Clinical Practice Guideline

Accidental Dural Puncture (ADP)

This document should be read in conjunction with the Disclaimer

Definition
An accidental (unintentional) puncture of the dura by a Tuohy needle during insertion of an epidural catheter can lead to leakage of cerebrospinal fluid (CSF). The decrease in intracranial CSF pressure that may occur, particularly when the patient is upright, with subsequent tension on the meninges and compensatory cerebral vasodilatation, can 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 placement, can lead to a high/total spinal block or (rarely) respiratory depression.

Incidence
Globally, accidental dural puncture (ADP) occurs in 0.5-4% of obstetric epidural catheterisations, with PDPH in approximately two-thirds of those. In King Edward Memorial Hospital, the incidence of ADP falls in the range 0.8-1.5%. Risk factors include operator inexperience, a short or long distance to the epidural space, previous accidental dural puncture and anatomical abnormalities.

Recognition
A visible gush of CSF may be evident on insertion of the Tuohy needle or CSF may be aspirated from the epidural catheter. Alternatively, an unrecognised dural puncture may present as an unexpectedly profound or high block. As many as a quarter of ADPs are unrecognised at the time of the procedure and present as PDPH in the early puerperium. Signs of an intrathecal catheter include:

1. Very rapid onset of analgesia after catheter dosing
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 the needle introducer and consider options:

1. **Feed the catheter into the intrathecal space and convert to a regimen for patient controlled spinal analgesia.** This is the preferred technique at King Edward Memorial Hospital but is contingent upon having the appropriate equipment, staff and protocols available. This approach results in better analgesia and less motor block compared with continuous epidural analgesia\(^8\).

   i. Insert the catheter 3 cm into the intrathecal (subarachnoid) space and tape securely
   ii. Confirm CSF can be aspirated from the catheter
   iii. Deliver local anaesthetic and fentanyl as per the regimen below

   **Patient Controlled Spinal Anaesthesia (PCSA)**

   1. Give an initial dose of 2 mL of pre-mix (bupivacaine 0.125% with fentanyl 5 mcg/mL) as per the combined spinal-epidural technique
   2. Set up a CADD pump with the standard labour epidural solution (bupivacaine 0.0625% with fentanyl 2.5mcg/mL)
   3. Allow 3 mL boluses (1.875mg bupivacaine) every 45-min. Analgesic needs will increase as labour progresses and either the dose or lock-out may need revision
   4. Ensure regular monitoring of maternal block height and vital signs by the midwife.
   5. All extra supplementary boluses are to be given by the anaesthetist. A suggested rescue treatment is 1-2 mL of 0.25% bupivacaine\(^1\).

     iv. If analgesia is poor or very frequent dosing is required, remove the catheter and use an alternative analgesic method.
     v. Ensure the catheter and epidural charts are clearly marked “Intrathecal Catheter” with the pink sticker, to minimise the likelihood of epidural dosing. Handover to the duty first on-call anaesthetist (consultant or fellow) and subsequent anaesthetic staff likely to be involved. Provide a clear description of the management plan to midwifery staff.

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

   i. 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\(^7\)
   ii. Be aware that there is a high rate of repeat dural puncture (up to 10% in one study)\(^9\)
iii. 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.

iv. Use a test dose of 2-3 mL of the pre-mix solution (0.125% bupivacaine with fentanyl 5mcg/mL) to assess for intrathecal spread of drug or catheter placement. Establish block with subsequent boluses.

v. Discuss maintenance therapy with the supervising anaesthetist (consultant or SR). Consider either:
   1. 4 mL boluses every 15 min (0.0625% bupivacaine with fentanyl 2.5mcg/mL)
   2. 10 mL boluses every 20 min with or without a maintenance infusion (at the discretion of the senior anaesthetist)

