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Update in management of post dural puncture headaches

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THE DURAL PUNCTURE HEADACHE

August Bier, a German surgeon who performed the first spinal anesthetic using cocaine, was the first person to describe a dural puncture headache (DPH) in the late 1890's. He stated, «All symptoms disappeared immediately when I lay horizontally but came back when I got upright». International Classification of Headache Disorders defines post-dural puncture headache as occurring within five days of dural puncture, usually accompanied by neck stiffness and/or auditory symptoms, resolving within two weeks or after an epidural blood patch. Because up to 5% of patients do not have a postural component, this requirement has been removed from the definition[1].

PDPH can occur following accidental dural puncture (ADP) with an epidural needle, or following a spinal anesthetic. The incidence of ADP is between 0.4-6% of patients receiving an epidural. Once an ADP occurs, the risk of headache is between 50-90%. Approximately one third of ADP are unrecognized at the time of epidural placement. Risk factors for development of a dural puncture headache are: puncture with a large bore needle, use of a cutting needle, female gender, age 20-40, and history of a DPH[2,3]. Although obesity has historically been thought protective against development of a DPH, recent studies have not duplicated those findings[4]. Patients having a cesarean delivery have a decreased risk of headache compared to vaginal delivery likely secondary to increased CSF loss with pushing[5]. The risk of headache following a spinal is rare (approx. 0.5-1%). A 26-gauge Quincke (cutting) needle still carries an almost 10% risk of headache, despite its' small size[6]. The use of a non-cutting needle (such as Sprotte or Whitacre) is considered best practice in obstetric anesthesia, as stated in the 2007 Practice Guidelines for Obstetric Anesthesia. In addition, the smallest possible needle should be used.

The pathophysiology behind a dural puncture headache consists of 2 main processes. Loss of CSF results in caudal displacement of the brain, placing tension on pain-sensitive intracranial structures. In response to intracranial hypotension from loss of CSF, intracranial vessels dilate in an attempt to restore pressure. This compensatory vasodilation is adenosine-mediated and may be exaggerated when high levels of circulating estrogen are present, such as during pregnancy[7,8].

DPH are often debilitating, preventing patients from caring for their newborn baby. These patients often have increased healthcare costs, prolonged hospital stays and multiple return visits to the ED for headache evaluation and treatment[9]. In addition, one small study[10] found that patients who suffered from a DPH were significantly more likely to develop chronic headaches (28 vs 5%). An analysis of obstetric closed claims found that headaches accounts for > 10% of claims in the U.S.[11].

MANAGEMENT OF ACCIDENTAL DURAL PUNCTURES

The immediate management of an ADP centers around the decision to place an intrathecal catheter (IC) or re-site the epidural at another interspace. The benefits of placing an IC are faster onset of analgesia, potential use for surgical anesthesia and avoidance of the risk of repeat ADP, which is around 9%. On the other hand, an IC may increase the risk for meningitis, particularly if it remains in place for a long time. In addition, poor spread of local anesthetic administered through the catheter could be a cause of neurotoxicity. Accidental administration of large doses of local anesthetic intended for the epidural space could result in a high spinal and the need for emergent intubation and resuscitation. Several studies have been published looking at placement of an intrathecal catheter for prevention of DPH. The most notable study showing benefit was published by Ayad and colleagues in 2003[12]. Patients with an intrathecal catheter and delayed removal had significantly lower headache risk (3.1%) versus those whose epidural was re-sited (81.1%). No other study has shown this degree of benefit. A meta-analysis published in 2012 by Heesen et al. including 9 studies and almost 1,000 patients showed no difference in headache risk (with or without delayed catheter removal), but did show a reduction

in rate of therapeutic EBP[13]. In 2014, Verstraete[14] and colleagues showed a reduction in DPH following accidental dural puncture from 62% in those whose epidural was re-sited to 42% in patients who had prolonged IC placement (OR 2.3). Most recently, a retrospective review in Australia[15] showed no difference in PDPH but a significant reduction in the need for EBP following IC insertion (34 vs 68%) regardless of catheter duration. The only prospective controlled trial to date looking at continuous spinal analgesia vs repeat epidural, was published in 2012 by Russell et al[16]. The results of this study failed to show a reduction in headache or the need for EBP between the two groups. Given the conflicting literature on efficacy combined with the inherent risks of placing an intrathecal catheter for labor analgesia, this technique should be reserved for patients in whom epidural placement was very difficult and those who are near delivery. Communication including clear labeling of spinal catheter, minimizing catheter disconnection and provider hand-off are some strategies to reduce the risk of infection and inadvertent injection.

