

## EFFECTIVE MANAGEMENT OF THE POST DURAL PUNCTURE HEADACHE

### ANAESTHESIA TUTORIAL OF THE WEEK 181

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### QUESTIONS

Before reading this tutorial, try to answer the following questions. The answers can be found at the end of the article, together with an explanation

1. Which of the following statements is correct?
  - a. Bed rest and IV fluids should be instituted following accidental dural puncture
  - b. Spinal needle type and size is irrelevant in predicting development of PDPH
  - c. Epidural blood patch cures post-dural puncture headache in 90% of cases
  - d. The incidence of PDPH following spinal anaesthesia is <0.1%
  - e. An abdominal corset and laxatives are recommended after dural puncture
2. Describe how you would perform an epidural blood patch.
3. Postulated reasons for headache following dural tap include:
  - a. Cerebrospinal fluid (CSF) leak resulting in reduced intracranial pressure
  - b. Downward traction on pain sensitive intracranial structures
  - c. Cerebral venodilatation
  - d. Raised intracranial pressure

### INTRODUCTION

*“Toward the evening I was forced to take to bed and remained there for nine days, because all the manifestations recurred as soon as I got up. At midnight a violent headache set in that quickly became insupportable.”*

*August Bier 1898— a personal experience of post-dural puncture headache.*

Post-dural puncture headache (PDPH) was first described by August Bier in 1898 and classically presents as a postural headache following therapeutic or diagnostic interventions of the epidural or spinal space.

The incidence of PDPH is estimated to be between 30-50% following diagnostic or therapeutic lumbar puncture, 0-5% following spinal anaesthesia and up to 81% following accidental dural puncture during epidural insertion in the pregnant woman.

Although PDPH usually resolves spontaneously, it is unpleasant, it may interfere with a new mothers ability to care for her newborn and it may extend the length of hospital stay. More rarely PDPH may be associated with serious complications such as subdural haematoma, seizures and saggital sinus thrombosis. Effective treatment is limited so measures including the use of suitable needles and acquisition of appropriate skills in spinal and epidural placement are essential to reduce the development of PDPH.

## **PATHOGENESIS AND ANATOMY**

The pathogenesis of PDPH remains unclear but is thought to be caused by CSF leakage into the epidural space via a tear in the dura. CSF loss leads to a reduction in intracranial pressure and downward traction on pain-sensitive intracranial structures, including veins, meninges and cranial nerves, resulting in a headache that is classically worse in the upright position. The fall in intracranial pressure may also cause compensatory cerebro-vascular venodilation and this may contribute to the development of the headache.

**Figure 1:** Anatomy of the Dura Mater

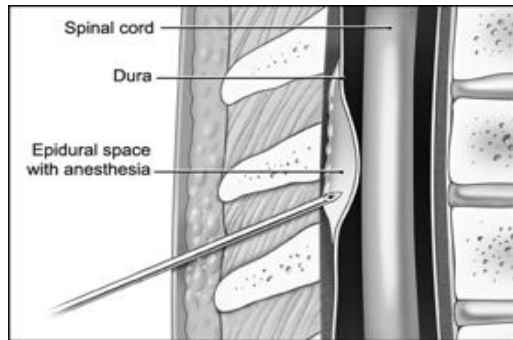


Illustration © Chris Gralaap

## **DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS**

The fundamental principle in the assessment of any parturient with a post-partum headache is to carefully consider the differential diagnosis.

**Table 1:** Causes of post-partum headache

Infective Meningitis Encephalitis	Pharmacological/Metabolic Dehydration Caffeine withdrawal
Vascular Migraine Cerebral vein thrombosis Cerebral infarction Subdural haematoma Subarachnoid haematoma	Other Post-dural puncture headache Pre-eclampsia Tension headache Benign intracranial hypertension Pneumocephalus Lactation headache
Neoplastic Space occupying lesion	

A history and examination should be performed taking account of the timing of the headache in relation to the neuraxial procedure, the nature of the headache as well as other symptoms and signs. Since PDPH can present following an unrecognised dural puncture with an epidural needle or epidural catheter, details of the epidural insertion should be reviewed including the difficulty of the procedure and number of attempts. In the case of a headache following a spinal procedure, PDPH is more likely following dural puncture with a larger gauge ‘cutting’ tipped needle (see later) or after multiple attempts at spinal block which might result in a number of dural tears (‘pepper potting’ of the dura), increasing the chance of a CSF leak.

