Protocol for Obstetrical Management of
Accidental Dural Puncture &
Post Dural Puncture Headache
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Jennifer Racine, MD, FRCPC.

Accidental Dural Puncture

Introduction
An accidental puncture of the dura (ADP) by a Tuohy needle during placement of a labour epidural can lead to leakage of cerebrospinal fluid (CSF). If undetected, infusion of epidural doses of local anesthetic and opioid through the dural puncture, or an unrecognized intrathecal catheter, can lead to a high/total spinal block or respiratory depression.

Risk Factors

Patient risk factors:
• Parturients are at increased risk due to young age, peripartum dehydration and postpartum diuresis reducing levels of cerebral spinal fluid (CSF). Bearing down during the second stage of labour increases CSF leak. This combined with the abrupt release of intra-abdominal pressure and vena caval compression at delivery reduces epidural venous pressure and increases the risk of post-dural puncture headache (PDPH).
• Previous post-dural puncture headache.  

Anesthetic procedure related risk factors:  

• Needle Type/ Size: Quincke 22g: 30%, larger Tuohy 16g: 52-100%, 18g: 55%,
• Pencil Point smaller gauge needle: 0.4-0.5%
• Bevel orientation
• Operator inexperience
• Multiple needle insertions

Recognition

A visible gush of cerebrospinal fluid may be evident on insertion of the Tuohy needle OR CSF may be aspirated from the epidural catheter. Alternatively, dural puncture may present as an unexpectedly profound or high block. As many as 26% of ADPs are unrecognized at the time of the procedure and present as PDPH in the early puerperium.  

Signs of an intrathecal catheter include:

• Rapid onset of analgesia
• Unexpected profound leg weakness or sudden onset of new leg weakness
• Clinically significant hypotension during maintenance of epidural analgesia
• Ability to freely aspirate clear fluid from the epidural catheter
• Non-reassuring fetal heart rate (fetal bradycardia)
PROTOCOL

The priorities are to ensure safe management of labour analgesia and watch for/manage subsequent Post-dural puncture headache (PDPH).

If a parturient has developed a dural puncture from placement of an epidural needle she should receive a Post-dural puncture headache (PDPH) pamphlet. The pamphlets are located in the anesthetic carts, as well as at the nursing stations on the birthing unit and postpartum unit. Prior to discharge, the patient should be followed by the Acute Pain Service (APS). After discharge, the patient should be contacted on a daily basis until the headache has resolved or follow up has been organized. The information pamphlet provides instructions for patients to follow should they develop a PDPH. These instructions should be reviewed with the patient before discharge home. If a parturient who is known to have a dural puncture is discharged home and subsequently develops a headache, she should be instructed to present directly to the birthing unit triage and not the Emergency Department.

The following are guidelines relevant to anesthetics.

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<th>ACCIDENTAL DURAL PUNCTURE (ADP) DURING LABOUR EPIDURAL ANALGESIA</th>
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<td><strong>Immediate management:</strong></td>
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<tr>
<td>1. Re-insert introducer and consider re-siting the epidural</td>
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<td>2. This is the preferred technique at The Ottawa Hospital</td>
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<td>3. Every case is unique. If the epidural was technically</td>
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<td>challenging, there is urgency, or the anesthesiologist</td>
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<td>feels they have a high chance of a repeat accidental</td>
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<td>dural puncture, then consider threading an intrathecal</td>
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Management of the patient with a Re-Sited epidural in the setting of accidental dural puncture:

1. Re-insert the epidural catheter at another interspace
2. Use caution as the hole in the dura may allow entry of local anesthetic into the cerebrospinal fluid and may result in a greater than expected block height or opioid induced respiratory depression
3. There is a high rate of repeat dural puncture (up to 10%)^6
4. Preferably re-insert the Tuohy needle at a level above the previous attempt and direct the catheter cephalad to avoid the dural puncture
5. Use a test dose of 2-3mL of the epidural loading solution (0.1% Ropivacaine with fentanyl 3mcg/mL) to assess for intrathecal placement
6. Carefully titrate the epidural

Patient Controlled Epidural Anesthesia (PCEA), Programmed Intermittent Epidural Bolus (PIEB):