Other methods for headache prevention following ADP have been investigated. A prophylactic epidural blood patch (PEBP) is performed through the existing labor epidural prior to removing the catheter in a patient with known ADP. There are conflicting results as to the utility of this technique. One systematic review published in 2010 included nine trials[7]. There was significant heterogeneity within the studies. The authors concluded there was no statistically significant difference in headache risk between those patients who received a prophylactic EBP and those who did not. One of the RCT included in the review compared PEBP with a «sham» blood patch and found no benefit[17]. This unique study design eliminated the possibility of placebo effect. A more recently published RCT[18] compared the risk of headache in 2 groups: 1) PEBP using 15-20 mL of blood, performed 5 hours after the last dose of local anesthetic, and 2) non-standardized conservative therapy. This study did find a reduction in headache following PEBP (18 vs 79%). The use of this technique remains controversial given that headache prevention has not been proven and there is potential for infection when injecting blood through a long term indwelling catheter. Consider reserving this technique for patients in whom epidural placement was very difficult.

Other prophylactic measures such as epidural saline (bolus or infusion), IV/PO fluids, bedrest, abdominal binder, IV Cosyntropin (an ACTH analog) and epidural morphine have been studied. Only epidural morphine and IV Cosyntropin have demonstrated benefit, each in a single, small RCT[19,20]. Both medications produced a significant reduction in PDPH and the need for blood patch. Cosyntropin is thought to act by increasing CSF production and circulating β-endorphins in the brain. There is insufficient evidence to recommend routine use of any of these medications for headache prevention.

DIAGNOSIS

Forty percent of women develop a **postpartum headache**[21]. Approximately half are primary headaches, such as a migraine or tension headache. Postpartum preeclampsia is the 2nd most common cause of postpartum headache. Other secondary causes include caffeine withdrawal, sleep deprivation, DPH and rarely intracranial pathology. Dural puncture headaches classically present within 72 hours after the dural puncture, although delayed presentation has been reported. Patients complain of a bilateral frontal-occipital headache that is positional. Commonly associated symptoms are: neck pain, nausea, vomiting, photophobia, tinnitus, decreased low frequency hearing and diplopia. It is critical to perform a thorough history and physical exam to rule out more serious intracranial pathology. A review of the anesthetic record may reveal a witnessed ADP. Pertinent questions include a history of headaches, relieving and exacerbating factors, associated symptoms, presence of fever or chills, bowel/bladder dysfunction, gait instability and other neurologic abnormalities. Physical exam should include a neurological assessment looking for focal deficits, as well as signs of nuchal rigidity. If a patient presents with a severe, non-remitting headache that does not fit into the classical presentation of a PDPH, imaging should be obtained to rule out the presence of an intracranial thrombus, hemorrhage or tumor. In addition, patients with changes in behavior or level of consciousness or focal findings of physical exam, such as ataxia or papilledema, should have imaging. A patient with DPH will generally have signs of intracranial hypotension on contrast-mediated MRI, including sagging of the intracranial structures and meningeal enhancement from vessel dilation.

TREATMENT

Alternatives to EBP

Treatment of DPH consists of a therapeutic epidural blood patch (gold standard) versus conservative therapy. **Conservative treatment** centers around analgesics, enhancing CSF production, and vasoconstriction to reverse the compensatory intracranial vessel dilation. Bedrest improves headache symptoms and may decrease the rate of CSF loss. IV and PO fluids may encourage CSF production. Ibuprofen and opioid analgesics are prescribed, but are generally minimally helpful. Caffeine and sumatriptan (5-HT agonist) have been used for headache treatment due to their vasoconstrictor properties. Caffeine also stimulates CSF production and may reduce the need for TEBP. Gabapentin decreased VAS pain scores in one study. Hydrocortisone, through an unclear mechanism, may also decrease VAS scores. Although Cosyntropin (ACTH) showed benefit for prevention of DPH

following accidental dural puncture, it does not appear useful once the headache develops[22]. There is insufficient evidence to recommend routine use of any medications in the treatment of a dural puncture headache. Analgesics should be made available to the patient. If caffeine is used, dose should not exceed 300 mg (900 mg/24 hours), and should be reduced to 200 mg in breastfeeding mothers with low birth weight babies. Pregnant patients have reduced caffeine metabolism, resulting in doubling of the elimination half-life[23].

Two less invasive treatment options have been used with some success. These blocks have long been used for migraine and cluster headache therapy, but only recently for DPH. The first, **Sphenopalatine Ganglion (SPG) Block**, has been described in a retrospective review and several case series[24]. Blockade of the SPG interrupts parasympathetic-mediated vasodilation thought to contribute to headache. Lidocaine 2, 4 and 5% have been used with success. The transnasal block is performed with the patient in the sniffing position. A long cotton-tipped applicator soaked in local anesthetic is placed in the nose towards the middle turbinate and left for 10 minutes. A new soaked swab is then placed for an additional 20 minutes. Repeat block may be necessary, and some patients may be educated to repeat the block themselves if symptoms return.

