Treatment of obstetric post-dural puncture headache

Obstetric Anaesthetists’ Association

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EXECUTIVE SUMMARY OF RECOMMENDATIONS
All women who experience dural puncture with an epidural needle or post-dural puncture headache after a spinal block should be reviewed daily by a member of the anaesthetic team. When a woman experiences post-dural puncture headache, follow-up should continue until the headache resolves. Furthermore, any case of suspected obstetric post-dural puncture headache should be referred for anaesthetic assessment and reviewed by the anaesthetic team within 24 hours. A medical history should be taken and a physical examination performed to exclude other potential causes of postnatal headache. Before hospital discharge, women who have experienced dural puncture with an epidural needle or post-dural puncture headache should be given information on symptoms that require further medical assessment and on whom they should contact. Appropriate follow-up after discharge from hospital should be arranged for any woman who experiences dural puncture with an epidural needle or obstetric post-dural puncture headache. Based on available evidence, a proposed outline for treatment of obstetric PDPH is presented in Appendix A.

CONSERVATIVE TREATMENT

Bed rest
Although most women gain some relief from obstetric post-dural puncture headache when supine, the effect may be transient. Prolonged bed rest is not recommended as it may increase the risk of thromboembolic complications.

Oral fluids
Normal hydration should be maintained but there is no evidence of benefit from excessive fluid administration in the treatment of obstetric post-dural puncture headache.

Intravenous fluids
In the treatment of obstetric post-dural puncture headache, intravenous fluids need only be used to prevent dehydration when adequate fluid cannot be taken orally.

Abdominal binders
There is currently insufficient evidence to recommend the use of abdominal binders in the treatment of obstetric post-dural puncture headache.

PHARMACOLOGICAL MANAGEMENT

Simple oral analgesia
Regular oral analgesia should be offered to women with postnatal headache.

Opioid analgesia
Opioid analgesia may be offered to women with obstetric post-dural puncture headache if simple oral analgesia is ineffective but long-term therapy is not recommended.
Caffeine
There is limited evidence to support the use of caffeine in the treatment of obstetric post-dural puncture headache. If used, treatment with caffeine should not exceed 24 hours, oral therapy is preferred and doses should not exceed 300 mg with a maximum of 900 mg in 24 hours. A lower maximum dose of 200 mg in 24 hours should be considered for women who are breastfeeding particularly those with low birth weight or premature infants. Women receiving caffeine therapy should have their intake of caffeinated drinks monitored and the recommended daily dose should not be exceeded.

Other theophyllines
There is currently insufficient evidence to recommend the use of theophylline or aminophylline in the treatment of obstetric post-dural puncture headache.

ACTH and analogues
There is currently insufficient evidence to recommend the use of ACTH and its analogues in the treatment of obstetric post-dural puncture headache.

Steroids
There is currently insufficient evidence to recommend the use of hydrocortisone, dexamethasone or methylprednisolone in the treatment of obstetric post-dural puncture headache.

Triptans
There is currently insufficient evidence to recommend the use of triptans in the treatment of obstetric post-dural puncture headache.

Gabapentinoids
There is currently insufficient evidence to recommend the use of gabapentinoids in the treatment of obstetric post-dural puncture headache.

Other medications
There is currently insufficient evidence to recommend the use of desmopressin, methylergonovine, ondansetron or neostigmine and atropine in the treatment of obstetric post-dural puncture headache.

INVASIVE PROCEDURES

Acupuncture
There is currently insufficient evidence to recommend the use of acupuncture in the treatment of obstetric post-dural puncture headache.

Greater occipital nerve blocks
There is currently insufficient evidence to recommend the use of greater occipital nerve blocks in the treatment of obstetric post-dural puncture headache.
**Sphenopalatine ganglion blocks**
There is currently insufficient evidence to recommend the use of sphenopalatine ganglion blocks in the treatment of obstetric post-dural puncture headache.

**Epidural morphine**
There is currently insufficient evidence to recommend the use of epidural morphine in the treatment of obstetric post-dural puncture headache.

**EPIDURAL FLUID ADMINISTRATION**

**Epidural crystalloids**
There is currently insufficient evidence to recommend the use of epidural crystalloid infusions in the treatment of obstetric post-dural puncture headache. Epidural saline bolus administration may improve symptoms but the effect is usually transient.

**Dextran**
There is currently insufficient evidence to recommend the use of epidural dextran infusion in the treatment of obstetric post-dural puncture headache.

**Hydroxyethyl starch**
There is currently insufficient evidence to recommend the use of epidural hydroxyethyl starch infusion in the treatment of obstetric post-dural puncture headache.

**Gelatin**
There is currently insufficient evidence to recommend the use of epidural gelatin in the treatment of obstetric post-dural puncture headache.

**Fibrin glue**
There is currently insufficient evidence to recommend the use of epidural fibrin glue in the treatment of obstetric post-dural puncture headache.

**EPIDURAL BLOOD PATCH**

**What is the role of an epidural blood patch in the management of obstetric post-dural puncture headache?**
When conservative therapy is ineffective in the management of obstetric post-dural puncture headache and the woman experiences difficulty performing activities of daily life and caring for her baby, treatment with an epidural blood patch should be considered.

**How effective is an epidural blood patch in obstetric post-dural puncture headache?**
Multiple factors are likely to affect the success of an epidural blood patch. Although success rates of over 90% have been reported in older observational studies, more recent evidence suggests that complete and permanent relief of symptoms following a single epidural blood patch is only likely to occur in up to one third of cases where headache follows dural puncture with an epidural needle. Complete or partial relief may be seen in 50-80%. In cases of partial or no relief, a second epidural blood patch may be performed after consideration of other causes of headache.
What is the optimum time to perform an epidural blood patch?
Women should be informed that performing an epidural blood patch within 48 hours of dural puncture is associated with a reduction in its efficacy and a greater requirement for a repeat epidural blood patch. However, in severe obstetric post-dural puncture headache, an epidural blood patch within 48 hours of dural puncture may be considered for symptom control although it may need to be repeated.

What investigations should be performed to aid diagnosis before performing an epidural blood patch?
If the diagnosis of obstetric post-dural puncture headache is strongly suspected, there is no evidence that imaging is needed before performing an epidural blood patch. If the headache changes in nature, neurological signs develop, conscious level reduces, headache is atypical in nature, or when two epidural blood patches have been unsuccessful, urgent consideration should be given to further investigation and imaging.

What practical steps should be completed before an epidural blood patch is performed?
Before performing an epidural blood patch, written information should be offered to women to aid the consent process. As an epidural blood patch is a therapeutic intervention written consent is recommended. An appropriate time should elapse before an epidural blood patch is performed for women receiving anticoagulants. Maternal systemic infection and ‘red-flag’ symptoms suggesting an alternative diagnosis should be excluded.

What are the risks of an epidural blood patch?
**Repeat dural puncture:** The risk of further inadvertent dural puncture during an epidural blood patch should form part of the consent process.

**Back pain:** Back pain during an epidural blood patch may occur in 50% of women. Twenty four hours after an epidural blood patch, over 80% of women may experience back pain. This may continue for several days but severity usually decreases over a few days with resolution for most by four weeks. There is no evidence to support increased rates of chronic back pain after an epidural blood patch. As back pain both during and after an epidural blood patch is common, and in some cases severe, it should be discussed as part of the consent process.

**Neurological complications:** Neurological symptoms may occasionally develop after an epidural blood patch. Their exact incidence is unknown. The relationship between an epidural blood patch and neurological symptoms may not be causative. Given the severity of some neurological symptoms, their development should be discussed as part of the consent process for an epidural blood patch.

Are there risks to not performing an epidural blood patch?
There is currently insufficient evidence to suggest that an epidural blood patch reduces the risk of chronic headache, chronic back pain, cranial subdural haematoma, cerebral venous sinus thrombosis or improves outcome in cranial nerve palsy in women with obstetric post-dural puncture headache.

At which level should an epidural blood patch be performed?
The major effect of an epidural blood patch appears to be within a few segments of the site of injection. Blood injected during an epidural blood patch spreads predominantly cranially. It is therefore recommended that an epidural blood patch is performed at the same level or one space lower than that at which the original dural puncture occurred.

Is ultrasound or radiological guidance of benefit when performing an epidural blood patch?
There is currently insufficient evidence to recommend the routine use of ultrasound or radiological guidance when performing an epidural blood patch.
How much blood should be injected?
A volume of blood of 20 mL is recommended when performing an epidural blood patch. Injection should stop before 20 mL is injected if not tolerated by the patient.

Should blood cultures be sent when performing an epidural blood patch?
There is currently insufficient evidence to recommend that blood cultures should be sent routinely when performing an epidural blood patch. There is insufficient evidence to recommend the administration of antibiotics when performing an epidural blood patch. An epidural blood patch should not be performed in the presence of maternal systemic infection.

How should a patient be managed immediately after an epidural blood patch?
There is currently insufficient evidence to recommend for how long women should remain in bed following an epidural blood patch or in what precise position. It is recommended that regular observations of maternal pulse, blood pressure and temperature are recorded following an epidural blood patch.

What are the indications to perform a repeat epidural blood patch?
A second epidural blood patch may be performed once other causes of headache have been excluded. Where the diagnosis of obstetric post-dural puncture headache is likely and an epidural blood patch has produced resolution of symptoms but the headache subsequently returns, a second epidural blood patch may be offered as it is likely to be of benefit. If an epidural blood patch has produced some improvement in symptoms but headache persists, a second epidural blood patch can be considered as it may be of benefit. In cases where an epidural blood patch has no effect on headache, or if the diagnosis of obstetric post-dural puncture headache is less certain, or if the nature of headache has changed, discussion with other specialties including obstetrics, neurology and neuroradiology should take place before a second epidural blood patch is performed. If two epidural blood patches have failed to relieve symptoms, other causes of headache must be considered and involvement of other specialties is recommended before performing a third epidural blood patch. There is insufficient evidence to state the optimum timing of a repeat epidural blood patch in terms of efficacy and safety.

Does an epidural blood patch affect the success of a subsequent neuraxial technique?
Evidence of an effect of an epidural blood patch on the success of subsequent neuraxial blockade is equivocal. All studies that have assessed the effect have methodological flaws. Current evidence is insufficient to comment on whether an epidural blood patch affects outcome of subsequent neuraxial blockade.

How should patients who have undergone an epidural blood patch be followed up?
Women who receive an epidural blood patch should be reviewed by an anaesthetist within four hours of the procedure. Women who are discharged home on the day of an epidural blood patch should be contacted the following day. Women who remain in hospital should be reviewed daily until discharge or until symptoms resolve. Before discharge, women should be given verbal and written advice on when to contact the hospital should their headache return or other symptoms develop. Information on obstetric post-dural puncture headache and epidural blood patch should also be given to the woman’s general practitioner and community midwife.
USEFUL LINKS AND SUPPORT GROUPS
Royal College of Anaesthetists. Risks associated with your anaesthetic- headache after a spinal or epidural injection RCOA 2015

Labour Pains. Headache after an epidural or spinal injection- What you need to know
[http://www.labourpains.com/ui/content/Content.aspx?ID=42]

Patient. Complications after spinal or epidural anaesthetic – headache
[https://patient.info/health/anaesthesia/headache-after-anaesthetic]
These guidelines on the treatment of obstetric post-dural puncture headache (PDPH) have been produced by an Obstetric Anaesthetists’ Association (OAA) working group and approved by the OAA Executive Committee. Recommendations have been made to assist clinicians and patients in making decisions about appropriate treatment for obstetric PDPH. The recommendations are not intended to dictate an exclusive course of treatment; rather they should be used to guide management to meet individual patient needs.

1. PURPOSE AND SCOPE AND/OR AIMS AND OBJECTIVES

The 2009-12 MBRRACE-UK report highlighted the deaths of two women in whom dural puncture had occurred during insertion of a labour epidural catheter. One woman received an epidural blood patch (EBP), the other did not but both suffered with chronic headaches following hospital discharge. Neither woman was adequately followed-up. Death resulted from a cerebral vein thrombosis in one case and a subdural haematoma in the other. Surveys of clinical practice in the UK have revealed significant variation in practice amongst anaesthetists in the management of obstetric PDPH. To help provide guidance on treatment of obstetric PDPH, the OAA set up a working group to review the literature and produce evidence-based guidelines.

The purpose of this guideline is to describe and summarise evidence pertaining to the treatment of PDPH in the obstetric population, and present recommendations for clinicians. The focus is on treatment of PDPH, rather than prevention and the guideline considers both pharmacological and non-pharmacological approaches. The role of an epidural blood patch (EBP) is reviewed in detail.