1. Discuss maintenance therapy with the staff anesthesiologist
2. Consider reducing the PIEB/PCEA with: 3 mL boluses every 10min (0.08% Ropivacaine with fentanyl 2mcg/mL) and 3 mL boluses every 45 min, total of 30 ml maximum
3. If analgesia is not adequate, increase the dosing slowly as per our PIEB or PCEA protocol, or consider a continuous infusion
Management for caesarean section:

1. Ensure CSF is not able to be aspirated from the catheter
2. Use a mixture of 20mL of lidocaine 2% with adrenaline, and 50-100mcg of fentanyl
3. Initially give 2-3mL and assess for response before topping up in increments
4. Consider early removal of the epidural post-delivery

Management of intrathecal catheter:

1. Feed the catheter into the intrathecal space and convert to a regime for patient controlled spinal analgesia
2. Insert the catheter 3cm into the intrathecal space and tape securely
3. Confirm CSF can be aspirated from the catheter
4. Deliver local anesthetic and fentanyl as per the regimen below

Continuous spinal anesthesia:

1. Give an initial dose of 2mL of the pre-mix Ropivacaaine 0.1% with fentanyl 3mcg/mL top up solution
2. Set up a pump with the standard labour epidural solution (Ropivacaaine 0.08% with fentanyl 2mcg/mL)
3. Start a continuous infusion of: 1mL/hour of standard epidural solution. Analgesic needs will increase as labour progresses. Increase slowly infusion rate
4. Ensure regular monitoring of block height and hemodynamics by the OB bed side nurse/midwife
5. All additional top-ups are to be performed by the anesthesiologist. A suggested rescue treatment is 1-2mL of 0.25% bupivacaine
6. If analgesia is poor or very frequent dosing is required, remove the catheter and use an alternative analgesic method
7. Ensure the catheter, epidural record and patient chart are clearly marked “Intrathecal Catheter” with the GREEN SPINAL STICKER (located in the blue folder on epidural cart) to minimize the likelihood of inadvertent epidural dosing
8. Handover to on call anesthetist and resident and subsequent anesthetic staff likely to be involved
9. Provide a clear description of the management plan to nursing or midwifery staff

In addition to routine epidural analgesia monitoring protocols

10. Obstetric nurses/midwives should be asked to monitor for, and notify the anesthesiologist if:
    - Dense motor block of the lower limbs
    - Inability to empty the bladder
    - High sensory block (T4 or higher)
    - Marked hypotension after drug delivery
11. Consider abandonment of neuraxial analgesia: not recommended in the majority of cases
12. All additional top-ups are to be performed by the anesthesiologist
13. Remove catheter following delivery
ACCIDENTAL DURAL PUNCTURE DURING ANAESTHESIA FOR CAESAREAN SECTION

Ex: ADP with Tuohy needle occurring primarily during initiation of neuraxial anesthesia

1. Feed the catheter as per the technique described for labour analgesia above
2. Suggestions: give increments of 0.5-1mL of hyperbaric or plain bupivacaine 0.5% and fentanyl 5mcg, followed by a small saline flush, up to a maximum dose of 2.5mL of bupivacaine and 15mcg of fentanyl. Note the dead space volume of an epidural catheter and filter is approximately 1mL
3. Post operatively, remove the catheter and provide alternative analgesia
4. Intrathecal morphine 100-150mcg prior to removal with a saline flush
5. Oral multimodal analgesia

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

1. This should be discussed with the on-call anesthetic consultant so that potential complications relating to this technique are acknowledged
2. The patient may have a degree of existing anesthesia – always check the block height before making decision regarding appropriate action
3. Check CSF can be aspirated from catheter
4. Administer 0.5-1mL doses of 0.75% Bupivacaine and up to a total of 15mcg of Fentanyl each with a small flush (1mL of saline)
5. Use 1 or 3mL syringes for accurate dosing
6. Monitor block height to ice to determine whether additional local anesthetic is required prior to re-dosing
7. Remove the catheter following the procedure and administer appropriate analgesia

Subsequent management:

1. All cases should be discussed with the duty 1st on-call anesthesiologist and/or OB anesthesia staff/fellow assigned to labour and delivery if occurring on a weekday
2. Provide thorough documentation in the epidural procedure note on the EPIC anesthetic record.
3. Add the patient to Acute Pain Service (APS) for proper follow-up. Handover to the APS team to monitor for complications such as PDPH
4. Add “Postdural puncture headache” to the patient’s Problem List on EPIC. This will facilitate future data collection on this population.
Post Dural Puncture Headache (PDPH)

The resultant decrease in CSF pressure with subsequent tension on the meningeal vessels and nerves may precipitate a post-dural puncture headache (PDPH). Decreased CSF pressure may also cause a compensatory cerebral vasodilation\(^{25}\). Post dural puncture headache (PDPH) is an important iatrogenic cause of patient morbidity in modern obstetrical anesthesia and is one of the most common complications of epidural analgesia in labor. The incidence of dural puncture can be as high as 1.3% in experienced hands. A PDPH typically manifests as a postural, frontal, frontotemporal or occipital headache that is made worse with ambulation and improves by assuming the decubitus position. It can be accompanied by nausea, vomiting and neck stiffness. It can be very severe, incapacitating and potentially last for a few days to weeks or even months. Infrequently, the headache may become chronic. There are reports of untreated PDPH leading to cranial nerve palsy. More recently, a rare association has been described between PDPH and development of an intracranial subdural hematoma.\(^{10,23,24}\) After a dural puncture, a headache will usually develop within 48 hours but may be delayed up to 5 days.

Prophylaxis and Management:

At The Ottawa Hospital, a general consensus within the obstetrical anesthesia group in collaboration with the quality and patient safety team was made. If there is an intrathecal catheter used for labor analgesia and/or cesarean section, **PLEASE DO NOT leave the intrathecal catheter in place postpartum.** The evidence to suggest PDPH or epidural blood patching is reduced by leaving an intrathecal catheter in-situ is equivocal\(^{11,12}\). A wide range of popular therapies, both invasive and noninvasive, are available for the practicing anesthesiologist for management of PDPH, but very few are supported by high quality evidence.

We strongly advise to **pull out the catheter as per our usual protocol immediately after delivery,** when patient is still on the labour and delivery ward.

Nurses on the Obstetric postpartum ward are **NOT** familiar with epidural and intrathecal catheters. If the decision was made to keep the catheter in place for 24 hours, the patient should remain on labour and delivery. Arrangements for this can be made with the labour and delivery charge nurse. If the decision is made to keep intrathecal catheter in place, please ensure that the catheter is clearly marked or tamper-proofed (tie a knot and fix it securely under several tegaderms). The end of the catheter should be tightly closed with a cap, to avoid any CSF leakage. An open catheter or loose syringe attached to catheter exposes the patient to potentially severe complications.
If you are consulted to assess a parturient for a suspected PDPH:

1) Confirm that the patient had a neuraxial anesthetic
2) Perform a thorough history and physical exam, including vitals, review recent blood work to rule out other causes of headache
3) Differential diagnoses include: dehydration, intracranial pathology, preeclampsia, migraine, lactation headache, caffeine withdrawal, stress, cerebral venous thrombosis, meningitis, etc. 
4) In the setting of a recognized dural puncture with classic symptoms, a PDPH 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 an alternative diagnosis
5) The skin over the epidural or spinal puncture should be inspected for CSF leak, inflammation and tenderness

If PDPH is diagnosed:

1) Educate and reassure the patient that a PDPH is usually a self–limiting process. If left untreated, 75% will resolve within first week and 88% will have resolved by 6 weeks
2) Most treatment is geared towards symptomatic relief until the dural puncture resolves
3) Regular analgesia: we recommend regular NSAIDS and Acetaminophen for 24 hours if no contraindication
   a. Consider platelet function /renal function/ any contraindication for NSAIDS
   b. Consider breast feeding mother

   Example of Analgesia: Acetaminophen 650mg po q6, Ibuprofen 400mg po q6h, hydromorphone 2-4mg po q4h PRN

4) Conservative treatment recommended for the first 24h
5) Without treatment the headache typically lasts 2-15 days (but potential for up to 6 months or longer)
6) No evidence for abdominal binders or bed rest
7) While routine administration of fluid may be unnecessary, avoidance of dehydration is advisable to help limit headache severity
8) There is some mild evidence for the use of caffeine, consider side effects and contraindications (i.e. risk of arrhythmias)

Consider caffeine beverage, or 300mg Caffeine tablet po daily or twice daily if no contraindication

Caffeine in high dose is associated with adverse events including cardiac arrhythmia and maternal seizures, > 300mg may enter breast milk and lead to potential neonatal irritability.

