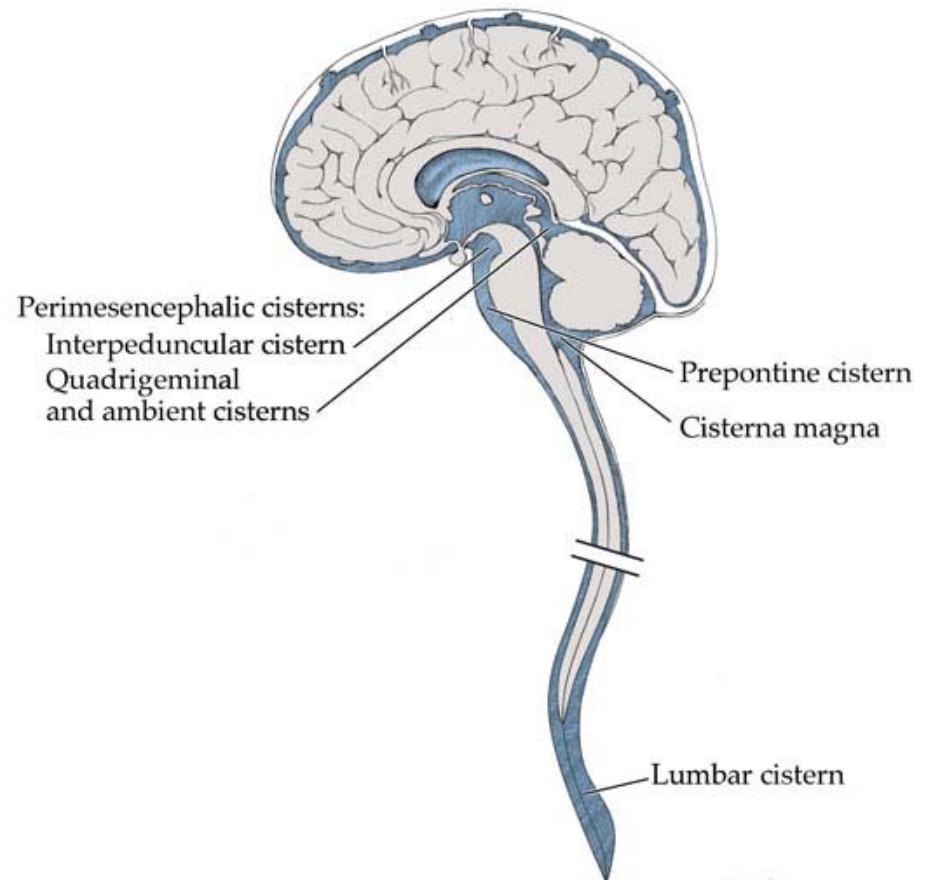


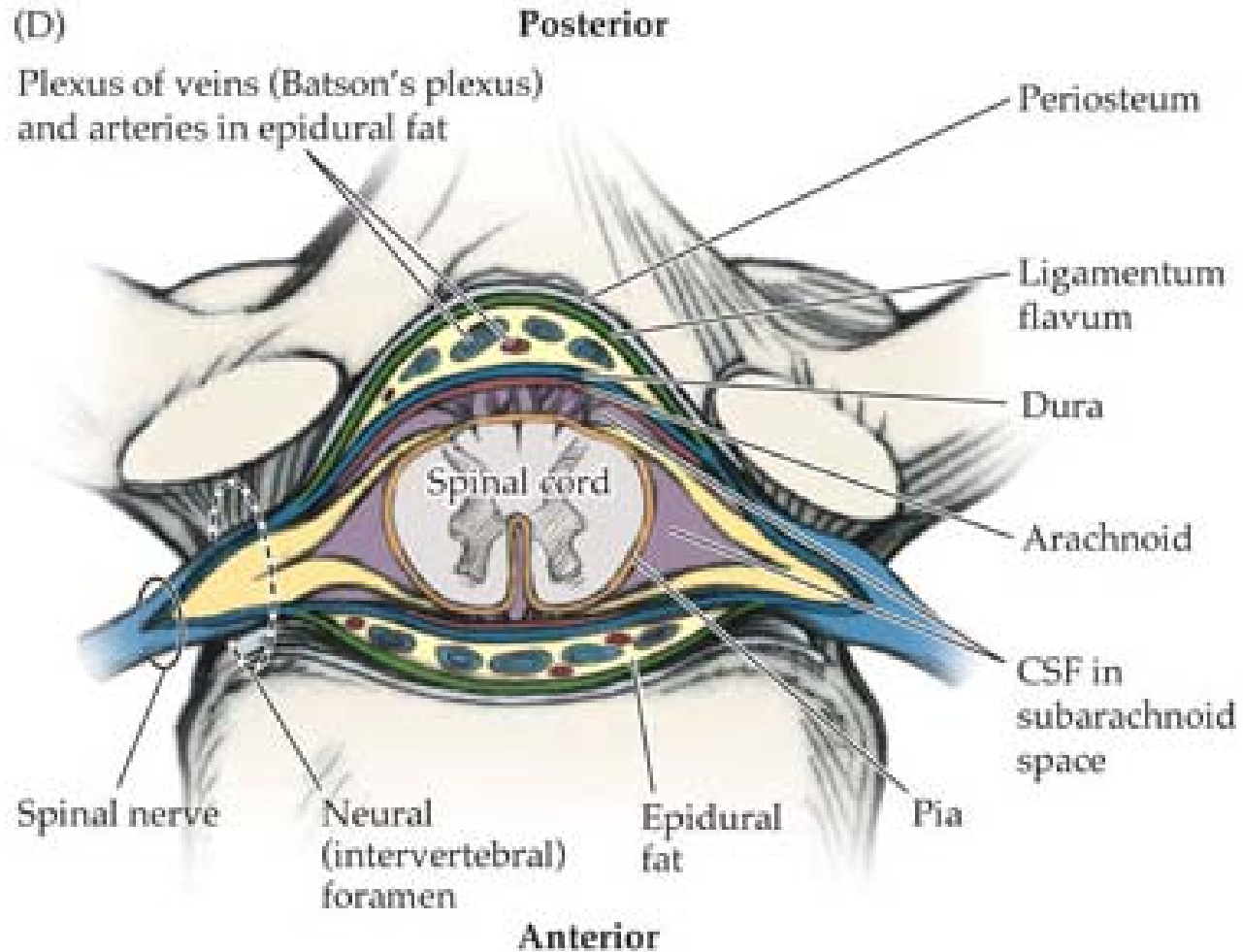
Lumbar Puncture

Anatomical Review

Lumbar cistern is site of
lumbar puncture for
removal of CSF sample
LC contains cauda equina



Anatomical review



Overview

- An LP (lumbar puncture) is an invasive diagnostic test, in which CSF (cerebrospinal fluid) is extracted for examination, and pressure of the spinal column is measured.
- The CSF is generally used to diagnose, or rule out such things as: primary or metastatic brain or spinal cord neoplasm, cerebral hemorrhage, meningitis, encephalitis, degenerative brain disease, autoimmune diseases of the central nervous system, demyelinating disorders (such as MS), neurosyphilis.
- An LP can also be used to inject therapeutic agents such as anesthesia (as in epidural) or chemotherapy. An LP can be used to introduce contrast media for a myelogram.
- The CSF that is withdrawn is evaluated for color, blood, cells, bacteria, malignant cells, glucose, protein, chloride, lactic dehydrogenase, lactic acid, and glutamine.

The Evaluation CSF	Normal Findings CSF	What abnormal findings <i>may</i> indicate
Pressure	Adults: Less than 200mm H2O Children: Less than 100 mm H2O	tumors, hydrocephalus, intracranial bleeding
Color	Clear and colorless	Cloudy-bacteria, WBCs Red-tinged--subarachnoid bleeding
Blood	None	Cerebral hemorrhage or Traumatic tap (inadvertent rupturing a blood vessel)
Cells	No Red blood cells, <5 lymphocytes/mm ²	Red blood cells--an indication of the amount of blood within the spinal canal, White blood cells--cerebral abscess, bacterial meningitis, viral meningitis, tubercular meningitis, encephalitis
Culture & Sensitivity	No organisms present	Bacterial or fungal infection

