Regional Anesthesia For Postdural Puncture Headache (PDPH): A New Solution For An Old Problem? A Systemic Review.

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Research article

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Abstract

Background: Postdural puncture headache (PDPH) is one of the earliest recognized complications of regional anesthesia. It is a common complication after inadvertent dural puncture. When conservative management is ineffective, the Epidural Blood Patch (EBP) is the "*gold standard*" for the treatment of PDPH. Due to the potential complications of EBP, several alternatives have been promoted as peripheral nerve blocks.

A systematic review of the use of regional anesthesia for PDPH is needed to identify an alternative method of pain management.

Objectives: To systematically review literature to establish the efficacy and applicability of regional anesthesia used in the treatment of PDPH in the hospital setting.

Methods: Embase, MEDLINE, Google Scholar and Cochrane Central Trials Register were systematically searched in May 2020 for studies examining regional anesthesia for PDPH. The methodological quality of the studies and their results were appraised using the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) checklist and specific measurement properties criteria, respectively.

Results: Nineteen studies evaluating peripheral nerve blocks for PDPH were included for a total of 221 patients. Sphenopalatine ganglion block (SPGB), greater occipital nerve block (GONB) and lesser occipital nerve block (LONB) were performed. All participants reported NRS lower than 4 after peripheral nerve blocks at 1, 24 and 48 hours. Only patients who experienced PDPH after diagnostic lumbar puncture reported NRS ≥ 4 after 48 hours. No adverse event was reported after the execution of nerve blocks, except an occasionally discomfort related to the insertion of cotton-tip applicators intranasally for SPGB. 17% of patients underwent a second or more peripheral nerve block due to uncontrolled pain. In 30 participants, EBP was required; none of cases followed spinal anesthesia.

Conclusion: Peripheral nerve blocks can be considered as analgesic options in the management of PDPH, as not all cases require EBP for successful treatment. Treatment of PDPH with peripheral nerve blocks seems to be a minimal invasive, easy and effective method, which can offer to patients when conservative management is ineffective.

Background

Rationale. The postdural puncture headache (PDPH) is one of the first recognized complications of regional anesthesia, described in 1898 by Dr. August Bier in the first patient to receive successful spinal anesthesia.[1]

PDPH is one of the most common complications after accidental dural puncture (DP). The incidence of dural puncture, in the literature, ranges between 0.16% and 1.3% according to the experience of the provider.[2] The development of PDPH depends on several factors, patient related such as young age, female sex and pregnancy, and needle related such as design, size and direction.[3-5] After DP, the incidence of PDPH ranges from 16% to 86% of cases.[6]

The International Headache Society (IHS) defines PDPH as a headache that occurs within 5 days of a lumbar puncture, usually accompanied by at least one of neck stiffness, tinnitus, hearing loss, photophobia, and nausea.[7]

Management of PDPH is often challenging for anesthesiologists. Despite the lack of supporting evidence, aggressive hydration continues to be the cornerstone in the treatment of PDPH.A number of therapeutic agents have been suggested: analgesics, such as acetaminophen, nonsteroidal anti-inflammatory drugs (NSAIDs) or opiates, and methylxanthines, such as caffeine, are commonly used, yet the relief obtained is often inadequate, especially with severe headaches.[3-5]

During the past several decades, the Epidural Blood Patch (EBP) has been proposed as the “gold standard” for the treatment of PDPH. The exact mechanism by which the EBP relieves PDPH is still not precisely defined. The first mechanism of action is the “plug effect” when the blood arrives at the cerebrospinal fluid (CSF) leak. The blood clotting closes the defect in the meninges and stops further liquoral loss. The second is the “mass effect”: the blood injected in the epidural space lead to the cephalad displacement of CSF increasing liquor pressure. It provides pain relief in around 61–98% of cases. Possible complications of the EBP include chances of another DP, infection, and neurological sequelae such as meningitis, arachnoiditis, seizures, loss of hearing or vision, radicular pain, and neural deficits.[3-5]

Several alternatives to EBP have been proposed as peripheral nerve blocks, such as sphenopalatine ganglion block (SPGB), greater occipital nerve block (GONB) and lesser occipital nerve block (LONB).

Since no randomized controlled trials (RCTs) investigating the use of these three peripheral nerve blocks have been published to our knowledge, assessment of their safety in humans relies, in part, on observational methodologies. In the absence of rigorous cohort studies, the best available evidence may be provided by case reports and observational studies describing efficacy in individuals suffering PDPH and receiving SPGB, GONB and LONB published in the peer-reviewed literature.

Whilst it is understood that randomized controlled trials are the appropriate methodology for determining efficacy and safety, informations gleaned from case studies are often used to inform about the use of new techniques. In the case of PDPH, case reports of efficacy and safety events associated with SPGB, GONB and LONB should best serve as signals to conduct RCTs.

Objectives. The aim of this systematic review is to find all relevant case reports and assess their reliability to inform the debate about the potential efficacy and safety of regional anesthesia used in the treatment of PDPH.

Methods

Protocol and registration. We performed a systematic review based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.[8] This article is based on previously conducted studies and does not contain any studies with human participants or animals performed by any of the authors.