vi. In addition to 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

3. Consider abandonment of neuraxial analgesia: not recommended in the majority of cases.

Subsequent management¹⁰

1. All cases should be discussed with the duty first on call anaesthetist
2. Record thoroughly in the notes AND the yellow audit form the technique employed
3. Ensure the patient is seen daily on the acute pain service (APS) round to monitor for complications such as PDPH
4. The evidence suggesting that PDPH or epidural blood patching is reduced or less severe after leaving an intrathecal catheter in-situ is equivocal⁹,¹¹: the management details of removal versus retention should be discussed with the anaesthetic consultant but usually the catheter is removed after clinical utility has passed.
5. Nurses on the ward are very familiar with epidurals and routinely administer top-ups. Ensure that if an intrathecal catheter is left in-situ it is clearly marked or tamper-proofed (tie a knot and fix it securely under several Tegaderm dressings).
6. If you are concerned about post-operative or post-delivery analgesia, consider giving 100 mcg of intrathecal morphine prior to tamper-proofing the catheter
Accidental dural puncture during anaesthesia for caesarean section
I.e. ADP with a Tuohy needle occurring primarily at the time of initiation of neuraxial anaesthesia.

Management

1. Feed the catheter as per the technique described for labour analgesia above
2. Give increments of 0.5-1 mL of hyperbaric or plain bupivacaine 0.5% and fentanyl 5 mcg, followed by a small saline flush, up to a maximum dose of 3 mL of bupivacaine and 25 mcg of fentanyl. Note the dead space volume of an epidural catheter and filter is almost 1 mL.
3. Post operatively, remove the catheter and provide alternative analgesia. Either:
   a. Intrathecal morphine 100 mcg prior to removal with a saline flush
   b. Fentanyl PCIA
   c. Oral multimodal analgesia

Management of caesarean section in the patient with a known/suspected intrathecal catheter

1. This should be discussed with the duty 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 0.5-1 mL doses of hyperbaric or plain 0.5% bupivacaine and fentanyl 5 mcg, followed by small saline flush, up to a maximum dose of 3 mL of bupivacaine and 25 mcg of fentanyl. Use 1 or 3 mL syringes for accurate dosing. Monitor block height to ice frequently 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 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 20 mL of lignocaine 2% with adrenaline, 2 mL of sodium bicarbonate and 50 mcg of fentanyl. Initially give 2-3 mL and assess for response before topping up in increments
3. Consider early removal of the epidural post-delivery. Weak evidence suggests repeat doses of epidural morphine 2-3 mg prior to catheter removal may have a beneficial effect in preventing PDPH\textsuperscript{12}. 
**Post dural puncture headache (PDPH)**

**Definition, incidence and risk factors**

PDPH is typical of low intracranial pressure headaches; 85% of patients present within 48-hours of accidental dural puncture, but may rarely present up to five days later\(^5\text{-}^7\). The usual symptom is severe frontal or occipital pain, often with nuchal pain/stiffness. It is almost always worse on standing and better lying down. Some patients experience photophobia, nausea, vomiting, diplopia and tinnitus\(^6\) due to tension on the cranial nerves and cranial nerve palsies may occur. Differential diagnoses include preeclampsia, cerebral venous thrombosis, space-occupying lesion such as cranial subdural haematoma, other intracranial haemorrhage, meningitis, tension headache and migraine\(^13\). In the setting of a recognised dural puncture with typical symptoms, PDPH is very likely. However if there are atypical symptoms, neurological signs, no apparent history of dural puncture or failed repeat blood patch, a thorough assessment (including cranial MR imaging) should be made to rule out competing diagnoses.

PDPH normally persists for at least a week after ADP during epidural placement, however greater than 10% of women continue to be symptomatic for more than one month\(^6\text{-}^14\) and weak evidence suggests many develop chronic headache. The incidence of PDPH varies according to the type of needle used, being higher use of cutting bevel spinal needles (e.g. Quincke 22 gauge – 30-50%) and larger needles, including larger Tuohy needles (52-80% with 16 gauge and 55% with 18 gauge)\(^15\text{-}^16\). Small gauge pencil point needles have an incidence as low as 0.5%. Other 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 PDPH\(^16\).

