2 to 1.1 |
| Hour-12 | 82.1 ± 5.7 | 83.8 ± 4.0 | 0.282 | − 1.7 ± 1.6 | − 4.9 to 1.5 |
| Hour − 24 | 80.2 ± 6.1 | 81.7 ± 3.8 | 0.338 | − 1.6 ± 1.6 | − 4.8 to 1.7 |
| Heart rate (beat/minute) | | | | | |
| Baseline | 89.1 ± 4.2 | 89.1 ± 5.9 | 0.976 | 0.0 ± 1.6 | − 3.2 to 3.3 |
| Minute-5 | 85.7 ± 3.9 | 88.2 ± 5.9 | 0.114 | − 2.6 ± 1.6 | − 5.7 to 0.6 |
| Minute-15 | 84.8 ± 4.2 | 87.6 ± 5.8 | 0.093 | − 2.8 ± 1.6 | − 6.0 to 0.5 |
| Minute-30 | 83.9 ± 4.2 | 86.4 ± 5.8 | 0.127 | − 2.5 ± 1.6 | − 5.7 to 0.7 |
| Hour-1 | 81.4 ± 4.0 | 83.4 ± 4.3 | 0.133 | − 2.0 ± 1.3 | − 4.6 to 0.6 |
| Hour-2 | 80.7 ± 3.7 | 82.6 ± 4.5 | 0.156 | − 1.9 ± 1.3 | − 4.6 to 0.8 |
| Hour-4 | 79.8 ± 4.3 | 81.4 ± 4.8 | 0.274 | − 1.6 ± 1.4 | − 4.5 to 1.3 |
| Hour-6 | 78.0 ± 3.8 | 79.6 ± 5.0 | 0.280 | − 1.6 ± 1.4 | − 4.4 to 1.3 |
| Hour-8 | 77.0 ± 4.3 | 78.8 ± 5.3 | 0.258 | − 1.8 ± 1.5 | − 4.8 to 1.3 |
| Hour-12 | 76.4 ± 4.0 | 77.9 ± 5.3 | 0.318 | − 1.5 ± 1.5 | − 4.5 to 1.5 |
| Hour-24 | 74.5 ± 3.9 | 76.1 ± 5.3 | 0.285 | − 1.6 ± 1.5 | − 4.6 to 1.4 |

Data expresses as mean and standard deviation

*SE* Standard error, *CI* Confidence interval, *SPGBG* Sphenopalatine ganglion block group, *PG* Paracetamol group

^Independent *t*-test

saturated in EMLA cream for 10 min in each nostril. Only two patients could not tolerate the applicators, so they applied cetacaine nasal spray. It was proved to be effective and none of the patients complained of any adverse effects. It was recommended to be used for the management of PDPH After this experience.

Cohen et al. (Cohen et al. 2009) in 2009 involved in their study 13 parturient suffering from moderate to severe PDPH and the SPG block was done using a cotton-tipped applicator and lignocaine 4% topical ointment. Eleven out of 13 patients reported adequate pain reduction with no need for EBP, while the other 2 patients were only relieved after an EBP.

Kent and Mehaffey (Kent and Mehaffey 2015) applied SPG blocks for 3 patients with proved PDPH in the emergency room. They used 2% viscous lignocaine. The 3 patients reported adequate pain relief after the block. They suggested that the intervention can be precisely and safely applied in the emergency room. Kent and Mehaffey (Kent and Mehaffey

**Table 3** Comparison regarding pain perception

| Time | SPGBG (*N* = 20) | PG (*N* = 20) | *p*-value^ |
|---|---|---|---|
| Baseline | 5.0 (4.0–5.0) | 5.0 (4.0–5.0) | 0.456 |
| Minute-5 | 4.0 (3.0–5.0) | 5.0 (4.0–5.0) | 0.151 |
| Minute-15 | 2.0 (1.3–2.8) | 5.0 (4.0–5.0) | < 0.001* |
| Minute-30 | 2.0 (2.0–2.0) | 4.5 (4.0–5.0) | < 0.001* |
| Hour-1 | 2.0 (1.0–2.0) | 4.0 (4.0–4.0) | < 0.001* |
| Hour-2 | 2.0 (1.0–2.0) | 4.0 (3.0–4.0) | < 0.001* |
| Hour-4 | 1.0 (1.0–2.0) | 1.5 (1.0–2.8) | 0.093 |
| Hour-6 | 1.0 (0.3–1.8) | 1.0 (1.0–2.0) | 0.466 |
| Hour-8 | 1.0 (1.0–2.0) | 2.0 (1.0–2.0) | 0.124 |
| Hour-12 | 1.0 (1.0–2.0) | 1.5 (1.0–2.0) | 0.564 |
| Hour-24 | 2.0 (1.0–3.0) | 2.0 (1.0–3.0) | 0.832 |