The Evaluation CSF	Normal Findings CSF	What abnormal findings <i>may</i> indicate
Protein	15 - 45 mg/dl up to 70mg/dl for elderly and children	Meningitis, encephalitis, myelitis, tumors, inflammatory processes
Glucose	50 - 75 mg/dl or 60 to 70% of blood glucose level	Meningitis, neoplasm
Chloride (not routinely evaluated)	700 - 750 mg/dl	Meningeal infections, tubercular meningitis
Lactic dehydrogenase	<2.0 - 7.2 U/ml	Bacterial meningitis, inflammation
Lactic acid	10 - 25 mg/dl	Bacterial or fungal meningitis
Cytology	No malignant cells	Tumors of brain or spinal cord
Glutamine	6 - 15 mg/dl	Hepatic encephalopathy, Reye's syndrome

Contraindications

- Patients with infections near the puncture site. Contamination from an infection could cause meningitis.
- Patients with increased intracranial pressure. Cerebral or cerebellar herniation could occur in these patients.
- Patients that have degenerative vertebral joint disease. It may be difficult to locate and pass a needle through the interspinal space.
- Coagulation defects and anticoagulant therapy are relative contraindications.
- Septicemia without CNS involvement.

Complications

- Severe headaches caused by CSF leakage.
- Meningitis from introducing bacteria into the CSF.
- Back or leg pain/paresthesia.
- Accidental puncture of the spinal cord.
- Accidental puncture of the aorta or vena cava, causing serious hemorrhage.
- Herniation of the brain. In a patient with increased pressure, the sudden decrease of pressure through the LP, could cause herniation of the brain--compression of the brain stem.

Prevention of Complications

- Post lumbar puncture headache occurs in 10% to 30% of patients within 1 to 3 days and lasts 2 to 7 days.
- The pain is relieved by lying flat.
- Treatment consists of bed rest and fluid with simple analgesics.

Prepare the patient

- Explain to the patient why the procedure is necessary.
- Explain the entire procedure to the patient
- Perform a *baseline* neurologic assessment of the patient.
- Document leg strength, movement and sensation.
- Question the patient about any complications

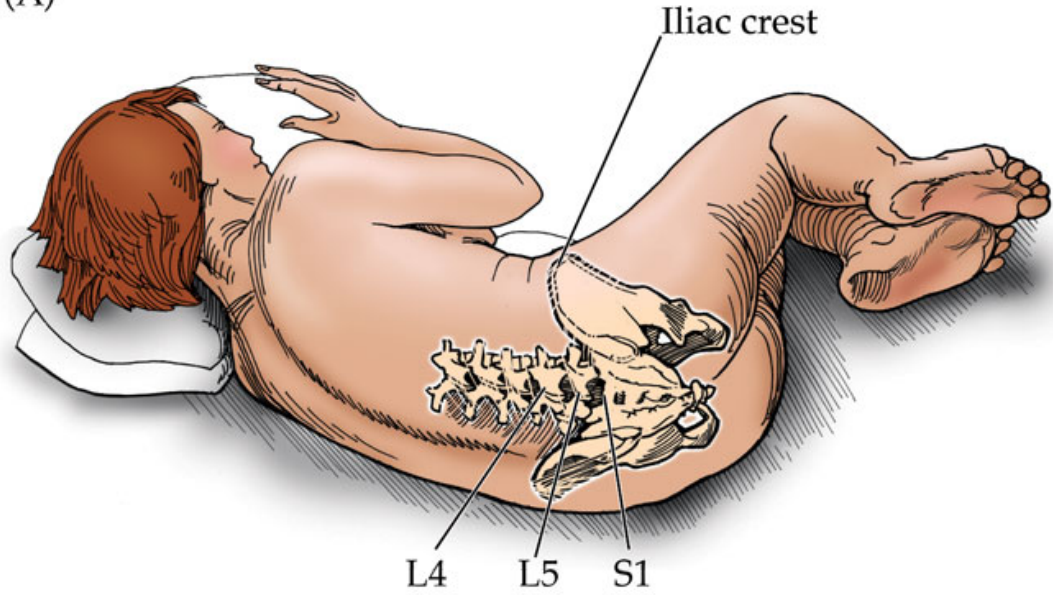
Prepare the Patient

- Answer any questions the patient might have concerning the procedure
- Encourage the patient to empty their bladder before the procedure.
- Explain to the patient that they should be prepared to lie very still during the procedure-- movement during the procedure may cause traumatic injury.
- Ask an assistant to stand on the opposite side of the patient from you to help maintain the patient's position

