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Postdural Puncture Headaches and the Development of a Treatment Protocol

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Introduction of the Problem

The postdural puncture headache (PDPH) has been a complication since the first neuraxial anesthetic in the late 1800s (Harrington & Reina, 2020). Although there are a number of risks associated with neuraxial anesthesia, the frequency of PDPH is only second to back pain (Simic et al., 2019). While any patient receiving neuraxial anesthesia is at risk of developing a PDPH, the incidence is highest among young female obstetric patients following placement of a labor epidural (Kwak, 2017). The symptoms of PDPH negatively impact maternal-newborn bonding, length of hospitalization, and the birthing experiences as a whole (Apfel, 2010; Angle et al., 2005). Although PDPH poses a real risk to parturients, many facilities offering obstetric services lack a written protocol addressing the prevention or treatment of PDPH (Suescum et al., 2016). As a result, the aim of this project was to create a customized, evidence-based protocol for postpartum PDPH treatment for a community hospital in the St Louis metro-east region to improve patient satisfaction and encourage optimal maternal-newborn bonding in the postpartum period by standardizing the treatment of PDPH.

Literature Review

PDPH may present after puncture (either intentional or unintentional) of the arachnoid mater. The pathophysiology behind PDPH development is typically explained using two main theories. The mechanism behind the first theory is that the loss of cerebrospinal fluid (CSF) through a puncture in the arachnoid mater exceeds its rate of production. The result is a net loss of CSF, leading to lowering of the brain in the cranial cavity. Displacement of the brain then leads to tension on sensitive surrounding structures, resulting in pain. Alternatively, the second theory is related to the Monro-Kellie Doctrine. The Monro-Kellie Doctrine states that the skull is

a fixed cavity containing brain tissue, blood, and CSF. Decreases in one of these variables must produce an increase in one or both of the others and vice versa. In PDPH, the net loss of CSF leads to an increase in blood volume via cerebral vasodilation, which is believed to be the cause of the pain (Simic et al., 2019; Kwak, 2017; FitzGerald & Salman, 2019; Bateman et al., 2021; Rodriguez et al., 2015).

The recognition and diagnosis of PDPH is crucial for anesthesia providers as over one third of women report some type of headache within the first week after delivery (Goldszmidt, 2005). According to Harrington & Reina (2020), a PDPH presents as a dull, throbbing, bilateral headache that is usually accompanied by neck pain, tinnitus, photophobia, and most commonly nausea. The headache is orthostatic and is alleviated within 15 minutes of lying flat (Patel et al., 2020). Headache onset is typically 24-48 hours after the meningeal puncture, but delayed presentation has been reported up to 5 days (International Headache Society, 2018).

The patient specific characteristics that increase likelihood of developing a PDPH include decreased age, female sex, history of headaches, BMI <31.5, and pregnancy (DelPizzo, 2020; Ramanuj et al., 2019; Uluer et al., 2019; Amorim et al., 2012; Khraise et al., 2017; Almeida et al, 2011; Peralto et al., 2015; Kwak, 2017; Kuczkowski, 2016; Orbach-Zinger et al., 2016). One study also found a correlation between non-smokers and PDPH development as well (Geracioti et al., 2013). Procedure related characteristics that increase the risk of PDPH include increased needle size, cutting spinal needles, bevel orientation perpendicular to meningeal fibers, and repeat punctures (Weji et al., 2020, Mehmood et al., 2021; Zorilla-Vaca et al., 2018; Costa et al, 2019; Harrington & Reina, 2021; Ahmed et al., 2006; Khraise et al., 2017). Provider related

characteristics that increase the incidence of PDPH include decreased experience level and fatigue (Harrington & Reina, 2021; Pirbudak, 2019; Paech et al., 2019)

The best method to prevent PDPH is to avoid accidental dural punctures (ADP) during epidural placement. When dural puncture is planned, the key is to mitigate modifiable risks. Once an ADP has occurred, the anesthesia provider has a few options available to prevent PDPH.

One option for PDPH prevention following ADP is intravenous cosyntropin, which is an adrenocorticotropic hormone analogue. Although the use of cosyntropin for PDPH prevention appears promising, large scale trials are lacking (Hakim, 2010; IBM Watson Health, 2020; Hanling et al. 2016).

Another option for PDPH prevention following ADP is the placement of an intrathecal catheter. Although some studies have found this to be an acceptable way to decrease PDPH risk, it poses additional risks to the parturient. The largest risk includes mistaking the intrathecal catheter as an epidural catheter. If an intrathecal catheter strategy is utilized, an overabundance of caution should be used to ensure that all staff members are aware of the catheter's termination in the intrathecal space (Russel, 2012; Ahuja et al., 2019; Verstraete et al., 2014; Deng et al., 2017; Harrington & Reina, 2020; Moaveni, 2020).

Additional strategies, including intrathecal saline injection, epidural saline administration, epidural morphine, and a prophylactic epidural blood patch, were noted in the literature, but their effectiveness appears to be inconsistent.

After the development and diagnosis of a PDPH, anesthesia providers should educate the patient on the cause and available treatment options. Treatment is often guided based on

the headache severity. If conservative measures are unsuccessful, escalation to more invasive treatments, such as a nerve block or epidural blood patch, may be necessary. Additionally, if symptoms are severe at onset, anesthesia providers may consider skipping to more invasive treatments.

Without treatment, PDPH will resolve by 1-2 weeks (International Headache Society, 2018). Ahmed & Jude (2006) recommend conservative treatment be utilized initially, as over 85% of PDPH will resolve with conservative measures. Conservative treatment consists of bedrest, analgesics, antiemetics, caffeine, and the avoidance of dehydration (Peralt & Devroe, 2017; Obstetric Anaesthetists' Association, 2018, Kwak, 2017; Basurto et al., 2015; Ragab & Facharzt, 2014; Harrington and Reina, 2020).

If conservative treatments fail, or symptom severity warrants escalation of treatment, invasive treatments such as a sphenopalatine ganglion block or epidural blood patch (EBP) should be offered to the patient. The sphenopalatine ganglion block offers a less invasive, safer, inexpensive, and easy to perform alternative to the traditional EBP, but its duration of action may necessitate repeating the block. The EBP remains the gold standard for treatment of severe PDPH due to its high success rate (50-80%). However, its more invasive nature poses additional risks to the patient such as back pain, repeat PDPH, spinal hematoma, and meningitis. It is recommended to perform an EBP at least 48 hours after ADP. An epidural blood patch may be repeated 24 hours later if necessary but consider other etiology and consult neurology if symptoms return after two EBPs (Kwak, 2017; Harrington & Reina, 2020; Obstetric Anaesthetists' Association, 2018; Cohen et al., 2018).

Project Methods

The development of an evidence-based treatment protocol for postpartum post dural puncture headache (PDPH) used a non-experimental design. This project was used to educate anesthesia staff on the most up to date treatment options for PDPH and provide an evidence based PDPH treatment algorithm that could be implemented into practice at the host facility if the anesthesia staff desired to do so. This project did not fall under the category of generalized research and did not involve human subjects, animals, biohazards, or recombinant DNA. Rather, this project was designed for quality improvement and therefore, deemed exempt by the Institutional Review Board (IRB) at Southern Illinois University Edwardsville (SIUE).

Evaluation

During a planned anesthesia staff meeting, time was allotted to provide a brief educational PowerPoint presentation to anesthesia staff on PDPH. The effectiveness of the educational presentation was evaluated by comparing anonymous and voluntary pre and post education questionnaires provided to the anesthesia staff in attendance. The change in scores reflected knowledge gained. After comparing the results from the pre and post education questionnaires, it was evident that knowledge was gained regarding PDPH onset (score increase from 71.4% to 100%) as well as the effectiveness of conservative treatment with PDPH (score increase from 42.9% to 100%). There did appear to be a lack of knowledge concerning the time a patient should remain in the supine position after the administration of an EBP as evidenced by a score of 28% that did not improve post education. The lack of improvement could have been related to the wording of the question. Also, there was a question directed at the likelihood of implementing knowledge gained from the presentation into practice. All

anesthesia staff in attendance reported that they planned to implement the proposed treatment protocol into their practice.

One limitation of this project was the volume of content to cover in a short amount of time. Extending the amount of time for implementation would have been beneficial to allow more time to cover the content in more detail. Another limitation included the number of anesthesia staff members available to participate in the implementation of this project.

Impact on Practice

This project will have a positive impact on practice at the host facility. Anesthesia staff identified a strong likelihood of implementing the PDPH treatment protocol into their practice. Additionally, during the educational presentation, several members of the anesthesia team commented that they had learned something new or realized they needed to make a change to their practice. The long-term impact of this project could positively impact the birthing experience for parturients visiting the host facility. One alteration that would be helpful in the ongoing implementation of this project would be to speak with the pharmacy department about the specific medications on the treatment protocol to ensure they are on formulary and available as some of the medications may not be currently used for the treatment of PDPH at the host facility.

Conclusions

After comparing the results from the pre and post education questionnaires, it appears that the educational PowerPoint presentation was effective at providing up to date information to anesthesia staff at the host facility regarding PDPH as questionnaire scores showed improvement after the educational presentation. Additionally, all staff either strongly agreed

(85.7%) or agreed (14.3%) that they would implement the proposed protocol into their practice. It would be beneficial to conduct a follow up study in the future to see if the treatment protocol is continuing to be used and if there are any recommended alterations to the protocol itself by anesthesia staff.

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