Data expresses as median and interquartile range

*SPGBG* Sphenopalatine ganglion block group, *PG* Paracetamol group

^Mann Whitney test

* Significant

**Table 4** Comparison regarding the onset, duration of analgesia, and total dose of rescue analgesic

| Time | SPGB (*N* = 20) | PG (*N* = 20) | *p*-value | Effect of SPGBG relative to PG | |
|---|---|---|---|---|---|
| | | | | Mean ± SE | 95% CI |
| Onset (minutes) | 10.3 ± 4.1 | 127.5 ± 55.0 | ^ < 0.001* | − 117.3 ± 12.3 | − 142.2 to − 92.3 |
| Duration (minutes) | 582.0 ± 76.7 | 253.0 ± 92.5 | ^ < 0.001* | 329.0 ± 26.9 | 274.6–383.4 |
| Total rescue analgesic dose (mg) | 52.5 ± 28.7 | 94.6 ± 29.6 | ^0.024* | − 42.1 ± 16.8 | − 78.0 to − 6.2 |

Data expresses as *n* (%)

*RR* Relative rate, *CI* Confidence interval, *SPGBG* Sphenopalatine ganglion block group, *PG* Paracetamol group

^Independent *t*-test

* Significant

**Table 5** Comparison regarding adverse effects, hospital stay, and patients' satisfaction

| Time | | SPGB (*N* = 20) | PG (*N* = 20) | *p*-value | Effect of SPGBG relative to PG | |
|---|---|---|---|---|---|---|
| | | | | | Mean ± SE | 95% CI |
| Bitter taste | | 5 (25.0%) | 0 (0.0%) | §0.047* | NA | |
| Nasal congestion | | 3 (15.0%) | 0 (0.0%) | §0.231 | NA | |
| Lacrimation | | 1 (5.0%) | 0 (0.0%) | §0.999 | NA | |
| Epistaxis | | 0 (0.0%) | 0 (0.0%) | NA | NA | |
| Dizziness | | 0 (0.0%) | 0 (0.0%) | NA | NA | |
| Hospital stay for EBP | | 1 (5.0%) | 7 (35.0%) | §0.044* | RR: 0.14 | 0.02–1.06 |
| Satisfaction | Satisfied | 13 (65.0%) | 6 (30.0%) | ¤0.019* | RR: 2.17 For satisfaction | 1.03–4.55 |
| | Borderline | 6 (30.0%) | 8 (40.0%) | | | |
| | Unsatisfied | 1 (5.0%) | 6 (30.0%) | | | |

Data expresses as n (%). *NA* Not applicable. §Fisher's exact test. ¤Linear by linear association

*RR* Relative rate, *CI* confidence interval, *SPGBG* Sphenopalatine ganglion block group, *PG* Paracetamol group, *EBP* Epidural blood patch

* Significant

2016) published another experience with 3 parturient with PDPH. The setting was Labor and Delivery Suite, where transnasal SPGB was performed by cotton-tipped applicators with 2% viscous lidocaine. All patients reported fast adequate relief of pain and none of the patients needed EBP.

Patel et al. (Patel et al. 2016) demonstrated the retrospective data of 72 patients who suffered from PDPH and were collected through 17 years. The patients were divided into 2 groups. The 33 patients of the first group had SPGB. It was applied while the patient in either supine or Trendelenburg position. Cotton-tipped hollow applicators were placed transnasally and 1.5 cc of 4% lidocaine was injected through each applicator. The 39 patients in the second group had EBP. After 1 h, the SPGB group reported better pain relief. Yet, there was no significant difference between groups after 24 h. In addition, complications were more observed in the EBP group.

Puthenveettil et al. (Puthenveettil et al. 2018) included 20 obstetric patients in their study on the block effectiveness in managing post-spinal headache compared to the conservative treatment. In the SPGB group, patients received the block in the intensive care unit using a cotton-tipped applicator soaked in 2% lignocaine. The other group received 1 g paracetamol three times daily intravenously. They recorded that SPGB offered effective and sustained pain relief throughout the study time but in the conservative procedure, the effective relief of pain began only after 4 h.

In Jespersen et al. (Jespersen et al. 2020) study, participants received bilateral sphenopalatine ganglion block using hollow cotton swabs with 1 ml of either local anesthetic (lidocaine 4% and ropivacaine 0.5%) or placebo (saline). They proved that SPGB was effective as the pain was reduced and EBP was avoided in half the patients of both block groups (the local anesthetic and saline groups), which suggests a major effect not necessarily related to the local anesthetics. The mechanism could be due to mechanical stimulation of the sphenopalatine ganglion since saline placebo also offered pain relief.

