MANAGEMENT OF ACCIDENTAL DURAL PUNCTURE

This guideline gives some clinical background information and management suggestions that are appropriate at our hospital when faced with an accidental dural puncture. They should be used in conjunction with advice from your consultant if you feel unsure about their content.

DEFINITION
An unintentional puncture of the dura by a Tuohy needle during epidural anaesthesia, which can lead to leakage of cerebrospinal fluid (CSF). The resultant decrease in CSF pressure with subsequent tension on the meningeal vessels and nerves may precipitate a post-dural puncture headache (PDPH). If undetected, infusion of epidural doses of local anaesthetic and opioid through the hole in the dura, or an unrecognised intrathecal catheter, can lead to a high/total spinal block or respiratory depression.

INCIDENCE
Globally, accidental dural puncture (ADP) occurs in 1-1.5% of epidurals with PDPH in approximately half of those. An audit of epidurals in this hospital in 2014 showed an ADP rate of 1.8%. Risk factors include operator inexperience, short or long distance to the epidural space, previous accidental dural puncture and anatomical abnormalities 4, 5.

RECOGNITION
ADP may present as
(i) A visible gush of CSF on insertion of the Tuohy needle,
(ii) CSF aspirated from the epidural catheter
(iii) an unexpectedly profound or high block.
(iv) PDPH. As many as 26% of ADPs are unrecognised at the time of the procedure6.

Signs of an intrathecal catheter include:
1. Rapid onset of analgesia
2. Unexpectedly profound leg weakness or sudden onset of new leg weakness
3. Clinically significant hypotension during maintenance of epidural analgesia
4. Ability to aspirate greater than a drop or two of clear fluid from the epidural catheter

ACCIDENTAL DURAL PUNCTURE DURING EPIDURAL ANALGESIA FOR LABOUR

The priorities are to ensure safe management of labour analgesia and watch for/manage subsequent PDPH:

Immediate management:
Re-insert introducer into Tuohy and consider your three options:

Option 1. Feed the catheter into the intrathecal space
and use the catheter to provide analgesia for the remainder of labour, and anaesthesia for obstetric interventions.

- Insert the catheter 3 - 5 cm into the intrathecal space and tape securely. A Lock-It device is ideal.
- Confirm CSF can be aspirated from the catheter
- Deliver local anaesthetic and fentanyl as below

1. Give an initial dose of 1 - 2mL Ropivacaine 0.2%, then assess motor and sensory block after 5-10 mins. It is preferable to include some fentanyl – if you have already mixed the ropivacaine poly-bag with 2mcg/ml fentanyl then just use that. Otherwise add 10-15mcg fentanyl after the initial Ropivacaine dose has established a block.

2. Ensure ongoing regular monitoring of block height, haemodynamics, sedation score and O2 saturation by the mid-wife. Fetal monitoring will also have to be instituted. These observations should
all be identical to those performed after standard epidural placement. It is your responsibility to assess block height in the first 20 mins after initial bolus or any top-up.

3. All subsequent top-ups must be performed by an anaesthetist. Ensuring that the patient understands this will add a significant layer of safety after you leave. 1ml of 0.2% Ropivacaine would be a reasonable starting point, however this volume may need to be adjusted up or down as haemodynamic changes and block height / quality / duration dictate. Remember that the inconvenience of more frequent dosing is preferable to the dangers of leaving a denser/higher spinal without anaesthetist attention. Decanting the top-up dose from a labelled syringe, of known sterility and content, that you have kept, is preferable to leaving solutions on the labour ward for later use. Using a new ampoule for each top up is also reasonable.

4. If analgesia is poor or very frequent dosing is required, remove the catheter and use an alternative analgesic method. Likewise, remove the catheter if there is persistent paraesthesia during or after insertion.

5. Ensure that the catheter, and patient’s charts, are clearly marked “Intrathecal Catheter”, to minimise the likelihood of inadvertent epidural dosing. This should be written both on the dressings on the patient’s back and on a dressing / sticker around the filter. Specific “Intrathecal Catheter” stickers are available on the epidural trolleys. Hand over to any relevant anaesthetic staff likely to be involved, and provide a clear verbal description and written record of the management plan to midwifery staff. Affirm that continuous midwifery presence in the room is necessary for the remainder of labour. Until intrathecal specific forms are created, use the existing epidural forms to record boluses and to allow midwifery to record observations. The forms need to be relabelled to remove the word epidural. A sticker or two will achieve this well.