Eligibility criteria. The population, intervention, comparison, and outcome (PICO) criteria were applied to the research question. Patients of at least 18 years diagnosed with PDPH were considered as the population (P); the intervention (I) was PDPH treatment using peripheral nerve blocks; the comparison (C) concept was not applicable to the research question; pain intensity, adverse events (AEs) and need for other therapeutic interventions after regional anesthesia for PDPH management were considered the outcomes (O) for this systematic review.

PICO criteria are summed in Table 1.

Literature search. We identified the articles by searching electronic databases (Embase, MEDLINE, Google Scholar and Cochrane Central Trials Register). Other relevant studies were identified from the reference lists.

We used a combination of terms for *"postdural puncture headache (PDPH)", "sphenopalatine ganglion block", "greater occipital nerve block", "lesser occipital nerve block", "case reports", "observational study","clinical trial",* and *"randomized clinical trial" .*

We applied no language restrictions in searches. The initial search was performed in May 2020. The latest in September 2020.

The studies included in this review evaluated adult patients clinically diagnosed with PDPH and treated with peripheral nerve blocks.

Primary outcomes. The primary outcome was the pain intensity assessed via a Numeric Rating Scale (NRS) at 0, 1, 24 and 48 hours after treatment. Pain intensity data assessed by means other than a zero to 10 NRS were normalized to such a scale.

Secondary outcomes. We extracted data on the following secondary outcomes:

1. Adverse Events;
2. Other therapeutic interventions (need for a second nerve block or EBP).

Selection of studies. We determined eligibility by reading the abstract of each study identified by the search. We eliminated studies that clearly did not satisfy our inclusion criteria and obtained full copies of the remaining studies. Two review authors (LGG and FC) read these studies independently and reached agreement by discussion.

The methodological quality of the included studies was evaluated and rated using the COSMIN checklist, which has a 4-point rating scale.[9,10]

Data extraction and management. Data extracted included the following:

- Age and sex of participants;
- Number of participants enrolled and completing the study;
- Type of operation;
- Regional anesthesia technique;
- Pain intensity for all time points at which it was measured;
- Severity and incidence of adverse events;
- Type of other therapeutic intervention.

Statistical analysis. Data were analyzed using standard computer program (Excel, 2016). Results were reported as mean ± standard deviation (SD). We tested the consistence of our data using Chi-square test and 95% confidence level. Comparisons were performed using Student *t*-test and the level of statistical significance was $p < 0.05$.

Results

The flow diagram (Figure 1) shows the results from the literature search and the study selection process. Nineteen studies met the eligibility criteria.

Table 2 displays the nineteen papers included in this review.

According to the COSMIN checklist, all studies included in this review showed an adequate-to-doubtful quality. The majority of clinical trials had a high-to-moderate risk of bias. This is due to the design of the included studies, mainly case reports and observational studies. According to the "Chauvenet's criterion", almost all data lie within one standard deviation of the mean and they can be considered reliable, without the risk of outliers (see Figure 2).

In the included studies, 221 patients were diagnosed with PDPH and treated with regional anesthesia: 97 received sphenopalatine ganglion block, 58 received greater occipital nerve block, while the others patients received a combination of nerve blocks (42 received both SPNB and GONB in *Xavier J et al 2020,* 24 received both GONB and LONB in *Naja et al 2009*). All participants were female with mean age of 32.87 ± 5.16 years (*Puthenveettil N et al 2018, Matute E et al 2008, Niraj G et al 2014* did not reported age of participants).

The largest studies involved 42 patients (*Cohen S et al, 2018; Xavier J et al, 2020*), while the smallest consisted of single case report (*Cardoso JL et al, 2017; Channabasappa SM et al, 2017; Goncalves et al,* *2018; Murphy CA et al, 2020; Singla D et al, 2018; Akin Takmaz S et al, 2009*). All analyzed studies were conducted in inpatient settings.

Patients underwent various operation; the most common surgeries were labor pain/delivery (8 studies: *Cohen S et al, 2018; Furtado et al, 2018; Goncalves et al, 2018; Kent S et al, 2016; Puthenveettil N et al, 2018; Xavier J et al, 2020; Matute E et al, 2008; Niraj G et al, 2014; Türkyilmaz EU et al, 2016*), followed by gynecological (3 studies: *Channabasappa SM et al, 2017; Dubey P et al, 2018; Naja et al 2*009), abdominal (2 studies: *Akin Takmaz S et al, 2009; Matute E et al, 2008*), diagnostic (2 studies: *Kent S et al, 2015; Murphy CA et al, 20*20), urological (2 studies: *Cardoso JL et al, 2017; Dubey P et al, 2018*), and orthopedic procedures (2 studies: *Naja et al 2009; Singla D et al, 2018*). Two studies (*Jespersen MS et al, 2020; Akyol F et al, 2015*) did not report the intervention.

Concerning anesthesia technique, peridural anesthesia was performed 10 times (*Cardoso JL et al, 2017; Cohen S et al, 2018; Furtado et al, 2018; Goncalves et al, 2018; Jespersen MS et al, 2020; Kent S et al, 2016; Puthenveettil N et al, 2018; Xavier J et al, 2020; Matute E et al, 2008; Niraj G et al, 2014*); subarachnoid anesthesia was reported in ten studies (*Dubey P et al, 2018; Jespersen MS et al, 2020; Singla D et al, 2018; Xavier J et al, 2020; Akin Takmaz S et al, 2009; Akyol F et al, 2015; Matute E et al, 2008; Naja et al 2009; Niraj G et al, 2014; Türkyilmaz EU et al, 2016*); combined spinal-epidural (CSE) technique was performed in *Channabasappa SM et al 2017, Furtado et al 2018* and *Xavier J et al 2020;* finally in two studies (*Kent S et al, 2015; Murphy CA et al, 2020*) patients underwent diagnostic lumbar puncture (LP).