Greater Occipital Nerve (GON) Block has also been described with case series and one small randomized trial[25,26]. These publications have shown great success with 1-4 blocks. The GON has sensory fibers from C2-C3. Blockade may also block the trigeminal nucleus caudalis, which is activated by dural stretching and likely plays a role in the headache associated with dural puncture. Injection of local anesthetic lateral to nuchal midline, but medial to the occipital artery can be done with nerve stimulation or ultrasound guidance. Intravascular injection, bleeding and infection are potential complications.

The **therapeutic epidural blood patch (TEBP)** is the gold standard treatment for PDPH. It was first described by James Gormley in 1960 who reported successful treatment of DPH with as little as 3 mL of autologous blood injected into the epidural space. Epidural blood compresses the spinal space, resulting in cephalad spread of CSF and temporarily increases intracranial pressure, relieving traction on pain sensitive structures. This accounts for the immediate relief many patients experience. A fibrin clot seals the dural tear and prevents or reduces further CSF leakage[2,8]. TEBP is contraindicated in patients with coagulopathy, systemic infection or skin infection at the planned insertion site, abnormalities on neurological exam and patient refusal. Fluoroscopy should be considered for patients whose initial epidural procedure was extremely difficult.

The largest RCT to date looking at TEBP for treatment of DPH was the BLOPP study[27]. It included only 40 patients, but the authors reported complete recovery in 84% of the TEBP group at one week vs only 14% in the conservative group. Efficacy of TEBP is variable with most studies showing complete or partial success in 50-80% of patients. The optimal volume of autologous blood injected into the epidural space is 20 mL. Smaller volumes may be ineffective, while larger volumes result in worsening back pain without

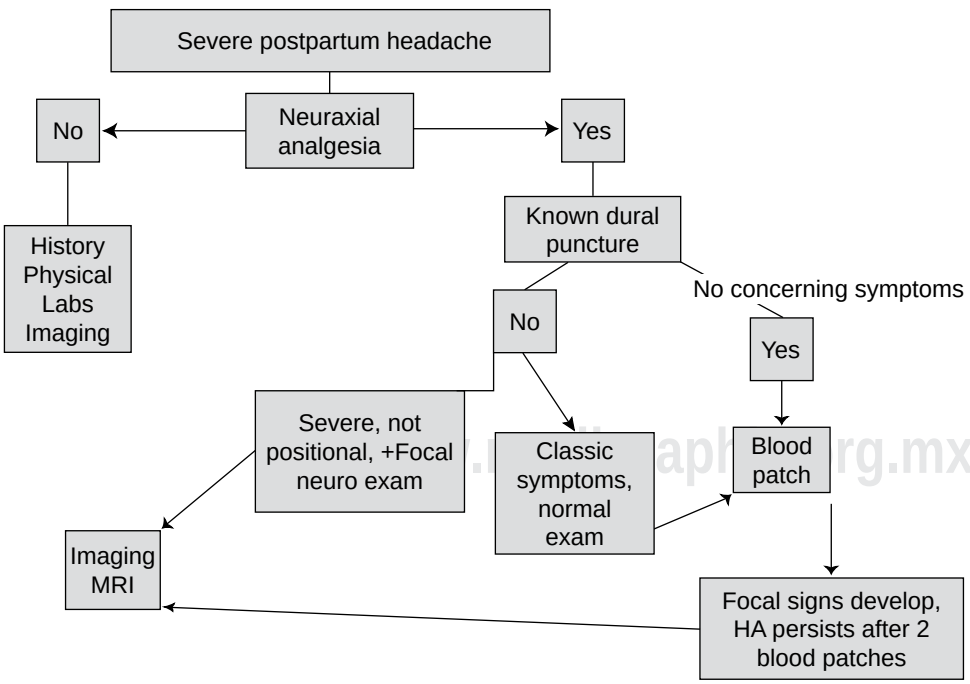

Figure 1.

Algorithm for evaluation and diagnosis of the postpartum headache.

improved success[28]. Some studies have shown that delaying TEBP following ADP may increase the success[29,30]. One study showed that when TEBP was performed 48 hours after puncture, the odds ratio for permanent relief was 2.35[29]. These results may be explained by selection bias, as those who present before 48 hours may have a larger dural tear that is less likely to be successfully treated with a TEBP. No randomized studies exist regarding timing. Patients typically experience mild to moderate back pain during injection of blood. Complications of this procedure are: repeat ADP, infection, neurological injury, arachnoiditis and iatrogenic subdural hematoma.

Very rarely, an untreated or treated DPH can result in subdural hematoma formation from tearing of the stretched bridging veins. If at any point along the treatment course of a DPH, the patient's symptoms appear to be worsening, neurological changes develop, or the headache changes in nature, imaging should be obtained promptly. MRI with contrast will give the most information. A CT can be used to quickly rule out an acute intracranial bleed.

FOLLOW-UP

Patients with known dural puncture or post-dural puncture headache should be followed daily until resolution. Patients should be counseled on their options including epidural blood patch. Written instructions should be given to all patients prior to discharge and should include contact information and a list of symptoms requiring return to the hospital.

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