6. The intrathecal catheter should be removed after birth/ perineal repair.

Option 2. Re-insert the epidural catheter at another interspace:

- Use caution as the hole in the dura may allow entry of local anaesthetic into the cerebrospinal fluid and may precipitate a greater than expected block height or opioid induced respiratory depression.
- There is a high rate of repeat dural puncture (up to 10% in one study).
- Preferably re-insert the Tuohy needle at a level above the previous attempt and direct the catheter cephalad to avoid the hole in the dura.
- Use a test dose of 3ml Ropivacaine 0.2% to assess for intrathecal placement. Establish the block cautiously with subsequent boluses, and chart the infusion / PCEA in the usual manner.
- In addition to the routine epidural analgesia monitoring protocols, midwives should be asked to monitor for, and notify the anaesthetist of:
  a. Dense motor block of the lower limbs
  b. Inability to empty the bladder
  c. High sensory block (T4 or higher)
  d. Marked hypotension after drug delivery

Re-siting the epidural may be preferable to an intrathecal catheter if labour is likely to be prolonged and/or resources to provide an intrathecal top-up service might not be available. The decision to use an intrathecal catheter is also easier if you know you are not going to have to hand the “problem” over any time soon.

Option 3. Consider abandonment of neuraxial analgesia:

not recommended in the majority of cases. This should be discussed with a consultant, who may choose to attempt re-insertion themselves.

Regardless of the management plan chosen after ADP, full disclosure to the patient is required after analgesia is achieved, with immediate consequences and likely sequelae explained.
**Subsequent management of ADP:**

1. All cases should be discussed with the Obstetric anaesthesia consultant in-hours, and the First-On anaesthetist at other times.
2. Record thoroughly in the notes the technique employed, and the patient disclosure
3. Ensure the patient is seen daily on the obstetric round to monitor for complications such as PDPH.
4. The evidence to suggest PDPH or epidural blood patching is reduced by leaving an intrathecal catheter in situ is equivocal 9, 11: At present, intrathecal catheters should be removed immediately after use, assuming such action is safe with respect to coagulation status.
5. If you are concerned about post operative/post delivery analgesia, consider 100 mcg of intrathecal morphine prior to removing the catheter, flushed in with 2-3ml NS.

**ACCIDENTAL DURAL PUNCTURE DURING EPIDURAL PLACEMENT FOR CAESAREAN SECTION**

(eg during planned CSE placement).

**Management:**

1. Feed the catheter as per the technique described for labour analgesia above
2. Give increments of 0.5-1mL of hyperbaric bupivacaine 0.5%, and fentanyl 15mcg, followed by a small saline flush, up to a maximum dose of 3 mL of bupivacaine. If this has not achieved surgical anaesthesia, the catheter should be abandoned. Note the dead space volume of an epidural catheter and filter is approximately 1mL, so 1.5ml NS should flush most of any one dose in. Alternatively, avoid repeat flushes by priming the filter and catheter before insertion with bupivacaine, and inject just the desired volume without subsequent flushing.
3. Post operatively, consider intrathecal morphine 100mcg before removal of the catheter and provide routine post-operative analgesia. In the absence of IT morphine, consider TAP blocks.

**Management of the patient for c-section with a known/suspected intrathecal catheter:**

1. This should be discussed with the anaesthetic consultant so that potential complications relating to this technique are acknowledged
2. The patient may have a degree of existing anaesthesia – always check the block height before making a decision regarding appropriate action
3. Check that CSF can be aspirated from the catheter
4. Administer 0.5-1mL doses of 0.5% bupivacaine, and up to a total of 15mcg of fentanyl, by either the small flush (1-1.5mL of saline) technique, or by flushing the temporarily disconnected filter with bupivacaine, and acknowledging the dead space of the catheter (0.6ml for a 16g) containing labour ward solution or saline), and then administering subsequent doses without flushing, as above. Use 3mL syringes for accurate dosing. Monitor block height to determine whether additional local anaesthetic is required prior to re-dosing
5. Remove the catheter following the procedure and administer appropriate analgesia

**Management of the patient for c-section with a re-sited epidural in the setting of prior dural puncture:**

1. Ensure no CSF is able to be aspirated from the catheter
2. Use a mixture of 20mL of lignocaine 2% with adrenaline. Initially give 2-3mL and assess for response before topping up in increments. Add 50-100mcg fentanyl to improve block quality.
3. Remove the epidural post delivery. Epidural morphine prior to catheter removal may have a beneficial effect in preventing PDPH, as well as surgical analgesia. Give 3-4mg, flushed in.

**POST DURAL PUNCTURE HEADACHE (PDPH)**

**DEFINITION, INCIDENCE AND RISK FACTORS**

PDPH is a headache typical of low intracranial pressure; 85% of patients present within 48-hours of dural puncture, but may rarely present up to five days later5-7. The usual symptom is severe frontal or
Occipital pain, sometimes with nuchal pain/stiffness. It is worse on standing and better lying down. Some patients experience photophobia, nausea, vomiting, diplopia and tinnitus due to tension on the cranial nerves. Differential diagnoses include intracranial haemorrhage, space occupying lesion, cerebral venous thrombosis, meningitis, tension headache and migraine. In the setting of a recognised dural puncture with typical symptoms, post dural puncture headache is very likely. However, if there are atypical symptoms, no apparent history of dural puncture or a failed blood patch, a thorough assessment (possibly including imaging) should be made to rule out competing diagnoses. Consultation from a neurologist may be advisable.