The cardinal features of PDPH as defined by the International Headache Society are a headache that develops within 7 days of dural puncture and disappears within 14 days; however PDPH has been reported to occur later and continue for longer than these times.

Classic features of the headache caused by dural puncture are listed below but presentation is often variable.

- Headache is often frontal-occipital.
- Most headaches do not develop immediately after dural puncture but 24-48 hours after the procedure with 90% of headaches presenting within 3 days.
- The headache is worse in the upright position and eases when supine.
- Pressure over the abdomen with the woman in the upright position may give transient relief to the headache by raising intracranial pressure secondary to a rise in intrabdominal pressure (Gutsche sign).

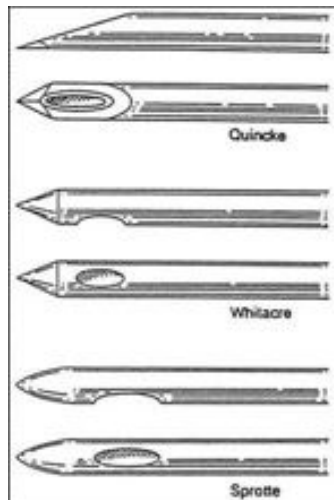
Associated symptoms that may be present include neck stiffness, photophobia, tinnitus, visual disturbance and cranial nerve palsies.

The skin over the epidural or spinal puncture site should be inspected for CSF leak, inflammation and tenderness. Baseline observations of heart rate, blood pressure and temperature should be recorded. PDPH is primarily a clinical diagnosis however if there is concern that the headache may be related to more serious intracranial pathology then diagnostic imaging should be considered early. In cases of PDPH, MRI may demonstrate diffuse dural enhancement and brain descent.

## PREVENTION

### Spinal Needle Selection

Smaller gauge spinal needles with pencil point tips such as the Whitacre and Sprotte needle are associated with lower rates of PDPH. Pencil point needles part rather than cut the dural fibres, and so the hole in the dura closes more quickly. Ideally, spinal needles no larger than 25G should be used.



**Figure 2:** Spinal Needle tips

### Neuraxial Block Technique

Epidurals can be inserted using a loss of resistance to saline (LORS) or to air (LORA.) Loss of resistance to saline performed with continuous pressure on the syringe plunger may have the effect of moving the dura anteriorly as the needle approaches thereby reducing the likelihood of dural puncture compared with an intermittent pressure technique with air. In addition, inadvertent dural tap while using LORA may result in pneumocephalus which itself can cause headache. Despite suggestions that

LORS is preferable to LORA, a recent retrospective study found that when anaesthetists used their preferred technique, whether air or saline, there were fewer attempts at insertion, less parasthaesia and fewer unintentional dural taps.

Orientation of the bevel of the spinal or epidural needle during insertion has been suggested to influence PDPH in the event of an inadvertent dural tap. There is weak evidence to indicate a lower incidence of headache if bevel orientation is parallel to dural fibres, however the exact orientation of dural fibres is unclear. Subsequent rotation of an epidural needle to allow catheter placement may itself be associated with higher rates of dural puncture so the benefits of a 'parallel' needle approach are unclear.

While there is no evidence that inadvertent dural puncture is less likely with an 18G Touhy needle compared with a 16G, in the event of a dural tap, the incidence of headache may be reduced. Other precautions should include ensuring an optimal patient position, slow controlled advancement of the needle and limiting patient movement during the procedure (especially important during labour) by using adequate local anaesthetic infiltration and maintaining verbal contact throughout. Operator experience is inversely related to inadvertent dural puncture and PDPH rates. Fatigue, haste, shift work and stress are other important factors which may contribute to PDPH.

After accidental dural puncture with a Tuohy needle, placement of the epidural catheter through the dural perforation may reduce the likelihood and severity of PDPH. This is thought to be due to the spinal catheter invoking an inflammatory response, which promotes healing of the dural tear and further reduces CSF leak. Randomised trials of the effectiveness of placing a spinal catheter are limited, evidence is conflicting, and how long the catheter should be left in place is unclear. The risks of leaving an intrathecal catheter include infection and drug overdose and hence the catheter should be clearly labelled. If staff are familiar with their use, the placement of an intrathecal catheter after unintentional dural puncture may be preferable to repeated attempts at epidural insertion.