Procedure

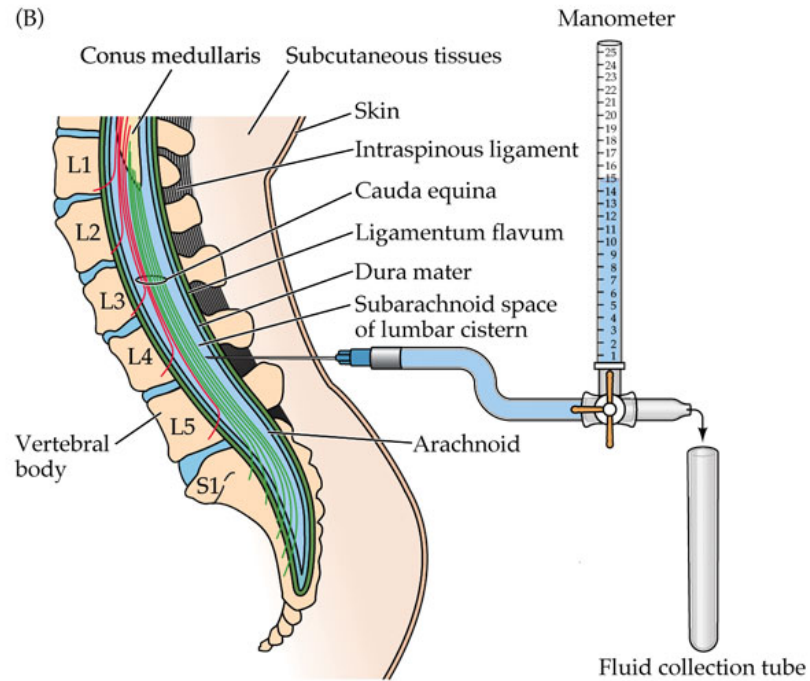
- Place the patient in the lateral decubitus position lying on the edge of the bed and facing away from operator.
- Place the patient in a knee-chest position with the neck flexed. The patient's head should rest on a pillow, so that the entire cranio-spinal axis is parallel to the bed.

(A)



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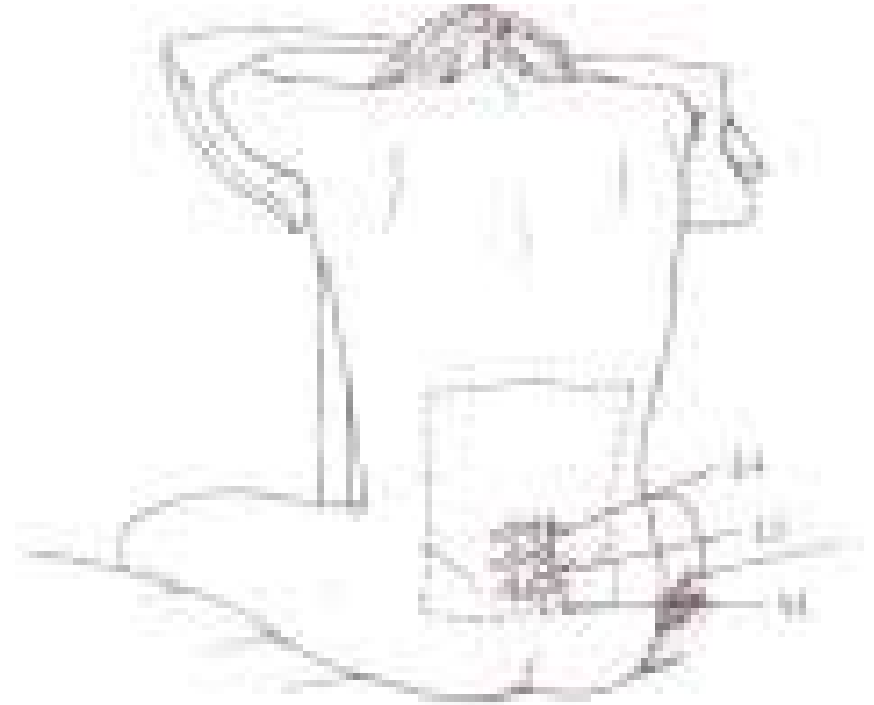
(B)