**Management**

Limited evidence exists for the efficacy of any preventative therapy against PDPH after recognised ADP\(^7\text{-}^9\text-,}^{11\text{-}12\text-,}^{16\text{-}18\). Due to the frequent persistence of the headache for greater than one week, the pros and cons of intervention (which may need to be repeated) versus symptomatic expectant management should be discussed with the patient. Epidural blood patch is a highly effective intervention for PDPH\(^19\) and barring contraindications, should be routinely offered to all patients with moderate to severe symptoms or persisting headache.
Epidural blood patch (EBP)

The placement of a small volume of autologous blood into the epidural space improves PDPH because of:

1. An immediate and sustained tamponade, with a rise in intracranial CSF pressure leading to adenosine receptor inhibition, cerebral vasoconstriction and a fall in elevated cerebral blood flow\(^{16}\)
2. Coagulation at 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)\(^{19}\). After dural puncture with a Tuohy needle, complete and permanent relief from an EBP occurs in 30% of patients, with partial relief in a further 50%; while rates of complete or partial relief after dural puncture with a spinal needle may be up to 95%\(^{20-22}\). After ADP-induced PDPH, recurrent headache occurs after initial success with an EBP in 30%, of whom 30-60% request a second blood patch\(^{22,23}\). 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\(^{20,21,23}\), EBP should not be delayed in severely affected parturients, as the overall time of suffering is shortened by earlier intervention.

EBP is indicated in patients with\(^\text{7}\):

1. Moderate to severe PDPH that interferes significantly with function or delays discharge
2. Persistent PDPH after several days

Contraindications

Most are relative and designed to avoid infection or bleeding within the neuraxis.

1. Local infection at the puncture site
2. Systemic sepsis
3. Coagulopathy (including iatrogenic)
4. Hematologic malignancy
5. Jehovah’s Witnesses – this is variable and should be discussed with the individual patient as interpretations differ and colloid can be used as a less effective alternative
6. High risk of repeat dural puncture
7. Atypical headache requiring investigation
8. Patient refusal
Procedure

1. Obtain written consent after discussion of the risks including infection, back/radicular pain, neuropathy and failure
2. Having two operators improves sterility and efficiency
3. Consider the lateral position for the patient to improve comfort
4. Have the most senior (consultant) anaesthetist perform the epidural
5. Gown, glove and mask and prepare the back and phlebotomy site with chlorhexidine and allow to dry
6. After local anaesthetic to the skin, locate the epidural space below or at the site of the previous epidural, using a loss-of-resistance to saline technique
7. Withdraw 25 mL of blood from the arm in a sterile fashion
8. Slowly inject blood into the epidural space. The suggested volume is at least 20 mL\(^2\). Stop if the patient experiences back or radicular pain that is not tolerable
9. Maintain the patient supine for at least two hours post procedure
10. The patient may be discharged following the procedure once comfortable. Ensure a paper discharge summary (MR207) is completed for outpatients
11. Follow up should be arranged via the APS for inpatients. For patients who are to be discharged, arrange daily APS telephone review. Organise follow-up with the patient’s GP or in the high-risk anaesthetic clinic – this can be done via the operating theatre clerks during working hours and requires a consultation request form.

Additional references of interest \(^{25, 26}\).

References and resources

8. Arkoosh V, Palmer C, Yum E, Sharma S. A randomized, double-masked, multicenter


### Accidental Dural Puncture (ADP)

<table>
<thead>
<tr>
<th>Keywords:</th>
<th>Epidural, dural puncture, dural tap, post dural puncture headache, epidural blood patch, PCSA, anaesthetist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Document owner:</td>
<td>OGiD</td>
</tr>
<tr>
<td>Author / Reviewer:</td>
<td>Anaesthetic Consultant</td>
</tr>
<tr>
<td>Date first issued:</td>
<td>07/2013</td>
</tr>
<tr>
<td>Last reviewed:</td>
<td>08/05/2017</td>
</tr>
<tr>
<td>Endorsed by:</td>
<td>PSMSC</td>
</tr>
<tr>
<td>Standards Applicable:</td>
<td>NSQHS Standards: 1 Governance, 3 Infection Control, 7 Blood Products, 9 Clinical Deterioration,</td>
</tr>
</tbody>
</table>

Printed or personally saved electronic copies of this document are considered uncontrolled. Access the current version from the WNHS website.