9) Stool softeners (prevent straining) i.e. Colace
10) Theophylline, Gabapentin and Hydrocortisone; should be “tertiary” level treatment. Basically the “benefit has to outweigh the risks”. To make this happen, the patient should fail primary “conservative” management (bed rest, fluids and Tylenol) and also either get no relief from (or refuse) secondary “interventional” EBP
11) *Consider early neurology consult with possible imaging before exposing the newborn to potential toxicity from these otherwise “low efficacy” therapies.*

12) Sphenopalatine Ganglion Block (SPGB). The SPGB needs further study before it can be recommended routinely. See further details below. Possible role for the SPGB include:

- contraindication to EBP
- patient refusal to EBP
- anticipated technically-challenging EBP with increased risk of additional ADP
- symptom management in initial 48 hours if an EBP is not performed
EPIDURAL BLOOD PATCH (EBP)

Limited evidence exists for preventative therapies of PDPH in recognized 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 the gold standard of treatment for an established PDPH, and barring contraindications, should be discussed with all affected patients. The placement of a small volume of autologous blood in the epidural space can treat a PDPH by several mechanisms. The autologous blood provides 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. After dural puncture with a Tuohy needle, complete and permanent relief from an epidural 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 rate of a second EBP is 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 patients.

Indications for EBP:
1. Moderate to severe PDPH that interferes significantly with function or delays discharge
2. Persistent PDPH after one week

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

1. Obtain a written consent after discussion of the risks and benefits
2. Discuss with obstetric nurse in charge for timing of procedure, in order to organize a BU nurse to monitor patient post procedure
3. Procedure to be done in OBS PACU if possible
4. Consider two operators improves sterility and efficiency
5. Consider the lateral position for patient comfort
6. Have the most senior anesthesiologist staff or resident perform or supervise the epidural
7. Glove and mask and prepare the back and phlebotomy site with chlorhexidine under sterile condition
8. After local anesthetic to the skin, locate the epidural space at the site of the previous epidural using a loss of resistance technique
9. Withdraw 20ml of blood from the arm in a sterile fashion
10. Slowly inject blood into the epidural space. The suggested volume is 20ml, Stop if the patient experiences back or radicular pain that is not tolerable. If the first EBP fails, a second can be placed approximately 24 hours after the first EBP
11. Maintain the patient supine for two hours post procedure
12. The patient may be discharged following the procedure once comfortable
13. Ensure an anesthetic clinical note is completed for handover and follow up
14. Follow up should be arranged via the acute pain obstetric service for inpatients
15. Give the PDPH pamphlet for follow up information and discharge instruction
16. If 2 EBPs have failed, consult Neurology to rule out other etiology and further imaging if not done previously
17. For patients who are to be discharged, arrange a daily telephone follow-up. The patient should be added to the EPIC APS for follow up by resident on call. Instruct patient to come to labor and delivery if any concerns in regards to the headache. Organize follow-up in the obstetric anesthesia clinic if the patient has any concerns regarding her next pregnancies anesthetics
REFERENCES


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**Epidural Blood Patch for the NON Obstetric Patient**

1. Epidural blood patch should be done in main OR PACU if possible
2. Discuss with obstetric nurse in charge for timing of procedure, in order to organize a BU nurse to monitor patient post procedure.
3. Please follow steps recommended above.


ADDENDUM:

Sphenopalatine ganglion block for treatment of PDPH

The sphenopalatine ganglion is located within the nasal cavity, in the bilateral pterygopalatine fossa, posterior to the middle nasal turbinate. It is primarily composed of parasympathetic ganglia. The SPGB is hypothesized to work by blocking efferent parasympathetic flow to the cerebral vasculature, resulting in cerebral vasoconstriction and improvement of headache symptoms. The SPGB has previously been described in management of chronic headache disorders, but only recently translated to use in the PDPH population.