Not all studies reported the type of needle used to administer anesthesia. Where data are available, peridural was administered using 16-gauge or 18-gauge Tuohy needles; 25-gauge or 27-gauge Quincke and 27-gauge Whitacre needles were used for spinal anesthesia. In *Türkyilmaz EU et al 2016, s*pinal blocks were performed using 26-gauge needles with an atraumatic bevel (Atraucan®, B-Braun, Germany).

PDPH appeared between the first (*Furtado et al, 2018; Kent S et al, 2016;Murphy CA et al, 2020; Akin Takmaz S et al, 2009; Matute E et al, 2008*) and seventh (*Cardoso JL et al, 2017*) day after the anesthetic procedure.

In some studies, patients referred the associated symptoms of nausea (*Cardoso JL et al, 2017; Cohen S et al, 2018; Dubey P et al, 2018; Goncalves et al, 2018; Murphy CA et al, 2020; Naja et al, 2009*), vomiting (*Cardoso JL et al, 2017; Dubey P et al, 2018; Naja et al, 2009*), photophobia (*Cohen S et al, 2018; Dubey P et al, 2018; Murphy CA et al, 2020; Naja et al, 2009*), phonophobia (*Murphy CA et al, 2020: Naja et al, 2009*), dizziness (*Goncalves et al, 2018; Naja et al, 2009*), blurry vision (*Kent S et al, 2015; Naja et al, 2009*), loss of appetite (*Naja et al, 2009)* and ataxia (*Naja et al, 2009*).

Conservative treatment was administered and consisted of bed rest and postural measures, oral and intravenous hydration, caffeine and multimodal analgesia (acetaminophen, NSAIDs and opioids). Three studies (*Cohen S et al, 2018; Dubey P et al, 2018; Kent S et al, 2016*) did not report conservative management.

Peripheral nerve blocks. Sphenopalatine ganglion block was performed using cotton-tip applicators dipped into local anesthetic: 0.5% levobupivacaine (*Cardoso JL et al, 2017*), 2% lidocaine (*Kent S et al, 2015; Kent S et al, 2016; Puthenveettil N et al, 2018*), 4% lidocaine (*Cohen S et al, 2018; Murphy CA et al, 2020*), 0.75% ropivacaine (*Furtado et al, 2018; Goncalves et al, 2018*), and a mixture of 4% lidocaine and 0.5% ropivacaine in *Jespersen MS et al 2020.* In two studies (*Channabasappa SM et al, 2017; Singla D et al 2018*), 0.75% ropivacaine was respectively injected using a spinal needle and an epidural catheter. *Xavier J et al 2020* performed SPGB with 1% ropivacaine both using cotton-tip applicators or an epidural catheter. *Dubey P et al 2018* used intranasal lidocaine spray.

Greater occipital nerve block consisted of injecting local anesthetic lateral to external occipital protuberance. *Akin Takmaz S et al 2009* used 0.5% ropivacaine, *Akyol F et al 2015* 0.25% levobupivacaine, *Matute E et al 2008* 0.5% bupivacaine and triamcinolone, *Naja et al 2009* 1% lidocaine, *Niraj G et al 2014* 1% lidocaine and dexamethasone, *Türkyilmaz EU et al 2016* 0.25% levobupivacaine and dexamethasone, and *Xavier J et al 2020* 1% ropivacaine.

In *Naja et al 2009,* lesser occipital nerve block was performed injecting 1% lidocaine at the superior third of the posterior limit of the sternocleidomastoid muscle.

Table 3 summarizes the techniques used.

Pain Intensity. Different investigators recorded this outcome on different scales and at different intervals. We normalized all NRS to a zero to 10 range (see **Table 4**). The majority of authors reported pain intensity before performing SPGB, GONB or LONB and 1, 24 and 48 hours after treatment.

Pain intensity before the procedure was reported in 13 studies, which involved 170 patients with PDPH. All participants reported NRS ≥ 8, except in *Akyol F et al, 2015 (*NRS 6.26) and *Naja et al 2009* (NRS 7).

After 1 hour, NRS was lower than 4 in all studies except for *Jespersen MS et al 2020.* NRS ≥ 4 was only reported in *Kent S et al 2015* and *Naja et al 2009* at 24 hours after nerve block, and in *Murphy CA et al 2020* at 48 hours.

Pain intensity before the procedure was 8.59 ± 1.06. NRS was 1.05 ± 1.28 after 1 hour, 1.78 ± 1.83 after 24 hours, and 1.71 ± 1.79 after 48 hours.

Cohen S et al 2018 did not reported pain evaluation. 71.4% of patients experienced headache relief 1 hour after the SPGB after the EBP treatment. After 24 and 48 hours, SPGB was effective in 85.7% and 92.9% of cases, respectively.

