Lumbar puncture, assisting, neonatal

Revised: November 19, 2020

Critical Notes!

Facility Specific Notes:

- Regardless of infant's gestational age—povidone-iodine swabs are to be used for lumbar punctures as antiseptic solution.
- 1% lidocaine without EPINEPHrine is optional
- Label tubes(s) per physician order and send specimen(s) to lab for appropriate studies within 20 minutes of collection.
- Specimens must be walked to the lab. Pneumatic Tube System should not be used to send CSF. Reference WH Pneumatic Tube Policy No. 213 http://webserver2/ppp/Secure/Gadmin.asp

Performed by RN

Introduction

Lumbar puncture involves the insertion of a sterile needle into the subarachnoid space of the spinal canal, usually between the third and fourth (L3-L4) or fourth and fifth (L4-L5) lumbar vertebrae. For significantly preterm neonates, use of the space between L4 and L5 is common to prevent possible cord penetration because the spinal cord gradually ascends from L4 to L2 between 25 and 40 weeks' gestation. A practitioner performs lumbar puncture, which requires sterile technique and careful neonate positioning, with the assistance of a nurse.

Lumbar puncture helps determine the presence of blood in cerebrospinal fluid (CSF), obtain CSF specimens for laboratory analysis, inject contrast dye for myelography, administer medication, and drain CSF in neonates with hydrocephalus. During the procedure, the practitioner may measure CSF pressure, which flows freely between the brain and spinal column.\(^1\)

Lumbar puncture is contraindicated when local infection is present at the insertion site, when lumbosacral anomalies or coagulopathy are present, or when the neonate's cardiac or respiratory status is unstable. It's also contraindicated when there's evidence of a space-occupying lesion, such as an intracrani al tumor or a brain abscess, because of the risk of cerebral herniation.\(^2\) Because of the risk of tonsillar herniation when intracranial pressure (ICP) decreases rapidly, the practitioner must perform lumbar puncture cautiously when using it to relieve increased ICP associated with hydrocephalus.\(^2\)

Equipment

- Overbed or procedure table
- Light source
- Antiseptic solution
- Spinal needle (20G to 22G, 1" or 1½" [2.5-cm or 3.8-cm])
- Sterile specimen tubes with screw tops
- Sterile drapes
- Small sterile adhesive spot bandage
- Sterile 2" × 2" (5-cm × 5-cm) gauze pad
- Labels
- Laboratory biohazard transport bag
- Cap
- Sterile gown
- Sterile gloves
- Mask with face shield or mask and goggles
- Gown
- Gloves
- 1-mL syringe
- 3-mL syringe
- 1% lidocaine without EPINEPHrine\(^2\)\(^4\)\(^5\)
25G to 27G needle
Sterile water or saline
Sterile gauze pads
Emergency equipment (code cart with emergency medications, defibrillator, handheld resuscitation bag with mask, intubation equipment)
Vital signs monitoring equipment
Stethoscope
Disinfectant pad
Optional: pacifier, 24% oral sucrose solution, breast milk, local anesthetic cream, manometer, radiant warmer, pulse oximeter and probe

Disposable lumbar puncture trays contain most of the needed sterile equipment.

### Preparation of Equipment

Inspect all equipment and supplies. If a product is expired, is defective, or has compromised integrity, remove it from patient use, label it as expired or defective, and report the expiration or defect as directed by your facility.

Make sure that emergency equipment is functioning properly and readily available.

### Implementation

- Verify the practitioner’s order.
- Check the neonate's medical record for a history of allergies to local anesthetic, latex, antiseptic solution, analgesia, or sedation.
- If required by your facility, confirm that informed consent has been obtained and that the signed consent form is in the neonate's medical record.
- Conduct a preprocedure verification to make sure that all relevant documentation, related information, and equipment is available and correctly matched to the neonate's identifiers.
- Verify that preprocedure laboratory and imaging studies are complete, as ordered, and that the results are in the neonate's medical record. Notify the practitioner of any unexpected results.
- Gather and prepare the necessary equipment and supplies.
- Perform hand hygiene.
- Confirm the neonate’s identity using at least two patient identifiers.
- Provide privacy.
- Reinforce the practitioner’s explanation of the procedure to the parents or guardians according to their individual communication and learning needs to increase their understanding, allay their fears, and enhance cooperation.
- Answer any questions.
- Maintain the neonate in a radiant warmer during the procedure, if necessary, to help maintain normothermia.
- Monitor the neonate's cardiac, respiratory, and neurologic status during the procedure because improper positioning can compromise the neonate's airway and the procedure can cause hemodynamic instability. Consider attaching the neonate to a pulse oximeter to monitor the neonate's oxygen saturation level during the procedure.
- Provide the neonate with a pacifier with sucrose, if indicated, for nonnutritive sucking, which helps control pain during the procedure; administer 24% oral sucrose solution 2 minutes before the procedure to control the neonate's pain during the procedure. Alternatively, use human milk to control the neonate’s pain.
- Provide adequate lighting at the puncture site.
- Adjust the height of the radiant warmer to allow the practitioner to perform the procedure comfortably.
- Perform hand hygiene.
- Put on a cap, a mask, a gown and gloves to comply with standard precautions and protect the sterile field.
- Open the lumbar puncture equipment tray on the overbed or procedure table, being careful not to contaminate the sterile field when you open the wrapper.
- Label all medications, medication containers, and other solutions on and off the sterile field.
- Place a sterile drape under the neonate.
Place the neonate in the proper position according to the neonate's condition and the practitioner's preference. (See Positioning a neonate for lumbar puncture.) Maintain the neonate's position throughout the procedure.

