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ORIGINAL INVESTIGATION

Early versus late sphenopalatine ganglion block with ropivacaine in postdural puncture headache: an observational study

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KEYWORDS
Postdural puncture headache;
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Abstract
Background: Postdural puncture headache (PDPH) is a common complication of neuraxial techniques which delays patients' discharge. Sphenopalatine ganglion block (SPGB) is a safe bedside technique with comparable efficacy to Epidural Blood Patch, the gold-standard treatment. There is no evidence on the ideal timing for SPGB performance. We aimed to evaluate the difference between early versus late SPGB concerning efficacy, symptom recurrence and hospital length of stay.
Methods: We present an observational study with 41 patients diagnosed with PDPH who were submitted to SPGB with ropivacaine 0,75%. The study sample (n = 41) was divided in two groups: an early (less than 24 hours after diagnosis) and a late (more than 24 hours after diagnosis) SPGB group. Pain was evaluated 15 minutes after the block and follow up occurred daily until patients were discharged. Patients' demographic characteristics, neuraxial technique, timing of SPGB, qualitative pain relief and post-SPGB length of stay were registered and analyzed with SPSS statistics (v26) software.
Results: Early SPGB resulted in a significant reduction in length of stay ($p = 0,009$) and symptom recurrence ($p = 0,036$), showing equally effective pain relief, compared to late SPGB.
Conclusions: SPGB was equally effective in both groups. Data showed that early SPGB reduces length of hospital stay and symptom recurrence, which potentially allows early resumption of daily activities and a reduction in total health costs.

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Introduction

Postdural puncture headache (PDPH) is a common complication of neuraxial techniques with an incidence of 1–2%.[1] It is classified by the International Classification of Headache Disorders 3rd edition (ICHD-3) as a headache attributed to low cerebrospinal fluid (CSF) pressure, caused by loss of CSF exceeding its production rate.[2] PDPH can be debilitating, with severe implications affecting daily activities, delaying recovery, and extending hospital stay with associated health care costs.[3,4] Common symptoms include severe frontal and occipital postural headache, often accompanied by neck stiffness, hearing and visual disturbances, nausea, vomiting or tinnitus.[3] The standard treatment is still epidural blood patch (EBP) with a success rate of 68 to 90%.[5] Although, this is an invasive technique susceptible to complications, such as bleeding, infection, and neurological impairment.[3,5]

The sphenopalatine ganglion (SPG), also known as Meckel's ganglion, is located 2–3 mm underneath the posterior nasal mucosa, in the pterygopalatine fossae. It is a junction of sympathetic, parasympathetic and sensory innervations that overlap in a small area, mediating pain due to various causes.[6] Topical transnasal SPG block (SPGB) is a noninvasive treatment first described in 1908 by Sluder,[7] which since then has been used for the treatment of headaches due to several etiologies.[4] The procedure is safe, easy to learn, and can be accurately performed in the emergency room.[6]

Literature evidence on the SPGB analgesic efficacy on PDPH is limited and is mainly available in the form of case reports and case series, most using lidocaine and limited to the obstetric population. None of the available studies refer to the ideal timing of SPGB performance after the diagnosis of PDPH.

We conducted an observational study to evaluate the difference between early (less than 24 hours) and late (more than 24 hours) performance of SPGB after PDPH diagnosis, using ropivacaine 0,75%. Our main hypothesis was that the early application of SPGB would allow effective pain control, with faster recovery and earlier discharge.

Methods

We conducted an observational retrospective study approved by the ethics committee of our institution, in accordance with the Declaration of Helsinki's Ethical Principles for Medical Research Involving Human Subjects. According to the ICHD-3 criteria[2], all the patients diagnosed with PDPH between March 2018 and December 2019 were enrolled. An individual written informed consent for participation was obtained from each patient enrolled. The PDPH diagnostic delay was no more than 48 hours after the beginning of the symptoms. Exclusion criteria were: patient's age under 18 years, SPGB refusal or the existence of contraindications to the technique (coagulopathy, nasal septal deviation, nasal polyps, epistaxis history, or allergy to local anesthetics).

