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Review Article

Postdural puncture headache: an update on treatment in obstetric patients

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ABSTRACT

Postdural puncture headache: an update on treatment in obstetric patients.

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Neuraxial analgesia and anaesthesia in an obstetric patient is associated with the risk of accidental dural puncture and subsequent development of a post dural puncture headache (PDPH). The management of accidental dural puncture requires consists of prevention of PDPH, patient's information, early diagnosis, treatment, and monitoring until remission of PDPH. When conservative measures and pharmacological treatment fail, then epidural blood patch (EBP) is considered to be the gold standard intervention for moderate or severe headache. In this article a review of literature has been undertaken to familiarize the obstetric anesthesiologists with the treatment of PDPH in anesthesia practice.

Keywords: Post dural puncture headache, epidural blood patch, obstetric anesthesia.

INTRODUCTION

Neuraxial analgesia is associated with the risk of accidental dural puncture and subsequent development of a post dural puncture headache (PDPH). Recent studies have shown that the incidence of accidental dural puncture complicating epidural cathether placement varying be-

tween 0,13-0,91%[1]. The purpose of this review is to present the current knowledge on the treatment of PDPH in obstetric anesthesia practice.

INCIDENCE AND CAUSES OF PDPH IN OBSTETRIC PATIENTS

Accidental dural puncture can lead to PDPH within 5 days and is bilateral, frontal and occipital. In 50% it is accompanied by neck stiffness, nausea, hearing disorders and photophobia. It is usually self-limiting within 2 weeks, while relief occurs sooner, by performing an epidural blood patch. It is usually orthostatic in nature with deterioration in the upright position and improvement with lying down while in 5% there is no orthostatic character. At the same time, up to 1/3 of the dural puncture may not be perceived at the time it occurs. The headache may be mild, moderate or severe. Risk factors associated with PDPH are young female with lesser BMI, history of chronic or recurrent headache, history of previous PDPH, large needle and spinal needles with cutting tip[2].

The production of cerebrospinal fluid is 500 ml/24 hours (21 ml/h) and its volume is 125-150 ml, half of which is intracranial. The dural puncture leads to CSF outflow through the hole. The larger the perforation, the greater the CSF loss. When the loss of CSF is greater than the production and, specifically, when the loss is about 10% or 15 ml of the estimated volume of the CSF, then intracranial hypotension is caused. Because the lumbar pressure of the CSF is 5-15cm H20 in the supine position and 40 cmH20 in the upright position, intracranial hypotension will be higher in the upright position[3]. Pathophysiological, intracranial hypotension leads to dilation of the cerebral and meningeal vessels as a compensatory mechanism for maintaining intracranial volume (Monro – Kellie), as well as to traction and irritation of the fibers of the sensory cranial nerves due to downward displacement of the brain. The above mechanisms lead to headache[4].

MANAGEMENT OF ACCIDENTAL DURAL PUNCTURE

The management of accidental dural puncture consists of prevention of PDPH, patient information, early diagnosis, treatment, and monitoring until remission of PDPH. The diagnosis is based on the clinical picture, i.e. the occurrence of orthostatic headache after neuraxial technique. Strong suspicion does not require imaging unless the headache changes in nature, if there are neurological deficits, or if therapeutic interventions are ineffective[5]. It is important to make a differential diagnosis from benign causes such as tension headache, migraine, caffeine deprivation and from more serious disorders such as preeclampsia, meningitis, subarachnoid hemorrhage and cerebral venous thrombosis[6]. Monitoring until remission of PDPH is necessary to avoid complications such as chronic headache, hearing problems such as dysacusis,

tinnitus and low frequency hearing loss and diplopia. The most serious disorders are venous thrombosis and subdural hematoma[7].

The prevention of the occurrence of headache and its treatment are based on the pathophysiological mechanisms of its creation. Initially, in the minimization of cerebral vasodilation (drugs, nerve blockages), in the replenishment of the CSF loss (drugs, invasive techniques) and, finally, in the sealing of the opening (insertion of an epidural catheter subarachnoidally immediately after puncture or applying an epidural blood patch that lead to increased pressure and inflammation with closure of the opening)[8].

Various interventions have been tried immediately after accidental dural puncture, but with dubious effects. Bed rest, hyperhydration and caffeine as well as epidural saline infusion and colloid solutions have not been shown to effectively reduce the occurrence of PDPH[9]. At the same time, prophylactic administration of morphine did not appear to reduce the incidence of headache or the performance of EBP.

Intentional advance of an epidural catheter into the subarachnoid space for 12 to 24 hours and at a depth of less than 3 cm appears to be somewhat effective in preventing headache[10]. The mechanical obstruction of the dura mater opening prevents the outflow of the CSF and with the inflammatory reaction caused by the catheter, healing is achieved after its removal. The advantages of this method include subarachnoid analgesia for labour, the easy conversion to surgical anesthesia for emergency CS and the reduction of the possibility of a new puncture. Serious complications (meningitis, abscess, hematoma, arachnoiditis or cauda equina syndrome) are rare. The disadvantages include involuntary intrathecal administration of drugs, increased risk of meningitis, risk of catheter detachment and loss of CSF, and increased risk of catheter migration. A meta-analysis showed that the subarachnoid catheter significantly reduced EBP but the headache did not decrease statistically significantly[11]. At the same time, in several retrospective and observational studies, the incidence of headache was reduced[10]. In general, few data are available and probably support some positive results from a subarachnoid catheter placement. It probably reduces the intensity of the headache.

TREATMENT

The treatment of post dural puncture headache (PDPH) can be conservative, pharmacological, and invasive.

Conservative treatment

In mild headache, conservative treatment is recommended. Bed rest offers temporary relief, while the prolonged one is not recommended, because it increases the risk of thromboembolic events. Thromboprophylaxis is required for more than 24 hours. Abdominal ligature does not show sufficient signs of improvement and it is recommended to maintain normal oral hydration and when this is not possible then intrave-

nously, because this is how the production of CSF increases. Studies have not shown that excessive fluid intake helps[12].

Pharmacological treatment

Caffeine belongs to the methylxanthine analogues and acts either by blocking adenosine receptors causing cerebral vasoconstriction or by activating the sodium and potassium pump and increasing the production of CSF. Randomized studies have shown that it offers short-term relief and not for more than 24 hours[13].

At the same time, the EBP did not decrease either. It appeared that there was a statistically significant difference in vas scores for only 4 and not for 24 hours. Overall, the data on effectiveness are insufficient. It is recommended to administer pos with a maximum dose of 900 mg/24 hours. In breastfeeding mothers of premature infants maximum dose 200 mg/24 hours to avoid side effects[14].

In the first line therapy is pos analgesia with paracetamol, NSAIDs and tramadol with caution in overdose. If simple pos analgesia is not enough, then opioids (morphine, oxycodone) are administered not for >72 hours to avoid side effects[15]. With conservative treatment the headache usually subsides at a rate of about 72% in one week.

Drug therapy mainly treats compensatory vasodilation and not the dura mater opening. Gabapentin, hydrocortisone and theophylline reduce pain scores, but not in the obstetric population. ACTH and its analogues, triptans, desmopressin, ergotamine alkaloids, mannitol and ondansetron have also been administered, but without clear indication for therapeutic efficacy. The problem is that most studies have not been performed in obstetric population and many involve subarachnoid administration. The combination of neostigmine and atropine in obstetric population has been shown to be effective in treating headache[16]. The therapeutic result is due to the effect on CSF secretion and intracranial vascular tone. However, there are not enough studies and new data are needed.

When the above treatments are not effective then more invasive treatments are required. Epidural administration of morphine may help or provide short-term relief. Epidural administration of saline and colloids, fibrin glue seems to relieve pain but the data are not enough since the studies are not randomized[17].

Invasive treatment

Epidural blood patch - Sphenopalatine ganglion block - Major occipital nerves block

When conservative and pharmacological treatment fail and the mother finds it difficult to care for the newborn, then epidural blood patch (EBP) is applied which is the gold standard intervention for moderate or severe headache. Blood is injected into the epidural space in the same intervertebral space or in a less mainly cranial one with an extension of 3-5 intervertebral spaces[18]. The thecal sac is immediately

compressed and the CSF pressure is increased causing reflex intracranial vasoconstriction, within 30 minutes or hours a clot forms while the final correction occurs within 7 days due to an inflammatory reaction, collagen formation, sealing of the dura mater opening. The application of EBP presupposes the consent of the patient, referring to the effectiveness and risks of the technique. Contraindications are increased intracranial pressure, taking anticoagulants, systemic infection and the presence of headache of other etiology. Blood pressure, heart rate and temperature should be monitored. The presence of bradycardia during the technique is common[19].

The efficacy in the first attempt is 65-70% after puncture with an epidural needle while the second EBP has a similar success rate[20]. Efficacy depends on the blood volume injected and the EBP performance time. Variety in anatomy and compliance and individualized pain resistance lead to a lack of correlation between injected blood volume, epidural pressure and EBP success[21].

A randomized multicenter study of patients with EBP with 15 ml, 20 ml and 30 ml resulted in complete symptom relief of 10%, 32%, and 26%, respectively. The study recommended 20 ml for optimal results[22].

In another study by Chen LK et al a recommendation for EBP with 20 ml or less was made with discontinuation in case of reported backache[23].While in the study of Booth LJ et al, volumes of up to 30 ml did not appear to reduce the need for repeat EBP[24].