To assist clinicians and patients, a number of appendices are attached to the guidelines. These include a proposed treatment pathway for obstetric PDPH; a PDPH care package with a proforma to facilitate good documentation; a checklist for performing an epidural blood patch (EBP); patient follow-up forms; and, examples of letters to be sent to general practitioners. The appendices are for guidance only and it is expected that individual units will design their own forms and letters.

2. INTRODUCTION

Post-dural puncture headache was first described by Bier in 1899. Having undergone dural puncture, Bier developed a postural headache 24 h later, the severity of which forced him to remain in bed for nine days. Post-dural puncture headache remains one of the more common complications of neuraxial blockade and a significant cause of morbidity in the postnatal period.

The International Headache Society (IHS) now defines PDPH as, “Headache occurring within 5 days of a lumbar puncture, caused by cerebrospinal fluid (CSF) leakage through the dural puncture. It is usually accompanied by neck stiffness and/or subjective hearing symptoms. It remits spontaneously within 2 weeks, or after sealing of the leak with autologous epidural lumbar patch.” Although no longer included in the IHS description, the headache is typically positional and may follow spinal anaesthesia or dural puncture with an epidural needle. Up to 5% of patients may present with an atypical headache that has no postural element.

Over 50% of women experience PDPH following dural puncture with 16-18 gauge epidural needles. The incidence of headache after spinal anaesthesia depends on needle size and design, with reported rates of between 1.5% and 11.2%. Data on headache duration are difficult to interpret due to differing forms of management and length of follow-up.
There are several differential diagnoses to consider both before PDPH is diagnosed, and during ongoing management if the nature of headache changes or therapeutic interventions prove ineffective. Primary headaches such as migraine and tension headaches are common and their incidence may increase in pregnancy. Preeclampsia and hypertensive diseases of pregnancy can present with a headache. Vascular causes, both haemorrhagic or ischaemic, must be considered and excluded. While the occurrence of a recognised dural puncture makes the diagnosis of PDPH more likely, up to a third of PDPHs occur following unrecognised dural puncture. It is, therefore, important to make a thorough assessment of any woman who presents with postnatal headache and establish the correct diagnosis.

Post-dural puncture headache can occur in a variety of settings as a result of interventions carried out by clinicians from a number of different disciplines. It may also occur spontaneously without an obvious precipitating cause. The pathophysiology of PDPH is uncertain. Dural puncture causes CSF leakage which results in radiologically demonstrable ‘sagging’ of intracranial structures. Sagging may be exacerbated by the upright position and is postulated to be the cause of the postural nature of the headache. Concurrent intracranial hypotension may lead to cerebral and meningeal vasodilation which of itself may cause or contribute to the headache. Post-dural puncture headache is more common in younger patients and increases in severity and frequency as needle size increases, making the obstetric population particularly vulnerable. While bed rest may relieve symptoms, it is a poor option for a new mother in the immediate postpartum period, busy with a new-born baby and in a relatively hypercoagulable state. As a result, obstetric anaesthetists are keen to find effective therapies.

Symptoms may not be limited to headache and neck pain as dural puncture can cause other neurological complications – ocular and auditory problems in particular (see section 8.6.3). Rarely, PDPH has been associated with severe morbidity and even mortality caused by cerebral haemorrhage or cerebral venous thrombosis. Although the IHS definition states that PDPH resolves within two weeks, headaches occasionally persist for longer. Furthermore, it has been suggested that sufferers are more likely to develop chronic headache or back pain (see section 8.7).

All women who experience dural puncture with an epidural needle or PDPH after a spinal block should be reviewed daily by a member of the anaesthetic team. When a woman experiences PDPH, follow-up should continue until the headache resolves. Furthermore, any case of suspected obstetric PDPH should be referred for anaesthetic assessment and reviewed by the anaesthetic team within 24 h. A medical history should be taken and a physical examination performed to exclude other potential causes of postnatal headache. Before hospital discharge, women who have experienced dural puncture with an epidural needle or PDPH should be given information on symptoms that require further medical assessment and on whom they should contact. Appropriate follow-up after discharge from hospital should be arranged for any woman who experiences dural puncture with an epidural needle or obstetric PDPH.

The EBP, first described in 1960, has been considered the definitive treatment for PDPH. Initial reports claimed very high success rates for an EBP, but more recent data have been less optimistic. In 2001, the first Cochrane review of the topic went so far as to suggest that evidence for the efficacy of EBP was so weak that the intervention should only be carried out in the setting of randomised controlled trials (RCTs). While this recommendation never achieved widespread acceptance, it certainly challenged previous beliefs. A number of other therapeutic modalities have been described and are assessed below. Unfortunately, although initial reports have often been encouraging, no convincing alternative management options have so far emerged. When examining the evidence to inform this guideline, numerous publications – reviews in particular – simply describe opinions from previous reviews without
critically appraising original scientific investigations or evidence. In summary, much of the existing advice on the management of PDPH is based on very little robust scientific evidence.

3. IDENTIFICATION AND ASSESSMENT OF EVIDENCE

To facilitate development of evidenced-based guidelines on the treatment of obstetric PDPH, a narrative review was undertaken. A literature search of English-language articles in PubMed, EMBASE, Ovid Medline and the Cochrane Databases was conducted in April 2017 to identify relevant published clinical trials, case reports and case series, clinical audits, systematic reviews and meta-analyses from 1960 to 2017 inclusive. Various search terms including ‘post-dural puncture headache’, ‘post-lumbar puncture headache’, ‘spinal headache’, ‘epidural headache’ and ‘blood patch’ were used. In addition, guidelines from national societies of obstetric anaesthesia and the National Guideline Clearinghouse were studied. Following completion of the draft guideline, a further literature search was performed in April 2018.

The literature search was limited to the treatment of PDPH and not prophylaxis. The effects of intrathecal catheters, various drugs regimens and the use of a prophylactic EBP in the prevention of PDPH are not included in these guidelines.

Papers identified during the literature search were reviewed by the authors. Treatment options for obstetric PDPH that were considered are listed in the Executive Summary of Recommendations. The literature search, study selection, data extraction and analysis followed PRISMA guidelines. Interpretation of the findings of many studies was limited by a number of factors including:

- The majority of randomised trials included small numbers of patients
- The process of randomisation and blinding was often unclear
- Outcome measures between trials were highly variable
- Many articles did not distinguish between males or females or between obstetric and non-obstetric patients
- Many articles did not separate PDPH following epidural from PDPH following spinal injections
- Epidural blood patches were variably used for prophylaxis or treatment, sometimes without a clear distinction in the same study.

Information was extracted from each publication regarding study design, population, intervention and primary (and secondary where available) outcome measures. All articles were retrieved and reviewed by at least two members of the working group to determine suitability for inclusion. Any disagreement was resolved through consensus or, if necessary, by discussion with a third member of the working group.

Recommendations for each treatment are based on the strength of supporting evidence and were agreed by members of the working group. In areas where evidence was lacking, the working group produced good practice points based on consensus. Opinions were sought from various groups including representatives from obstetrics, midwifery, neurology, neuroradiology, general practice and the lay public.
4. CONSERVATIVE TREATMENT

4.1 Bed rest

Although most women with PDPH gain some symptomatic relief in the supine position, the effect may be transient. There are no published randomised trials examining the effect of bed rest in the treatment of PDPH and bed rest has not been shown to speed resolution of PDPH. Furthermore, a meta-analysis has demonstrated little benefit of prophylactic bed rest in the prevention of PDPH. The meta-analysis also failed to show benefit from the prone position compared to lying supine. Whilst many women with PDPH prefer to remain supine, prolonged bed rest should not be encouraged as it may increase the risk of thromboembolic complications. When women feel confined to bed for longer than 24 h because of PDPH, thromboprophylaxis should be considered and discussed with the obstetric team. If pharmacological thromboprophylaxis is used and an EBP is to be performed (see section 8), adequate time between the last dose of anticoagulant and the EBP must have elapsed to reduce the risk of vascular complications.

Although most women gain some relief from obstetric PDPH when supine, the effect may be transient. Prolonged bed rest is not recommended as it may increase the risk of thromboembolic complications.

4.2 Oral fluids

It has been suggested that when treating PDPH, fluid therapy may help by increasing the production of CSF. There are no randomised studies examining the effect of oral fluid intake on recovery from PDPH. Dehydration may worsen headache but excess fluid intake appears to be ineffective and potentially, may be of harm. Therefore, normal hydration should be maintained; benefit from encouraging excessive fluid administration is unlikely.

Normal hydration should be maintained but there is no evidence of benefit from excessive fluid administration in the treatment of obstetric PDPH.

4.3 Intravenous fluids

As with oral fluids, there are no studies demonstrating benefit of intravenous fluid therapy in the treatment of PDPH. When PDPH is diagnosed, intravenous fluids need only be used to prevent dehydration when adequate fluid cannot be taken orally.

In the treatment of obstetric PDPH, intravenous fluids need only be used to prevent dehydration when adequate fluid cannot be taken orally.

4.4 Abdominal binders

Abdominal binders are thought to work by increasing pressure within the spinal canal, pushing CSF cephalad, thereby reducing headache. Although one study looked at the role of abdominal binders in the prophylaxis of PDPH, there are no randomised trials looking at their effect in the treatment of PDPH. They are cumbersome and usually unacceptable to postnatal women with observational studies highlighting poor compliance.

There is currently insufficient evidence to recommend the use of abdominal binders in the treatment of obstetric PDPH.
5. PHARMACOLOGICAL MANAGEMENT

5.1 Simple oral analgesia

Simple oral analgesic medication such as paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs) and weak opioids including codeine or tramadol are frequently prescribed following childbirth. They are used for postnatal headaches of all causes. However, they are often of limited efficacy when treating obstetric PDPH. There are no placebo-controlled trials examining the benefit of simple oral analgesia in obstetric PDPH, although they are usually included in the control group when other therapies are investigated. Regular analgesia should be offered to all women with postnatal headache and maximum daily doses should not be exceeded.

*Regular oral analgesia should be offered to women with postnatal headache.*

5.2 Opioid analgesia

Stronger opioid medication such as morphine or oxycodone is often given to women with PDPH when simple oral analgesia is ineffective. There are no randomised studies examining the efficacy of opioids in the treatment of obstetric PDPH. Whilst the use of strong opioids may be of some temporary benefit, long-term therapy (>72 h) is not recommended due to their recognised side effects.

*Opioid analgesia may be offered to women with obstetric PDPH if simple oral analgesia is ineffective but long-term therapy is not recommended.*

5.3 Caffeine

The proposed mechanism of action of caffeine in PDPH is by cerebral vasoconstriction and increased CSF production. Despite its widespread use, only two randomised studies have investigated the efficacy of caffeine in the treatment of PDPH, with both finding some short-term improvement in symptoms.

Sechzer and Abel compared intravenous caffeine 500 mg with placebo in 41 patients with PDPH, finding significant improvement in headache 2 h after caffeine administration. Long-term outcome was not reported. Camann et al. randomised 40 obstetric patients with PDPH following epidural or spinal blocks, to receive either oral caffeine 300 mg or placebo. The severity of headache was significantly better after 4 h in the caffeine group but there was no difference between groups at 24 h and no difference in the number of women receiving an EBP. There are no comparisons of oral with intravenous caffeine in the obstetric population. The optimum dose has yet to be established.

The benefit of caffeine in PDPH is supported in observational studies and case reports. Unfortunately, these reports and the two randomised studies have methodological flaws leading some authors to suggest that the endorsement of caffeine in PDPH is unwarranted.

Ingestion of large amounts of caffeine has a number of recognised side effects including maternal restlessness and insomnia. Furthermore, it is transferred into breast milk and may have effects on the infant. Of concern are cases of maternal seizures following the use of caffeine to treat PDPH. Whether this represents causation or an association is unknown. Seizures have occurred after large doses of caffeine were administered (≥1 g). Decreased metabolism of caffeine during pregnancy more than doubles its half-life (up to 16 h) leading to increased levels of active theophylline metabolites. Values usually return to normal within a month of delivery.
Based on current evidence, it is recommended that treatment of obstetric PDPH with caffeine should not exceed 24 h as it has only been shown to provide short-term benefit (up to 4 h) and repeated administration may increase the risk of side effects. Intravenous administration has not been shown to improve efficacy. Oral doses of caffeine should not exceed 300 mg with a maximum of 900 mg in 24 h. A lower maximum dose of 200 mg in 24 h is recommended by the National Health Service for women who are breastfeeding, and is particularly relevant to those with low birth weight or premature infants. The intake of caffeinated drinks should be monitored in those prescribed caffeine for PDPH. Commercially available coffees and high-energy drinks typically contain 100-200 mg of caffeine.

