

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

Access this article online	
Website: www.saudija.org	Quick Response Code 
DOI: 10.4103/sja.sja_651_21	

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Albaqami MS, Alwarhi FI, Alqarni AA. The efficacy of sphenopalatine ganglion block for the treatment of postdural puncture headache among obstetric population. Saudi J Anaesth 2022;16:45-51.

MOHAMMED S. ALBAQAMI, FARIS I. ALWARHI¹, ADEL A. ALQARNI¹

Department of Anaesthesia, College of Medicine, Majmaah University, Al Majma'ah 11952, ¹Department of Anaesthesia, King Saud University, Riyadh, Saudi Arabia

Address for correspondence: Dr. Faris I. Alwarhi, Department of Anaesthesia, King Saud University, P.O Box 145111, Riyadh 4545, Saudi Arabia. E-mail: fares10047@gmail.com

Submitted: 07-Sep-2021, **Revised:** 13-Sep-2021, **Accepted:** 26-Sep-2021, **Published:** 04-Jan-2022

epidural lumbar patch.^[11] 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.^[2,3] 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.^[4] 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.^[5,6] 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/m had a lower incidence of PDPH than parturients with a BMI < 31.5 kg/m.^[7] Adversely, a retrospective study among 125 parturient women with ADP, reported no evidence that parturients with higher BMI are less likely to develop PDPH.^[8]

Supportive measures such as oral analgesics, hydration, and anti-emetics have been shown to control PDPH symptoms in mild cases.^[9] 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.^[5] EBP shows a success rate of 95–98% in complete or partial relief of PDPH.^[9,10] 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.*^[11] Other complications like acute paresthesia, transient temperature elevations, spinal subdural hematoma, intrathecal hematoma, and arachnoiditis were also reported.^[12] EBP possesses many contraindications including coagulopathy, local infection in the back, and fever.^[13] 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.^[14] 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.^[15,16]

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. Editorials, review articles, and all studies that were related to other types of headaches, pain medicine, or PDPH in the nonobstetric population were excluded.

Eligibility criteria and study selection

We collected 18 results from different study reports were 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.^[17-25] 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.^[26-33] One retrospective observational study with a sample size of 81 patients in which 42 of them (51%) underwent SPGB.^[25] 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.^[34] 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

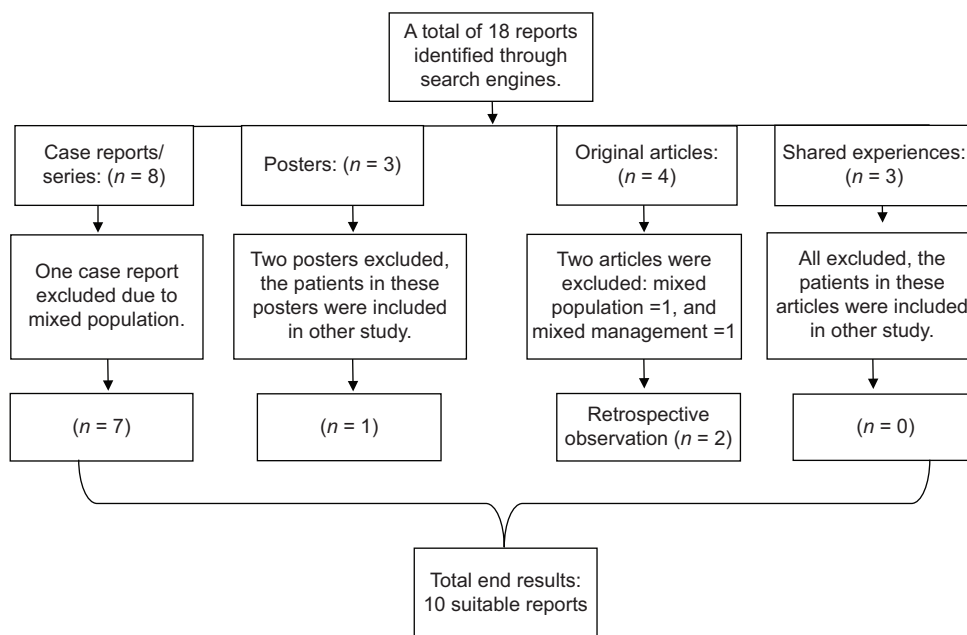


Figure 1: Flowchart of the included reports

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.^[25-34] 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 received spinal anesthesia for either 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