Regarding the time of performing the technique, it seemed that there are better results when it is applied after 48 hours. In a study by Kokki M et al, it was found that when done in less than 48 hours it was less effective and more in need of a second EBP[25]. It seems that local anesthetics and CSF reduce coagulation and do not allow the opening to close. Within the first 24 hours it can only be applied to severe headache to control symptoms, but may need to be repeated. More randomized studies are required.

In recurrence or partial elimination of the headache, a second EBP is performed after 24 hours, after first making a differential diagnosis from other causes of the headache. However, in case of focal neurological signs or persistent headache after second EBP, neurological assessment and imaging are needed[26].

The application of EBP may have general complications such as new accidental puncture (1%), bradycardia possibly due to increased ICP, temporary nerve damage, chronic headache, convulsions and backache. With regard to backache, a study showed that it occurred during the technique in 50% of cases, 24 hours after> 80% of patients while it subsides within 4 weeks. The randomized study by Peach mentioned that backache was probably due to an increase in blood pressure, directly from root irritation or blood in subcutaneous tissues[22].

Other neurological complications included meningitis, cerebral palsy, epidural abscess, cauda equina syndrome, venous thrombosis and spinal cord injury, subdural hematoma and arachnoiditis[27].

Prophylactic EBP prevents the effusion of CSF from blood clot and facilitates the sealing of the dura mater opening. Nevertheless, the data on efficacy are contradictory and indications are insufficient. A major disadvantage is that a large percentage of patients will not experience headache and therefore are exposed to unwarranted complications.

An alternative technique is the Sphenopalatine ganglion block. The loss of CSF from the puncture stimulates the sphenopalatine ganglion (parasympathetic ganglion), resulting in the production of acetylcholine, NO and the induction of vasodilation in the brain and activation of trigeminal nociceptors resulting in PDPH.

Parasympathetic block and the induced sympathetic stimulation lead to reduction of PNS impulses in the cerebral vessels. The above cause reduction of vasodilation in the brain and therefore symptomatic relief in supine position and with neck in extension. A transnasal local anesthetic is applied to the sphenopalatine ganglion in the posterior nasopharynx. A swab with 2-4% lidocaine solution (0.5-1.5 ml) is passed horizontally into the nasal funnel until resistance in the anterior wall of the middle nasal cavity. This can be repeated 3 times. Monitoring is required for 40-60 min.

The risks are epistaxis, temporary discomfort, hypotension and nausea. Related contraindications are coagulation disorders and anatomical facial disorder[28]. It is applied before EBP in moderate or severe headache and in failure of conservative treatment. In partial PDPH relief it is repeated. Compared to EBP, this block is minimally invasive, offers faster relief and immediate mobilization. In the current literature there are only a few observational studies that suggest the effectiveness of this block. There are no randomized studies for efficacy and further data are needed in obstetric patients[29].

Another block is that of the major occipital nerves which are C2, C3 branches of the spinal cord nerve root. The nuclei of the C2-C3 spinal roots are connected to the nucleus of the trigeminal nerve in the brainstem. Parasympathetic block leads to sympathetic stimulation and thus PDPH relief. It is done either using point guides (occipital torus, occipital artery, mastoid process) or ultrasound. 3 ml of a 1: 1 solution of 2% lidocaine and 0.5% bupivacaine (25G – 30G) may be administered[30]. It is a safe, simple, minimally invasive and effective technique. It is applied before EBP in moderate or severe headache and failure of conservative treatment. In partial PDPH relief, it is repeated. It probably reduces the need for EBP, but there are not enough data available.

With regard to the treatment of PDPH, in patients with active COVID-19 disease, the safety of EBP is unknown. These patients may have

viremia. Intentionally injecting virus-containing blood into the epidural space may risk inoculating the central nervous system (CNS). Given this uncertainty, professional societies urge caution when contemplating EBP[31]. In severe PDPH, in an obstetric patient with infection by Covid-19, the application of EBP is recommended, weighing the neurological complications from not treating PDPH. Special care is needed with anticoagulants. It is recommended to avoid sphenopalatine ganglion block due to aerosol. Block of major occipital nerves possibly reduces PDPH. In severe PDPH, it is probably not effective[32].

CONCLUSION

This review analyzes the published literature on providing information about the treatment of PDPH in obstetric patients. Data on the treatment of headache after dura puncture are scarce and there are not enough randomized clinical trials studies[12].

Pharmacological treatment is a little effective. Moreover, there are a lot of evidence in the literature concerning the effectiveness and mechanism of action of EBP. Their results remain a matter of debate. It is considered very important to monitor PDPH until it subsides. Finally, more research is needed in order to prevent, recognize and treat the PDPH syndrome in postpartum women and their results may lead to the limitation of the associated morbidity and mortality.

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