There is limited evidence to support the use of caffeine in the treatment of obstetric PDPH. If used, treatment with caffeine should not exceed 24 h, oral therapy is preferred and doses should not exceed 300 mg with a maximum of 900 mg in 24 h. A lower maximum dose of 200 mg in 24 h should be considered for women who are breastfeeding particularly those with low birth weight or premature infants. Women receiving caffeine therapy should have their intake of caffeinated drinks monitored and the recommended daily dose should not be exceeded.

5.4 Other theophyllines
There have been three randomised studies and two observational studies investigating the use of theophylline in PDPH. Two of the three randomised studies contained no obstetric patients and the third provided no details regarding pregnancy. Control groups were treated with a variety of medications including paracetamol, NSAIDs, opioids and caffeine. The manuscripts contain insufficient methodological details to exclude a significant risk of observer bias and their findings need to be interpreted with caution. All studies investigated headaches after spinal anaesthesia or diagnostic lumbar puncture. Consequently, even though statistically significant improvements in visual analogue scale (VAS) pain scores were reported, extrapolation to obstetric PDPH, especially after dural puncture with an epidural needle, may not be justified.

In an observational study, Wu et al. reported a reduction in VAS pain scores in a non-obstetric group of patients with PDPH treated with intravenous aminophylline 250 mg. With no control group, the significance of these findings is unclear. In a follow-up study by the same authors, 124 patients, of whom 31 were obstetric, with PDPH were randomised to receive either intravenous aminophylline 250 mg or placebo within 3 h of developing headache. No other medications were administered. Headaches followed either spinal or epidural blocks but relative numbers were not stated. Reduction in VAS pain scores was significantly greater in the aminophylline group. In view of the heterogeneity within study groups, caution should be exercised when extrapolating these findings to the obstetric population.

There is currently insufficient evidence to recommend the use of theophylline or aminophylline in the treatment of obstetric PDPH.

5.5 ACTH and analogues
Adrenocorticotropic hormone (ACTH) and its synthetic analogues tetracosactrin (Synacthen) and cosyntropin are thought to act by elevating endogenous aldosterone levels thereby increasing circulating volume. They may also increase CSF production and stimulate beta endorphin release.

Rucklidge et al. compared intramuscular Synacthen Depot with saline in 18 obstetric patients with PDPH and found no difference between groups in headache severity or EBP requirement. In 33 non-obstetric
patients, Zeeger et al. compared intravenous cosyntropin 0.75 mg with caffeine 1 g. The study was due to recruit 270 patients but was terminated after only 37 had been enrolled due to feasibility issues. Both therapies reduced pain scores with no significant differences between groups. Hanling et al. compared intravenous cosyntropin 0.5 mg with an EBP. Of the 34 patients recruited, six were obstetric. Headaches followed both spinal anaesthesia and dural puncture with an epidural needle. Pain scores over the seven day study period were lower in the EBP group although statistical significance was achieved only on Day 1. These results may reflect an inadequate sample size and the fact that PDPH symptoms improve over time regardless of treatment.

Other publications on ACTH and its analogues are limited to observational studies with no control groups. Of note, Oliver and White reported three cases of unexplained seizures following administration of Synacthen to obstetric patients with PDPH.

**There is currently insufficient evidence to recommend the use of ACTH and its analogues in the treatment of obstetric PDPH.**

### 5.6. Steroids

Three randomised studies have investigated the use of hydrocortisone in the treatment of PDPH, and all reported statistically significant improvement in the severity of headache. All three studies included headaches after spinal anaesthesia but none included obstetric patients. Hydrocortisone was added to pethidine and paracetamol in one study, to caffeine and simple analgesia in another, and compared with 20% mannitol in the third. The use of other medications and insufficient methodological detail make interpretation of the findings difficult. The successful use of hydrocortisone and methylprednisolone has been reported in small case series and abstracts. Prophylactic dexamethasone has not been shown to reduce the incidence of PDPH.

**There is currently insufficient evidence to recommend the use of hydrocortisone, dexamethasone or methylprednisolone in the treatment of obstetric PDPH.**

### 5.7 Triptans

Triptans are serotonin type-1 receptor antagonists used in the treatment of headache. There is only one randomised trial looking at the efficacy of triptans in treating PDPH: this study contained 10 obstetric patients who received either subcutaneous sumatriptan 6 mg or saline. There was no significant difference in outcome although with such small numbers the possibility of a type-2 error cannot be ignored. Other studies investigating triptans have not been randomised. The remainder of the evidence is from individual case reports.

**There is currently insufficient evidence to recommend the use of triptans in the treatment of obstetric PDPH.**

### 5.8 Gabapentinoids

The gabapentinoids gabapentin and pregabalin are anticonvulsant drugs that have gained increasing popularity in the treatment of neuropathic pain and migraine prophylaxis. In addition, they are increasingly used for postoperative analgesia. Their exact mechanism of action is unclear.
There are two randomised studies investigating the efficacy of gabapentin in PDPH following both spinal and epidural anaesthesia.\(^6\),\(^3\) Both are written by the same single author. Gabapentin (300 mg 8-hourly) was compared to placebo in one study,\(^6\) and with caffeine and ergotamine in the other.\(^3\) Although both studies reported statistically significant reduction in VAS pain scores, there is no mention of whether obstetric patients were included in either. In both manuscripts, the conduct of the study was not described in sufficient detail to rule out the possibility of significant observer bias.

An observational study by Wagner et al. of 17 obstetric patients with PDPH following both spinal and epidural blocks, treated with gabapentin (maximum dose 300 mg daily for up to 30 days) reported significant improvement in headache in 53% of patients.\(^5\)

Pregabalin (100 mg 8-hourly) has been compared to gabapentin (300 mg 8-hourly) and to paracetamol (500 mg 8-hourly) in a non-obstetric population with PDPH after spinal anaesthesia.\(^6\) As with the gabapentin studies, the methodology was not described in sufficient detail to eliminate a significant risk of bias. From 24 h to 72 h after administration, pregabalin was significantly more effective than gabapentin which was significantly more effective than paracetamol.

In a single-blinded randomised study comparing pregabalin (150 mg/day for 3 days followed by 300 mg/day for 2 days) with placebo in 40 patients by Huseyinoglu et al., VAS pain scores were significantly lower in the pregabalin group.\(^7\) Although the authors stated that obstetric patients were included, the exact numbers were not reported.

Sedation is a recognised side effect of gabapentin and pregabalin which is undesirable in the postnatal period. The effects of gabapentinoids on the baby in breastfeeding mothers have been reviewed.\(^8\) Although no adverse effects were observed, the lack of data was highlighted. The National Institute for Health and Care Excellence (NICE) recommends that gabapentin should be used with caution in breastfeeding mothers and only prescribed when benefit clearly outweighs risk.\(^9\)

In summary, all published studies on gabapentinoids in the treatment of obstetric PDPH have methodological flaws. More research is required to establish their efficacy and safety in the treatment of obstetric PDPH.

There is currently insufficient evidence to recommend the use of gabapentinoids in the treatment of obstetric PDPH.

5.9. Other medications

A number of other medications have been suggested to be beneficial in the management of PDPH, although most have not been put through the rigor of well-conducted randomised trials.\(^7\) Desmopressin (DDAVP), an anti-diuretic hormone analogue, produces fluid retention and vasoconstriction. Although, it has been tried in the prophylaxis of PDPH, there are no studies of its use in treatment. Despite the lack of evidence, intramuscular and subcutaneous desmopressin are listed as treatments for PDPH in the British National Formulary.\(^7\)

Methylergonovine (methylergometrine) is alpha adrenergic agonist causing cerebral vasoconstriction. Its efficacy in obstetric PDPH has only been reported in one observational study although few details were presented.\(^7\)
There is one randomised study in obstetric patients comparing ondansetron with saline in the prophylaxis of PDPH in which fewer of those in the ondansetron group developed a headache. There are no studies looking at treatment of obstetric PDPH with ondansetron.

Mannitol infusion was compared to hydrocortisone in one non-obstetric PDPH study. Its proposed mechanism of action is by plasma expansion decreasing viscosity and improving regional microvascular cerebral blood flow. The effects of mannitol on PDPH intensity were less marked than those of hydrocortisone.

A randomised study of 85 obstetric patients with PDPH following spinal anaesthesia for caesarean section examined the effect of intravenous eight-hourly neostigmine (20 μg/kg) and atropine (10 μg/kg) for up to 72 h. Compared to placebo, VAS pain scores were significantly lower in the treatment group at all time points. Further studies are required to investigate the efficacy of safety of neostigmine and atropine in obstetric PDPH.

There is currently insufficient evidence to recommend the use of desmopressin, methylergonovine, ondansetron, mannitol or neostigmine and atropine in the treatment of obstetric PDPH.

6. INVASIVE PROCEDURES

6.1 Acupuncture
Acupuncture has been used in the treatment of headache. Its mechanism of action is unclear but it may promote release of endorphins and relieve muscle spasm. There are several case reports and case series indicating benefit in obstetric PDPH but no randomised trials.

There is currently insufficient evidence to recommend the use of acupuncture in the treatment of obstetric PDPH.

6.2 Greater Occipital Nerve block
Greater occipital nerve blocks (GONBs) have been reported to be beneficial in the treatment of headaches. It has been suggested that they block pain transmission to the trigeminal nucleus caudalis reducing central sensitisation, which ‘switches off’ the headache.

A randomised study comparing GONBs with bed rest, hydration and simple analgesia in 47 patients (both obstetric and non-obstetric) with PDPH following spinal anaesthesia with a 27 gauge Quincke-point needle, demonstrated a statistically significant reduction in VAS pain scores on days 1-6. The GONBs were performed using a mixture of lidocaine, adrenaline, bupivacaine, fentanyl and clonidine. Other publications of GONBs are observational studies and case reports and consequently are not free of the risk of reporting bias. More evidence is required on the role of GONBs in obstetric PDPH.

There is currently insufficient evidence to recommend the use of GONBs in the treatment of obstetric PDPH.

6.3 Sphenopalatine ganglion blocks
The potential benefits of sphenopalatine ganglion blocks (SPGBs) have been suggested in one unrandomised retrospective study and a number of case series. Sphenopalatine ganglion blocks are
thought to work by blocking parasympathetic flow to cerebral vasculature reducing cerebral vasodilatation. Blocks may need to be repeated on more than one occasion. To date, there are no randomised trials investigating the efficacy of SPGBs in PDPH. Despite recent interest in SPGBs, well-conducted randomised trials are required to investigate its role in obstetric PDPH.

There is currently insufficient evidence to recommend the use of SPGBs in the treatment of obstetric PDPH.

6.4 Epidural morphine
The successful use of epidural morphine in preventing PDPH has been described in one randomised study and a number of case series.92,93 There are two published reports of the successful use of epidural morphine in the treatment of PDPH, both from the same authors.94,95 It is unclear whether these reports were in obstetric patients. More evidence is required on the role of epidural morphine in obstetric PDPH.

There is currently insufficient evidence to recommend the use of epidural morphine in the treatment of obstetric PDPH.

7. EPIDURAL FLUID ADMINISTRATION
7.1 Epidural crystalloids
Epidural saline injections are thought to work by increasing intracranial pressure (ICP) thereby reducing traction on pain sensitive structures which cause PDPH. The increase in ICP is, however, relatively short-lived providing only temporary relief in symptoms.

Prophylactic epidural infusions of Hartmann’s solution 1-1.5 L do not appear to decrease the incidence of PDPH although its severity may be reduced.7,92 Epidural crystalloid infusions are associated with back pain96 and are no longer in widespread use in the UK.97 In a retrospective study Che et al. demonstrated that an epidural saline infusion of 6 mL/h for up to seven days significantly reduced the incidence and duration of PDPH in Chinese women following dural puncture during either epidural and combined spinal-epidural anaesthesia.98

A randomised study by Kakinohana et al. investigating the effect of epidural saline administration in the treatment of PDPH.99 Of the 16 patients recruited, two were obstetric. All suffered PDPH following spinal anaesthesia. Patients were randomised to receive either an epidural saline bolus of 15-20 mL followed by an infusion of 20 mL/h for 3 h, or an EBP. No details were presented on other forms of treatment. Visual analogue scale pain scores were similar between groups at 15 min but significantly higher in the saline group at 3 h. There was no significant difference in VAS pain scores at 24 h.

Usubiaga et al. observed immediate relief of PDPH resulting from spinal anaesthesia in 10 of 11 non-obstetric patients given 10-30 mL of epidural saline. Eight patients had no further headache.100 Few details were given on other forms of treatment. In an observational study, Bart et al. found an epidural saline bolus of 30 mL effective in the treatment of obstetric PDPH at 24 h in 60% of patients where dural puncture occurred with a 25-gauge spinal needle.101 However, in those women in whom the dura had been punctured with a 17-gauge needle, saline was universally ineffective at 24 h.