### POSITIONING A NEONATE FOR LUMBAR PUNCTURE

Proper positioning for lumbar puncture is important because it helps the practitioner locate anatomic landmarks and widens the spaces between the vertebrae to facilitate needle insertion and prevent spinal cord injury. Position the neonate in a lateral recumbent or sitting position with the spine flexed (as shown below). A study of infants age 1 to 90 days showed no significant difference in lumbar puncture success between the lateral or sitting position. Select the position according to the neonate's condition and the practitioner's preference. The American Academy of Pediatrics recommends a sitting position with the hips flexed because this position increases the interspinous space of the lumbar spine, easing needle puncture. Avoid flexing the neonate's neck to prevent airway compromise.

#### Lateral recumbent position

![Lateral recumbent position]

#### Sitting position

![Sitting position]
The practitioner puts on a cap, a mask and goggles or a mask with a face shield, a sterile gown, and sterile gloves and then prepares the puncture site with antiseptic solution and allows it to dry to prevent contamination by the body's normal skin flora. Next, the practitioner drapes the area with a fenestrated drape to create a sterile field.

**Clinical alert:** Studies suggest that chlorhexidine is neurotoxic. Its use as an antiseptic agent for skin preparation before lumbar puncture is controversial.

**Clinical alert:** Use chlorhexidine with caution in premature infants or infants under 2 months of age because it may cause irritation or chemical burns.

- Conduct a time-out immediately before starting the procedure to ensure that the correct neonate, site, positioning, and procedure are identified and, as applicable, that all relevant information and necessary equipment are available.

- The practitioner uses a 1-mL syringe with 1% lidocaine without epinephrine, as indicated, to anesthetize the insertion site. The practitioner may also apply an anesthetic cream before preparing the site to reduce the neonate's pain during the procedure.

- As the practitioner inserts the sterile spinal needle into the subarachnoid space between the appropriate lumbar vertebrae, hold the neonate firmly in position to prevent sudden movement that may displace the needle.

- If the neonate remains quiet, the practitioner may remove the stylet and measure CSF pressure using a manometer. If the neonate isn't quiet, the practitioner proceeds with collecting the specimens; the practitioner removes the stylet and allows 1 mL of CSF to flow into each of the sterile specimen tubes. The practitioner then places the sterile specimen tubes in the lumbar puncture tray in the order of collection. Next, the practitioner reinserts the stylet, removes the spinal needle, and then applies pressure over the insertion site with a sterile gauze pad.

- Mark the sterile specimen tubes in sequence and tightly cap them. Label the specimens at the neonate's bedside to prevent mislabeling. Label the first tube for culture and sensitivity, the second for glucose and protein, and the third for cell count and differential. If you collected a fourth tube, label it according to the ordered testing.

- Remove and discard the pacifier, if used, to comply with the Baby-Friendly Hospital Initiative.

- Remove and discard your gloves.

- Perform hand hygiene.

- Put on sterile gloves.

- Clean the antiseptic from the neonate's skin with sterile water or saline on gauze pads because antiseptic remaining on the skin can cause local or systemic adverse effects.

- Place a small, sterile adhesive spot bandage over the insertion site.
- Assess the neonate’s cardiac, respiratory, and neurologic status to promptly detect complications associated with the procedure.
- Screen for and assess the neonate’s pain using facility-defined criteria that are consistent with the neonate’s age and condition.
- Treat the neonate’s pain, as needed and ordered, using nonpharmacologic, pharmacologic, or a combination of approaches. Base the treatment plan on evidence-based practices, the neonate’s clinical condition, and pain management goals. (See the “Pain assessment, neonatal” procedure.)
- Place the CSF specimens in a laboratory biohazard transport bag and send them to the laboratory immediately with completed laboratory request forms if necessary. You cannot refrigerate CSF specimens for later transport.
- Discard supplies in the appropriate receptacles.
- Remove and discard your gloves and other personal protective equipment.
- Perform hand hygiene.
- Clean and disinfect your stethoscope using a disinfectant pad.
- Perform hand hygiene.
- Document the procedure.

