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TITLE:

The Role of the Transnasal Sphenopalatine Ganglion Block in the Management of Postdural Puncture Headaches

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A postdural puncture headache (PDPH) is one of the most common complications that occurs following unintended puncture of the dura during placement of an epidural, or following diagnostic and therapeutic lumbar punctures, including subarachnoid blocks (SABs) (Basurto Ona et al., 2013). The overall incidence varies from 1 to 40% following a neuraxial procedure and fluctuates with the type of needle utilized and the number of attempts, and is more likely to occur in obstetrical patients (Basurto Ona et al., 2013; Nair and Rayani, 2017). Although a PDPH typically resolves spontaneously, it can be debilitating during the symptomatic period and delay recovery and discharge. There are both quantitative and qualitative costs of ineffective relief for a PDPH, as it can lead to prolonged hospital stays, increased readmission, increased healthcare costs, and inhibit mother-baby bonding in the obstetrical population (Kwak, 2017; Cohen et al., 2018).

The overall success rate of the AEBP is about 75% (Nair and Rayani, 2017; Jespersen et al., 2020). AEBP is considered an invasive intervention that carries risks such as back pain, infection, bleeding, nerve damage, and repeat accidental dural puncture (Buddeburg et al., 2019). Rare complications have been reported including facial nerve palsies, permanent spastic paraparesis, cauda equina syndrome, and meningitis (Cohen et al., 2018). The use of sphenopalatine ganglion blocks (SPGBs) was first reported as a headache treatment in 1908, but the utilization of SPGBs for PDPH management has only been described in the literature in recent years (Cohen et al., 2018). A SPGB is believed to provide pain relief by blocking the parasympathetic nerve fibers, thereby inhibiting the compensatory vasodilation that is thought to occur with cerebrospinal fluid hypotension (Puthenveettil et al., 2018).

The transnasal SPGB procedure is typically performed with the patient on standard vital sign monitors and placed in the supine position with slight head extension. The nasal passages are sometimes initially anesthetized with lidocaine, or bleeding risk is reduced by administering phenylephrine or xylometazoline prior to the block (Kent and Mehaffey, 2016; Kumar, Verma and Prasad, 2020). Cotton-tipped applicators (sometimes hollow) are soaked in LA and gently advanced through the nares posteriorly following the superior border until resistance is met to indicate encountering the posterior nasopharyngeal wall. Contact with the posterior border is maintained for 5-30 minutes. Additional LA is sometimes administered through the hollow exposed opening, trickled down the shaft of the applicator, or by removing, re-soaking the cotton-tip, and replacing it with the intention of topically anesthetizing the SPG through infiltration. Alternative approaches have been documented, to include the use of local anesthetic spray (Dubey and Dubey, 2018; Kumar, Verma and Prasad, 2020; López, Sastre and Gómez-Ríos, 2021). The aim of this review is to evaluate if the SPGB is an effective, minimally invasive option for relieving PDPH pain, and determine if and when it should be incorporated into a protocol for PDPH treatment.

Methods

The Cochrane Library was searched for existing systematic reviews. Literature searches were conducted in the CINAHL, PubMed, and Google Scholar. The following search terms were used alone or in combination utilizing appropriate Boolean operators and database filters: postdural, post-dural, headache, sphenopalatine ganglion, pterygopalatine ganglion, epidural blood patch. Table 1 shows the

searches conducted in various electronic databases.

Results

The initial search yielded 270 studies. After screening the relevant articles, 23 were included in this review: 1 meta-analysis (Hung et al., 2021), 2 randomized controlled trials (Jespersen et al., 2020; Kumar, Verma and Prasad, 2020)which is invasive and may result in rare but severe complications. Sphenopalatine ganglion block is suggested as a simple, minimally invasive treatment for postdural puncture headache. We aimed to investigate the analgesic effect of a transnasal sphenopalatine ganglion block with local anaesthetic vs saline.Methods: We conducted a blinded, randomised clinical trial including adults fulfilling the criteria for EBP. Participants received a sphenopalatine ganglion block bilaterally with 1 ml of either local anaesthetic (lidocaine 4% and ropivacaine 0.5%, 16 non-experimental, observational case reports (Cohen et al., 2009; Cohen et al., 2014; Kent and Mehaffey, 2015; Kent and Mehaffey, 2016; Cardoso et al., 2017; Channabasappa et al., 2017; Furtado, Lima and Pedro, 2017; Dubey and Dubey, 2018; Gonçalves et al., 2018; Singla and Mangla, 2018; Puthenveettil et al., 2018; Zamarelli, 2019; Altınpulluk, Çolakoglu and Yüceyar, 2020; Hickerson et al., 2020; Murphy, McBride and Sharma, 2020; López, Sastre and Gómez-Ríos, 2021), 2 narrative reviews (Katz and Beilin, 2017; Patel et al., 2020), and 2 retrospective chart reviews (Cohen et al., 2018; Jackson et al., 2018).

Efficacy (Success rate)

There is a high degree of disparity in the literature when examining if a SPGB is efficacious in treating PDPH. In the Hung et al. (2021) pilot meta-analysis of 139 patients, the three studies included in the meta-analysis vary in study type and control comparison. One is a retrospective review comparing SPGB to AEBP (Cohen et al., 2018), another is an observational study comparing paracetamol to SPGB (Puthenveettil et al., 2018), and the third is a randomized, controlled trial comparing SPGB to saline placebo (Jespersen et al., 2020). Pooled estimates suggested no advantage of SPGB with local anesthetic over saline placebo, and no advantage of SPGB over AEBP or paracetamol for headache relief (OR=3.68; 95% CI; P=0.08) (Hung et al., 2021).

The lack of significant difference between therapies is similar to a portion of the results from the Jespersen et al. (2020) randomized controlled trial, which reported no significant difference in pain scores between SPGB with local anesthetic versus a saline placebo. Jespersen and colleagues found median Visual Analog Scale (VAS) pain intensity on a 0-100mm scale in the upright position went from 74mm to 26mm in local anaesthetic group 30 minutes post SPGB, and from 84mm to 37mm in the placebo group 30 minutes post SPGB (estimated mean difference: 5 mm; 95% CI: -14 to 21; P=0.53). However, there was a significant reduction in pain intensity for both groups which may suggest a possible effect from mechanical stimulation of the SPG or saline absorption. Also, there was a 53% reduction in the need for AEBP overall, and 30% did not require any further treatment. Although the exact mechanism of action of the SPGB is not well understood, the block may play a role in PDPH management and reducing the need for more invasive treatments.

Puthenveettil et al. showed efficacy of SPGB in relieving pain associated with PDPH (2018). In their study, patients treated with paracetamol had inadequate pain relief, but almost 89% of the SPGB patients had adequate pain relief described as a Numeric Rating Scale (NRS) score of less than 4. In fact, patients who received SPGB reported a NRS <4 throughout the study period of 24 hours post intervention. Cohen et al. (2018) also demonstrated SPGB success with a 69% success rate of PDPH patients treated with SPGB (29/42 patients) who never required an AEBP. Similarly, 16 published case reports/series totaling 82 patients described similar efficacy of SPGB in preventing the need for. Approximately 77% of the case report patients (63/82 patients) did not require a rescue AEBP post-SPGB. A 60-patient RCT compared SPGB with varying concentrations of lidocaine to conservative treatment options including paracetamol, tramadol, caffeine, fluids, and bedrest (Kumar, Verma and Prasad, 2020). Posttreatment VAS scores were significantly lower in the SPGB groups than the conservatively managed group, and the mean treatment duration was shorter. Although there is mixed information on efficacy from the research, SPGBs may play a useful role in treating PDPHs as an alternative to conventional treatment options.

Safety (Low risk)

The safety profile of SPGB has been reported in some studies. When comparing SPGB to AEBP, Cohen and colleagues reported that no severe complications of SPGB were observed (2018). Puthenveettil et al. (2018) reported that none of the patients in the SPGB group experienced any complications or adverse effects. However, other studies described short-term unpleasantness during the SPGB procedure, unpleasant or bitter taste, and temporary numbness/tingling (Jespersen et al., 2020; Murphy, McBride and Sharma, 2020). In comparison, the post-treatment complications of AEBP in the Cohen et al. study included backache radiating to lower extremities, vasovagal reaction, and temporary hearing loss (2018).

Readiness for Discharge

Time to discharge post-SPGB in the case studies/series varied from 1 hour (Cardoso et al., 2017) to several days (Singla and Mangla, 2018), and was affected by variable underlying reasons for hospitalization. One RCT compared pain, readiness for discharge, and a 4-level feel-good index score among 3 groups of patients (Kumar, Verma and Prasad, 2020). The feel-good score was determined by asking, "How do you feel?" and participants chose from very good, good, poor, or very poor. One group received a SPGB with 4% lignocaine, another group received SPGB with 10% lignocaine, and the control group was managed conservatively. Discharge readiness had profound variations among the groups; 95% of the 10% lignocaine group, 88.89% of the 4% lignocaine group, and 5.26% of the conservatively managed group were ready for discharge at 72 hours after initialization of treatment.

Discussion

The broad range of SPGB treatment techniques, LA drugs/dosages, patient populations, and assessment modalities shed light on the need for additional prospective, randomized studies to determine what is most efficacious and safe. Recently, SPGB has been examined for its effectiveness in treating PDPH. Although the studies included in this review report varying outcomes, there are several end points that are beneficial to patients. SPGB may provide rapid PDPH relief and reduce the need for AEBP. The majority of the authors included in this review suggested the reduction of AEBP in patients treated with SPGB. A treatment option like SPGB, that avoids another neuraxial approach, could be a safe and less-invasive alternative for patients to enhance patient satisfaction by offering treatment choices. SPGB is safe, easy to perform with minimal undesirable side effects. Patients who received SPGB had a high possibility of being discharged early. A potentially positive, unique benefit of SPGB is its possible role as an option to enhance patient-directed care. Kent and Mehaffey (2015; 2016) describe instructing patients during the initial SPGB placement how to repeat the procedure on themselves or by a friend or family member. Educational materials could be provided to outline the technique and how to manage potential risks/complications. The option for self-administration has the potential to improve patient-satisfaction and decrease the time to discharge. Jackson et al. (2018) and López, Sastre and Gómez-Ríos (2021) also reported cases of patient self-administration. However, there are potential liability concerns with encouraging patient self-administration and that would need to be explored further.

The findings of this systematic review are only valid when interpreted in the light of their limitations. There is a high level of risk of bias due to the mostly experiential nature of the available literature. Further research with larger studies and adequate sampling to allow for subgroup analysis would be beneficial. There is significant variation in the studies' intervention techniques, comparisons, and outcomes. The SPGB procedure has been performed in various approaches to include transnasal, transoral, sub-zygomatic, suprazygomatic, and lateral infratemporal (Nair and Rayani, 2017; Olsen, Cometa and Zasimovich, 2020). Another limitation is the local anesthetic variance. SPGBs with lidocaine, bupivacaine, ropivacaine, and levobupivacaine have been documented. Additional randomized controlled trials are needed.

Impact to clinical practice

If a patient meets the diagnostic criteria for PDPH, an algorithm, such as Figure 1, with treatment options can be beneficial in guiding practitioners toward the ideal intervention for a specific patient's needs. Ideally an AEBP is delayed for 24-48 hours post neuraxial procedure to obtain the best relief (Nguyen and Walters, 2014; Kwak, 2017) and possibly avoid factors that inhibit clot formation at the dural puncture site (Kwak, 2017). However, earlier AEBP placement may be associated with a more severe, harder to treat dural puncture leading to severe PDPH which may warrant earlier intervention (Kwak, 2017; Harrington and Reina, 2018; Bateman et al., 2021).

Conclusions

AEBP is not without risk. The SPGB could be offered to relieve symptoms earlier, as it could avoid the need for AEBP altogether, possibly provide relief until the ideal time for an AEBP to be successful, and/or improve a patient's ability to tolerate sitting for AEBP placement. As depicted in Figure 1, we propose the SPGB be considered as an early addition to PDPH treatment algorithms due to the minimally invasive and low risk nature of this treatment. The SPGB may be an option as a PDPH treatment modality, particularly in patients requesting alternatives to AEBP. When comparing the documented risks of SPGB against those of AEBP, it is an alternative first-line treatment option that may offer improved patient satisfaction.

*References available upon request

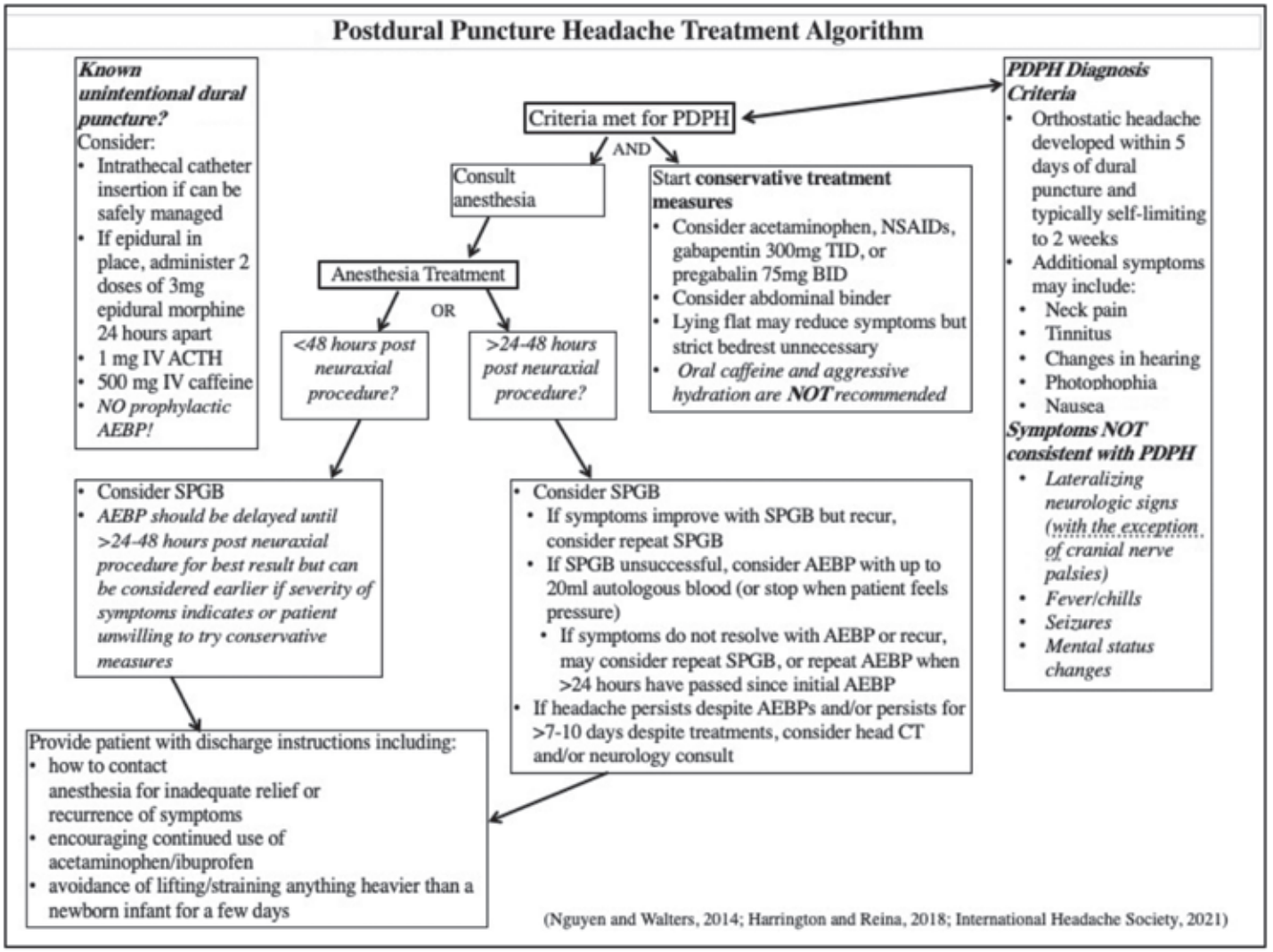

Figure 1. Algorithm for postdural puncture headache treatment.

Abbreviations: AEBP, autologous epidural blood patch; CT, computerized tomography; IV, intravenous; PDPH, postdural puncture headache; SPGB, sphenopalatine ganglion block.

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