Abdullah et al. reported the effects of repeated caudal boluses of saline (100-220 mL over 20 min) in the treatment of PDPH in 56 non-obstetric patients.102 Most patients required three or four injections but only
four patients ultimately received an EBP. In a literature review published in 2005, Gill et al. reported 12 cases of retinal haemorrhage resulting from large-volume epidural fluid injection.\textsuperscript{103}

There is currently insufficient evidence to recommend the use of epidural crystalloid infusions in the treatment of obstetric PDPH. Epidural saline bolus administration may improve symptoms but the effect is usually transient.

7.2 Dextran
Successful treatment of PDPH with an epidural infusion of dextran in obstetric and non-obstetric patients has been documented in case reports.\textsuperscript{104-106} However, the number of reports in obstetric patients is small and there are no randomised trials. There is a lack of safety data on the use of epidural dextran.

There is currently insufficient evidence to recommend the use of epidural dextran infusion in the treatment of obstetric PDPH.

7.3 Hydroxyethyl starch
Two case series containing nine obstetric patients have been published on the successful use of epidural hydroxyethyl starch (HES) in the management of PDPH.\textsuperscript{107,108} There are no randomised studies. Safety data on the use of epidural HES are lacking.

There is currently insufficient evidence to recommend the use of epidural HES infusion in the treatment of obstetric PDPH.

7.4 Gelatin
The use of epidural gelatin, either as fluid or reconstituted powder has been demonstrated in three obstetric patients.\textsuperscript{109,110} There are no randomised studies and limited safety data.

There is currently insufficient evidence to recommend the use of epidural gelatin in the treatment of obstetric PDPH.

7.5 Fibrin glue
The successful use of fibrin glue 3-5 mL injected through an epidural needle in the treatment of PDPH and headache associated with spontaneous intracranial hypotension has been reported.\textsuperscript{111-114} There are no case reports in obstetric patients. Cases of allergic reactions to fibrin glue have been reported.\textsuperscript{115} Further investigation is required regarding its efficacy and safety in the management of obstetric PDPH.

There is currently insufficient evidence to recommend the use of epidural fibrin glue in the treatment of obstetric PDPH.

8. EPIDURAL BLOOD PATCH
Treatment of PDPH with an EBP was first described by Gormley in 1960.\textsuperscript{14} Using a spinal needle, he injected saline into the CSF, withdrew the spinal needle until CSF ceased to flow at which point he injected 2-3 mL of blood. Since this initial description, the EBP technique has changed significantly. Multiple factors have the
potential to affect the outcome and consequently many aspects of its performance need to be considered (see below).

8.1 What is the role of an epidural blood patch in the management of obstetric post-dural puncture headache?
Postnatal headaches are common and PDPH is one of many potential causes. If PDPH is suspected, review by the anaesthetic team should take place within 24 h. A medical history should be taken and physical examination carried out. Other causes of headache must be considered and excluded before the diagnosis of obstetric PDPH is made. Features of the headache should be consistent with the IHS definition of PDPH, although it should be remembered that a postural component may not be present in up to 5% of cases. Furthermore, in one-third of cases dural puncture may not have been recognised. When PDPH is diagnosed, women should receive information on options for management which should include details about efficacy and side effects of various available treatments including an EBP (see section 8.6).

The intensity of maternal symptoms may dictate the need for an EBP. When PDPH is less severe, which may reflect a smaller dural tear with less CSF leak, conservative therapy may be preferred in the hope that headache resolves without the need for an EBP. If headache is more significant, leading to difficulty with performing activities of daily life and caring for the baby, an EBP is usually considered.

An EBP should not be performed where there is a contraindication to a neuraxial block. Contraindications include maternal systemic infection and coagulopathy. In particular, as postnatal thromboprophylaxis is common, adequate time must elapse after the last dose of anticoagulant and performance of an EBP.

When conservative therapy is ineffective in the management of obstetric PDPH and the woman experiences difficulty performing activities of daily living and caring for her baby treatment with an EBP should be considered.

8.2 How effective is an epidural blood patch in obstetric PDPH?
Establishing the efficacy of an EBP in the obstetric population is difficult. Success rates of 90% or greater, reported in the 1970s and 1980s, have not been reproduced in more recent prospective studies. Interpretation of evidence is problematic as a number of variables are not standardised in many studies and the definition of ‘success’ varies. Patient populations show marked heterogeneity (most notably, inclusion of both epidural and spinal dural punctures), with other variables such as timing, technique and follow-up differing between reports. The majority of studies reporting the success of EBPs in obstetrics have relied on retrospective case note review rather than prospective data collection.

Banks et al. reported the findings of a prospective assessment of dural puncture with an epidural needle in 100 obstetric patients of whom 58 received an EBP. Complete initial relief of headache with an EBP was seen in 67% with a further 28% obtaining partial relief. Of those women who experienced complete or partial relief, severe headache returned between 12 and 96 h in a third with the majority of these women receiving a second EBP. Overall, only 50% of those receiving one or more EBPs achieved complete relief, 38% achieved partial relief and 12% had no relief. The lower success rate compared to previous studies was attributed in part to longer follow-up, but the authors also highlighted factors such as the definition of success, timing of EBP, volume of blood injected and post-EBP management.
Paech et al. randomised 121 women with PDPH following labour epidural catheter placement to receive 15, 20 or 30 mL of blood (see section 8.10). The incidence of complete relief from a single EBP ranged from 10-32% while complete and partial relief combined was seen in 61-73%. Success rates were lower when 15 mL of blood was used and when the EBP was performed within 48 h of dural puncture. The former achieved statistical significance but the latter did not, although the study was not powered to do so.

In a large single-centre North American retrospective study, 394 women received an EBP for PDPH that developed after spinal or epidural blocks. The EBP was repeated in 16.8% of women but headache severity following EBP was not reported. The need for repeat EBP was correlated with the duration of symptoms and was higher when the EBP was performed sooner after the dural puncture. In a two-centre retrospective Scandinavian study of 129 women who received an EBP (volume 4-23 mL) following spinal or epidural anaesthesia, complete relief of PDPH was observed in 74%, partial relief in 15% and failure in 11%. Again, success was greater with a longer time interval between dural puncture and the EBP.

In a UK single-centre retrospective study of 41 women who received a therapeutic EBP following dural puncture with a 16-gauge epidural needle, 14 (34%) were effective, 22 (54%) partially effective and 3 (7%) ineffective (5% unknown). The partially effective group included women in whom symptom severity reduced and those who initially had a good result only for headache to return. Eleven women received a second EBP, of which six were effective, four partially effective and one ineffective. Injected volumes of blood ranged from 12 to 26 mL. In another UK single-centre retrospective study of 105 women who received an EBP after either epidural or spinal block, 74 (61%) were reported as successful with 13 (12%) repeated of which 5 (38%) were successful.

A randomised study of 33 Taiwanese women conducted over seven years, reported greater efficacy. Chen et al. compared 7.5 mL with 15 mL of blood for an EBP performed 48 h after the onset of PDPH. All headaches followed dural puncture with a 16-gauge Tuohy needle. Blood was injected via an epidural catheter rather than directly through the epidural needle. In contrast to Paech’s study, symptoms improved in all women: 24 h after the EBP 71% and 69% reported no headache and by 72 h 88% and 81% were symptom free in the 7.5 mL and 15 mL groups, respectively.

Studies have reported conflicting findings reflecting the different methodologies and variables that may affect the success of an EBP. It is difficult to predict accurately the likelihood of relief of headache with an EBP. Most recent prospective studies suggest complete and permanent relief of headache after one EBP in up to one third of women with PDPH following dural puncture with an epidural needle, but 50-80% if partial relief is included.

In a number of women a second or third EBP may be required (see section 8.13). It is, however, important to consider other causes of headache before embarking on repeat EBPs. Up to 20% of women receive little or no relief from an EBP, even if repeated. A discussion of these figures should be included in the consent process before an EBP is performed.

Multiple factors are likely to affect the success of an EBP. Although success rates of over 90% have been reported in older observational studies, more recent evidence suggests that complete and permanent relief of symptoms following a single EBP is only likely to occur in up to one third of cases where headache follows dural puncture with an epidural needle. Complete or partial relief may be seen in 50-80%. In cases of partial or no relief, a second EBP may be performed after consideration of other causes of headache.
8.3 What is the optimum time to perform an epidural blood patch?

The severity of maternal symptoms usually dictates the need for an EBP. When PDPH is less severe, which may reflect a smaller dural tear with less CSF leak, conservative therapy may be preferred in the hope that headache resolves without the need for an EBP. If headache is significant, leading to difficulty with the care of the baby, an EBP is more commonly considered.

A number of retrospective studies have found greater efficacy when an EBP is delayed by more than 48 h after dural puncture. There are, however, no randomised studies comparing the efficacy of early or late EBPs in obstetric PDPH. The prospective study by Paech et al. investigating blood volumes for EBP looked at timing as a secondary outcome. The risk of failure was greater with an EBP performed within 48 h of dural puncture. This outcome did not reach statistical significance, although the study was not powered to do so.

Studies in vitro have shown that both lidocaine and CSF have a detrimental effect on coagulation. Increasing concentrations of lidocaine cause hypocoagulability and fibrinolysis, whilst CSF has both procoagulant and clot destabilising effects. These effects are likely to be of lesser importance than the size of the dural puncture and the volume of CSF leak. Where there is a large dural tear with significant loss of CSF, severe symptoms are more likely at an earlier stage. Earlier intervention may be considered but a large dural tear may be less amenable to treatment with a single EBP. This explanation requires confirmation in clinical studies.

Delay in performing an EBP has disadvantages. Vilming et al. demonstrated greater patient suffering when blood patching was delayed. Large CSF leaks have occasionally been associated with significant morbidity such as cranial nerve palsies, seizures and intracerebral bleeding (see section 8.7). It is unknown whether an EBP reduces the risk of these potentially serious complications.

In a 2003 UK survey of practice, 125 (71%) of 176 maternity units used conservative measures before proceeding to an EBP. The survey did not state the duration of conservative therapy, although this is likely to have been dictated by its efficacy. A 2017 UK survey reported that 52 (49%) of 105 units would perform an EBP for treatment of PDPH within 48 h of a dural puncture, with 53 (51%) waiting until 48 h had elapsed. Differing views on timing may be related to the belief that delaying an EBP improves efficacy (see sections 8.2 and 8.3), but high-quality evidence supporting a delay is lacking.

Current evidence is not sufficient to recommend delaying an EBP simply on the grounds that it will be more successful. However, an EBP is not without risk and it would appear reasonable to offer a trial of conservative management since some headaches may resolve before an EBP is deemed necessary, especially if resulting from dural puncture with a spinal needle. Patients with PDPH in whom an EBP is considered should be made aware of the reduced efficacy when an EBP is performed within 48 h of dural puncture and that in such circumstances an EBP may need to be repeated.

Women should be informed that performing an EBP within 48 h of dural puncture is associated with a reduction in its efficacy and a greater requirement for a repeat EBP. However, in severe obstetric PDPH, an EBP within 48 h of dural puncture may be considered for symptom control although it may need to be repeated.
8.4 What investigations should be performed to aid diagnosis before performing an epidural blood patch?

Post-dural puncture headache has traditionally been a clinical diagnosis. Of particular note, the postural element traditionally considered to be pathognomonic of PDPH has been removed from the IHS definition. Atypical headaches are increasingly recognised to be a feature of PDPH, making the diagnosis more difficult. To aid diagnosis, various investigations and tests have been suggested.

Magnetic resonance imaging (MRI) of the brain and spine may reveal typical features of intracranial hypotension and CSF leak; these may include subdural fluid collections, dural-arachnoid enhancement, engorgement of venous structures, pituitary hyperaemia, sagging of the brain, periradicular leak and epidural fluid collections. However, MRI findings can be normal in the presence of known CSF leak and not all patients with evidence of a CSF leak develop headache. Studies looking for a correlation between CSF leakage and the risk of PDPH have shown mixed results. The optimal investigation appears to be whole spine heavily T2-weighted magnetic resonance myelography, which is a non-invasive, radiation-free imaging technique which can be used to detect the site and amount of CSF leak.

Transcranial Doppler readings in patients with and without PDPH have been compared in one small study of obstetric patients. Differences were observed between the two populations. This may prove to be of value in monitoring response to treatment but is unlikely to aid diagnosis as no pre-dural puncture readings are measured in those who develop headache. There is currently insufficient evidence to recommend transcranial Doppler in the investigation of PDPH.

Placing patients with headaches in the Trendelenburg position to screen for low CSF-pressure was used in a small observational study in non-obstetric patients. If headache improved in the Trendelenburg position CSF hypovolaemia was presumed. A much larger study is required to validate this test in the diagnosis of obstetric PDPH.