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

Reference	Study design	No. cases	Type of neuraxial block	Intervention
Kent <i>et al.</i> (2016)	Case report	3	Epidural	Long cotton-tipped applicator soaked in 2% lidocaine for 10 min then for another 20 min.
Furtado <i>et al.</i> (2017)	Case report	4	Two cases: Epidural Two cases: CSE	Bilateral with cotton-tipped applicator soaked in 4 ml of ropivacaine 0.75%
Puthenveetil <i>et al.</i> (2017)	Retrospective Observation	20	Postcesarean section	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.
Antunes <i>et al.</i> (2018)	Case report	1	Epidural	Bilateral with cotton-tipped applicator soaked in 2% lidocaine and 0.5% ropivacaine for 10 min.
Goncalves <i>et al.</i> (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 <i>et al.</i> (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 <i>et al.</i> (2019)	Case report	2	Spinal	Cotton-tipped applicator soaked in 2% lidocaine
Sandeep <i>et al.</i> (2020)	Case report	1	Spinal	10% xylocaine in each nostril then each nostril packed with gauze soaked with 4% xylocaine for 20 min.
Jackson <i>et al.</i> (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 <i>et al.</i> (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

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.

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.*^[25] 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.*,^[25] 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.

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. (2016)	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
	29	Labor analgesia	Epidural	NRS 8/10 on 4 th day postdelivery	N/A	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 phone follow-up: headache had returned 18 h post-SPGB - NRS 3/10, 48 h - NRS 2/10. No need for EBP
	21	Labor analgesia then Emergency CS	Epidural	NRS 9/10 on 4 th day postdelivery	On the 4 th day, the patient underwent an EBP her headache was relieved NRS 2/10 for 2 days. Five days post-EBP, NRS 9/10	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. (2017)	27	Labor analgesia	Epidural 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
	27	Labor analgesia	Epidural Tuohy	NRS 6-8/10	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	12 h - NRS 4/10, a second block done. 7 days - asymptomatic. No need for EBP
	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
	21	Labor analgesia	Combined Spinal - 27 g Epidural - 18 g	NRS 3-7/10	N/A	Cotton-tipped applicator soaked in 2 ml of ropivacaine 0.75%, after 10 mins, another 2 ml instilled over the applicator	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
Antunes et al. (2018)	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	24 h - NRS 0/10. No need for EBP
Goncalves et al. (2018)	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.
	26	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
	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.
	30	Labor analgesia	Epidural - transferred from another hospital.	VAS 10/10 on admission	Before transfer, an EBP has done first with temporary relief	Cotton-tipped applicator soaked in 4% lidocaine in each nostril.	Immediately VAS 4/10	The patient desired discharge home and was instructed how to do the block on herself at home using a 2% lidocaine cotton-tipped applicator.
Ribeiro et al. (2019)	30	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.
	27	Cesarean section	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.
Altimpulluk 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

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

- Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders, 3rd edition. *Cephalalgia* 2018;38:1-211.
- Sprigge JS, Harper SJ. Accidental dural puncture and postdural puncture headache in obstetric anaesthesia: Presentation and management: A 23-year survey in a district general hospital. *Anaesthesia* 2008;63:36-43.
- Newrick P, Read D. Subdural haematoma as a complication of spinal anaesthetic. *Br Med J (Clin Res Ed)* 1982;285:341-2.
- Kwak K-H. Postdural puncture headache. *Korean J Anesthesiol* 2017;70:136-43.
- Van de Velde M, Schepers R, Berends N, Vandermeersch E, De Buck F. Ten years of experience with accidental dural puncture and post-dural puncture headache in a tertiary obstetric anaesthesia department. *Int J Obstet Anesth* 2008;17:329-35.
- Choi PT, Galinski SE, Takeuchi L, Lucas S, Tamayo C, Jadad AR. PDPH is a common complication of neuraxial blockade in parturients: A meta-analysis of obstetrical studies. *Can J Anaesth* 2003;50:460-9.
- Peralta F, Higgins N, Lange E, Wong CA, McCarthy RJ. The relationship of body mass index with the incidence of postdural puncture headache in parturients. *Anesth Analg* 2015;121:451-6.
- Miu M, Paech MJ, Nathan E. The relationship between body mass index and post-dural puncture headache in obstetric patients. *Int J Obstet Anesth* 2014;23:371-5.
- Ostheimer GW, Palahnuk RJ, Shnider SM. Letter: Epidural blood patch for post-lumbar-puncture headache. *Anesthesiology* 1974;41:307-8.
- Banks S, Paech M, Gurrin L. An audit of epidural blood patch after accidental dural puncture with a Tuohy needle in obstetric patients. *Int J Obstet Anesth* 2001;10:172-6.
- Martínez B, Cansler E, Alonso A, Alonso E, Gredilla E, Díez J, et al. Postdural puncture headache and epidural blood patch in a large obstetric anaesthesia population. *Asian J Anesthesiol* 2018;56:23-32.
- Desai MJ, Dave AP, Martin MB. Delayed radicular pain following two large volume epidural blood patches for post-lumbar puncture headache: A case report. *Pain Physician* 2010;13:257-62.
- Ahmed SV, Jayawarna C, Jude E. Post lumbar puncture headache: Diagnosis and management. *Postgrad Med J* 2006;82:713-6.
- Day M. Sphenopalatine ganglion analgesia. *Curr Rev Pain* 1999;3:342-7.
- Sluder G. The role of the sphenopalatine ganglion in nasal headaches. *N Y State J Med* 1908;27:8-13.
- Ahamed SH, Jones NS. What is Sluder's neuralgia? *J Laryngol Otol* 2003;117:437-43.
- Jespersen MS, Jaeger P, Ægidius KL, Fabritius ML, Duch P, Rye I, et al. Sphenopalatine ganglion block for the treatment of postdural puncture headache: A randomised, blinded, clinical trial. *Br J Anaesth* 2020;124:739-47.
- Xavier J, Pinho S, Silva J, Nunes CS, Cabido H, Fortuna R, et al. Postdural puncture headache in the obstetric population: A new approach? *Reg Anesth Pain Med* 2020;45:373-6.
- Kumar N, Kumar A, Dubey PK. Modified epidural needle applicator for nasal Sphenopalatine ganglion nerve block. *Acta Anaesthesiol Belg* 2018;69:125-7.
- Danielle L, Cohen S, Kiss G, Mellender S. Sphenopalatine ganglion block followed by epidural blood patch for post-dural puncture headache management: A 17-year retrospective review. Poster presented in the 60th Annual Meeting of New Jersey State Society of Anesthesiologists, March 2019. New Brunswick, New Jersey.
- Sakr A, Rah K, Cohen S. Can we offer sphenopalatine ganglion block for our obstetric patients following accidental dural puncture. American Society of Regional Anesthesia and Pain Medicine 12th Annual Pain Medicine Meeting A, November 21-24,2013. Phoenix, Arizona.
- Cohen S, Trnovski S, Zada Y. A new interest in an old remedy for headache and backache for our obstetric patients: A sphenopalatine ganglion block. *Anaesthesia* 2001;56:606-7.
- Cohen S, Sakr A, Katyal S, Chopra D. Sphenopalatine ganglion block for postdural puncture headache. *Anaesthesia* 2009;64:574-5.
- Cohen S, Ramos D, Grubb W, Mellender S, Mohiuddin A, Chiricolo A. Sphenopalatine ganglion block: A safer alternative to epidural blood patch for postdural puncture headache. *Reg Anesth Pain Med* 2014;39:563.
- Cohen S, Levin D, Mellender S, Zhao R, Patel P, Grubb W, et al. Topical sphenopalatine ganglion block compared with epidural blood patch for postdural puncture headache management in postpartum patients: A retrospective review. *Reg Anesth Pain Med* 2018;43:880-4.
- Antunes C, Jesus T, Ferreira S, Coutinho A, Magalhaes J. Sphenopalatine ganglion block for postdural puncture headache. *J Pain Relief* 2018;7:315.
- Furtado I, Lima IF, Pedro S. [Ropivacaine use in transnasal sphenopalatine ganglion block for post dural puncture headache in obstetric patients - case series]. *Rev Bras Anestesiologia* 2018;68:421-4.
- Gonçalves LM, Godinho PM, Durán FJ, Valente EC. Sphenopalatine ganglion block by transnasal approach in post-dural puncture headache. *J Clin Anesth* 2018;48:50.
- Kent S, Mehaffey G. Transnasal sphenopalatine ganglion block for the treatment of postdural puncture headache in obstetric patients. *J Clin Anesth* 2016;34:194-6.
- Das KS, Rashmi NS, Rishardhan PP. Treat PDPH (Post dural puncture headache) with sphenopalatine ganglion block: Transnasal approach. *Int J Med Anesthesiol* 2020;3:315-7.
- Jackson ML, Guzman RS, Herbert K, Howell C, Maldonado S, Hernandez N. The role of transnasal sphenopalatine ganglion block in post-dural puncture headache management: A case series and review. *J Anesth Clin Care* 2018;5:24.
- Altınpulluk EY, Çolakoğlu N, Yüceyar L. Sphenopalatine ganglion block: Management of post-dural puncture headache after cesarean section. *Update Anaesth* 2020;35:58.
- Viegas Ribeiro M, Pacheco J, Lança F. ESRA19-0386 Transnasal sphenopalatine ganglion block for treatment of postdural puncture headache in obstetric patients. *Reg Anesth Pain Med* 2019;44:A191.
- Puthenvettil N, Rajan S, Mohan A, Paul J, Kumar L. Sphenopalatine ganglion block for treatment of post-dural puncture headache in obstetric patients: An observational study. *Indian J Anaesth* 2018;62:972-7.