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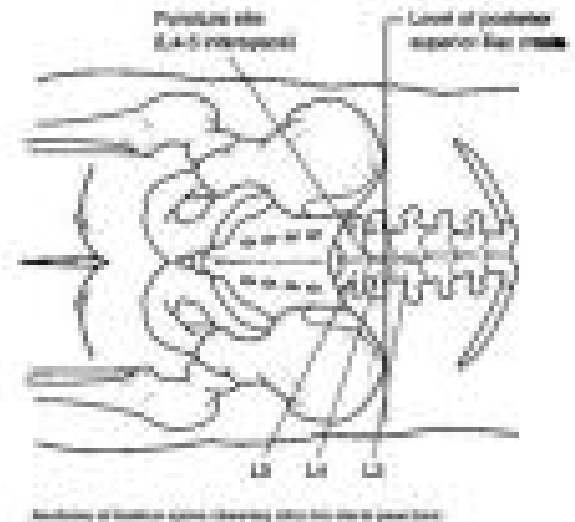
Procedure

- Sitting position is the second choice because there may be a greater risk of herniation and CSF pressure cannot be measured



Procedure

- Find the posterior iliac crest
- Palpate the L4 spinous process,
- Mark the spot.



Procedure

- Wash hands
- Open the LP tray
- Set up the lumbar puncture tray which should contain all necessary materials.

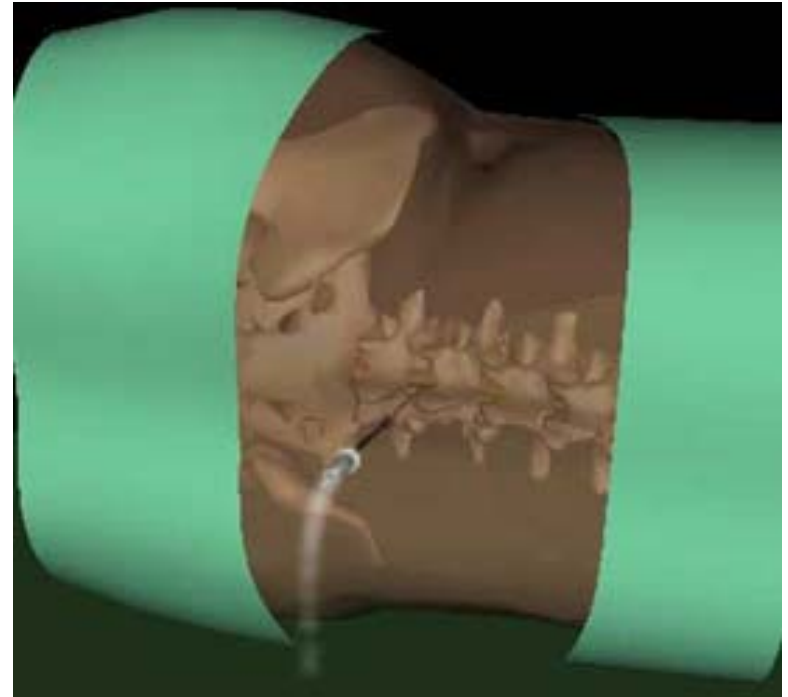


Materials in LP Tray

- Material for sterile technique (only gloves and mask are necessary)
- Spinal Needle, 20 and 22-gauge
- Manometer
- Three-way stopcock
- Sterile drapes
- 1% lidocaine without epinephrine in a 5-cc syringe with a 22 and 25 gauge needles
- Material for skin sterilization-povidine iodine
- Adhesive dressing
- Sponges - 10 X 10 cm
- Four tubes for fluid samples