Of 67 eligible patients, 26 did not receive SPGB, hence were excluded. Twenty-five of these patients received conservative treatment and one an EBP, according merely to the anesthesiologist's experience. Anesthesiologists' approach

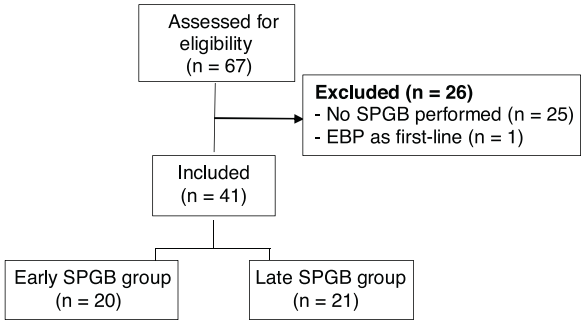

Figure 1 Flow Chart.

to PDPH differ significantly in our hospital, both in terms of treatment options offered and timing of SPGB performance. We aimed to standardize the department's practice with this study but still encountered significant differences in timing of SPGB performance. Hence, as shown in Figure 1, the enrolled patients (n = 41) were divided in two main groups according to the SPGB timing, which was determined exclusively by the anesthesiologist's preference: an early SPGB group that received the block less than 24 hours after diagnosis (n = 20); and a late SPGB group that received the block more than 24 hours after diagnosis (n = 21).

The SPGB technique was performed with the patient supine, in sniffing position. A cotton swab soaked with ropivacaine 7,5 mg.mL^{-1} was introduced in each nostril until resistance was encountered. Additionally, 1 mL of local anesthetic was applied in each nostril through the shaft. The swabs remained in place for 15 minutes, after which they were removed. All the patients without contraindication also received intravenous analgesia with paracetamol 1 g q6/6 h, a non-steroid anti-inflammatory (metamizole 1 g q8/8 h) and tramadol 100 mg q8/8 h as rescue analgesia. Pain relief was assessed 15 minutes after the block with 45° head of bed elevation. A simplified quantitative pain scale was used, asking the patients to rate their pain relief as ''No relief'', ''Minor relief'', ''Moderate relief'', or ''Total relief''. Follow up occurred daily with evaluation of pain control, treatment side-effects and symptom recurrence. Upon discharge all patients were instructed to contact their attending doctor or the emergency department if they had recurrence of symptoms. We emphasize that, in our sample, PDPH was the only medical concern prolonging the hospital stay.

The variables registered were the demographic characteristics of the patients, type of neuraxial technique executed, timing of SPGB application, qualitative pain relief, and post-SPGB length of hospital stay.

Our primary endpoint was to evaluate differences in efficacy between early (< 24 h) versus late SPGB (> 24 h). Our secondary outcomes were to evaluate differences in symptom recurrence and post-SPGB length of stay between the two groups. Data were expressed as median or mean ± standard deviation (SD), or number where appropriate. All analyses were performed with IBM SPSS statistics for Windows, version 26 (IBM Corp., Armonk, NY, USA). Normalization was tested using the Shapiro-Wilk test. Association between categorical variables was evaluated using $\chi 2$ test and the association between continuous variables was eval-

Table 1 Patients' characteristics. Results presented as number (% of total).

Variables	Total (n = 41)	SPGB		*p*-value
		Early (n = 20)	Late (n = 21)	
Mean age–years (SD)	33.5	35.1 (± 9.1)	31.9 ± 7.9	0.231
Gender				
Male	5	2 (10.0%)	3 (14.3%)	1.000
Female	36	18 (90.0%)	18 (85.7%)	
Surgical specialty				
Obstetric	24	11 (55.0%)	13 (61.9%)	0.756
Others (General Surgery, Urology, Gynecology, and Orthopedics)	17	9 (45,0%)	8 (38.1%)	
Neuraxial technique				
Spinal (Quincke–25 or 27G)	37	18 (90.0%)	19 (90.5%)	1.000
Combined spinal-epidural or epidural	4	2 (10%)	2 (9.5%)	

Table 2 Early versus Late SPGB outcomes. Results presented as mean or number (%).

Variables	Total (n = 41)	SPGB		*p*-value
		Early (n = 20)	Late (n = 21)	
Pain relief at 15 minutes				
''Total relief''	35	17 (85.0%)	18 (85.7%)	1.000
''No relief'', ''minimal'' or ''moderate relief''	6	3 (15.0%)	3 (14.3%)	
Symptom recurrence	10	2 (10.0%)	8 (38.1%)	0.036
Post-SPGB length of stay (days)		2 ± 1.6	3.2 ± 1.5	0.009

uated using Student's *t*-test and Mann-Whitney test. A *p*-value < 0.05 was considered statistically significant.

Results

Forty-one patients were included in the analysis. Patients' characteristics, type and context of neuraxial techniques are presented in Table 1. There were no statistically significant differences in these characteristics between both groups.

SPGB was equally effective for pain relief in both groups (85% vs. 85,7%, $p = 1$) as seen in Table 2. Twelve patients were discharged home on the same day or in less than 24 hours after the SPGB, without recurrence of symptoms. No SPGB side effects were reported.

