Lumbar Puncture in the Neonate

Related protocols / related links include:

<table>
<thead>
<tr>
<th>Protocol/Link</th>
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**Introduction**

A lumbar puncture (LP) is a procedure in which an aspiration needle is placed into the subarachnoid space of the spinal cord, usually via the fourth lumbar inter vertebral space, to collect cerebrospinal fluid (CSF) for diagnostic purposes.

![Diagrammatic representation of a lumbar puncture](http://www.mayfieldclinic.com/Images/PE-lumbarpuncture.jpg)

Figure 1- Diagrammatic representation of a lumbar puncture


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Main author: Letitia Gibbs CNS January 2011 - For revision Jan 2014
**Indications for Lumbar Puncture (LP)**

- Positive blood culture
- Group B Strep (GBS) in urine / Suspected late onset GBS
- Abnormal neurological signs
- Candida infection
- Positive Herpes Simplex Virus (HSV) surface swab or sick newborn of mother with primary HSV infection close to delivery or infant born through birth canal during active HSV disease, or infant with clinical signs of neonatal HSV disease (regardless of maternal history)
- Congenital Syphilis
- Suspected meningitis or encephalitis
- Suspected subarachnoid haemorrhage
- Seizures of unknown aetiology

**Contraindications**

- Active bleeding with a low platelet count
- Suspected meningococcal infection (purpura)
- Superficial infection at / near LP site
- Severe cardio respiratory instability
- Uncontrolled seizure activity
- Vertebral anomalies

**Potential Complications associated with Lumbar Puncture**

- Hypoxia and respiratory arrest from incorrect positioning
- Pain and discomfort
- Failure to obtain specimen
- Headache or irritability
- Spinal haematoma and abscess
- Risks increase with lower gestational ages

**Pain management**

- Give sucrose (24%) analgesia 2 minutes prior to local infiltration with lignocaine 1%
- Repeat if required every 2 minutes.
**Equipment**

Resuscitation equipment available

Neopuff® set at 20/5cms H2O at appropriate FiO2

<table>
<thead>
<tr>
<th>Clean Equipment</th>
<th>Sterile Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Clean dressing trolley with Lemex solution, leave one minute &amp; wipe dry</td>
<td>• sterile gown and sterile gloves</td>
</tr>
<tr>
<td>• Blue sterile plastic sheet to protect bedding.</td>
<td>• x 2 sterile green drapes (one fenestrated)</td>
</tr>
<tr>
<td>• masks</td>
<td>• dressing pack</td>
</tr>
<tr>
<td>• ampoule lignocaine 1% &amp; sucrose 24%</td>
<td>• additional gauze swabs</td>
</tr>
<tr>
<td>• aqueous chlorhexidine 0.015%</td>
<td>• spinal needle 22G / 25G bevelled with stylet</td>
</tr>
<tr>
<td>• kidney dish or other clean receptacle</td>
<td>• assorted needles / 2 mls syringes</td>
</tr>
<tr>
<td>• 3x CSF tubes labelled “1”, “2” and “3”</td>
<td>• Band aid</td>
</tr>
</tbody>
</table>

LP needles with a stylet are used in order to avoid later formation of a dermoid cyst.

**Preparation for the procedure**

- Ensure that procedure has been explained to parents by medical staff and document discussion in the *case history notes (MR45)*
- Obtain consent and document *in case history notes (MR45)*
- Confirm ID of infant with MO / TNP before procedure
- Ensure infant has not been fed immediately prior to procedure; aspirate stomach if necessary
- Place infant on cardiac / SpO2 monitor and perform baseline vital signs including temperature, respiratory rate / effort & heart rate / SpO2%.
- Administer sucrose 24% analgesia and document in *medication chart - nurse initiated medications*
- MO to prescribe lignocaine 1% on *medication chart – once only / prn section and sign*
Positioning the infant

- Use blue waterproof sheet under the infant
- The clinician performing the procedure should be on one side of the bed seated with baby’s spine at eye level
- The first registered nurse stands on the other side of the bed to position the infant
- Place the infant laterally at the edge of the bed with back to the clinician performing the procedure
- Avoiding flexion of the neck, the assistant holds the shoulders and legs curling the infant into the fetal position with maximum flexion of the spine
- Check that the infant’s head and neck are in a neutral position and that there is no respiratory compromise
- Ensure hips and shoulders remain in line and at 90 degrees to the bed.
- Complete immobilisation of the spine is important throughout the procedure
- The first registered nurse is responsible for monitoring physiological wellbeing and comfort of the infant

Pictures to be inserted here when available

*Figure 2* The RN places hands on the infant's shoulders and legs to flex the lower spine leaving the neck in a neutral position. The infant's back is positioned at the edge of the cot.

*Figure 3* The Proceduralist is seated so the infant’s back is at eye level.

Assessing the landmarks

Note: Never go above the L2-L3 interspace.