Following diagnostic lumbar puncture, replacing the stylet prior to removing the needle may reduce the risk of headache. Insertion of the stylet may prevent a strand of arachnoid that was trapped in the needle following CSF aspiration from being avulsed on needle withdrawal thereby reducing damage to the dura.

## MANAGEMENT

### **Conservative Management**

Most post-dural puncture headaches will resolve spontaneously. Conservative management has traditionally involved bed rest and fluids though there is little evidence to support either of these measures. A recent Cochrane review concluded that routine bed rest after dural puncture is not beneficial and should be abandoned. While routine administration of additional fluids may be unnecessary, avoidance of dehydration is advisable to help limit headache severity.

### **Pharmacological**

Many drugs have been recommended to treat PDPH, however in the vast majority of cases, evidence of effectiveness is limited.

Simple analgesia should be instituted in all patients with PDPH; regular paracetamol and non-steroidal anti-inflammatory medications (if tolerated) may control symptoms adequately.

### ***Caffeine***

Caffeine was first reported as a treatment for PDPH in 1949. Caffeine is a central nervous system stimulant and is thought to influence PDPH by inducing cerebral vasoconstriction. Doses from 75 – 500 mg have been investigated and caffeine has been administered orally, intramuscularly and intravenously. A survey of UK practise conducted in 2005 found that 30% of UK maternity units prescribed caffeine to treat PDPH and many obstetric anaesthetists advocated caffeine containing fluids. There is low level evidence that caffeine confers a temporary benefit in PDPH, however a recent American consensus review concluded that the widely held opinion that caffeine is beneficial in PDPH is unwarranted. Caffeine is associated with adverse events including cardiac arrhythmias and maternal seizures. In high doses (probably >300mg) caffeine may enter breast milk and potentially lead to neonatal irritability.

### *Synacthen (synthetic ACTH)*

Synthetic ACTH was first reported to be effective for treating PDPH in the 1990s. Postulated mechanisms include CSF retention through increased mineralocorticoid mediated sodium reabsorption, and a direct analgesic effect via its glucocorticoid activity. Most reports of its effectiveness stem from case reports and case series; however a randomised controlled trial in 2004 found no effect of a single intramuscular injection of Synacthen compared with an intramuscular injection of normal saline. It is unknown whether a larger or repeated dose of Synacthen may be beneficial.

### *Other Drugs*

Numerous other reports exist in the literature with promising results for a variety of other pharmacological agents including: 5HT agonists (e.g. sumatriptan), gabapentin, DDAVP, theophylline, and hydrocortisone. To date there is insufficient evidence to support their use.

## **Invasive Management**

### *Epidural blood patch (EBP)*

After the (probably erroneous) observation that patients who had a bloody spinal tap at lumbar puncture were less likely to develop PDPH, the first epidural blood patch was performed in 1960 by the American surgeon, Dr James Gormley. Just 2 ml of the patient's blood was injected during the first epidural blood patch and the headache was relieved.

Epidural blood patching involves injection of autologous blood into the epidural space. It remains one of the few proven treatments of PDPH however the mechanism of action remains unclear. The resulting blood clot may have a "patch effect" on the dural tear while the volume of blood transfused into the epidural space raises intracranial pressure and reduces ongoing CSF leak.

Despite the early successes and long history of the epidural blood patch a number of controversies exist regarding the technique including its true effectiveness, the best technique and its safety.

### *Effectiveness*

- Early studies of the efficacy of EBP (up to 90%) were overstated probably because of inadequate patient follow up and inclusion of patients who had PDPH resulting from dural puncture by different types and gauge of needles. Reported success rates have fallen over time and current data suggest that permanent cure by a single blood patch can be expected in 50% of patients.
- About 40% of patients require a second blood patch.
- Despite the falling success rates, EBP remains the most effective treatment for PDPH and has been shown in a randomised controlled trial to be more effective than conservative treatment in treating established PDPH.