Procedure

- Prepare the skin
- Starting at the spot and working outward in concentric circles.
- Swab the region in a spiral from the L4-5 interspace outwards until an area of approximately 20 cm in diameter has been covered with the povidine iodine
- Remove the last trace of povidine iodine with alcohol prior to the spinal tap
- Introduction of iodine into the subarachnoid space can produce irritative arachnoiditis

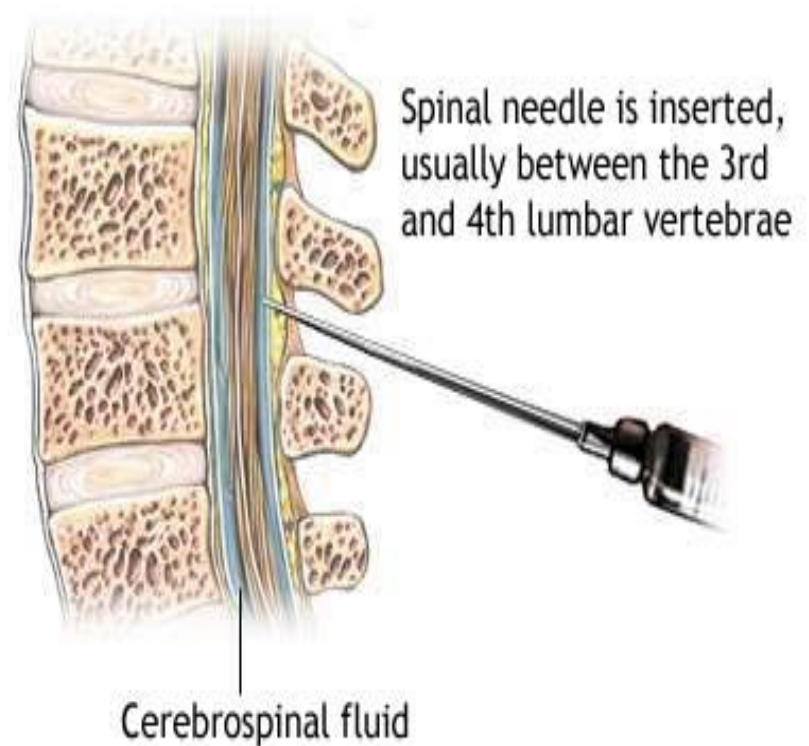


Procedure

- Drape the patient
- Anesthetize the skin using the 1% lidocaine in the 5 mL syringe with the 25-gauge needle.
- Change needle to 22 gauge. Insert the needle is exactly as in the act of performing a lumbar puncture and slowly infiltrate 1% lidocaine in the supraspinous and interspinous ligaments

Procedure

- Insert in the midline the LP needle with stylet parallel to the floor and the point directed toward the patient's umbilicus.