When the diagnosis of PDPH is not thought to be in doubt, imaging is rarely performed and not recommended. However, a change in the nature of headache, development of focal neurological signs, reduced conscious level and/or atypical headache, should prompt further investigation to exclude other causes of headache, and discussion with a senior radiologist and/or neurologist should be considered. Imaging should also be considered in postnatal headache unresponsive to treatment, such as after one or more unsuccessful EBPs.

If the diagnosis of obstetric PDPH is strongly suspected, there is no evidence that imaging is needed before performing an EBP. If the headache changes in nature, neurological signs develop, conscious level reduces, headache is atypical in nature, or when two EBPs have been unsuccessful, urgent consideration should be given to further investigation and imaging.

8.5 What practical steps should be completed before an epidural blood patch is performed?

Before performing an EBP, written information, such as the OAA leaflet Headache after an epidural or spinal injection, should be offered to women to aid the consent process. An EBP is a therapeutic intervention rather than an anaesthetic procedure to facilitate another treatment, and written consent is recommended. The consent process for an EBP should follow the principles for consent of any form of anaesthetic intervention as recommended by the Association of Anaesthetists of Great Britain and Ireland. Information about the procedure including risks, benefits and alternative treatments must be discussed and documented.
For women receiving anticoagulants, an EBP should be scheduled an appropriate time after the last dose of anticoagulant. A medical history should be taken and physical examination performed, particularly noting signs of maternal systemic infection and ‘red-flag’ symptoms that may suggest a different diagnosis, such as a change in the nature of headache, development of focal neurological signs, reduced conscious level and atypical headaches.

It has been suggested that women should lie flat for 2 h before a blood patch is performed, in order to reduce headache and minimise the volume of CSF within the epidural space which may dilute injected blood. Ferrante et al. reported a 90% success rate following a single EBP in a cohort study of 106 patients with headache from spontaneous intracranial hypotension. They attributed their success in part to placing patients in a 30° Trendelenburg position for 1 h before the procedure. There are no randomised studies investigating the optimum position for patients before an EBP is performed. Of note, a 2017 UK survey of practice found that 42% of responders performed an EBP with women in the sitting position.

Before performing an EBP, written information should be offered to women to aid the consent process. As an EBP is a therapeutic intervention written consent is recommended. An appropriate time should elapse before an EBP is performed in women receiving anticoagulants. Maternal systemic infection and ‘red-flag’ symptoms suggesting an alternative diagnosis should be excluded.

8.6 What are the risks of an epidural blood patch?
As part of the consent process for an EBP, the risks of the procedure must be discussed. The amount of information given should be based on what the patient regards as relevant to reach a decision on whether to agree to an EBP. The following issues may be included:

8.6.1. Repeat dural puncture
The incidence of dural puncture during insertion of an obstetric epidural catheter in the UK has been reported to be about 1%. It is usual to quote a similar incidence when discussing the risks of an EBP. There are, however, few reports of repeat dural puncture during performance of an EBP, with only three cases identified in the larger surveys of practice. Although most authors have not commented on the incidence of repeat dural puncture, it cannot be assumed that it did not occur.

Not all dural punctures are identified at the time of identification of the epidural space, and the presence of CSF in the epidural space makes the diagnosis more difficult. The incidence of dural puncture during an EBP may be lower than 1% as the operator is usually more experienced, the woman is not in labour and the procedure is carried out in a more controlled environment. However, the exact incidence is unknown.

If dural puncture occurs during an EBP, there may be an increased risk of intrathecal blood injection (see below). Continuing with the procedure after repeat dural puncture is at the discretion of the operator. Spinal imaging should be considered when repeat dural puncture occurs during an EBP.

There is a risk of further inadvertent dural puncture during an EBP and so this possibility should form part of the consent process.
8.6.2 Back pain

Back pain may occur both during and after an EBP. Studies vary on how accurately back pain is described with better reporting seen in prospective work. In the study by Paech et al. investigating the blood volume injected for an EBP, the incidence of back pain during an EBP was reported as 37% with 15 mL, 49% with 20 mL and 54% with 30 mL.\(^\text{18}\) Median pain scores (scale 0-10) ranged from 0-1 with an interquartile range of 0-6. The increase in pain with larger volumes of blood was not statistically significant although the study was not powered to detect a difference. Safa-Tisseront et al. reported outcomes of 504 EBPs in both obstetric and non-obstetric populations.\(^\text{123}\) Discomfort was experienced by 78% of patients after injection of a mean (± standard deviation [SD]) of 19 ± 5 mL and pain, which was always preceded by discomfort, occurred in 54% after 21 ± 5 mL. Pain was more common in those aged less than 35 years. The presence of back pain was not related to overall success of the EBP. Back pain during an EBP is thought to be the result of increased pressure within the spinal canal resulting from the injection of blood.\(^\text{140}\)

Back pain after an EBP was reported by over 80% of patients in Paech study regardless of the volume of blood injected.\(^\text{18}\) Mean onset time was 27 h and in a quarter of patients was reported as moderate or severe for up to five days. This pain is thought to originate from direct nerve root irritation or the presence of blood in the subcutaneous tissues.

Back pain lasting longer than a week has been reported after an EBP. Unfortunately in many studies investigating outcomes of an EBP patients are followed-up for only a few days making it difficult to estimate the duration and severity of post-EBP back pain. In 19 non-obstetric patients with PDPH who received an EBP of 15-20 mL, back pain at seven days was described as mild in 11% and moderate in 16%.\(^\text{141}\) Another study of 81 non-obstetric patients who received an EBP with 10-15 mL blood, reported that all back pain had resolved four weeks after injection.\(^\text{142}\) More severe back pain of longer duration has been described in a number of case reports (see below).

Chronic back pain following an EBP has been investigated in two studies (see section 8.7).\(^\text{143,144}\) Webb et al. reported the incidence of chronic symptoms lasting up to two years in 40 women who sustained a dural puncture with a 17-gauge epidural needle and 40 matched controls who did not experience dural puncture.\(^\text{143}\) In the dural puncture group 33 women developed PDPH and of these women 24 received an EBP. Although women in the dural puncture group were significantly more likely to develop chronic back pain than controls (43% versus 15%), treatment with an EBP was not a risk factor for chronic back pain (EBP 32% versus no EBP 60%). This study was not adequately powered to detect a significant difference in outcome for the effect of an EBP. Ranganathan et al. reported chronic postnatal symptoms in 162 women who experienced dural puncture in labour with a 17-gauge needle.\(^\text{144}\) Compared with controls who did not experience dural puncture, the incidence of chronic back pain lasting longer than six weeks was significantly increased (58% versus 4%). The incidence of chronic back pain in those women who received an EBP was only 12.5%

**Back pain during an EBP may occur in 50% of women. Twenty four hours after an EBP, over 80% of women may experience back pain. This may continue for several days but severity usually decreases over a few days with resolution for most by four weeks. There is no evidence to support increased rates of chronic back pain after an EBP. As back pain both during and after an EBP is common, and in some cases severe, it should be discussed as part of the consent process.**

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8.6.3 Neurological complications

Arachnoiditis

Injection of blood adjacent to nerve tissue is considered to be a risk factor for developing arachnoiditis, yet despite injecting relatively large volumes of blood during an EBP, reports of arachnoiditis are rare. It is unclear whether reports of severe back pain following an EBP represent cases of arachnoiditis.

Four cases of arachnoiditis following an EBP in obstetric patients have been reported.\textsuperscript{145-148} All had unusual features. Carlsward et al. described a patient who having received two EBPs (25 mL + 30 mL) within 48 h, developed protracted back and leg pain and reduced mobility which was still present two years later.\textsuperscript{145} Arachnoiditis was confirmed on MRI. Riley and Spiegel reported the use of three EBPs (35 mL + 60 mL + 70 mL) in a woman with PDPH.\textsuperscript{146} Ten weeks later the patient reported burning pain in her buttocks and left thigh; MRI suggested a diagnosis of arachnoiditis and her symptoms had not resolved six months later. Aldrete and Brown performed a prophylactic EBP with 19 mL of blood through a catheter that may have been in the subdural space.\textsuperscript{147} Five days later the patient reported back pain radiating to her legs which was still present 18 months later. Subdural and epidural blood collections and signs of arachnoiditis were noted on MRI. Roy-Gash et al. reported intense lower back pain after an EBP of 30 mL. Arachnoiditis secondary to an intrathecal haematoma was diagnosed on MRI.\textsuperscript{148} Symptoms resolved after three weeks.

Whist it is not possible to make recommendations based on these four cases, the possibility of neurological complications should form part of the consent process for an EBP. Repeated large-volume EBPs were used in two of the four cases of arachnoiditis but causation is not proved. Since EBP volumes greater than 20 mL have not been shown to produce additional benefit (see section 8.10), repeated large volumes of blood should be avoided.

Spinal Haematoma

Space occupying lesions in the spinal canal have the potential to produce both ischaemic and inflammatory damage to nerve tissue. A number of obstetric cases of spinal-subdural haematoma\textsuperscript{145,149,150} and intrathecal haematoma\textsuperscript{147,148,151,152} associated with the performance of an EBP have been reported and non-obstetric cases have been described.\textsuperscript{153-159}

In addition to arachnoiditis, Riley and Speigel reported a spinal-subdural haematoma following a 58 mL EBP.\textsuperscript{146} One week after the procedure, the patient complained of back and leg pain with leg weakness. The diagnosis was confirmed with MRI and symptoms resolved within two weeks. Verduzco et al. described a case of spinal-subdural haematoma following a 20-mL EBP.\textsuperscript{149} The patient subsequently reported back pain radiating to her legs with resolution of symptoms in two weeks. Devroe et al. reported a similar case also following a 20-mL EBP.\textsuperscript{150} Again symptoms improved within two weeks.

In Aldrete’s case (see above), an intrathecal haematoma was associated with arachnoiditis and prolonged neurological symptoms.\textsuperscript{147} Kalina et al. described the case of an obstetric patient who presented with increasingly severe back and leg pain after a 27-mL EBP.\textsuperscript{151} Magnetic resonance imaging demonstrated a large intrathecal haematoma and the symptoms improved over several months. In another report, intrathecal haematoma was diagnosed on MRI after a second EBP and symptoms resolved within two weeks.\textsuperscript{152}

Based on these cases, spinal-subdural and intrathecal haematoma may be possible complications of an EBP. In some cases large volumes of blood were used but in other they were not, and so the potential to produce complications when smaller volumes are used still exists. It is not possible to quantify risk from
these isolated reports. However, given their severity, the possibility of neurological complications should form part of the consent process.

**Other neurological complications**

A variety of other neurological complications have been reported after an EBP. It is unclear whether these were the direct result of the EBP, the dural puncture and CSF loss, or unrelated. None are common and the issue of reporting bias must be considered.

Seizures have been reported in association with an EBP. In five case reports, four of which were in obstetric patients, despite the temporal relationship, seizures were not thought to result from the EBP. The four obstetric cases all received caffeine or caffeinated beverages. Seizures were thought to be due to either eclampsia or CSF loss and associated subdural haematoma. Based on these cases, it cannot be excluded that seizures are a complication of EBP. As part of the consent process, discussion regarding seizures may take place.

Cerebral venous sinus thrombosis (CVST) after EBP has been reported in five obstetric cases, although a direct link between EBP and CVST is unproven. An EBP leads to increased fibroblast activity and collagen formation but does not explain an increased risk of CVST, the incidence of which increases in pregnancy. As part of the consent process, discussion regarding CVST may take place although there is insufficient evidence of increased risk.

Four cases of intracerebral haemorrhage after EBP have been reported. None were in obstetric patients. An underlying neurological condition cannot be ruled out and the relationship with the EBP is questionable. Whilst it may be discussed in the consent process there is insufficient evidence of an increased risk of intracerebral haemorrhage when an EBP is performed.

Five cases of facial nerve palsy following EBP have been reported. Although others may have occurred, this would appear to be a rare complication; it is arguably more likely due to CSF loss. The possibility of facial nerve palsy may be discussed as part of the consent process but there is insufficient evidence of an increase in risk when an EBP is performed.

Bradycardia following an EBP has been described in two case reports. It is most likely due to an increase in ICP and supports the need for cardiovascular monitoring and vascular access during and after an EBP. This may be discussed during the consent process.

Infection, either localised to the lower back or meningitis, has been reported after an EBP. These cases serve as a reminder for a meticulous aseptic technique when performing an EBP. This is a rare complication which may be discussed as part of the consent process.

Other complications following an EBP described in case reports include visual disturbance, incontinence, neck and shoulder pain, chronic back pain from calcification of injected blood, monoplegia, cerebral ischaemia and Horner’s syndrome. Given the rarity of these reports and the uncertainty regarding their relationship to an EBP, they would not normally be included in the consent process.