- The spinal cord in neonates extends further down the spinal canal than in adults and older children. At conception the spinal cord extends the entire length of the vertebral canal. The distal end of the spinal cord gradually comes to lie at higher levels as gestation progresses.
- At 24 weeks, it lies at the level of the first sacral vertebra.
- At term it lies at the level of L2-L3 - in the adult the spinal cord usually terminates at L1.
- Locate the space between L3 and L4 by drawing an imaginary line between the tops of the iliac crests
- Find the L4 spinous process and use the interspace between L4 and L5 as the site of the lumbar puncture – *see Figure 4 below.*
Procedure

- **Under aseptic technique**, prepare the site with aqueous chlorhexidine 0.015% - MO to check label with 2nd (assisting) RN and allow 3 minutes to dry. Remove chlorhexidine and used swabs from sterile field.
- Apply the fenestrated drape to skin once dry
- **Local anaesthetic** – draw up the lignocaine 1% directly from the ampoule. MO to check label with 2nd RN and immediately infiltrate the skin and then deeper tissue, wait for anaesthetic effect before commencing procedure. Do not commence procedure until the syringe with lignocaine is removed from the sterile field – place in receptacle held by the assisting RN.
- Relocate L4 and keep one finger of your non dominant hand on each side of L4
- Hold the needle between the first two fingers of your dominant hand and place the thumb on the hub
- Position the needle with the bevel pointing towards the ceiling
- Enter the skin strictly in the midline and **pause**
- Wait for the infant to settle
- Aiming for the umbilicus (70-90 degrees towards the head), advance the needle slowly into the spinous ligament until there is a fall in resistance (about 0.5 cm) – *see Figure 5.*
- There is not necessarily a *pop* as with older children and adults
- Remove the stylet and observe for CSF flow
- If none, rotate the needle slightly to initiate flow/replace the stylet and advance the needle slightly and recheck for CSF flow
- If unsuccessful repeat the procedure in the next inter space down or consult another more experienced practitioner
- The 2nd registered nurse collects ~10 drops of CSF into each of the three labelled tubes in numerical order

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Blood stained CSF
Blood stained CSF is indicative of traumatic LP. Blood stained fluid may still be useful for culture. If the CSF clears it may be used for a cell count, however if it fails to clear, another LP attempt at a different level may be indicated.

CSF Interpretation

**Tube 1:** Used for culture, sensitivity and gram stain
**Tube 2:** Glucose and protein
**Tube 3:** Cell count, PCR

### Interpretation of abnormal results

<table>
<thead>
<tr>
<th></th>
<th>White cell count</th>
<th>Biochemistry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Neutrophils (x 10⁶/L)</td>
<td>Lymphocytes (x 10⁶/L)</td>
</tr>
<tr>
<td>Normal (&gt;1 month of age)</td>
<td>0</td>
<td>≤ 5</td>
</tr>
<tr>
<td>Normal term neonate</td>
<td>0*</td>
<td>&lt; 20</td>
</tr>
<tr>
<td>Bacterial meningitis</td>
<td>100-10,000 (but may be normal)</td>
<td>Usually &lt; 100</td>
</tr>
<tr>
<td>Viral meningitis</td>
<td>Usually &lt;100 (but may be normal)</td>
<td>10-1000</td>
</tr>
<tr>
<td>TB meningitis</td>
<td>Usually &lt;100 (but may be normal)</td>
<td>50-1000</td>
</tr>
</tbody>
</table>

(Royal Children’s Hospital Melbourne)

**Factors which may affect results**

- Blood stained CSF
- Prior use of antibiotics
- Poor aseptic technique

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**Nursing care post procedure**
- Ensure the site is clean, dry and well covered with the band-aid
- Remove wet blue sheet
- Infant should be nursed flat – with consideration to other problems such as oxygenation / comfort
- Infant may be nursed by parents
- Settle and reposition infant comfortably
- Repeat vital observations – remove cardiac / SpO2 monitor if not otherwise indicated
- Inform parents of outcome of procedure
- Observe for signs of pain or distress in the infant and consider use of dummy (and paracetamol)
- Check site and remove bandaid at next nursing care – note any CSF or other discharge
- Document procedure in the *case history notes (MR45)* using the *procedure labels*
- Observe injection site for any discharge / inflammation for at least 48 hours and report same in *case history notes (MR45)*

**Key points**
- Verbal consent from parents must be obtained and documented in the *case history notes (MR45)*
- The procedure must be performed using aseptic technique
- Correct positioning is vital – avoid flexing the infant’s neck
- Pain management including local anaesthetic is necessary
- The distal end of the spinal cord is lower in an infant than an adult

**References**


NSW Health Safety Notice 10/10 Correct identification of medication and solutions for epidural anaesthesia and analgesia.  

Royal Hospital for Children Clinical Practice Guidelines Lumbar Puncture Guideline.  

University of Iowa Children’s Hospital Department of Pediatrics Lumbar Puncture.  
