The efficacy of sphenopalatine ganglion block for the treatment of postdural puncture headache among obstetric population

ABSTRACT
Background: Postdural puncture headache (PDPH) is a common complication among parturients who had undergone obstetric neuraxial block. Epidural blood patch is the current gold standard treatment for PDPH, although it is an invasive procedure. We conducted this systematic review to assess the efficacy of sphenopalatine ganglion block (SPGB) as a noninvasive treatment of PDPH.

Methods: Relevant reports were searched from Google Scholar, PubMed, Science Direct, and Scopus from the inception of the databases to November 30, 2020. A total of 10 reports found to be related to SPGB for the treatment of PDPH in the obstetric population were enrolled. Significant relief of headache with no further intervention and initial relief of headache that requires further interventions were considered as the primary outcomes. The secondary outcome was the complications after SPGB.

Results: A total of 68 patients were identified. We found that 41 of 68 patients (60.3%) had effective management with significant relief of headache with no further interventions needed. Moreover, a total of 27 of 68 patients (39.7%) had initially effective management that needed further interventions. The use of 2% lidocaine was found to be the most effective among all used local anesthetics with 85.7% effective management. Furthermore, parturients who developed PDPH after spinal anesthesia responded to SPGB better than other obstetric neuraxial techniques.

Conclusions: This systematic review showed that SPGB is a promising treatment modality for the management of PDPH with no reported complications. Before recommending this technique for treating PDPH, we are calling for randomized clinical trials to prove its efficacy.

Key words: Dural puncture, lidocaine, obstetric population, postdural puncture headache, sphenopalatine ganglion block

Introduction

According to the International Headache Society, PDPH is described as headache occurring within 5 days of a lumbar puncture, caused by cerebrospinal fluid leakage through the dural puncture. It is usually accompanied by neck stiffness and/or subjective hearing symptoms. It remits spontaneously within 2 weeks, or after sealing of the leak with autologous

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epidural lumbar patch. Occasionally, it is accompanied by serious morbidities, such as neuraxial nerve damage, subdural hematoma, or chronic headache and it could lead to death as reported in the literature. It is a major complication especially in the obstetric population as it can affect the mother’s care for the baby and increase the length of hospital stay. Accidental dural puncture (ADP) in the obstetrical population who underwent epidural anesthesia ranges from 0.5% to 1.5%, nearly half of those from 52% to 61% will develop PDPH in 72 h. The incidence of PDPH among parturient women who had ADP is reported to be reduced by increased BMI. A previous study among 518 parturient women revealed that parturients with BMI ≥31.5 kg/m² had a lower incidence of PDPH than parturients with a BMI <31.5 kg/m². Adversely, a retrospective study among 125 parturient women with ADP, reported no evidence that parturients with higher BMI are less likely to develop PDPH.

Supportive measures such as oral analgesics, hydration, and anti-emetics have been shown to control PDPH symptoms in mild cases. Epidural blood patch (EBP) is the standard treatment for PDPH in patients who fail to improve after conservative treatment although it is an invasive procedure. EBP shows a success rate of 95–98% in complete or partial relief of PDPH. However, a high risk of developing long-term low back pain was reported in a large observational study among obstetric population undergone EBP by Martínez et al. Other complications like acute paresthesia, transient temperature elevations, spinal subdural hematoma, intrathecal hematoma, and arachnoiditis were also reported. EBP possesses many contraindications including coagulopathy, local infection in the back, and fever. The transnasal approach for sphenopalatine ganglion block (SPGB) on the other hand, is considered a noninvasive and easy procedure. Trigeminal neuralgia, migraine and cluster headaches, sciatica, angina, arthritis, and atypical facial pain all are cases in which SPGB is used as a treatment in different approaches with varying success rates. SPGB was first described in 1909 by Sluder with the use of cocaine injection in treating what was called Sluder’s neuralgia, which mostly resembles cluster headache.

The aim of this systematic review was to assess the efficacy of SPGB in the treatment of PDPH among the obstetric population.

**Methods**

**Information sources and search strategy**

Relevant reports were searched from Google Scholar, PubMed, Science Direct, and Scopus from the inception of the databases to November 30, 2020. Search words were as follows: “Sphenopalatine AND “Postdural puncture headache” and “Sphenopalatine AND PDPH” with adding obstetric, postpartum, and cesarean section with each of previous keywords. We also screened all the citing and related articles. Eligibility criteria and study selection

We collected 18 results from different study reports as follows: case reports, case series, original articles, posters, and shared experiences all were screened, identified through different search engines, and found to be related to SPGB for treatment of PDPH in the obstetric population. Eight reports were excluded and those were as follows: one randomized controlled trial (RCT) because of inclusion of mixed population without a clear enrolment of any obstetric patient in their sample, one retrospective study because of mixed management, one article because of the mixed population without detailed information, and two posters and three shared experiences because of more recent enrolment in other included study. We are aware that a systematic review is performed on RCTs. However, we could find only one prospective observational study that was included in this systematic review. Therefore, and because of the importance of this technique to manage PDPH, we included case reports and case series. A total of 10 studies found to be suitable to our objectives were included. Eight case reports and case series. One retrospective observational study with a sample size of 81 patients in which 42 of them (51%) underwent SPGB. One prospective observational study with a sample size of 20 patients in which 10 of them (50%) underwent SPGB and one patient was lost to be followed up. The flow diagram of the study selection is shown in Figure 1.

**Data collection process and items**

All data from the included reports were checked to prevent duplication. Study characteristics were as follows: indication of obstetric procedures, PDPH onset time, type of neuraxial block, pain assessment before and after SPGB, initial management of PDPH including conservative management and EBP, and SPGB technique. Significant headache relief with no further intervention and initial headache relief that required further intervention was considered as the primary outcomes. The secondary outcome included complications after SPGB.

**Quality assessment in individual studies**

The assessment of the severity of pain in the majority of the reports was performed either by numerical rating scale
or by visual analog scale (VAS). All enrolled studies clearly defined the used agent and technique to apply SPGB. The complications after SPGB were recorded for all the enrolled reports. In this systematic review, we followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist protocol.

**Results**

A total of 68 patients were included in this systematic review. Seventeen patients were included from case reports and case series, 42 patients included from a retrospective observational study, and 9 patients included from a prospective observational study. All enrolled patients were diagnosed with PDPH after obstetric neuraxial block. Fifty-two of enrolled patients underwent an epidural insertion for labor analgesia, two of them had an emergency cesarean section (CS). Fourteen of the enrolled patients underwent an epidural insertion for labor analgesia, two of them had an emergency cesarean section (CS). Fourteen of the enrolled patients received spinal anesthesia for elective or emergency CS. Two of the enrolled patients underwent combined spinal-epidural for urgent CS and labor analgesia. Transnasal SPGB was applied to all patients. Sixty-six patients received a cotton-tipped applicator with different local anesthetics (LAs). These LAs include 2% lidocaine (n = 14), 4% lidocaine (n = 46), 0.75% ropivacaine (N = 5), and mixture of 2% lidocaine and 0.5% ropivacaine (n = 1). Two patients received 10% lidocaine spray, one of them had a nostril pack with gauze soaked with 4% lidocaine after the spray. Characteristics of all studies enrolled are presented in Table 1. Detailed data of case reports/series are shown in Table 2.

We investigated all enrolled patients to determine the efficacy of SPGB for the treatment of PDPH. In this systematic review, the efficacy of SPGB was assessed based on our determined primary outcomes which they were: significant headache relief with no further intervention and initial relief of headache that required further intervention. Any reported SPGB that provides relief of headache that does not need further EBP or second SPGB is considered as significant relief of headache and will be labeled as effective management. However, some patients initially responded to SPGB and had initial relief of headache after the procedure but they developed PDPH symptoms that needed either EBP or second SPGB, these blocks will be labeled as initially effective management. Taking into consideration that any administered fluids or medications to patients before or after SPGB will not be considered as an intervention, due to missing data about conservative treatment in most of the enrolled patients.

We found that 41 of 68 patients (60.3%) had effective management with significant relief of headache that does not need further interventions. A total of 27 of 68 patients (39.7%) had initially effective management of PDPH that needed further interventions which were as the following: 10 patients received an EBP, 8 patients received second time SPGB, and 9 patients received both second-time SPGB and EBP. Different types of LAs were used for SPGB as mentioned before. The use of 2% lidocaine was among 14 of enrolled patients (22%), was found to be the most effective among all used LAs with 85.7% effective management. 4% lidocaine was found to be the most frequently used LAs, it was used in 46 of enrolled patients (67.6%), and showed
SPGB showed faster relief of headache in 30 and 48 min. SPGB is a cost-effective treatment and can widely been used in obstetric anesthesia, although it is an EBP is the current gold standard treatment of PDPH and has been widely used in patients who developed PDPH secondary to epidural analgesia. No complications were reported in all enrolled patients apart from the failure of the technique. In addition, worth noting that parturients who developed PDPH secondary to spinal anesthesia responded to SPGB better than other obstetric neuraxial techniques.

EBP is the current gold standard treatment of PDPH and has widely been used in obstetric anesthesia, although it is an invasive procedure. However, the use of SPGB as a simple, noninvasive treatment of PDPH is limited and recently tried by Cohen et al. SPGB is a cost-effective treatment and can be done as an outpatient procedure without the need for imaging or a theater room. As reported previously by Cohen et al., SPGB showed faster relief of headache in 30 and 60 min compared with EBP; however, they were similar in effectiveness after 24, 48 h, and 1-week post-treatment. The current study reported promising results with 60.3% success rate from the first SPGB. Moreover, the success rate has improved following the second SPGB.

The limitations of this study included: (1) small sample size, (2) 17 of 68 patients were from case reports and case series which they are more prone to be biased results than other study designs, and (3) there was no previous RCT on the efficacy of SPGB for the treatment of PDPH specifically among the obstetric population to be included in this study.

In conclusion, SPGB is a promising treatment modality for the management of PDPH among the obstetric population. However, before routine clinical application, well-designed RCTs are required to confirm and validate their efficacy.

| Reference            | Study design | No. cases | Type of neuraxial block | Intervention                                                                 |
|----------------------|--------------|-----------|-------------------------|-----------------------------------------------------------------------------|
| Kent et al. (2016)   | Case report  | 3         | Epidural                | Long cotton-tipped applicator soaked in 2% lidocaine for 10 min then another 20 min. |
| Furtado et al. (2017)| Case report  | 4         | Two cases: Epidural Two cases: CSE | Bilateral with cotton-tipped applicator soaked in 4 ml of ropivacaine 0.75% Group A: 10 patients “one patient lost to follow-up” Paracetamol 1 g q 8 h, if no adequate pain relief, the patient will receive 75 mg diclofenac. Group B: 10 patients “one patient lost to follow-up” SPGB using few drops of 2% lidocaine installed into both anterior nares, then cotton-tipped applicator soaked in 2% lignocaine was passed to both the nares for 5 min. |
| Puthenveetil et al. (2017) | Retrospective Observation | 20 | Postcesarean section | Two swabs with ropivacaine 0.75% were used to apply 3.5 ml in each nostril for 20 min. 42 patients received SPGB, cotton-tipped applicators soaked in 4% lidocaine water-soluble ointment and 0.5–1.5 mL lidocaine 4% solution for 15 min. 39 patients received EBP |
| Antunes et al. (2018) | Case report  | 1         | Epidural                | Bilateral with cotton-tipped applicator soaked in 2% lidocaine and 0.5% ropivacaine for 10 min. |
| Goncalves et al. (2018) | Case report | 1         | Epidural                | Two swabs with ropivacaine 0.75% were used to apply 3.5 ml in each nostril for 20 min. |
| Cohen et al. (2018)  | Retrospective Observation | 81 | Epidural using 17-gauge Touhy needle | 42 patients received SPGB, cotton-tipped applicators soaked in 4% lidocaine water-soluble ointment and 0.5–1.5 mL lidocaine 4% solution for 15 min. 39 patients received EBP |
| Ribeiro et al. (2019) | Case report | 2         | Spinal                  | Cotton-tipped applicator soaked in 2% lidocaine |
| Sandeep et al. (2020) | Case report | 1         | Spinal                  | 10% xylocaine in each nostril then each nostril packed with gauze soaked with 4% xylocaine for 20 min. |
| Jackson et al. (2018) | Case report | 4         | Three cases: Epidural One case: spinal | Bilateral transnasal SPGB with 4% lidocaine applied with cotton-tipped applicators which were soaked in local anesthetic, then placed in each nostril. |
| Altinpulluk et al. (2020) | Case report | 1         | Spinal                  | Total of two puffs of lidocaine 10% spray applied in each nostril with an applicator. |

