Lumbar puncture (LP) to obtain a sample of cerebrospinal fluid (CSF) is helpful in many neurological diagnoses. The advent of computed tomography and magnetic resonance imaging has superseded lumbar puncture for some diagnoses, but has also improved the safety of its use. Examination of the cerebrospinal fluid remains the most direct and accurate method to determine central nervous system infection.

INDICATIONS

- Central nervous system infection suspected (Cell count, CSF gram stain, and bacterial culture are essential. Countercurrent immuno-electrophoresis is frequently helpful. Fungal culture, acid-fast bacillus, and India ink studies are optional.)
- Subarachnoid hemorrhage suspected (Computed tomography [CT] scan first. Note xanthochromic color and RBC count [>1000/ mm³].)
- Pseudotumor cerebri
- Guillain-Barré syndrome (Very high protein [200 mg%])
- Multiple sclerosis (Elevated IgG amounts and oligoclonal banding present on electrophoresis.)
- Spinal analgesia
- Systemic lupus erythematosus
- Meningeal carcinomatosis
- Intrathecal antibiotics or chemotherapeutics
- Imaging procedures (myelography or cisternography)

CONTRAINDICATIONS

- Local lumbar skin infection (absolute contraindication)
- Raised intracranial pressure (except pseudotumor cerebri)
- Supratentorial mass lesions (should be evaluated by CT scan first)
- Severe bleeding diathesis (relative contraindication)
- Platelet count less than 50,000/mm³

**EQUIPMENT**

Spinal tray (Fig. 141-1) containing:
- Skin swabs
- Povidone-iodine
- Alcohol swab
- Fenestrated drape and sterile gloves
- Manometer, three-way stopcock
- 1% lidocaine
- 3 cc syringe
- 20- and 25-gauge needle
- 20- or 22-gauge spinal needle, plus a spare
- Four numbered, capped test tubes
- Sterile dressing

**TECHNIQUE**

1. Position the patient near the edge of the bed or the examination table in the lateral recumbent or sitting position. Flex the spine anteriorly. Identify the L3 to L4 interspace at the level of the iliac crests. Lumbar puncture can be performed safely below the level of the conus medullaris, which can be as low as L2 to L3 (Figs. 141-2 and 141-3).

![FIG. 141-1.](image)
Lumbar puncture equipment tray.
2. Open the spinal puncture tray in a sterile manner. After donning sterile gloves, preassemble the manometer and attach a three-way stopcock. Set this to the side of the tray. Next, open the test tubes and place them in order in an upright position in the slots provided in the plastic tray.

3. Sterilely prepare the skin at the selected interspace, plus the one above and below, with an antiseptic solution such as povidone-iodine. Cover the area with a fenestrated drape.

4. Draw 3 cc of 1% lidocaine up into a syringe. Administer local anesthetic by raising a wheal in the skin with the lidocaine. Inject a small amount into the posterior spinous region.
5. Using the posterior spinous processes and the umbilicus as landmarks, insert a 22- or 20-gauge spinal needle through the skin. Angle the needle about 15 degrees cephalad toward the umbilicus, keeping it level with the sagittal midplane of the body (Figs. 141-4 and 141-5). If bone is encountered, withdraw the needle slightly and change its angle. Depending on the size of the patient, after the needle has advanced about 3 to 4 cm, stop, withdraw the stylus, and check the hub for fluid. If there is no fluid, replace the stylus and advance another fraction before repeating this again. Usually, there is a slight “pop” felt as the spinal needle penetrates the dura. Advance the needle 1 to 2 mm farther.

6. Once fluid is obtained, place the end of the stopcock with the attached manometer onto the hub of the needle. Have the patient straighten the legs and relax his or her position so as not to artificially elevate the opening pressure.

**FIG. 141-4.**
Proper angle for entering spinal canal. Needle is directed cephalad.

**FIG. 141-5.**
A drop in resistance will be felt as the needle penetrates the dura.
The cerebrospinal fluid will rise in the manometer to the opening pressure. Note the color of the fluid and the opening pressure.

7. Turn the stopcock to allow the cerebrospinal fluid to flow into the test tubes in order. Fill at least three test tubes with 2 to 3 cc of cerebrospinal fluid each. Label each tube in the order it was collected (Fig. 141-6).

8. Once you have obtained enough cerebrospinal fluid, replace the stylus and withdraw the needle.

9. Cover the puncture site with a sterile dressing. Have the patient turn to the supine position and remain there for the next 2 hours.

**Normal Cerebrospinal Fluid Values**

<table>
<thead>
<tr>
<th></th>
<th>Opening pressure</th>
<th>Elevated CSF pressure</th>
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<tbody>
<tr>
<td></td>
<td>50-200 mm H₂O</td>
<td>&gt;250 mm H₂O</td>
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<tr>
<td>WBC</td>
<td>&lt;5 /mm³</td>
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<tr>
<td>Glucose</td>
<td>60% to 70% of blood glucose</td>
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<tr>
<td>Protein</td>
<td>15 to 45 mg/dl</td>
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**Recommended Cerebrospinal Fluid Tests**

<table>
<thead>
<tr>
<th>Tube #1</th>
<th>Tube #2</th>
<th>Tube #3</th>
<th>Tube #4</th>
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<tbody>
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<tr>
<td>glucose</td>
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<td>cell count</td>
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<td>culture</td>
<td>differential</td>
<td>India ink⁺</td>
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<td>protein electrophoresis*</td>
<td>bacteria</td>
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<td></td>
<td>fungal*</td>
<td></td>
<td>Oligoclonal bands</td>
</tr>
<tr>
<td></td>
<td>TB⁺</td>
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<td>myelin basic protein</td>
</tr>
<tr>
<td></td>
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*If clinically indicated

**FIG. 141-6.**
Test tubes and assembled manometer for doing a lumbar puncture.
COMPLICATIONS

- Postlumbar puncture headache (10% to 25%) is usually self-limiting, lasting for only a few days, but may sometimes last longer. Spinal headache usually occurs 24 to 48 hours following dural puncture. The incidence is reduced when using a 20-gauge or smaller needle and having the patient remain at bed rest following the procedure. Epidural blood patch has been used since 1960 by anesthesiologists for refractory spinal headaches.
- Traumatic or "bloody" tap from inadvertent puncture of the spinal venous plexuses is possible. This is self-limiting in the majority of patients, but could lead to a spinal hematoma in those with bleeding disorders.
- Brain herniation from a supratentorial mass or extreme pressure is another complication. Always check the fundi first for papilledema. If a tumor, an intracranial bleed, or marked increased pressure is suspected, an emergency CT scan should be obtained first to reduce the chances of herniation.
- Shooting pains in the lower extremities are usually transient, but rarely last for more than a year.
- Local pain in the back may be due to injury of periosteum or spinal ligaments.
- Aspiration of nerve roots may be prevented by withdrawing the needle with the stylet in place.
- Meningitis as a result of the procedure is a theoretical complication.

CPT/BILLING CODES

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<td>Spinal puncture, lumbar, diagnostic</td>
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<tr>
<td>62272</td>
<td>Spinal puncture, therapeutic, for drainage of spinal fluid</td>
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BIBLIOGRAPHY