We made the hypothesis that these data be well described by a single number, determining the weighted mean of the measurements. We performed Chi-square test using 95% confidence level for available data before ($x^2/v = 6.57/5 \approx 1.31$; $\alpha = 0.25$), and at 1 hour ($x^2/v = 0.44/4 \approx 0.11$; $\alpha = 0.98$), 24 hours ($x^2/v = 6.06/6 \approx 1.01$; $\alpha = 0.42$) and 48 hours ($x^2/v = 0.57/1 \approx 0.57$; $\alpha = 0.45$) after peripheral nerve blocks. We have therefore no good reason to reject the hypothesis and conclude that the measurements are consistent with each other.

We performed Student *t*-test between NRS before treatment and after 1 hour ($p < 0.05$), 24 hours ($p < 0.05$), and 48 hours ($p < 0.05$). No statistical difference was found between NRS after 1 and 24 hours ($p = 0.37$), and after 24 and 48 hours ($p = 0.52$).

Adverse events (AEs). An adverse event is defined as any undesirable experience associated with the use of a medical product in a patient. No AE was reported after the execution of SPGB, GONB or LONB, except in *Jespersen MS et al 2020* and *Murphy CA et al 2020.* In the first study, AEs were recorded in 10 patients: one patient reported severe nasal discomfort and nausea during the insertion, and five patients reported light pain or discomfort during the insertion. Throat discomfort, light left ear pain during insertion and tingling sensation in the left cheek during insertion were also reported after receiving the block. In *Murphy CA et al 2020,* the patient described an unpleasant taste after dropping the lidocaine into nostril.

Other therapeutic interventions. 38 patients needed to receive a second or more nerve block, SPGB, GONB or LONB, and 30 patients an EBP.

In five patients, the procedure had to be repeated after 1 hour in *Dubey P et al 2018.* A second SPGB was performed in 2 patient after 24 hours with relief in the next hour (*Furtado et al, 2018*); other two patients received EBP. In *Jespersen MS et al 2020* from 1 hour to 7 days after the block, 13 patients received a rescue block and 10 received an EBP.

Xavier J et al 2020 reported 2 courses in 15 patients; among these, nine patients required EBP due to treatment failure with peripheral nerve block. *Kent S et al 2015* reported EBP after 12 hours with complete resolution of headache.

A total of 3 patients treated with GONB (*Akin Takmaz S et al, 2009; Türkyilmaz EU et al 2016*) received a second nerve block with pain resolution. *Türkyilmaz EU et al 2016* reported a patient's NRS not change two hours after primary GONB and an EBP was performed. Following the occipital block in *Naja et al 2009*, the headache was completely relieved in 68.4% of patients after one to two injections; the remaining 31.6% of patients experienced relief only after the third or fourth injection. In *Niraj G et al 2014*, six patients reported partial resolution of the symptoms after GONB and all received EBP.

Discussion

In our review, several studies describe the use of peripheral nerve blocks as a treatment for PDPH, most with a sphenopalatine ganglion block, greater occipital nerve block and lesser occipital nerve block.

The **sphenopalatine ganglion (SPG)** is the largest of the four parasympathetic ganglions of the head. It is located in the pterygopalatine fossa between the middle nasal concha posteriorly and the pterygoid canal anteriorly.[30] Since Dr. Greenfield Sluder described the SPG as a pain originator and transmitter in

1908,[31,32] it has been blocked using different techniques. The SPG may absorb local anesthetic via the middle turbinate and lateral nasal mucosa from a cotton-tipped applicator, the so-called "intranasal approach".[30] SPGB has been reported to threat cluster headache,[33] migraine,[34] trigeminal neuralgia,[35] herpes zoster involving the ophthalmic nerve,[36] paroxysmal hemicrania,[37] head and neck cancer pain,[38] atypical facial pain,[39] complex regional pain syndrome (CRPS),[40] temporomandibular disorder,[41] nasal contact point headache,[42] and vasomotor rhinitis.[43]

The **greater occipital nerve (GON)** is the sensory branch of the posterior ramus of the C2 spinal nerve. It innervates the skin of the occipital region up to the vertex, together with the lesser occipital nerve.[44] The GON is the main sensory nerve of the occipital area and is involved in various pain syndromes such as occipital neuralgia,[45] cervicogenic headaches,[46] and migraines.[47] The GONB consists on injection of local anesthetic medial to the occipital artery at the level of the superior nuchal line (SNL), i.e. one-third of the distance between the external occipital protuberance and the mastoid process.[48]

The **lesser occipital nerve (LON)** is the superficial branch of the cervical plexus and it is formed by fibers of ventral rami of C2 and C3. It is responsible for the innervation of the lateral part of the occiput. The nerve is located at the lateral third of a hypothetical line between the mastoid process and occipital protuberance.[44] The LONB is usually performed together with the GONB to treat headache of the lateral portion of the occipital region.

In this analysis, intranasal approach was commonly performed for the SPGB. The advantage of this approach is that it may be done in an ambulatory setting. *Dubey P et al 2018* hypothesized that lidocaine nasal spray should also be effective in achieving SPG anesthesia. The classical landmark technique was used for the GONB, except in *Akyol F et al 2015,* and LONB. However, the ultrasound guided technique is more target specific and it should be preferred.[49] Lidocaine, levobupivacaine, bupivacaine, or ropivacaine were the local anesthetics of choice.

Pain intensity. Pain intensity on the numeric rating scale was lower than 4 in all participants after peripheral nerve blocks at 1, 24 and 48 hours, with the exception of results reported by *Jespersen MS et al 2020* at 1 hour, *Kent S et al 2015* and *Naja et al 2009* at 24 hours, and *Murphy CA et al 2020* at 48 hours.