CSE=Combined spinal epidural; SPGB=Sphenopalatine ganglion block; EBP=Epidural blood patch

Table 1: Characteristics of enrolled case reports, posters, and original articles

54.3% effective management. Other LAs includes 0.75% ropivacaine (n = 5) with 40% effective management, mixture of 2% lidocaine and 0.5% ropivacaine (n = 1) with 100% effective management, and 10% lidocaine spray (n = 2) with 50% effective management.

Discussion

In this study, we demonstrated that transnasal SPGB was an effective and safe procedure for treating PDPH after obstetric neuraxial block with significant relief of headache. Moreover, the use of 2% lidocaine resulted in higher efficacy than other used LAs, although it was mainly used in patients who developed PDPH secondary to spinal anesthesia. Although the use of 4% lidocaine was less effective than 2% lidocaine, that is likely because it was mainly used in patients who developed PDPH secondary to epidural analgesia. No complications were reported in all enrolled patients apart from the failure of the technique. In addition, worth noting that parturients who developed PDPH after spinal anesthesia responded to SPGB better than other obstetric neuraxial techniques.
### Table 2: Detailed data of case reports/series

| Reference       | Age  | Indication of obstetric procedure | Type of neuraxial block | Pain score | Initial management                                                                 | SPGB                                                                                           | Primary outcomes                  | Follow-up                      |
|-----------------|------|-----------------------------------|-------------------------|------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------|---------------------------------|
| Kent et al.     | 24   | Labor analgesia then emergency CS | Epidural                | NRS 9/10   | Oral analgesics were then discharged for 5 days with the same score                 | The cotton-tipped applicator was saturated with 2% viscous lidocaine applied for 10 min, then resaturated again with 2% viscous lidocaine for 20 min. | Immediately NRS 0/10            | 24 h and 48 h - NRS 0/10       |
| Furtado et al.  | 27   | Labor analgesia                   | Epidural 18 g Tuohy     | N/A        | Oral caffeine, hydration, and Ketorolac.                                           | Cotton-tipped applicator soaked in 2 ml of ropivacaine 0.75%, after 10 min, another 2 ml instilled over the applicator | Immediately NRS 0/10            | 7 days - asymptomatic No need for EBP |
| Furtado et al.  | 26   | Urgent cesarean section           | Combined Spinal - 25 g Epidural - 18 g | NRS 4-6/10 | N/A                                                                              | Cotton-tipped applicator soaked in 2 ml of ropivacaine 0.75%, after 10 min, another 2 ml instilled over the applicator | Immediately NRS 0/10 for 48 h   | 48 h - - NRS 6/10. An EBP has done - was not effective. Patient refused a second EBP  |
| Antunes et al.  | 33   | Labor analgesia                   | Epidural - 2 attempts    | NRS 8/10   | Oral analgesics, caffeine, and corticosteroids.                                   | Cotton-tipped applicators soaked in 2% lidocaine + 0.5% Ropivacaine X 10 min                    | Immediately NRS 0/10 for 48 h   | 48 h - - NRS 8/10. An EBP has done - was not effective NRS 4-6/10. Patient refused second EBP 7 days - asymptomatic  |
| Goncalves et al. | 34  | Labor analgesia                   | Epidural                | NRS 6-10/10 | NSAIDs, hydration, caffeine, paracetamol, and bed rest                           | 2 swabs moistened with ropivacaine 7.5 mg/mL used to apply 3.5 ml in each nostril X 20 min         | Immediately NRS 0-3/10          | 24 h - asymptomatic             |