In Santos et al. (Santos et al. 2021), 41 patients with PDPH had SPGB with ropivacaine 0.75%. Patients were divided into two SPGB groups: an early (less than 24 h after diagnosis) and a late (more than 24 h after diagnosis) group. The block was effective equally in the 2 groups, the rescue analgesic therapy was needed only in two patients (10%), and twelve patients were discharged home in less than 24 h after the block. No side effects were reported with the block.

Furtado et al. (Furtado et al. 2018) used 4 mL of ropivacaine 0.75% to apply sphenopalatine block in 4 obstetric patients suffering PDPH. These patients reported pain control for 12–24 h. This longer duration of pain relief could be referred to the use of longer-acting local anesthetic drug as ropivacaine.

Takmaz et al. (Takmaz et al. 2021) in their study included 26 non-obstetric patients with PDPH. They found that PDPH was rapidly relieved after receiving transnasal SPGB, and the treatment effect lasted for 48 h after the procedure in all patients. Almost half of the patients were pain-free at 24 h after the procedure, and a VAS score of < 3 was recorded in all patients.

Candido et al. (Candido et al. 2013) used a nasal applicator to deliver 0.5 mL of ropivacaine 0.5% and 2 mg of dexamethasone for SPGB in 3 patients with different head and face pain conditions as chronic migraine headache, trigeminal neuralgia, and post-herpetic neuralgia. Patients showed a high degree of pain relief that was continued throughout the 28-day follow-up period for 2 of the 3 study participants. All 3 patients had a high degree of satisfaction with this technique.

In the study by Candido et al. (Candido et al. 2013), one patient developed minimal bleeding from the nose immediately post-treatment which resolved spontaneously in less than 5 min. Cohen et al. (Cohen et al. 2018) and Puthenveettil et al. (Puthenveettil et al. 2018) stated that in their studies, patients had no side effects related to the block. Takmaz et al. (Takmaz et al. 2021) documented that nasal discomfort, throat numbness, and nausea were reported after SPGB, all completely resolved by 24 h after the procedure. Almost most studies (Cohen et al. 2009, 2001; Jespersen et al. 2020) showed a reduction in the need for EBP with overall high patient satisfaction.

Apparently, most of the related studies used lignocaine alone and sometimes only saline to test the effect of SPGB or even stimulation on PDPH. In our study, we used a combination of lignocaine and dexamethasone so our patients could have faster onset and longer duration of the block and less pain intensity which means rapid and extended pain-free period. Moreover, some studies performed the block in ICU, in the emergency room, or labor and delivery suite. We performed our study in the ward which makes it easier. We also used a cotton-tipped applicator which is readily available including places lacking resources, but on the other hand, some studies as (Patel et al. 2016) used special device (Tx360®) nasal applicator.

Finally, while all the studies recorded the pain score, only few ones recorded the onset and duration of the block and others documented the side effects, the need for EBP, and or patient satisfaction. Our study collected all these mentioned data.

### Limitations

Some limitations of our study included that it was not a triple-blind study. We could have prolonged the duration of analgesia by either increasing the concentration of lignocaine or by using longer-acting local anesthetic such as bupivacaine. On return of the pain, block could have been repeated also.

## Conclusions

In conclusion, PDPH can be treated effectively and rapidly with transnasal SPGB. It is a noninvasive, safe, and easy method with a low complication rate, long duration of analgesia, and good patient satisfaction. It also reduces the need to EBP and hospital stay.

#### Abbreviations

EBP: Epidural blood patch; ACTH: Adrenocorticotrophic hormone; ASA: American Society of Anesthesiologists; BMI: Body mass index; CI: Confidence interval; IQR: Interquartile range; NRS: Numeric rating scale; PDPH: Post-dural puncture headache; PG: Paracetamol group; RR: Relative rate; SD: Standard deviation; SPGB: Sphenopalatine ganglion block; SPGBG: Sphenopalatine ganglion block group; SPSS: Statistical Package for Social Sciences.

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Not applicable.

#### Authors' contributions

MM and RA have full access to all the data in the study and take responsibility for the integrity of the data. Study concept and design: MM and RA; acquisition of data: MM and RA; analysis of data and critical revision of the manuscript: MM and RA. All authors have read and approved the final manuscript.

#### Funding

None.

#### Availability of data and materials

We intend to share the study protocol as well as the individual de-identified participants' data. Data will be accessible through direct contact with the corresponding author, beginning 6 months and ending 24 months following article publication.

### Declarations

#### Ethics approval and consent to participate

The study obtained approval from the Ethical Committee of Ain Shams University (FMASU R 12/2021). The study was registered at the ClinicalTrials.gov (NCT04793490, March 11, 2021; https://clinicaltrials.gov/ct2/show/NCT04793490). Informed written consent was obtained from each patient.

#### Consent for publication

Not applicable.

**Competing interests**
The authors declare that they have no competing interests.

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