We considered NRS lower than 4 as optimal cut-off point between mild and moderate pain. This cut-off was identified as the tolerable pain threshold.[50]

Jespersen MS et al 2020 and *Naja et al 2009* showed NRS lower than 4 in the subsequent surveillance intervals.

Kent S et al 2015 and *Murphy CA et al 2020* reported the first case series in which SPGB was offered for patients who have received diagnostic LPs and then presented to the emergency department (ED) with PDPH. Postdural puncture headache occurs in 10% to 40% of subjects after LP.[51] The more serious symptoms could depend on the greater CSF leakage, according with Bier's hypothesis that continued CSF leakage through the lumbar puncture site could be an important contributing factor for PDPH.[52,53]

Safety. No AE was reported after the execution of SPGB or GONB, except in *Jespersen MS et al 2020* and *Murphy CA et al 2020.* Discomfort related to the insertion of cotton-tip applicators intranasally was reported.

The most common AEs related to SPGB are: epistaxis secondary to aggressive placement of a cotton-tipped applicator into the nasal passage; local or retro-orbital hematoma can result from puncturing the venous plexus overlying the pterygopalatine fossa or maxillary artery, including branches; infection may occur without aseptic technique.[30]

The most frequent side effects of GONB include pain at the injection site and numbness. Lightheadedness and syncope may also occur, as well as local hematoma, local infection, and nausea. Skin atrophy, hyperpigmentation or hypopigmentation of the skin, and local alopecia have also been reported when GON block is used in conjunction with steroids.[44]

However, these peripheral nerve blocks seem to be safe and well-tolerated compared to other treatments and their side effects.

Compared to these relatively safe techniques, EBP includes chances of another possible DP, infection, and neurological sequelae such as meningitis, arachnoiditis, seizures, loss of hearing or vision, radicular pain, and neural deficits.[3-5] Furthermore, a higher prevalence of low back pain (LBP) has recently been highlighted.[54] Peripheral nerve blocks seem to improve the care provided to patients and further reduce levels of perceived pain in the postoperative period.[55]

Other therapeutic interventions. 38 patients (17% of total: 19 SPGB, 4 GONB, 15 SPGB + GONB) underwent a second peripheral nerve block due to uncontrolled pain. Among these, sixteen patients reported complete resolution of symptoms after the second course.

In 30 participants (13% of total), epidural blood patch was required. Two patients required a second EBP (*Furtado et al, 2018*), while a second GONB was necessary after unsuccessful EBP in *Niraj G et al 2014.* The remaining patients showed complete pain resolution following the rescue procedure.

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, both as first-line treatment or as rescue therapy after a less invasive treatment has failed.[56] None of the cases of PDPH following spinal anesthesia required EBP for satisfactory treatment, expect in *Türkyilmaz EU et al 2016*.

EBP might be avoidable in cases of PDPH after subarachnoid block, in favor of less invasive techniques such as SPGB, GONB or LONB, in addition to standard conservative treatment. On the other hand, PDPH may be successfully treated with peripheral nerve blocks, but occasionally EBP could be required.

Limitations. A possible limitation is the use of case series and observational studies in this review. Due to the greater potential for bias, they are often excluded from systematic reviews of treatments. In a typical systematic review of a rapidly developing technology, that is, regional anesthesia for the treatment of PDPH, case series and observational studies contribute substantially to the available evidence base, and their results supplement the limited evidence available from other studies. Potential biases should be taken into account, such as: biases inherent in this study design; overrepresentation of specialist centers with better results than routine clinical practice; publication bias; possible multiple publication of results from the same patients in several series.[57]

Conclusion

To our knowledge, this is the first review on the use of regional anesthesia to treat PDPH. Peripheral nerve blocks can be considered as analgesic options in the management of PDPH, as not all cases of PDPH require EBP for successful treatment. The idea of regional anesthesia is to relieve the distressing headache experienced by a patient who has a dural puncture.

Treatment of PDPH with peripheral nerve blocks could be a minimal invasive, easy and effective method, which could be offered to patients when conservative management is ineffective. Even after a partially successful block, SPGB, GONB or LONB could be repeated. Nerve blocks could also be offered to patients who did not receive complete pain relief after an EBP and is not willing to undergo a repeated EBP. The injection does not address the ongoing CSF leak, therefore other supportive measures like bed rest, hydratation and analgesics should be continued.

Given the nature of the studies available to date, we cannot provide any recommendations on the use of regional anesthesia techniques in the treatment of PDPH. Well-designed controlled studies are needed to assess the role of these peripheral nerve blocks in the treatment of PDPH.

List Of Abbreviations

- AEs, Adverse Events;
- CRPS, Complex Regional Pain Syndrome;
- CSE, Combined Spinal-Epidural;
- CSF, CerebroSpinal Fluid;
- DP, Dural Puncture;
- EBP, Epidural Blood Patch;
- ED, Emergency Department;
- GON, Greater Occipital Nerve;
- GONB, Greater Occipital Nerve Block;
- IHS, International Headache Society;

- LBP, Low Back Pain;
- LON, Lesser Occipital Nerve;
- LONB, Lesser Occipital Nerve Block;
- LP, Lumbar Puncture;
- NRS, Numeric Rating Scale;
- NSAIDs, Nonsteroidal Anti-Inflammatory Drugs;
- PDPH, PostDural Puncture Headache;
- PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses;
- SPG, SphenoPalatine Ganglion;
- SPGB, SphenoPalatine Ganglion Block.