PDHP normally persists for 4-6 days after ADP during epidural placement, however greater than 10% of women continue to be symptomatic beyond one month. The incidence varies according to the type of needle used with an association with cutting beveled spinal needles (Quincke 22g - 30%) and larger Tuohy needles (52-100% with 16g and 55% with 18g). Smaller gauge pencil point needles have an incidence as low as 0.4-0.5%. Other potential risk factors include operator inexperience, needle bevel insertion perpendicular to the dural fibre orientation, multiple needle insertions, epidural loss of resistance to air, pregnancy, age (paediatric and geriatric populations are relatively protected), female gender and previous PDHP.

Management
Limited evidence exists for preventative therapies of PDHP in recognised ADP. Due to the frequent persistence of the headache for greater than one week, the pros and cons of intervention versus expectant management should be discussed with the patient. Epidural blood patch is a highly efficacious treatment for PDHP and, barring contraindications, should be routinely offered to all patients.

Epidural Blood Patch (EBP)

The placement of a small volume of autologous blood in the epidural space improves PDHP through:
1. An immediate and sustained tamponade with a rise in intracranial CSF pressure leading to adenosine receptor inhibition, cerebral vasodilatation and a fall in elevated cerebral blood flow.
2. Coagulation around the site of the dural hole effecting a reduction in ongoing efflux of CSF.

EBP is more effective than either conservative treatment or a sham procedure (OR 0.18). After dural puncture with a Tuohy needle, complete and permanent relief from a blood patch occurs in 30% of patients with partial relief in a further 50%; rates of complete or partial relief after dural puncture with a spinal needle may be up to 97%. Recurrent headache occurs after initial success in 30% of whom 30-60% request a second blood patch. The success rates of a second EBP are similar. While performance of the EBP within 48-hours has a higher rate of recurrent headache compared with intervention after 48-hours, EBP should not be delayed in severely affected parturients.

EBP is indicated in patients with:
1. Moderate to severe PDHP that interferes significantly with function or delays discharge
2. Persistent PDHP after one week

Contraindications:
Most are relative and aimed at avoiding the introduction of infection or bleeding to the neuraxis.
1. Local infection at the puncture site
2. Systemic sepsis
3. Coagulopathy (including LMWH and other iatrogenic)
4. Hematologic malignancy
5. Jehovah’s Witnesses – this is variable and should be discussed with the individual patient as interpretations differ
6. High risk of repeat dural puncture
7. Atypical headache
8. Patient refusal

Procedure:
Blood patches need to be booked on a red slip at theatre front desk, and an appropriate time and location discussed with the recovery room red–hat and the other proceduralist. Blood patches can be done in either the PACU or anaesthetic bay of OT6.
1. Obtain written consent after discussion of the risks including infection, back/radicular pain, neuropathy and failure
2. Have two operators— one to draw blood, the other to inject it
3. Consider the lateral position for patient comfort, and to allay the risk and consequences of mid-procedure vasovagal
4. Have the most senior available anaesthetist perform the epidural
5. Gown, glove and mask and prepare the back and phlebotomy site with chlorhexidine, maintaining strict asepsis
6. After local anaesthetic to the skin, locate the epidural space at the site of the previous epidural, or one space lower, using a loss of resistance to saline technique
7. Withdraw 25mL of blood from the arm in a sterile fashion. A small cannula is helpful to minimise the time that the tuohy needle spends in the epidural space
8. Slowly inject blood into the epidural space. The suggested volume is about 20mL. Stop if the patient experiences back or radicular pain that is not tolerable
9. Maintain the patient supine for two hours post procedure
10. The patient may be discharged following the procedure once comfortable
11. Follow up should be arranged during the obstetric anaesthesia round for inpatients. For patients who are to be discharged, arrange daily telephone review as necessary, and a telephone or clinic review at about six weeks to discuss any ongoing symptoms and implications for future pregnancies.

While prior ADP may be a risk factor for a repeat ADP, neither it nor blood patching are a contraindication to future epidural placement.

The six week follow up should ideally be organised by the initial proceduralist who punctured the dura. If you are unable or unwilling to do this yourself, place a sticker in the handover book on an appropriate date, with clinical and contact details, or organise a clinic appointment for the patient to see the clinic anaesthetist of the day. This may become a better option if we move to a dedicated obstetric anaesthesia clinic.

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REFERENCES