A proposed technique is described below. Side effects of the SPGB include: numbness or stinging at the palate; bitter taste; and lacrimation of the ipsilateral eye. When needle injections are performed in chronic headache management, complications include local bleeding, infection and epistaxis. Contraindication includes true allergy to the local anesthetic.

There are several limitations to the SPGB. First, it is important to note that the pathophysiology of PDPH differs from the other headache disorders where the SPGB has been used. The technique described typically involves administering topical local anesthetic over the SPGB, although the optimal technique has not been determined. The most robust evidence supporting the SPGB in the PDPH population was a single-centre retrospective review with methodological limitations. Additionally, emerging literature describes a rare association between PDPH and the development of intracranial subdural hematoma, and a SPGB would not protect against the proposed mechanism. The SPGB needs further study before it can be recommended routinely.

Until further evidence for the SPGB is established, potential roles for the block include patients in which an EBP is contraindicated or refused. At the discretion of the Anesthesia team, the SPGB could be performed when an EBP is anticipated to be technically-challenging with an increased risk of another ADP. The SPGB could also be considered in the initial 24 to 48 hours of PDPH onset, given that an EBP performed in this period may fail and have a recurrent headache.

References:

postpartum patients. A retrospective review. Regional Anesthesia and Pain Medicine, (2018); 43(8), 880-884.


Anatomy:

- Also known as pterygopalatine/nasal/Meckel’s ganglion
- Ganglion of the sensory, sympathetic, and parasympathetic nervous system
- Largest collection of neurons in the calvarium outside of the brain
- Only ganglion having access to outside environment through the nasal mucosa

Sphenopalatine ganglion block and PDPH:

- Prevents parasympathetic flow to the cerebral vasculature, vessels return to normal diameter, thus relieving the headache
Procedure:

https://www.youtube.com/watch?v=ebvS6tvr4Yk&feature=youtu.be

We position the patients in the supine position with their heads off the bed in the chin-up position. We draw up 5ml 4% lidocaine solution (2% lidocaine was used when 4% was back order) solution in 5ml syringe, remove the needle and drip this solution in each nostril while pushing the tip of the nose gently upward until the patient feels it in the back of the throat. After the patient feels it in the back of the throat, we let her rest in that position for 15 minutes and then ask her to sit up slowly. We may repeat this process up to three time every 15 minutes until the patient is relieved of her headache. More than 70% of our patients have complete recovery after the first application. The rest may recover hours or days later because the headache may return and require repeating the procedure by us or by the patients at home from lidocaine solution that we prescribe. At any time if dripping the solution is unsuccessful we may try to apply the cotton-tip applicators or blood patch at patient’s request.

I like to position the patient in a little bit of Trendelenburg.

For the cotton-tip applicator approach, cotton-tip applicators are dipped into 4% lidocaine water-soluble ointment and attached to 2-mL syringes with 10-inch shortened intravenous extension tubing that are advanced into the patients' nostrils until they are in contact and bounced against the posterior wall of the pharynx. Lidocaine 4% solution 0.5 to 1.5 mL are administered via the syringes until the patients feel the solution in the back of their throats. The syringes are then disconnected temporarily, and the applicators remain in the patients' nostrils for 15 minutes while the patients continue to lie in the described position. As described above, the patients are then briefly asked to sit up. If their headache is not sufficiently relieved, this procedure is repeated every 15 minutes up to 2 more times. If their headache is still not sufficiently relieved, their choice is to either receive the same procedure up to a total of 3 times a day or receive an EBP at least 24 hours after the initial SPGB treatment.
Side effects:

- **Stinging** in nose and/or palate
- Numbness or lacrimation of ipsilateral eye
- Bitter taste or numbness of the throat
- With needle injection there is risk of bleeding, infection, and epistaxis
- LAST

Quality of evidence:

Level C evidence

- Need for higher quality evidence for SPG block
- Cheap, easy, minimally invasive, low risk
- Autologous EBP remains the gold standard
- Consider the Sphenopalatine Ganglion Block if patient as contra indication to EBP, and or refuses EBP and as fail conservative management.

References:

