

Recent recommendations for prevention of post dural puncture headache in pregnant females undergoing cesarean section

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Abstract

Background: Post-dural puncture headache (PDPH) is a common complication after lumbar puncture. PDPH typically presents with headache in frontal/occipital region which is postural in nature, that is worse on standing and better when lying down. Associated symptoms include stiff neck, hearing loss, tinnitus, photophobia and nausea. The prevalence of PDPH is higher in pregnant women. This study aims at reviewing of recent update in prevention of post dural puncture headache in pregnant female undergoing cesarean section. **Methods:** This is a review article, The search was performed in MEDLINE, Embase, Pubmed and CINAHL Plus in the same date range with the following mediactl terms: "post dural; puncture; headache; cesarean section.", including articles from 2000 to 2020, Excluded articles from review are those of language other than English. **Results and conclusion:** The management of headache after accidental dural puncture varies. This varied management extends to the literature with different definitions of PDPHA and indications for epidural blood patch. More concerning from a survey sent to members of the Society for Obstetric Anesthesia and Perinatology was the lack of follow-up of patients after accidental dural puncture. Given the conflicting data and opinions, a written protocol is important and is to be followed by all members of the department.

Keywords: post dural; puncture; headache; cesarean section

1.Introduction

Post-dural puncture headache (PDPH) is an important iatrogenic cause of patient morbidity in modern anesthesia, pain management after attempted epidural block and after spinal taps. The incidence of dural puncture ranges from 0.16%–1.3% in experienced hands. Post-dural puncture headache develops in 16%–86% of cases after attempted epidural block with large bore needles [1].

The incidence of PDPH following ADP varies and can be 80–86% in the obstetric population. There exist limited data with respect to DP in non-obstetric patients [2].

Dural puncture is a commonly performed invasive procedure for various indications like diagnostic lumbar puncture, spinal anaesthesia, myelography and intrathecal chemotherapy. However, in anaesthesia practice apart from intentional dural puncture as in spinal anaesthesia, unintentional dural puncture can also occur while performing epidural anaesthesia or analgesia for various indications, including postoperative and labour pain relief. Carrie and Collins define post dural puncture headache (PDPH) as "a headache occurring after dural puncture and has a significant effect on the patients post operative well being i.e. headache which is not only postural but also continues for more than 24 hours at any level of intensity or so severe at any time that the patient is unable to maintain upright position [3].

Historical reference to PDPH was recorded by August Bier in 1899, when he gave a personal account of his headache, he suffered after spinal anesthesia given to him on his request by his assistant. Dr. Bier described the headache as a feeling of very high pressure

in the head, accompanied by light dizziness when raising quickly from the chair. He also described the most important sign of PDPH as follows: "all symptoms disappeared immediately when I laid horizontally but came back when I got upright" [4].

Post-dural puncture headache (PDPH) is a common complication after lumbar puncture. PDPH typically presents with headache in frontal/occipital region which is postural in nature, that is worse on standing and better when lying down. Associated symptoms include stiff neck, hearing loss, tinnitus, photophobia and nausea. The prevalence of PDPH is higher in pregnant women [5].

The cause of PDPH is not entirely certain. The best explanation is that low CSF pressure results from CSF leakage through a dural or arachnoid tear; a leakage that exceeds the rate of CSF production. As little as 10% loss of CSF volume can cause an orthostatic headache. There are two basic theoretical mechanisms to explain PDPH. First one is reflex vasodilatation of the meningeal vessels due to the lowered CSF pressure. The second is traction on the pain-sensitive intracranial structures in the upright position. Traction on the upper cervical nerves including C1, C2, and C3, causes pain in the neck and shoulders. Traction on the fifth cranial nerve causes a frontal headache. Traction on the sixth cranial nerve causes visual symptoms. Pain in the occipital region is due to the traction of the ninth and tenth cranial nerves [6].

The third explanation involves the role of substance P and the regulation of neurokinin-1 receptors (NK1R). According to the International Headache Society, a PDPHA is any headache that develops within 5 days of dural puncture and is not better accounted for

by any other cause. It is usually accompanied by neck stiffness and subjective hearing symptoms.⁴ It also usually remits spontaneously within 2 weeks or after sealing of the leak with an epidural blood patch [7].

This study aims at reviewing of recent update in prevention of post dural puncture headache in pregnant female undergoing cesarean section

3.Results

Management of PDPH, figure 1.

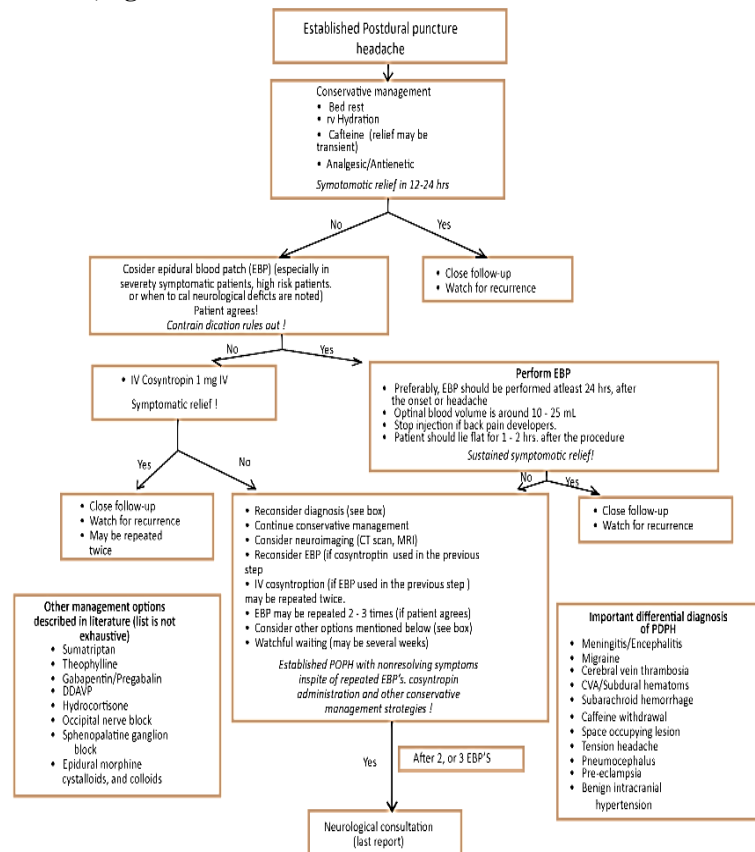


Fig 1: Algorithm For Management Of Post Dural Puncture Headache (Pdph)

3.1Management

Not all patients will require hospital admission, but for those who do, routine ward monitoring may be appropriate assuming the correct diagnosis of PDPH has been made. For those with evidence of neurological compromise, regular neurological observations may be warranted and will be advised by medical staff. If invasive intervention is required (i.e. epidural blood patch), then hospital admission will be required. Management options are outlined below:

Written information to facilitate discussion should be provided.

3.2Psychological reassurance:

Patients who develop post-Dural puncture headache may suffer a wide range of bad emotional responses from misery and tears to anger and panic. It is important both from a clinical and medico-legal point of view, to

2.Methods

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discuss the possibility of headache before a procedure is undertaken that has a risk of this complication. Even this discussion will not prepare the patient for the sensations he or she feels when the headache develops. [8]

Obstetric patients are particularly prone to develop this complication, especially as they expect to feel well and happy and to be able to look after their new baby. It is important to give the mother a thorough explanation of the reason for the headache, the expected time, course, and the therapeutic options available. Regular review is essential to monitor the course and therapeutic maneuvers undertaken. [8]

3.3Conservative

Aims to relieve symptoms while waiting for the dural tear to heal by itself It includes:

3.4Simple Analgesics

Simple analgesics such as paracetamol and non-steroidal anti-inflammatories (NSAIDs), in conjunction with anti-emetics, are the mainstay of PDPH management and have evidence to support their routine use in PDPH. [9]

This Regular paracetamol and NSAIDs (if not contraindicated) may be enough in mild cases. A weak opioid such as codeine, as required, is usually needed as well in moderate and severe cases. Laxatives should be prescribed in conjunction with codeine to prevent constipation. [9]

3.5 Hydration

Although there is no evidence to support the therapeutic effect of vigorous hydration, no patient with PDPH should be allowed to become dehydrated and adequate fluid intake should be encouraged. If patients are euvolemic, CSF production is anticipated to be sufficient and increased fluid intake would not be expected to increase its production. [10]

3.6 Posture

There is no evidence to support bed rest or specific postures following PDPH. Although it relieves the symptoms, it does not prevent them.

Patients thus should be encouraged to adopt the position which they find most comfortable, including lying flat, as a reduction in analgesic requirements decreases the likelihood of pursuing invasive treatment. It should be kept in mind that post-partum patients are in a hypercoagulable state, so prolonged bed rest may increase risk of venous thromboembolism. Adequate VTE prophylaxis should be prescribed if indicated. So Patients whose headache is severe enough to make them bedridden should be given elasticated stockings and prescribed clexane, around 6pm, in order not to delay a possible EBP the next day [10].

3.7 Abdominal Binder:

A tight abdominal binder raises the intra-abdominal pressure. The elevated intra-abdominal pressure is transmitted to the epidural space and may relieve the headache. Unfortunately, tight binders are uncomfortable and are not used very often in current practice. Few units recommend this approach. [11]

3.8 Pharmacological Treatment

Methylxanthine derivatives such as caffeine and aminophylline are the most commonly used drugs for the treatment of PDPH. Caffeine use was introduced in 1949. [11]

Caffeine

Caffeine is a central nervous system stimulant that poses other properties produces cerebral vasoconstriction. Although previously

thought to be of some benefit recent evidence suggests that caffeine intake does not provide a clinically significant improvement and may in fact cause more problems, such as maternal insomnia or neonatal irritability [11].

Adrenocorticotrophic hormone

Adrenocorticotrophic hormone is another drug, which is being investigated for treating PDPH. It has been administered as an infusion (1.5 µg/kg). IT acts by two mechanisms – first, it increases pain threshold by increasing beta-endorphin levels, secondly, it increases CSF production via sodium transporters. Ghai reported 80% pain relief in a patient who had previously failed conservative therapy after 4 doses of intramuscular ACTH given for 2 days. [9]

3.9 Cosyntropin

A recent study using cosyntropin which is an ACTH analog reported remarkable efficacy and need for EBP and significant prolongation of the time from ADP to the occurrence of PDPH but has yet to be independently confirmed. [9]

3.10 Other drugs

Both pregabalin and gabapentin have been shown to have a clinical benefit, with pregabalin being the more effective of the two. 5HT agonists (e.g. sumatriptan), DDAVP, theophylline, and hydrocortisone have also been used in the treatment of PDPH, but again there is limited evidence to support their routine use in PDPH treatment. Despite non-conclusive recommendations regarding the efficacy of steroids, one hospital reported their use. [9]

3.11 Sumatriptan

Sumatriptan is a 5-HT_{1D} receptor agonist that promotes cerebral vasoconstriction, the same way as caffeine do. Sumatriptan is advocated for the management of migraine and recently, for post-dural puncture headache. There have been only a few case reports where Sumatriptan was used successfully to manage post-dural puncture headache. However, a recent controlled trial found no evidence of benefit from Sumatriptan for the conservative management of post-dural puncture headache. [12]

3.12 Gabapentin

Gabapentin is an antiepileptic drug (AED) with analgesic properties. It is approved by the Food and Drug Administration (FDA) for adjunctive treatment of partial epilepsy and management of post herpetic neuralgia. The mechanism by which gabapentin exerts its analgesic action is unknown.

Indications of gabapentin treatment also include: Post herpetic neuralgia, partial seizures, painful diabetic neuropathy, social

phobia, anxiety disorders, acquired pendular nystagmus, essential tremor, generalized tonic-clonic seizures, migraine headaches prophylaxis, Parkinsonism, refractory spasticity, restless leg syndrome, phantom limb pain, spinal cord injury-related pain, Guillain-Barre-related pain, acute post-mastectomy pain, postmenopausal hot flashes, bipolar mood disorders, panic disorder, Cocaine dependence (Grade D/I), insomnia disorders, posttraumatic stress disorder, irritable bowel syndrome, Trigeminal neuralgia & other types of neuropathic pain [12].

3.13 Neostigmine

Neostigmine methylsulphate is used in the treatment of myasthenia gravis in usual doses of 1 to 2.5 mg daily given in divided doses by subcutaneous, intramuscular, or intravenous injection according to the severity of the condition. Neostigmine is used in conditions of urinary bladder atony due to post anesthetic depression or to neurological disorders. [13]

The possible pathways and mechanisms by which the neostigmine/atropine combination acts to resolve PDPH are shown in Figure 20. Following World Health Organization recommendations, breastfeeding was withheld for 24 hours after the last dose of neostigmine/atropine for the safety of the newborn. As no participants required >2 doses, breastfeeding was resumed within a relatively short average time of 36 hours after the start of the study intervention. The clinical side effects associated with neostigmine/atropine were primarily cholinergic effects of neostigmine such as abdominal cramps, muscle twitches, and urinary bladder hyperactivity [13].

3.14 Invasive measures

Epidural saline: There is a potential danger of an autologous epidural blood patch for the treatment of post-dural puncture headache. The immediate resolution of the headache with a blood patch is due to thecal compression raising the CSF pressure. An epidural injection of saline would also produce the same mass effect and restore normal CSF dynamics. As saline is a relatively inert and sterile solution, epidural saline bolus or infusion appears to be an attractive alternative. Regimens that have been advocated include:

- 1.0–1.5 liter of epidural Hartmanns solution over 24 h, starting on the first day after dural puncture
- Up to 35 ml.h-1 of epidural saline or Hartmanns solution for 24–48 h, or after development of the headache.
- A single 30 ml bolus of epidural saline after development of headache.
- Reduction in the leak would allow the dura to repair. [14]

However, observations of the pressures produced in the subarachnoid and epidural space show that, despite a large rise in epidural pressure, the consequent rise in subarachnoid pressure maintains the differential pressure across the dura. The pressure rise is also not sustained and is dissipated within 10 min. The saline may induce an inflammatory reaction within the epidural space, promoting closure of the dural perforation. Histological studies have not demonstrated an inflammatory response following epidural Dextran 40 administration, however, in contrast to an autologous blood patch. [14]

There are many case reports describing the success of epidural saline, comparative trials with epidural blood patches have not demonstrated the long-term efficacy of epidural saline placement. It is difficult to conclude from the evidence, that epidural saline administration will restore normal CSF dynamics. [14]

Epidural Dextran: Those studies that recommend Dextran 40, either as an infusion or as a bolus, conclude that the high molecular weight and viscosity of Dextran 40 slows its removal from the epidural space. The sustained tamponade around the dural perforation allows spontaneous closure. However, it is unlikely that Dextran 40 will act differently to saline in the epidural space. Any pressure rise within the subarachnoid space would, like saline, be only transient. Histological inspection of the epidural space after administration of Dextran 40, does not demonstrate any inflammatory response that would promote the healing process. The evidence for the administration of epidural Dextran to treat post-dural puncture headache is not yet proven, rendering it as an arguable line of treatment [15].

3.15 Epidurally administered opioids

A number of authors have advocated the use of epidural, intra thecal or parenteral morphine, however, the majority of these reports are either case reports or inadequately controlled trials. Some of the studies used epidural morphine after the onset of headache; others used epidural or intrathecal morphine as prophylaxis or in combination with an intrathecal catheter. [15].

A reported trial of intrathecal fentanyl as prophylaxis found no evidence of a reduction in the incidence of post-spinal headache after dural puncture with a 25-gauge spinal needle. Also the use of epidural opioids, either as a single injection or continuous infusion, is an important analgesic option for the treatment of postoperative pain & despite some of the side effects associated with epidural opioid administration, there are many advantages of

using epidural opioids for analgesia including some data that suggest an improvement in some clinically oriented patient outcomes. [9]

4. Discussion

Following the procedure the patient should remain supine for 2 hours. Routine ward observations are appropriate and women can be discharged once they are mobilising and have been reviewed by an anaesthetist. Although greatest success has been demonstrated in those who had an EBP performed >24-48 hours after the dural puncture, the procedure should not be withheld before this time if patients are significantly symptomatic. If repeat EDB are required, fluoroscopic/CT guided procedures/imaging can be considered. [9]

Epidural blood patch involves locating the epidural space and then injecting autologous blood, 15 mL to 20 mL. The use of an epidural blood patch for the treatment of headache after dural puncture is attributed to Gormley, who noted that patients with a bloody lumbar puncture had a lower likelihood of developing a headache compared with those who did not. Gormley then studied 7 patients with a headache after dural puncture, with 1 of the patients being himself. All had a headache that resolved with the epidural injection of 2 mL to 3 mL of blood. The amount of blood for an epidural blood patch has been studied. There have been numerous case series, with the amount of blood injected epidurally ranging from 6 mL to 50 mL. [16].

In a randomized study, 120 parturients with accidental dural puncture with an epidural needle and with a headache were randomized to receive an epidural blood patch. The volume for the blood patch was either 15 mL, 20 mL, or 30 mL. The incidence of partial relief was 51%, 41%, and 41% respectively, and of complete relief was 10%, 32%, and 26%, respectively. If a patient complained of severe back pain during injection, the final volume of blood used was limited. As such, only 81% of the parturients in the 20-mL group received the full 20 mL whereas only 54% of the parturients in the 30-mL group did. The major point of the study is that 20 mL of blood is the optimal volume for an epidural blood patch, assuming that the patient did not develop back pain or leg pain during the injection. There was no advantage to increasing the volume, with the larger amounts being limited due to back pain [17].

Epidural blood patch improves the visual disturbances accompanying cranial nerve IV involvement. It also improves the hearing alteration from cranial nerve VIII involvement. There is still some residual hearing alteration,

which is clinically not significant or noticed by the patient.

The chance of a patient developing a chronic headache is decreased. From the SCORE project, approximately 10% of epidural blood patches need to be repeated due to a return of symptoms.

Complications of epidural blood patch include ;

back pain with an estimated incidence of 80% of patients developing back pain.

Another common complication is radicular pain, which is a result of the inflammatory response in the epidural space by the blood clots as well as compression of the nerve roots. Other rare complication that have been reported :chronic adhesive arachnoiditis. Chronic adhesive arachnoiditis is an extremely rare condition consisting of back pain, leg pain, neurologic abnormalities, and MRI changes. Spinal subdural hematoma has also been described, requiring urgent neurosurgical correction. [18]

The concern with epidural blood patch is whether it will interfere with the success of sequent epidural catheters. In a retrospective study, 29 patients with PDPHA and epidural blood patch were matched to 55 patients with dural puncture and no epidural blood patch. There was no difference in the success of subsequent epidural anesthetics between the 2 groups. A patient had a failed epidural after an epidural blood patch for an accidental dural puncture. On the epidurogram in this patient, there was scarring, with contrast material restricted to T12 to L2. Alternative agents to blood, such as fibrinous glue, have been proposed to repair spinal dural perforations. [19].

Cranial dural perforations are frequently repaired successfully with it. In the case of lumbar dural perforation, the fibrin glue may be placed blindly or using CT-guided percutaneous injection [16].

There is, however, a risk of the development of aseptic meningitis with this procedure. In addition, manufacturers have recently warned against the application of some types of tissue glue where it may be exposed to nervous tissue. After accidental dural perforation with a Tuohy needle, it has been suggested that placement of a spinal catheter through the perforation may provoke an inflammatory reaction that will seal the hole. Evidence to support this claim is conflicting. The mean age of the patients in some of the trials has been >50 year, where the rate of post- dural puncture headache is low. Some trials have used spinal micro catheters,

26G–32G; others have placed 20G epidural catheters through an 18G Tuohy needle. [17]

Histopathological studies in animals and humans with long-term intrathecal catheters confirm the presence of an inflammatory reaction at the site of the catheter. Comparison between the effects of a catheter left in situ for 24 h and for several days or weeks would seem inappropriate. If, after accidental dural puncture with a Tuohy needle, the insertion of an intrathecal catheter reduced the post-dural puncture headache rate, then it would be worth considering. However, neurological complications, such as cauda equina syndrome and infection, should preclude the use of intrathecal catheters. The method of bilaterally blocking the greater occipital nerve (GON) with local anaesthetic has been utilized for the treatment of many different kinds of headache, and its benefit has also been seen in the treatment of PDPH. Greater occipital nerve blocks (GONB) have been demonstrated to provide symptomatic relief in patients with PDPH refractory to conservative measures making it a viable alternative technique that can be utilized in patients that decline an epidural blood patch. [19]

GONB is conducted by an experienced anaesthetist using ultrasound or a landmark based technique. Local anaesthetic is injected into the area immediately surrounding the GON with usually rapid subjective clinical improvement reported by patients [15].

Sphenopalatine ganglion block: Sphenopalatine ganglion blocks (SPGB) represent another regional technique that is occasionally utilized to treat patients with PDPH that is not responsive to conservative treatment. [19].

On rare occasions surgical intervention maybe required for a dural repair if significant headache persists and is refractory to non-surgical treatments. Evidence of a significant CSF leak on imaging may also be an indication for surgical intervention. [16]

5. Conclusion

The management of headache after accidental dural puncture varies. This varied management extends to the literature with different definitions of PDPHA and indications for epidural blood patch. More concerning from a survey sent to members of the Society for Obstetric Anesthesia and Perinatology was the lack of follow-up of patients after accidental dural puncture. Given the conflicting data and opinions, a written protocol is important and is to be followed by all members of the department. The key components to a successful protocol after accidental dural puncture are presented as

follows : See all patients after delivery and every day while in hospital. Provide patients with a number to call should they develop a headache after going home. Track all patients with symptoms consistent with postdural puncture headache. If a patient is unable to attend to activities of daily living, offer epidural blood patch. Consider intrathecal catheter if placement is difficult. For epidural catheter resiting after accidental dural puncture, consider prophylactic epidural blood patch. When doing an epidural blood patch, do not use a volume greater than 20 mL

6. References

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