Contd...
Table 2: Contd...

| Reference               | Age | Indication of obstetric procedure | Type of neuraxial block | Pain score | Initial management                                                                 | SPGB                                                                 | Primary outcomes                                                                 | Follow-up                                                                                     |
|-------------------------|-----|----------------------------------|-------------------------|------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Jackson et al. (2018)   | 27  | Labor analgesia                  | Epidural multiple attempts | VAS 10/10  | NSAIDS, and Fluids for 24 h. Then, EBP was attempted causing second dural puncture. | Cotton-tipped applicator soaked in 4% lidocaine in each nostril.     | Immediately and 10 min VAS 4/10                                                              | 2 h - symptoms returned. The patient had EBP resulted in prolonged relief of symptoms.       |
|                         |     | Cesarean section                 | Spinal                  | VAS 4/10   | N/A                                                                                 | Cotton-tipped applicator soaked in 4% lidocaine in each nostril.     | Immediately and 10 min VAS 0/10                                                              | 24 h - VAS 0/10. Two days post-SPGB the patient came back with a headache and underwent EBP, which resulted in prolonged relief. |
|                         | 29  | Labor analgesia                  | Epidural                | VAS 7/10   | N/A                                                                                 | Cotton-tipped applicator soaked in 4% lidocaine in each nostril.     | Immediately and 10 min VAS 0/10                                                              | 24 H - VAS 0/10. Two days post-SPGB the patient came back with a headache and underwent EBP, which resulted in prolonged relief. |
|                         |     | Cesarean section                 | Spinal 27 g Quincke     | NRS 9/10   | N/A                                                                                 | Cotton-tipped applicator soaked in 2% lidocaine.                    | Immediately within 5 min significant pain relief was reported, a high degree of pain relief was sustained for 24 h. | After 24 h, NRS 8/10. EBP was performed which provided symptomatic relief.                  |
|                         | 23  | Emergency CS                     | Spinal 25 g Quincke     | NRS 10/10  | N/A                                                                                 | Cotton-tipped applicator soaked in 2% lidocaine.                    | Immediately within 5 min significant pain relief was reported, a high degree of pain relief was sustained for 24 h. | After 24 h, NRS 8/10. EBP was performed which provided symptomatic relief.                  |
| Altinpulluk et al. (2020)| 22  | Emergency CS                     | Spinal 25 g Quincke     | VAS 10/10  | IV fluids, Bed rest, paracetamol, caffeine, and IV theophylline.                     | Two puffs of lidocaine 10% spray with an applicator in each nostril. | 10 min - VAS 0/10                                                                            | 24 h up to 4 days - asymptomatic                                                              |
| Sandeep et al. (2020)   | 23  | Emergency CS                     | Spinal 25 g Quincke     | VAS 8-9/10 | NSAIDS, bed rest, IV fluids                                                         | 10% xylocaine sprayed in each nostril with spray nozzle, then each nostril packed with gauze soaked with 4% xylocaine for 20 min | Immediately VAS 1/10, 6 h -VAS 2/10, 12 h - VAS 4/10                                           | 24 h - VAS 6/10. SPGB reapplied using only 10% xylocaine spray without the need of packing. 2 h and 6 h - VAS 2/10. 12 h and 24 h - VAS 0/10 |

CSE = Combined spinal epidural; PDPH = Postdural puncture headache; SPGB = Sphenopalatine ganglion block; EBP = Epidural blood patch; NRS = Numerical rating scale; VAS = Visual analog scale; CS = Cesarean section
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Conflicts of interest
There are no conflicts of interest.

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