### *Optimal Technique*

- EBP should be performed by two personnel, one an experienced anaesthetist, the other competent in taking a volume of blood from the arm. Both should employ full aseptic precautions.
- Contraindications to EBP include: sepsis, coagulopathy and patient refusal.
- EBP is likely to be most effective if performed at least 24 hours after the onset of PDPH.
- Volumes of between 2-60mls of blood have been used. Optimal volume is unknown but current recommendations suggest 10 to 20ml should be injected. If the patient reports discomfort in the back during the procedure the injection should be stopped.
- The patient should lie flat for 1-2 hours after the procedure. There is no evidence that bed rest for longer than this time is beneficial.
- Once discharged from hospital, follow up by telephone over the first few days after EBP and review at 6 weeks is sensible.

### **Safety**

- Strict asepsis must be maintained during epidural blood patching.
- EBP should not be performed in the presence of leucocytosis or fever due to the risk of meningitis.
- Minor complications include backache, neckache and transient bradycardia.
- Major complications of epidural blood patching, although rare, may occur and include: meningitis, subdural haematoma, seizures, arachnoiditis, spastic paraparesis, dural puncture, cauda equina syndrome.
- Epidural blood patch may be unacceptable to some Jehovah's Witness patients.
- Clinicians should discuss the risks and benefits of an epidural blood patch with individual patients.
- If an epidural blood patch fails to relieve a PDPH, it may be prudent to consider radiological imaging of the head to exclude other pathology prior to repeating the blood patch.

### ***Prophylactic Epidural Blood Patch***

A potentially attractive option in the face of a recognised dural puncture with a Tuohy needle is to resite the epidural so that a prophylactic epidural blood patch (PEBP) can be provided in the hope of preventing a subsequent PDPH. The popularity of this technique has diminished recently for a number of reasons including the limited evidence that PEBP reduces the requirement for a therapeutic EBP, the increasing use of intrathecal catheter placement following dural puncture which may itself reduce the risk of subsequent PDPH and the recognition that some dural punctures don't result in a PDPH and many PDPHs do not require a therapeutic EBP. Administering a PEBP to patients following dural puncture may therefore expose these patients to an unnecessary procedure with associated risks.

### ***Other techniques***

#### ***Epidural Fluids***

A number of fluids, both crystalloids and colloids have been infused in to the epidural space. Fluid infusion may increase the CSF pressure and provide temporary relief of the headache. Longer term relief is less likely and the long term effect of colloid particles in the epidural space is unknown.

#### ***Epidural Morphine***

A number of authors have advocated the use of epidural opioids for the treatment and prophylaxis of PDPH. A recent small randomized study found that 3mg epidural morphine reduced the development of PDPH and need for EBP following inadvertent dural tap. Larger trials of this therapy are awaited.

## **SUMMARY BOX**

- PDPH will resolve spontaneously in the majority of cases
- Prevention of PDPH by good insertion techniques with appropriately sized and designed needles is better than cure
- Drug treatment is attractive, but no one drug stands out as an effective therapy
- If symptoms persist after 24-48 hours, or the headache is disabling, consider an epidural blood patch
- The epidural blood patch is an effective treatment but probably not as effective as once thought
- Always consider whether the headache is due to a dural puncture and not as a result of more serious pathology

## ANSWERS TO QUESTIONS

1. FFFFF

There is no evidence that either bed rest or additional IV fluids reduces the likelihood of a headache developing following accidental dural puncture.

Both the gauge and type of spinal needle tip does affect the risk of headache. Small gauge spinal needles with a non-traumatic (pencil-point) tip should be used to minimise PDPH after spinal anaesthesia.

Although PDPH cure rates of 90% were originally reported following epidural blood patch, more recent studies suggest the success rate is much lower (around 50%).

The incidence of headache after spinal anaesthesia is related to the needle type and gauge. Rates of PDPH around 0.5% may be achieved with very fine pencil-point needles, but higher rates can be expected with larger needles.

2. See text for a full explanation of how to safely perform an epidural blood patch.

3. TTTF

Although the exact mechanism by which dural tap leads to headache is unclear, several have been postulated. Why some women do not develop a headache despite a dural puncture with a large gauge needle (e.g. Tuohy) is unknown.

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