Declarations

Ethics approval and consent to participate.

This article is based on previously conducted studies and does not contain any studies with human participants or animals performed by any of the authors.

Consent for publication.

Not applicable.

Availability of data and materials.

Dataset derived from public resources and are available on request.

Competing interests.

The authors declare that they have no competing interests.

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Authors' Contributions.

LGG helped design the study, conduct the study, analyse the data, and write the manuscript; FC helped design the study, conduct the study, and analyse the data; CA helped design the study and analyse the data; VE helped design the study and analyse the data; MCP helped design the study and analyse the data; MBP helped design the study and analyse the data; VP helped design the study and analyse the data; PS helped design the study, conduct the study and analyse the data. All authors have read and approved the manuscript.

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Disclosures.

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Tables

Table 1.

PICO criteria for including studies.

POPULATION	Patients of at least 18 years diagnosed with PDPH.
INTERVETION	Regional anesthesia blocks (sphenopalatine ganglion block, greater occipital nerve block, lesser occipital nerve block).
COMPARATOR	No comparator.
OUTCOMES	Pain intensity, Adverse Events (AEs), need for other therapeutic interventions.
STUDY TYPE	Case Report, Observational Study, Clinical Trial, Randomized Clinical Trial.
TIME	No time limitation.

Table 2.

Studies characteristics.

Study, year	Center, No.	Design	No.	Surgery	Nerve blocks
Cardoso JL et al,[11] *2017*	Portugal, 1	Case Report	1	Sling procedure	SPGB
Channabasappa SM et al,[12] *2017*	India, 1	Case Report	1	Total abdominal hysterectomy	SPGB
Cohen S et al,[13] *2018*	US, 1	Observational Study	42	Labor pain/Delivery	SPGB
Dubey P et al,[14] *2018*	India, 1	Case Series	11	Urological procedures or cesarean section	SPGB
Furtado et al,[15] *2018*	Portugal, 1	Case Series	4	Labor pain/Delivery	SPGB
Goncalves et al,[16] *2018*	Portugal, 1	Case Report	1	Labor pain/Delivery	SPGB
Jespersen MS et al,[17] *2020*	Denmark, 5	Randomized Controlled Trial	20	?	SPGB
Kent S et al,[18] *2015*	US, 1	Case Series	3	Diagnostic	SPGB
Kent S et al,[19] *2016*	US, 1	Case Series	3	Labor pain/Delivery	SPGB
Murphy CA et al,[20] *2020*	US, 1	Case Report	1	Diagnostic	SPGB
Puthenveettil N et al,[21] *2018*	India, 1	Observational Study	9	Labor pain/Delivery	SPGB
Singla D et al,[22] *2018*	India, 1	Case Report	1	Femur reduction and fixation	SPGB
Xavier J et al,[23]	Portugal, 1	Observational Study	42	Labor pain/Delivery	SPGB ±

2020					GONB
Akin Takmaz S et al,[24] 2009	Turkey, 1	Case Report	1	Inguinal hernia repair	GONB
Akyol F et al,[25] 2015	Turkey, 1	Observational Study	21	?	GONB
Matute E et al,[26] 2008	Spain, 1	Case Series	2	Umbilical herniorrhaphy/Labor pain	GONB
Naja et al,[27] 2009	Lebanon, 1	Randomized Controlled Trial	24	Lower extremity fracture/ Arthroscopy/ Cesarean section	GONB ± LONB
Niraj G et al,[28] 2014	UK, 1	Observational Study	18	Labor pain/Delivery or non obstetric procedures	GONB
Türkyilmaz EU et al,[29] 2016	Turkey, 1	Observational Study	16	Labor pain/Delivery	GONB

Table 3.

Peripheral nerve blocks techniques.

	Peripheral nerve blocks techniques
Cardoso JL et al, 2017	Cotton-tip applicators dipped into 0.5% levobupivacaine
Channabasappa SM et al, 2017	Intranasal 0.5% ropivacaine injection (spinal needle)
Cohen S et al, 2018	Cotton-tip applicators dipped into 4% lidocaine
Dubey P et al, 2018	Intranasal lidocaine spray
Furtado et al, 2018	Cotton-tip applicators dipped into 0.75% ropivacaine
Goncalves et al, 2018	Cotton-tip applicators dipped into 0.75% ropivacaine
Jespersen MS et al, 2020	Cotton-tip applicators dipped into 4% lidocaine and 0.5% ropivacaine
Kent S et al, 2015	Cotton-tip applicators dipped into 2% lidocaine
Kent S et al, 2016	Cotton-tip applicators dipped into 2% lidocaine
Murphy CA et al, 2020	Cotton-tip applicators dipped into 4% lidocaine
Puthenveettil N et al, 2018	Cotton-tip applicators dipped into 2% lidocaine
Singla D et al, 2018	Intranasal 0.5% ropivacaine injection (epidural catheter)
Xavier J et al, 2020	SPGB: Intranasal 1% ropivacaine injection (epidural catheter) or cotton-tip applicators dipped into 1% ropivacaine GONB: 1% ropivacaine injection lateral to external occipital protuberance (L)
Akin Takmaz S et al, 2009	0.5% ropivacaine injection lateral to external occipital protuberance (L)
Akyol F et al, 2015	0.25% levobupivacaine injection lateral to external occipital protuberance (US)
Matute E et al, 2008	0.5% bupivacaine and triamcinolone injection lateral to external occipital protuberance (?)
Naja et al, 2009	GONB: 1% lidocaine injection lateral to external occipital protuberance (L) LONB: 1% lidocaine at the superior third of the posterior limit of the sternocleidomastoid muscle (L)
Niraj G et al, 2014	1% lidocaine and dexamethasone injection lateral to external occipital protuberance (L)
Türkyilmaz EU et al, 2016	0.25% levobupivacaine and dexamethasone injection lateral to external occipital protuberance (L)

L: landmarks technique; **US**: ultrasound technique

Table 4.