Early SPGB was associated with a statistically significant reduction in symptom recurrence ($p = 0{,}036$) and length of stay after the block ($p = 0{,}009$), as seen in Table 2. Nine patients (45%) in the early SPGB group were discharged home in less than 24 hours after the block. Patients in the late SPGB group had a higher rate of symptom recurrence (38,1% vs 10%, $p < 0{,}05$). Only two patients with symptom recurrence required rescue therapy due to persistent severe symptoms, one received a second SPGB and the other an EBP. After hospital discharge, there were no patients with recurrence of symptoms.

Discussion

The SPG is an extracranial parasympathetic ganglion, composed of multiple autonomic, sensory, and motor neural connections. For many years it has been accepted that PDPH results from the disruption of CSF homeostasis.[8]

Low CSF pressure causes the loss of the brain's buoyant support, which is thought to allow it to sag in the upright position, resulting in traction on pain sensitive structures in the cranium. However, the actual means by which CSF hypotension generates headache is debatable. It is currently described as a bimodal mechanism involving both loss of intracranial support and cerebral vasodilation mediated by parasympathetic nerve fibers travelling through the SPG. SPGB is believed to be effective in PDPH pain reduction by blocking these preganglionic parasympathetic nerve fibers.[9]

To our knowledge, this is the first observational study comparing different timing for SPGB performance in PDPH. In our sample, SPGB showed equal effectiveness in pain reduction between the early and late SPGB groups. Early performance of SPGB showed a statistically significant reduction in length of stay and symptom recurrence. One could speculate that, as a first-line therapy, SPGB could result in better outcomes, allow earlier resumption of daily activities, improve patients' satisfaction and potentially reduce health care costs.

When comparing SPGB to EBP in a study with 20 obstetric patients with resistant PDPH, after a course of 7 days on conservative therapy, Nitu et al.[5] concluded that SPGB produced faster analgesia than EBP or conservative measures. Although the effectiveness in pain relief was evident, the authors did not report data on symptom recurrence or time to discharge.

In our study, rescue analgesic therapy after the SPGB performance was only required in two patients (10%). Comparing to the results obtained by Cohen et al.,[10] this is a significantly lower recurrence rate, which may be related

to possible diagnostic or treatment delays, which were not specified by this author in the manuscript. This difference may also be related to variations in the pharmacokinetics of the local anesthetic used. However, the ideal local anesthetic and the subsequent duration of the analgesic effect remain poorly defined, as stated by Furtado et al.[11]

Over the years, several PDPH therapies ranging from conservative to invasive procedures have been tried, with insufficient literature support.[10] There is no evidence that conservative measures like bed rest, supplemental intravenous fluid or intravenous analgesics help improve PDPH.[3] Despite this, many practitioners still use these conservative therapies and wait spontaneous recovery of PDPH. Compared to the gold-standard treatment with EBP, SPGB is safer, easier to learn, can be performed in an uncontrolled setting like the emergency department and has a low incidence of complications.[4]

Very few studies on the application SPGB for PDPH exist and most have small unrepresentative patient samples limited to the obstetric population.[10–13] Our findings are in agreement with recent case reports, case series, and retrospective reviews on the efficacy of SPGB in PDPH treatment.[10–12,14,15] However, compared to our study, the former were limited to obstetric population, lidocaine was the local anesthetic of choice, and outcomes like length of stay or timing of SPGB application were not registered or evaluated. Hence, data on the optimal timing of SPGB application is still lacking.

Several limitations prevent us from generalizing our results. We used a small convenience sample and patients were not randomized between groups, which could have introduced bias in the results. Our study's results would have been stronger if we conducted it as a randomized prospective clinical trial with a larger sample size. Although SPGB involves a simple technique which we tried to standardize in our department, individual performance discrepancies between physicians may have occurred. These variations can impair the reproducibility of these results in other institutions. Also, small variations in the intravenous analgesic regimens applied might have introduced bias in the results. The exact quantification of pain before the application of the block was not uniformly collected by all physicians involved, which can also lead to bias when evaluating results. Also, the low literacy level of the patients in both cohorts and their associated social context limited the application of a validated pain numeric scale, which would better characterize the analgesic efficacy of SPGB.

This study motivated us to design a prospective randomized controlled trial in our institution to better characterize the importance of SPGB timing in its analgesic effect in PDPH treatment.

Conclusions

SPGB showed similar analgesic efficacy when applied earlier or later than 24 hours after the diagnosis of PDPH. The earlier SPGB application showed a reduction in patients' length of hospital stay and symptom recurrence. We speculate that the early SPGB application potentially allows a faster resumption of daily activities and a reduction in total health costs. In the future, prospective and randomized controlled trials are needed to confirm these findings.

Conflicts of interest

The authors declare no conflicts of interest.

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