Neurological symptoms may occasionally develop after an EBP. Their exact incidence is unknown. The relationship between an EBP and neurological symptoms may not always be causative. Given the severity...
of some neurological symptoms, their development should be discussed as part of the consent process for an EBP.

8.7 Are there risks to not performing an epidural blood patch?
There are risks associated with an EBP (see section 8.6). There may, however, be disadvantages to a continued CSF leak which is not treated with an EBP. A number of possible complications have been reported. These may be discussed during the consent for the procedure.

**Chronic Headache**
In a survey sent to all women who delivered in a UK maternity unit between 13 months and nine years after childbirth (response rate 38%), MacArthur et al. reported that of 74 women who sustained a dural puncture with an epidural needle, 17 (23%) suffered with headaches lasting longer than six weeks. No details on the severity of headache or the effect of an EBP were included.

A prospective case-control study looked at chronic headaches in 40 women who suffered a dural puncture with a 17-gauge epidural needle in labour. These women were compared to a group of 40 women who received uncomplicated neuraxial anaesthesia. Eighteen months after delivery, significantly more women in the dural puncture group (28%) reported headaches compared with controls (5%). In the dural puncture group, the headache rate in those women who received an EBP was 20% compared with 40% in those who did not; this difference was not statistical significant although numbers were small. Using a validated questionnaire, disability resulting from headaches was reported by 8% of women who received an EBP compared with 33% in those who did not. This difference was not statistically significant. The authors conceded that larger studies were required to investigate the effects of an EBP on chronic symptoms.

**Chronic Back Pain**
Back pain is recognised to occur either during or in the first few days after an EBP in a significant number of patients (see section 8.6.2). The development of chronic back pain following an EBP has been less widely investigated. In the case-control study by Webb et al. chronic back pain 18 months after delivery was significantly more common in those women who experienced dural puncture than those who did not (43% versus 15%). In the dural puncture group chronic back pain was reported by 32% of women who received an EBP compared to 60% in those who did not. Back pain-related disability was observed in 24% who received an EBP and 47% or those who did not. Neither of these outcomes was statistical significant. Ranganathan et al. carried out postnatal interviews on 162 women who had suffered a dural puncture with a 17-gauge epidural needle during labour. The overall incidence of chronic back pain, defined as that lasting longer than six weeks, was 58% compared to 4% in controls in whom dural puncture did not occur; amongst those women who had received an EBP, the incidence of chronic back pain was only 12.5%. No details on the EBP were reported. Larger prospective studies are needed before conclusions can be drawn about the relationship between an EBP and chronic back pain.

**Cranial-Subdural Haematoma**
Cranial-subdural haematoma is a rare complication of dural puncture. Caudal shift of the brain resulting from CSF leak may lead to rupture of fragile subdural bridging veins and bleeding into the subdural space. Cuypers et al. identified 56 published cases in obstetric patients, of whom 19 received an EBP for the treatment of PDPH, 17 before the diagnosis of cranial-subdural haematoma was made. The authors speculated that the incidence of cranial-subdural haematoma may be reduced by minimising CSF leak with an EBP. However, without randomised studies it is not possible to state that an EBP reduces this
risk. Furthermore, to perform an EBP in a patient with raised ICP is not recommended. Cranial-subdural haematoma should be included in the differential diagnosis of postpartum headache after dural puncture.

**Cerebral Venous Sinus Thrombosis**
Cerebral venous sinus thrombosis (CVST) produces a headache which may be difficult to differentiate from PDPH. Hypercoagulability in pregnancy increases the risk of thrombotic complications. Dural puncture may further increase the risk of CVST due to both damage to the cerebral venous endothelium caused by a negative spinal-cranial pressure gradient and stasis from cerebral vasodilation. Wilder-Smith et al. reviewed 66 cases of CVST and found dural puncture to be the fourth most frequent risk factor. The effect of an EBP on the development of CVST was not assessed. Kueper et al. reviewed five cases of CVST following EBP for the treatment of presumed PDPH (see above). Blood patches were repeated in three of the five cases with the diagnosis of PDPH being questioned. The authors were unable to comment on whether an EBP was a risk factor for CVST. The possibility of CVST should be included in the differential diagnosis of persistent headache after dural puncture.

**Cranial Nerve Palsy**
In a recent review of 43 cases of cranial nerve palsy following central neuraxial blockade Chambers and Bhatia found intracranial hypotension to be the most frequent aetiology. The most common palsies affected cranial nerves VI and VII. The authors suggested that if other causes of cranial nerve palsy, such as haemorrhage and thrombosis, were excluded, an EBP may be performed. However, the response to this treatment was mixed with fewer than half of those experiencing resolution of symptoms within a week. Bechard et al. reviewed 12 cases of VI nerve palsy and found no improvement in symptoms after an EBP if this was performed more than 24 h after the development of symptoms. Improvement was seen in only two cases when an early EBP was performed. Some authors have advocated performing an EBP after four days if conservative therapy for PDPH is unsuccessful as this might reduce the number of cranial nerve palsies. Given the small number of case reports, it is difficult to support this recommendation.

**Seizures**
Postnatal seizures may result from hypertensive disease, epilepsy, haemorrhage, thrombosis, infection and space occupying lesions. Seizures have been reported after dural puncture in the obstetric population in association with PDPH, and some modes of treatment, notably caffeine, Synacthen, sumatriptan and EBPs. The nature of these relationships is, however, uncertain. No studies have examined whether an EBP reduces the incidence of seizures in those with PDPH. Consequently, there is insufficient evidence on which to make any recommendation.

There is currently insufficient evidence to suggest that an EBP reduces the risk of chronic headache, chronic back pain, cranial subdural haematoma, CVST or improves outcome in those with cranial nerve palsy in women with obstetric PDPH.

8.8 At which level should an epidural blood patch be performed?
A number of studies have looked at the spread of blood within the spinal canal following an EBP. Using technetium-labelled red blood cells (range 12-18 mL) Szinfeld et al. performed EBPs in the lateral position with a 17-gauge Tuohy needle on 10 patients with PDPH. The range of spread was 7-14 spinal segments with mean volume per segment of 1.6 mL. Mean spread of blood was six spinal segments cephalad and three caudad. All EBPs successfully relieved the PDPH.
Beards et al. used MRI to study the spread of blood after an EBP in five patients with PDPH. Procedures were carried out with the patient sitting; 18-20 mL of blood was injected through a 16-gauge Tuohy needle. The range of spread was 9-10 spinal segments, the majority in a cephalad direction. The initial mass effect of the clot, however, was restricted to 3-5 segments around the site of injection. Vakharia et al. used MRI to investigate the spread of a 20-mL EBP performed in the lateral position. Mean ($\pm$ SD) spread was 4.6 $\pm$ 0.9 spinal segments with most of the blood spreading in a cephalad direction.

The reason for greater cephalad spread of blood, observed with lumbar EBPs performed in both sitting and lateral positions, may be related to the negative pressure gradient within the epidural space as lower pressure is observed at higher spinal levels. It may also reflect the design of the Tuohy needle with its Huber point directing blood flow in a cranial direction.

The major effect of an EBP appears to be within a few segments of the site of injection. Blood injected during an EBP spreads predominantly cranially. It is therefore recommended that an EBP is performed at the same level or one space lower than that at which the original dural puncture occurred.

8.9 Is ultrasound or radiological guidance of benefit when performing an epidural blood patch?

Ultrasound is increasingly used to aid neuraxial blockade. Its use may help identify the correct lumbar interspace, predict the depth of the epidural space, reduce the number of needle passes and increase efficacy of blocks. There are no randomised studies comparing the efficacy of EBPs performed with or without ultrasound guidance. Evidence is restricted to case reports that have demonstrated mixed results. Ultrasound can be used to identify the epidural space and confirm placement of blood but there is no evidence that this is superior to a conventional landmark-based loss of resistance technique.

Fluoroscopic-guided EBP has been successfully used in a small number of PDPH cases, the majority from the non-obstetric population. There are no studies comparing this approach to a landmark-based loss of resistance technique. For treatment of spontaneous intracranial hypotension, CT-guided EBPs have been reported to be successful, but again there are no randomised comparisons with conventional techniques.

At present, there is no evidence to suggest that ultrasound and radiological guidance is of benefit when performing an EBP. As identification of the epidural space using ultrasound becomes more popular, its use may in the future supersede landmark techniques. In the rare case in which confirmed PDPH does not respond to an EBP using a conventional landmark-based loss of resistance technique, diagnostic investigations to locate the source of the leak (see section 8.4) with radiological-guided EBP may be of benefit.

There is currently insufficient evidence to recommend the routine use of ultrasound or radiological guidance when performing an EBP.

8.10 How much blood should be injected?

In Gormley’s original report of seven cases of PDPH treated with an EBP, only 2-3 mL of blood was injected; this in addition to 15 mL of intrathecal saline. Subsequently, larger volumes of blood were used (usually 5-10 mL), although supporting evidence was from observational studies only. Crawford reported a 70% success rate using 6-15 mL of blood compared to 96% success when 20 mL were used. Volumes greater than 20 mL have been used but appear to offer no additional benefit and may increase the risk of side effects.
The two accepted mechanisms by which an EBP relieves PDPH, namely increasing CSF pressure and sealing the dural puncture with blood clot, rely on both the volume of blood injected and the pressure this generates within the spinal canal. Patients frequently report pressure and pain as blood is being injected, the incidence of which increases with larger volumes of blood. This is thought to be a mass effect with pressure exerted on neurological tissue. The lack of correlation between volume injected, epidural pressure and success of an EBP likely to be caused by variability in epidural space anatomy and compliance, and individual pain tolerance.

In the prospective study by Paech et al. 121 obstetric patients were randomised to receive 15, 20 or 30 mL of blood. Only 46% of those in the 30 mL group received the assigned volume due to pain during injection. Over the 48 h after the EBP, headache scores were highest in those receiving 15 mL but 30 mL appeared to confer no additional benefit when compared to 20 mL. The authors suggested their findings supported the use of 20 mL blood when performing an EBP.

Chen et al. randomised 33 Taiwanese obstetric patients with PDPH after epidural analgesia or anaesthesia, to an EBP with either 7.5 or 15 mL of blood. No difference in headache was observed at either 24 h (success 71% vs. 69%) or three days (success 88% vs 81%) after the procedure. Taivainen et al. randomised 53 non-obstetric patients with PDPH following spinal anaesthesia or myelography to an EBP with either 10 mL or 10-15 mL of blood. Mean (±SD) volume injected in 10-15 mL group was 12.7 ± 1.2 mL. No difference in success rates was demonstrated.

The retrospective study by Booth et al reported the outcome of 466 EBPs performed on 394 obstetric patients. The unit policy was to inject up to 30 mL of blood although 91% did not receive the full amount. The mean (±SD) volume injected was 20.5 ± 5.4 mL. Increasing the volume of blood injected did not reduce the need for a repeat EBP.

Although injection of larger volumes of blood is associated with more immediate back pain, post-procedural back pain does not appear to be more common or severe. However, reports of subdural and intrathecal blood may be more likely when larger volumes of blood are injected (see section 8.6.3).

A volume of blood of 20 mL is recommended when performing an EBP. Injection should stop before 20 mL is injected if not tolerated by the patient.

### 8.11 Should blood cultures be sent when performing an epidural blood patch?

Transient bacteraemia is not uncommon at the time of delivery. Blood taken within 30 min of delivery may yield positive blood cultures in 1% of women. Fever usually, but not invariably, accompanies bacteraemia and when present represents a contraindication to an EBP. As fever is not invariably present in a patient with systemic infection, it has been suggested that blood cultures should be taken at the time of an EBP. However, surveys of practice reveal that blood cultures are sent in fewer than 50% of cases and their value has been questioned. Fortunately, infectious complications of an EBP are rare although both localised infection and meningitis have been reported (see section 8.4.3). There are no studies looking at the effect of antibiotic administration on infectious complications of an EBP.

There is insufficient evidence to support the routine sending of blood cultures or administration of antibiotics at the time of performing an EBP. The decision on whether to do so should remain with the individual clinician. An EBP should not be performed in presence of maternal systemic infection.
There is currently insufficient evidence to recommend that blood cultures should be sent routinely when performing an EBP. There is insufficient evidence to recommend the administration of antibiotics when performing an EBP. An EBP should not be performed in the presence of maternal systemic infection.

8.12 How should a patient be managed immediately after an epidural blood patch?
Evidence to guide management of obstetric patients immediately following an EBP is lacking. Maintaining the supine position for a period of time is common practice but there is little supporting evidence regarding duration. Most authors report lying patients supine for 1-2 h.

Martin et al. randomised 30 male and female patients to lie supine for 30, 60 or 120 min after an EBP for PDPH. Headache was more severe on first standing and at 24 h in the 30-min group compared to the 120-min group. The authors concluded that patients should remain supine for at least 60 min and preferably 120 min after an EBP.