Special Considerations

- Monitor CSF test results and report critical results to the practitioner within the time frame determined by your facility to prevent treatment delays. (See Normal CSF values in a neonate.)

### Normal CSF Values in a Neonate

This table lists the normal values of cerebrospinal fluid (CSF) in a preterm and term neonate.

<table>
<thead>
<tr>
<th>Test Component</th>
<th>Preterm Neonate</th>
<th>Term Neonate</th>
</tr>
</thead>
<tbody>
<tr>
<td>White blood cell count</td>
<td>0 to 25.4/mm³</td>
<td>0 to 22.4/mm³</td>
</tr>
<tr>
<td>Glucose</td>
<td>24 to 63 mg/dL</td>
<td>34 to 119 mg/dL</td>
</tr>
<tr>
<td>CSF glucose/blood glucose</td>
<td>55% to 105%</td>
<td>44% to 128%</td>
</tr>
<tr>
<td>Protein</td>
<td>65 to 150 mg/dL</td>
<td>20 to 170 mg/dL</td>
</tr>
<tr>
<td>Initial pressure</td>
<td>80 to 100 mm H₂O</td>
<td>80 to 100 mm H₂O</td>
</tr>
</tbody>
</table>

- Frequently monitor the puncture site for redness, swelling, and drainage.
- After the procedure, assess the neonate’s neurologic status and vital signs, as ordered and according to the neonate’s condition.
- Obtain additional laboratory specimens, as ordered. In addition to CSF analysis and culture, initial laboratory testing may include serum glucose for comparison with CSF glucose values along with other blood and urine specimens.
- If performing lumbar puncture to administer medication, it isn’t necessary to drain CSF first.
- When using lumbar puncture to treat hydrocephalus, the practitioner usually allows 10 to 15 mL of CSF to drain.
- Assess the neonate’s neurologic status frequently to monitor for signs of increased ICP.

### Complications

The complication most commonly associated with lumbar puncture in a neonate is transient hypoxemia caused by positioning. Other complications include aspiration, cerebral herniation, infection (meningitis, spinal cord abscess, epidural abscess, discitis, or vertebral osteomyelitis), intraspinal epidermoid tumor, spinal cord injury, lumbar spine deformity, and bleeding (epidural hematoma, subdural hematoma, subarachnoid hematoma).

### Documentation

Record that you took a time-out before the procedure to verify the correct neonate, correct site, and correct procedure. Document the start time and end time of the procedure, the neonate’s response, any medications that you administered, and the number of CSF specimen tubes that you collected. Record the volume of CSF that drained as well as its color and consistency. Document the neonate’s cardiac, respiratory, and neurologic status; any complications that occurred during the procedure; prescribed interventions; and the neonate’s response to those interventions. Also document teaching that you provided to the parents or guardians, their understanding of that teaching, and any need for follow-up teaching.
References

(Rating System for the Hierarchy of Evidence for Intervention/Treatment Questions)


   UpToDate Full Text

   Abstract | Complete Reference | Full Text


   Abstract | Complete Reference | Full Text


Lippincott Procedures - Lumbar puncture, assisting, neonatal


   Abstract | Complete Reference

   Abstract | Complete Reference | Full Text | Ovid Full Text


   Abstract | Complete Reference | Ovid Full Text


   UpToDate Full Text


Additional References

- Bailie, H. C., et al. (2013). Weight-based determination of spinal canal depth for paediatric lumbar punctures. Archives of Disease in Childhood, 98, 877–880. (Level VI)  
  Abstract | Complete Reference | Ovid Full Text


  Abstract | Complete Reference | Ovid Full Text

Facility Review

Woman's Hospital reviewed procedure on 01/04/2021. Procedure was approved by Nurse Exec. per email from S. Henry 1/19/2021.

Rating System for the Hierarchy of Evidence for Intervention/Treatment Questions

The following leveling system is from Evidence-Based Practice in Nursing and Healthcare: A Guide to Best Practice (2nd ed.) by Bernadette Mazurek Melnyk and Ellen Fineout-Overholt.

Level I: Evidence from a systematic review or meta-analysis of all relevant randomized controlled trials (RCTs)

Level II: Evidence obtained from well-designed RCTs

Level III: Evidence obtained from well-designed controlled trials without randomization

Level IV: Evidence from well-designed case-control and cohort studies

Level V: Evidence from systematic reviews of descriptive and qualitative studies

Level VI: Evidence from single descriptive or qualitative studies

Level VII: Evidence from the opinion of authorities and/or reports of expert committees


  Abstract | Complete Reference | Full Text | Ovid Full Text