Pain intensity (mean ± SD) evaluated at 0, 1, 24 and 48 hours .

	NRS 0	NRS 1h	NRS 24h	NRS 48h
Cardoso JL et al, 2017	–	0 ± 0	0 ± 0	–
Channabasappa SM et al, 2017	–	0 ± 0	0 ± 0	–
Cohen S et al, 2018	–	–	–	–
Dubey P et al, 2018	9.0 ± ?	2.3 ± ?	0 ± ?	–
Furtado et al, 2018	–	0 ± 0	1.0 ± 1.73	3.5 ± 3.57
Goncalves et al, 2018	10 ± 0	3.0 ± 0	0 ± 0	–
Jespersen MS et al, 2020	8.4 ± ?	4.3 ± ?	–	–
Kent S et al, 2015	9.0 ± 0	2.0 ± 1.41	5.6 ± 1.69	0 ± 0
Kent S et al, 2016	8.7 ± 0.57	0 ± 0	1.0 ± 1.41	0.7 ± 0.94
Murphy CA et al, 2020	10 ± 0	0 ± 0	–	4.0 ± 0
Puthenveettil N et al, 2018	8.4 ± 0.7	1.2 ± 2.4	2.7 ± 0.5	–
Singla D et al, 2018	–	0 ± 0	0 ± 0	0 ± 0
Xavier J et al, 2020	8.0 ± 1.5	1.0 ± 1.5	–	–
Akin Takmaz S et al, 2009	10 ± 0	0 ± 0	2.5 ± 0	–
Akyol F et al, 2015	6.26 ± 0.84	1.86 ± 0.59	3.28 ± 0.9	–
Matute E et al, 2008	–	0 ± 0	–	0 ± 0
Naja et al, 2009	7 ± ?	–	5.2 ± ?	3.8 ± ?
Niraj G et al, 2014	8.2 ± 1.25	–	1.57 ± 2.82	–
Türkyilmaz EU et al, 2016	8.75 ± 0.9	1.18 ± 1.97	2.13 ± 1.58	–
TOTAL	**8.59 ± 1.06**	**1.05 ± 1.28**	**1.78 ± 1.83**	**1.71 ± 1.79**
p =		**< 0.05**	**< 0.05**	**< 0.05**

Figures

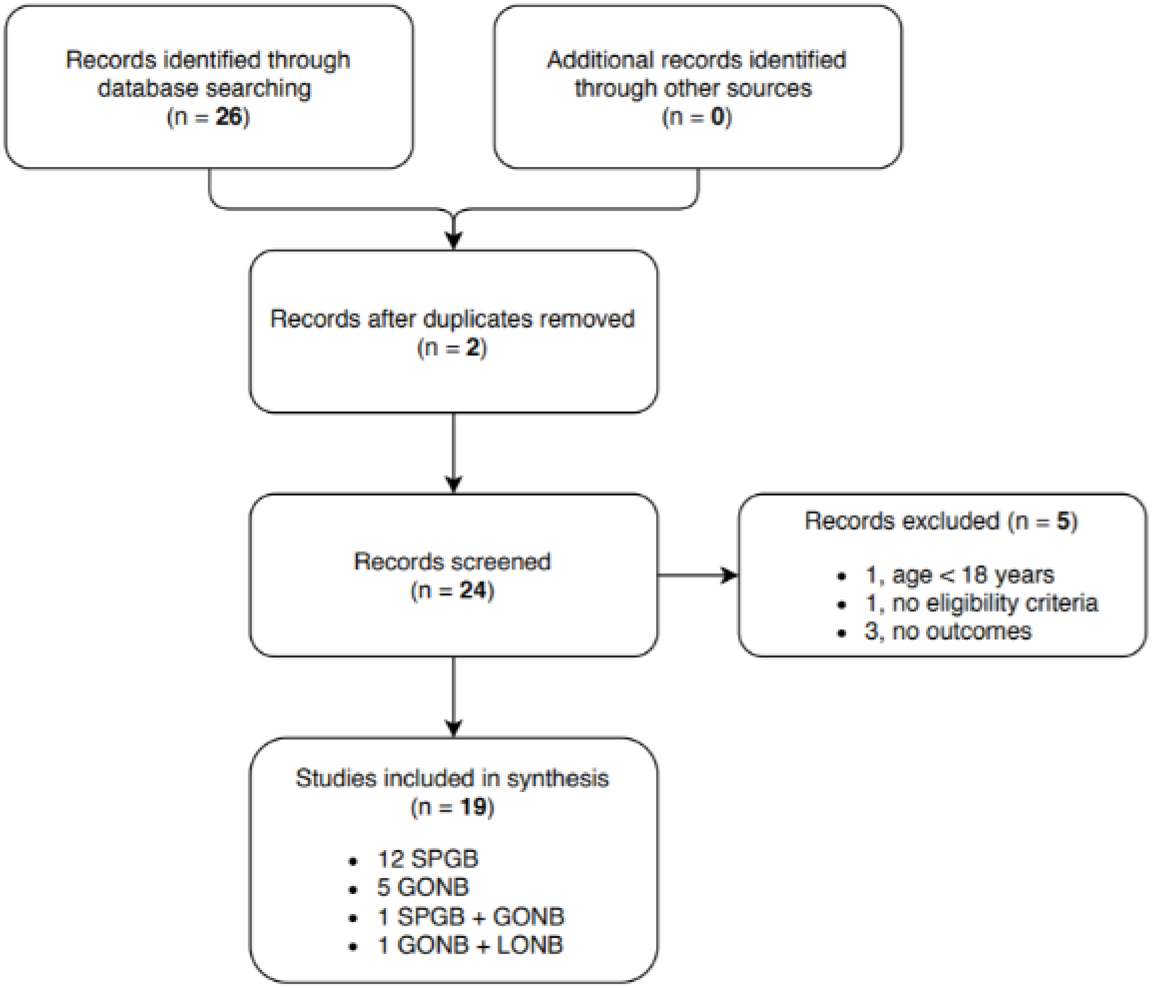

Figure 1

Flow diagram study selection process.

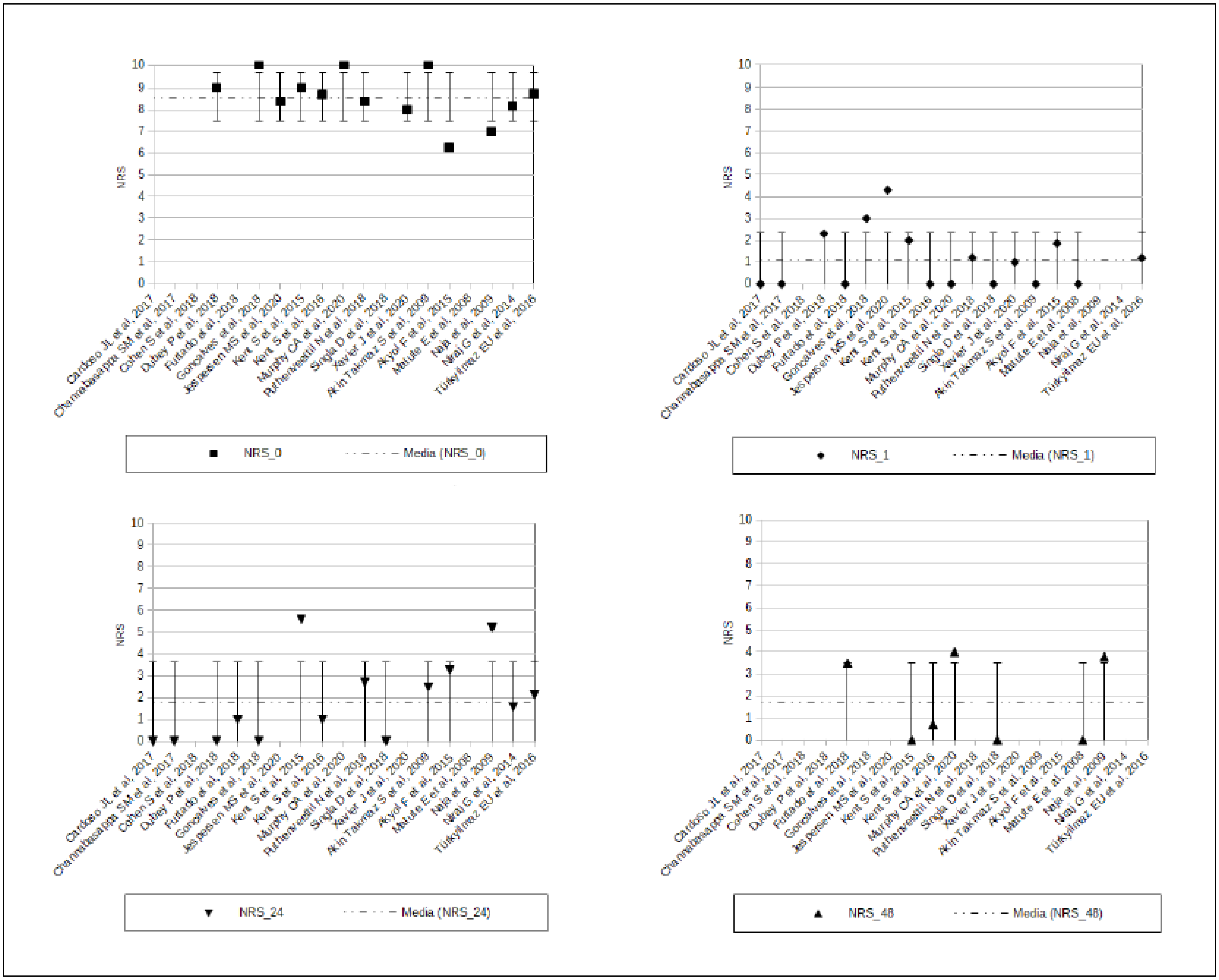

Figure 2

Data distribution (Chauvenet’s criterion).

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