There are no current evidence-based guidelines on what observations should be made following an EBP, although regular observations of maternal pulse, blood pressure and temperature should be made following the procedure. The frequency and duration of these observations should be decided by individual units and must take into account maternal health.

Women who have received an EBP are often told to avoid straining for several days after the procedure as it is thought that this reduces the risk of dislodgement of the blood clot covering the dural tear. Laxatives may be prescribed to avoid constipation especially when opioids have been used in headache management. In addition, women may be told to avoid twisting and bending and to keep their backs straight as these measures are thought to reduce the risk of headache recurrence. This advice has not been assessed in clinical trials and so there is currently insufficient evidence regarding optimum back care following an EBP.

There is currently insufficient evidence to recommend for how long women should remain in bed following an EBP or in what precise position. It is recommended that regular observations of maternal pulse, blood pressure and temperature are recorded following an EBP.

8.13 What are the indications to perform a repeat epidural blood patch?
An EBP is frequently ineffective in providing complete and permanent cure of PDPH. In some cases complete relief of PDPH is followed by return of symptoms days later, while in others EBPs provide only partial relief of symptoms. Many authors have reported the use of two or more EBPs in the treatment of PDPH but most have not stated whether a second EBP was performed for return of PDPH or for partial or minimal relief of headache. When a second EBP is performed, there is no evidence on the optimum time interval between the first and second EBP in terms of efficacy and safety.

In a retrospective case series of 129 obstetric patients with PDPH following epidural and spinal blocks, Kokki et al. reported an initial EBP success rate of 89% although headaches returned in 15%. Complete and permanent relief of symptoms was reported in all women after a second EBP. Median times from dural puncture to first and second EBP were 72 and 96 h, respectively.
In the prospective audit of 58 EBPs for PDPH following dural puncture with a Tuohy needle, Banks et al. reported complete success in 39 (67%) women, partial success in 16 (28%) women and failure in 3 (5%) women. In those 55 women with complete or partial success, 17 experienced recurrence of moderate or severe PDPH of whom 11 received a repeat EBP. This produced complete relief of symptoms in seven (64%) women. Timing of the second EBP was not stated. Safa-Tisseront et al. included both obstetric and non-obstetric patients in a prospective observational study, reporting a 7% failure with an EBP. Of these patients 56% had a second EBP with 53% and 37% obtaining complete or partial relief of headache, respectively. The authors stated that the second EBP was performed a median of five days after the first procedure.

Performance of a third EBP is less frequently reported. Booth et al. described six women (1.5%) in a cohort of 394 who received a third EBP although no further details were provided. Chan et al. reported five women (2%) out of 240 in whom a third EBP was performed. Banks et al. provided more details on four women (7%) out of 58 who received a third EBP. In two cases, a prophylactic EBP did not prevent headache and therapeutic EBP provided complete relief only for the headache to return. A third EBP successfully relieved the headache. The third case achieved relief of symptoms after both a first and second EBP, only for the headache to return; the woman requested a third EBP which provided only partial relief of symptoms. The fourth case achieved complete relief of headache only after the third EBP. The authors recommended that after a failed EBP alternative causes of headache should be considered.

Stocks et al. reported the case of a woman who developed a headache after dural puncture with an epidural needle in labour. Two EBPs were performed, both of which provided only temporary relief of symptoms. A change in the nature of headache following the second EBP prompted referral to a neurologist and cortical vein thrombosis was subsequently diagnosed on MRI. This case highlights the need to reconsider the aetiology of headache, especially when its nature changes, and the value of seeking advice from other specialties.

A second EBP may be performed once other causes of headache have been excluded. Where the diagnosis of obstetric PDPH is likely and an EBP has produced resolution of symptoms but headache subsequently returns, a second EBP may be offered as it is likely to be of benefit. If an EBP has produced some improvement in symptoms but the headache persists, a second EBP can be considered as it may be of benefit. In cases where an EBP has no effect on headache, or if the diagnosis of obstetric PDPH is less certain, or the nature of headache has changed, discussion with other specialties including obstetrics, neurology and neuroradiology should take place before a second EBP is performed. If two EBPs have failed to relieve symptoms, other causes of headache must be considered and involvement of other specialties is recommended before performing a third EBP. There is insufficient evidence to state the optimum timing of a repeat EBP in terms of efficacy and safety.

8.14 Does an epidural blood patch affect the success of a subsequent neuraxial technique?

Performing an EBP has potential implications for the efficacy of a subsequent neuraxial block. This may be relevant in the days following a blood patch or, more likely, in a future pregnancy. Concerns have been raised about the efficacy of neuraxial blocks and the possibility of side effects. There are several case reports where a neuraxial block has been successful in the first week after an EBP; reporting bias cannot be excluded.

Ong et al. published a retrospective analysis of labour epidural analgesia in 46 women who suffered a dural puncture with an epidural needle in a previous labour of whom 29 women received an EBP. Success rates
for subsequent epidurals were 59% in those who received an EBP and 65% in those who did not. This compared to a 90% success rate in those in whom dural puncture had not previously occurred. In addition, several case reports have highlighted failure of epidural analgesia in women who have previously undergone an EBP.221-223

In a retrospective study, Hebl et al. looked at outcomes for subsequent neuraxial blocks in obstetric and non-obstetric patients who had previous undergone an EBP for PDPH.224 Each EBP patient was matched with two controls who had previously experienced dural puncture without an EBP and two who had experienced uneventful neuraxial blockade. There was no significant difference in success rates for neuraxial blocks between groups.

Beards et al. reported MRI findings at 30 min and 3, 7, 9 and 18 h after an EBP.140 Spread from the injection site was predominantly cephalad. A mass effect was observed for 3 h. At 7 h a thick layer of clot was observed over the posterior surface of the dura and by 18 h only small clots on the posterior dura were demonstrated. Studies on goats have shown that 24 h after an EBP, the blood clot still contained considerable numbers of intact red and white blood cells with no fibrous reaction.225 At four days clot organisation with immature fibroblasts was observed and by the second week the blood had disappeared to be replaced by mature fibroblasts with collagen deposition. The thickness of the scar was greatest at three weeks but shrank to normal size at three months. It is unclear when small clots fully resolve but it may be assumed that this occurs at a similar rate to an epidural haematoma with the process complete in four to six weeks.226

There is a recognised failure rate of epidural analgesia in those who have not previously undergone an EBP. The evidence to support an increased failure rate of epidural analgesia after an EBP is weak and studies refuting a negative effect are not of high quality. Radiological studies, albeit on relatively few patients, do not indicate prolonged effects of injecting blood into the epidural space. Further evidence is required before guidance can be offered on the effects of an EBP on subsequent neuraxial blockade.

Evidence of an effect of an EBP on the success of subsequent neuraxial blockade is equivocal. All studies that have assessed the effect have methodological flaws. Current evidence is insufficient to comment on whether an EBP affects outcome of subsequent neuraxial blockade.

8.15 How should patients who have undergone an epidural blood patch be followed-up?
In keeping with the principles of Duty of Candour, when dural puncture occurs during epidural catheter insertion or PDPH develops, women should be provided with a full account of events and an apology for any distress caused by anaesthetic interventions.227 In addition, women should receive an explanation of mechanism of PDPH and treatment options. Any questions about aspects of PDPH and its management should be answered.

Following discharge from hospital, all women who experience a recognised dural puncture with an epidural needle or have a PDPH diagnosed require follow-up regardless of whether an EBP is performed. Early discharge from hospital is increasingly common after childbirth. Discharge may be delayed when PDPH develops,228 but women may leave hospital shortly after an EBP is performed. Following an EBP, headache may or may not be relieved, or it may temporarily improve only to return when the woman has returned home.229 Complications of an EBP, although infrequent, may arise immediately or in the days following the procedure when the woman may no longer be in hospital. When PDPH develops after discharge, women may undergo an EBP as an outpatient.
In whatever circumstances an EBP is performed, women require appropriate follow-up to ensure treatment has been effective and that side effects are assessed and addressed. Women who receive an EBP should be reviewed by an anaesthetist within 4 h of the procedure. The effect on headache and presence of side effects should be documented. After the initial review, women may mobilise and, where appropriate, they may be discharged home. Those women who remain in hospital should be reviewed daily until discharge or until symptoms resolve. Information from each consultation should be documented.

Before discharge, women should be given verbal and written advice on when to contact the hospital should headache return or other symptoms develop. This should contain information regarding symptoms that should be reported including: recurrent headaches; back pain; nerve root pain; leg numbness or weakness; difficulty passing urine or opening bowels; fevers; and visual or hearing disturbance. The Obstetric Anaesthetists’ Association leaflet entitled Headache after epidural or spinal injection? What you need to know contains relevant information and is available on-line on the LabourPains.com section of the OAA Website at http://www.labourpains.com/assets/_managed/cms/files/Headache_after_epidural.pdf. Women who are discharged home on the day of an EBP should be contacted the following day. If symptom free, further follow-up should be discussed and agreed between the woman and the anaesthetist. Consideration should be given to offering women who have suffered from PDPH or who have undergone an EBP a follow-up appointment to see the anaesthetist 1-2 months after delivery.

The significance of PDPH and side effects of an EBP may not be recognised by general practitioners and community midwives. It is therefore important that the woman’s general practitioner and community midwife are informed whenever PDPH is diagnosed or an EBP is performed. Maternal mortality following hospital discharge after dural puncture was reported in the 2009-2012 MBRRACE-UK report. Two women died, one from cerebral vein thrombosis and one from subdural haematoma. Failure of hospital follow-up or referral to the general practitioner in women with persistent postnatal headache was highlighted. Routine follow-up should therefore be arranged. Clear instructions should be given to the general practitioner and community midwife, with a copy to the woman on who to contact in the event of further headaches or the development of red flag symptoms (see above).

Women who receive an EBP should be reviewed by an anaesthetist within 4 h of the procedure. Women who are discharged home on the day of an EBP should be contacted the following day. Women who remain in hospital should be reviewed daily until discharge or until symptoms resolve. Before discharge, women should be given verbal and written advice on when to contact the hospital should their headache return or other symptoms develop. Information on obstetric PDPH and EBP should also be given to the woman’s general practitioner and community midwife.
9. RECOMMENDATIONS FOR FUTURE RESEARCH

Large prospective RCTs on PDPH and the evaluation of an EBP are very limited; Paech et al, in their multicentre RCT of 121 women, helped draw some conclusions on the ideal volume of blood injected for an EBP. However, further large RCTs to confirm these findings and to re-investigate the optimum timing, duration of supine position after EBP, and overall success of EBP are warranted.

High-quality evidence supporting many widely used forms of conservative and pharmacological methods of treatment of obstetric PDPH is lacking. Certain interventions have shown limited positive results, but these are confined to case reports, small observational series, non-obstetric data, or studies with methodological flaws. Further investigation of the use of steroids, gabapentinoids, and greater occipital nerve blocks or sphenopalatine ganglion blocks in obstetric PDPH would be helpful. The epidural injection of fibrin glue has seen some success but, as with other inventions, further work is necessary to confirm its efficacy and safety.

The balance of the risks of an EBP versus the potential consequences of non-interventional management is not fully understood. At present, there is no evidence to suggest an EBP mitigates against the potential complications of low pressure headache e.g. subdural haematoma, permanent cranial nerve palsy, and randomised studies to evaluate these rare complications would be difficult. However, few studies have compared the incidence of long-term headache or back pain (lasting longer than 3-6 months) in obstetric PDPH patients managed with or without an EBP. In addition, the effect of an EBP on the success of subsequent neuraxial blockade is unclear. Further research may help guide informed consent.

Many postnatal patients are treated with prophylactic low-molecular-weight heparin. Guidance on how long to withhold anticoagulants before performing an neuraxial procedure is well established, but the effect of these drugs, restarted 4-24 h after an EBP, on the overall efficacy of the EBP itself is currently unknown.

10. AUDITABLE TOPICS

1. Appropriate documentation about an EBP procedure and its associated risks, benefits and alternative treatments (standard 100%)
2. The proportion of women who received an EBP reviewed by an anaesthetist within 4 h of the procedure (standard 100%)
3. The proportion of women with PDPH who were reviewed daily until discharge from hospital (standard 100%)
4. The proportion of women who were sent home the same day of an EBP and contacted the following day (standard 100%)
5. Notification to the general practitioner when PDPH is diagnosed or an EBP is performed (standard 100%)
6. Notification to the community midwife when PDPH is diagnosed or an EBP is performed (standard 100%)
7. The proportion of women who receive information on ‘red-flag’ symptoms and who to contact if they occur (standard 100%)
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14. DECLARATIONS OF INTERESTS
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15. APPENDICES

Appendix A: Treatment pathway for obstetric PDPH

Appendix B: PDPH care package
It is appreciated that the increasing use of shift working patterns means that follow-up is often carried out by several different anaesthetists during a woman’s in-patient stay. The care package outlined in Appendix B is intended to provide an example of a proforma that could be used to facilitate good documentation of follow-up both in hospital and after discharge. This may form part of the woman’s electronic record or a hard copy may be included in the case notes (or both).

Appendix C: Checklist for performing an epidural blood patch

Appendix D: Epidural blood patch and follow-up form

Appendix E: GP letters
Examples of letters to general practitioners for (A) women with PDPH and (B) women with known dural puncture with an epidural needle but no headache. Copies of these letters should be given to the woman and sent to the community midwife.
APPENDIX A

Treatment pathway for obstetric PDPH

All women who experience dural puncture with an epidural needle or PDPH after a spinal block should be reviewed daily by a member of the anaesthetic team whilst still in hospital. Furthermore, any woman suspected of having PDPH should be referred for anaesthetic assessment and reviewed by the anaesthetic team within 24 h. A medical history should be taken and a physical examination performed to exclude other potential causes of postnatal headache. When a woman experiences PDPH, follow-up should continue until the headache resolves. Whether or not an EBP is performed, appropriate follow-up after discharge from hospital must be arranged for any woman who experiences obstetric PDPH.

When PDPH is diagnosed the following treatment options should be considered:

1. Bed rest may reduce the intensity of symptoms, but prolonged bed rest is not recommended as it may increase the risk of thromboembolic complications.
2. Thromboprophylaxis should be considered for women whose mobility is reduced due to PDPH.
3. Encourage fluid intake to maintain adequate hydration.
4. Offer simple oral analgesia such as paracetamol, weak opioids and NSAIDs if not contraindicated.
5. Stronger opioids such as morphine or oxycodone may be offered but treatment should usually be limited to < 72 h duration.
6. Caffeine may be offered but limited to 24 h duration with a maximum dose of 900 mg (200 mg maximum in breastfeeding women).
7. Offer an EBP when symptoms affect daily living and care of the baby (a guide for EBP management is provided in Appendix C).
8. Before hospital discharge, women who have experienced dural puncture with an epidural needle or PDPH should be given information on symptoms that require further medical assessment and on whom they should contact.
9. Arrangements should be made for appropriate follow-up after discharge from hospital for women who have experienced dural puncture with an epidural needle or PDPH.
10. When women experience dural puncture with an epidural needle or PDPH, the GP and community midwife should be informed of treatment received and arrangements for further follow-up.
**APPENDIX B:**

**PDHP care package**

### Dural puncture with an epidural needle and post-dural puncture headache (PDHP)

**Management and Follow-up Form**

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#### INITIAL EVENT

- **Date:** __/__/____  **Time:** ______  **Performed by:** ___________________  **Grade:** ____________
- **Recognised dural puncture** [ ]  **Deliberate subarachnoid block** [ ]
- **Type / Size needle:** ____________  **Spinal level:** ________  **Loss of resistance:** Air [ ]  Saline [ ]
- **Details of insertion:**
  a) No attempts overall: 0 / 1 / 2 / 3 / >3
  b) more than one level: Yes [ ]  No [ ]

#### SUBSEQUENT MANAGEMENT

- **Labour analgesia:** Epidural re-sited? Yes [ ]  No [ ]  **Level:** ________
- **Intrathecal catheter:** Yes [ ]  No [ ]
- **Mode of Delivery:** Spontaneous [ ]  Instrumental [ ]  Caesarean section [ ]
- **Significant events (e.g. PPH):** __________________________________________________________
- **Onset of headache**
  - **Date:** __/__/____  **Time:** ________
- **Verbal / written information:** Delivery suite [ ]  Postnatal ward [ ]  N/A as HA started at home [ ]
- **Critical Incident or Datix completed:** Yes [ ]  No [ ]
- **Duty of Candour followed:** Yes [ ]  No [ ]

#### MANAGEMENT PRINCIPLES

- Senior anaesthetists must be involved in the management of PDHP
- Postnatal headaches are common: consider differential diagnosis
- In particular, consider need for neurological opinion/imaging
- Prescribe simple analgesia including NSAIDS if no contraindications
- All women with suspected PDHP should receive an information leaflet if in hospital
- Bed-rest is not necessary, although many women find it reduces symptoms
- Remember need for thromboprophylaxis if woman is bed-bound
- Daily follow-up is required
- A letter to thromboprophylaxis if woman is bed-bound

#### COMMENTS

**GP letter sent:** Yes [ ]  No [ ]  **Date sent:** __/__/____  **Signed By:** ___________________
**Follow up appointment required:** Yes [ ]  No [ ]  **Date:** __/__/____
Document all follow-up below
(inpatient review or telephone)
Print and attach extra copies as needed

Patient Name: 
Unit No: 
DOB: 

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<th>Date:</th>
<th>Time:</th>
<th>Days since onset:</th>
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<td>Yes / No</td>
<td>Pain score: 0 1 2 3 4 5 6 7 8 9 10</td>
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Continued follow-up after hospital discharge or post epidural blood patch

Date:                      Time:                      
Details:                   

Signed                      Name:                      GMC:                      

Date:                      Time:                      
Details:                   

Signed                      Name:                      GMC:                      

Date:                      Time:                      
Details:                   

Signed                      Name:                      GMC:                      

Use additional sheets as necessary
APPENDIX C

Checklist for performing an epidural blood patch

Pre EBP procedure checklist

- Give patient written information to aid consent process (e.g. OAA headache after an epidural leaflet http://www.labourpains.com/assets/_managed/cms/files/Headache_after_epidural.pdf).
- Check when the last dose of anticoagulant was given.
- Check for evidence of maternal systemic infection.
- Check for the absence of ‘red-flag’ symptoms suggesting a different diagnosis e.g. change in the nature of headache, development of focal neurological signs, reduced conscious level and atypical headaches.

Consent

Written consent should be obtained and the following may be discussed:

Benefits of EBP

- Efficacy: complete relief of symptoms following a single epidural blood patch is likely to occur in up to one third of cases. Complete or partial relief may be seen 50-80%. In cases of partial or no relief, a second epidural blood patch may be performed after consideration of other causes of headache.

Risks and Side effects

- Repeat dural puncture.
- Back pain during and for several days after EBP is common and can be significant.
- Rare complications include nerve damage, bleeding and infection.

EBP Procedure

- The procedure requires two clinicians. A consultant obstetric anaesthetist or experienced senior trainee should perform the epidural injection and a second clinician to take blood.
- Cardiovascular monitoring and intravenous access may be considered to detect and treat bradycardia during the procedure.
- The patient may be placed in the lateral or sitting position, considering the comfort of the patient in relation to her symptoms and the preference of the anaesthetist.
- The epidural injection should be performed at the same space or one space lower than the level at which the original dural puncture occurred.
- A full aseptic technique should be employed for both the epidural component and venesection.
- The epidural space should be located before venesection is performed.
- After venesection blood should be injected immediately into the epidural space through the epidural needle. Volumes of up to 20 mL are recommended if tolerated by the patient.
- There is insufficient evidence to recommend the routine collection of blood for culture. The decision on whether to do so should remain with the individual clinician.

Post EBP procedure management

Guidance on the management of obstetric patients immediately following an EBP is lacking. The following is suggested:

- Keep patients in the supine position for 1-2 h.
- Regular observations of maternal pulse, blood pressure and temperature may be made following the procedure. The frequency and duration of these observations should be decided by individual units and must take into account maternal health.
- Consider prescribing laxatives to avoid constipation and advising patients to avoid twisting, bending and straining.
- Women should be reviewed by an anaesthetist within 4 h of the procedure. The effect on headache and presence of side effects should be documented. After the initial review, women may mobilise and, where appropriate, they may be discharged home. Those women who remain in hospital should be reviewed daily until discharge or until symptoms resolve.
- For further review and follow-up procedures see Appendix B.
### Epidural Blood Patch Procedure and Follow-up

[Attach addressograph label]

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#### PRE-PROCEDURE CHECKS

- Written information given
- Consent form signed
- No evidence of sepsis
- Appropriate delay from last dose of anticoagulant
- Absence of ‘red-flag’ symptoms

#### EPIDURAL BLOOD PATCH

- **Date:** ........../........../........  **Time:** ............
- **Anaesthetist 1:** Name: ..................................................  **Grade:** ..................................................
- **Anaesthetist 2:** Name: ..................................................  **Grade:** ..................................................
- **Patient monitoring:** ........................................................................................................................................................................................................................................
- **Patient position:** Lateral  Sitting
- **Aseptic technique:** ........................................................................................................................................................................................................................................
- **Lumbar interspace:** ..................................................
- **Loss of resistance technique:** ..................................................
- **Depth of epidural space:** .................................................. cm
- **Volume of blood injected:** .................................................. mL
- **Immediate complications:** ........................................................................................................................................................................................................................................
- **Indication to stop injection:** ........................................................................................................................................................................................................................................

#### POST EPIDURAL BLOOD PATCH INSTRUCTIONS - please include information on the following:

- Patient positioning and duration
- Patient observations
- Medication review
- Time of anaesthetic review
- Letters to GP / Community midwife
- Follow-up instructions

#### FOLLOW-UP

- **Date:** ........../........../........  **Time:** .............  **Anaesthetist:** ..................................................
- **Headache:** Nil  Mild  Moderate  Severe
- **Back pain:** Nil  Mild  Moderate  Severe
- **Other symptoms:** ........................................................................................................................................................................................................................................
- **Management Plan:** ........................................................................................................................................................................................................................................

#### COMMENTS
APPENDIX E

GP Letters

Post-dural puncture headache

Dear Dr

Re: [insert name and details]

(This letter may be repeated if an additional intervention e.g. blood patch has occurred since the first letter was sent)

[insert name] has a headache following an obstetric anaesthetic procedure performed on [insert date]

Simple headaches are common in the postnatal period. However, as this headache follows a spinal/epidural injection it is possible that it is related to dural puncture. Post-dural puncture headache (PDPH) is caused by low intracranial pressure and usually has the following characteristics:

- Fronto-occipital
- Usually postural: worse on standing/sitting compared with lying down
- Severity ranging from mild to incapacitating
- Associated features include neck stiffness, photophobia, nausea, tinnitus, cranial nerve palsies

Severe PDPH not responding to other forms of management is often treated by the anaesthetist with an epidural blood patch. This is likely to relieve PDPH, but there is a recurrence rate and sometimes a second epidural blood patch is indicated.

Epidural blood patch performed: Yes ☐ No ☐ Date [insert date]

Very rarely, headaches suggestive of serious pathology can occur postnatally. Please consider the following ‘red-flag’ headache symptoms, and if any are present, refer directly to the duty anaesthetist at [insert hospital name] using the telephone number above:

- Sudden onset, or sudden increase in severity (e.g. ‘thunderclap’)
- Syncope or seizures
- Altered consciousness or cognition
- Focal neurological symptoms/signs including cranial nerve palsies
- Worsening of headache on exertion, coughing or straining

Please refer to the duty anaesthetist if you require further guidance regarding assessment or management of post-dural puncture headache.

Yours sincerely

Name
Grade
GMC number:

A copy of the letter should be given to the woman and community midwife
Dural puncture without headache

Dear Dr

Re: [insert name and details]

[insert name] had a suspected dural puncture at the time of an epidural catheter insertion, which was performed on [insert date]. She is currently asymptomatic.

Simple headaches are common in the postnatal period. However, a specific headache may follow a dural puncture. Post-dural puncture headache (PDPH) is caused by low intracranial pressure and usually has the following characteristics:

- Fronto-occipital
- Usually postural: worse on standing/sitting compared with lying down
- Severity ranging from mild to incapacitating
- Associated features include neck stiffness, photophobia, nausea, tinnitus, cranial nerve palsies

Severe PDPH not responding to other forms of management is often treated by the anaesthetist with an epidural blood patch. This is likely to relieve PDPH, but there is a recurrence rate and sometimes a second epidural blood patch is indicated.

[Insert name] has been advised to contact the duty anaesthetist on the delivery suite (insert telephone number) if she develops a headache.

Very rarely, headaches suggestive of serious pathology can occur postnatally. Please consider the following ‘red-flag’ headache symptoms, and if any are present, refer directly to the duty anaesthetist at [insert hospital name] using the telephone number above:

- Sudden onset, or sudden increase in severity (e.g. ‘thunderclap’)
- Syncope or seizures
- Altered consciousness or cognition
- Focal neurological symptoms/signs (including cranial nerve palsies)
- Worsening of headache on exertion, coughing or straining

Please refer to the duty anaesthetist if you require further guidance regarding assessment or management of post-dural puncture headache.

Yours sincerely

Name
Grade
GMC number

A copy of the letter should be given to the woman and community midwife