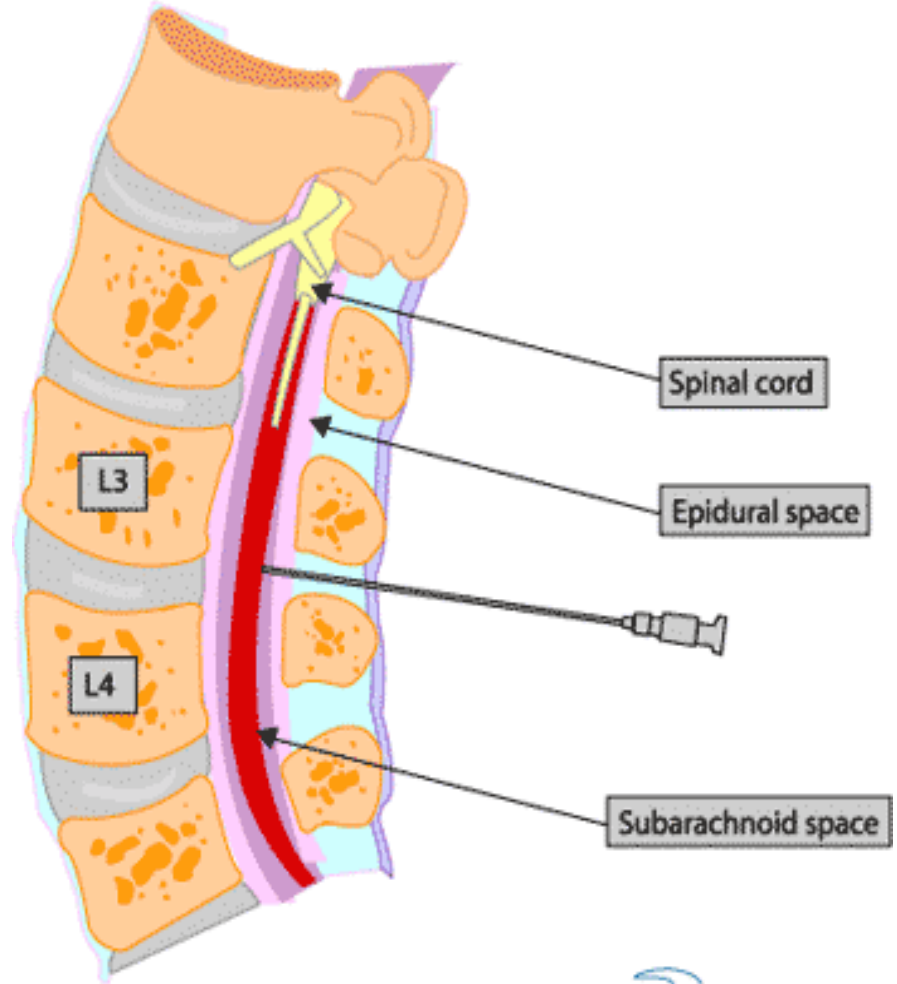


Procedure

- Advance slowly about 2 cm or until a "pop" (piercing a membrane of the dura) is heard. Then withdraw the stylet in every 2- to 3-mm advance of the needle to check for CSF return.
- If the needle meets the bone or if blood returns (hitting the venous plexus anterior to the spinal canal), withdraw to the skin and redirect the needle.

Procedure

- If CSF is not returned from the redirected needle try one disk space down
- Most errors are made by aiming the needle too far caudally, by being off the midline or if the needle is not precisely parallel to the ground.



Procedure

- When cerebrospinal fluid begins to flow from the needle, discard the first few drops.
- Do not aspirate cerebrospinal fluid, because a nerve root may be trapped against the needle and injured.
- If measuring pressures, the manometer is attached to the hub of the needle with a three-way stop-cock in the appropriate position.

Procedure

- A measurement of opening pressure should be attempted, unless the patient is so uncooperative as to invalidate the reading.
- Assure the patient is as relaxed as possible, breath holding and tension may drive CSF pressures up by 30, 40 or 50 mm.
- Check for good respiratory variation of the fluid level in the manometer to ensure that the needle is properly positioned.
- The patient's leg should be gently extended and the neck returned to a neutral position and supported as necessary with a pillow. An assistant will make these arrangements.

ICP

- Normal range is 80-180 mm H₂O, with small, visible excursions related to respiration and pulse.
- In cases of extremely high pressure (eg, 730 mm H₂O) the smallest sample possible (for the required testing) should be removed, followed by consideration of CSF pressure-lowering treatment, with continuous monitoring of the pressure until it decreases significantly.

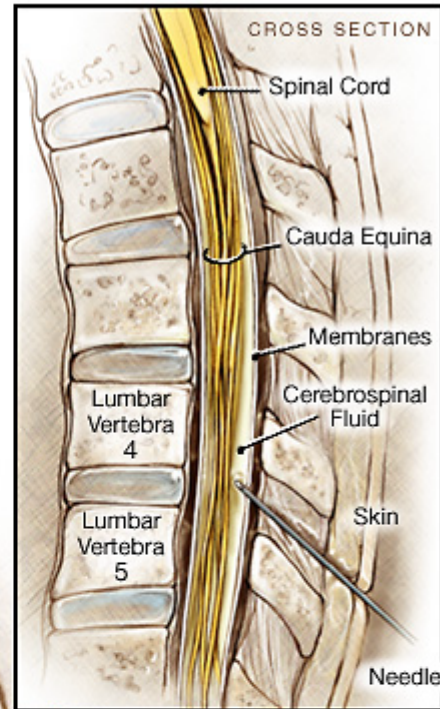
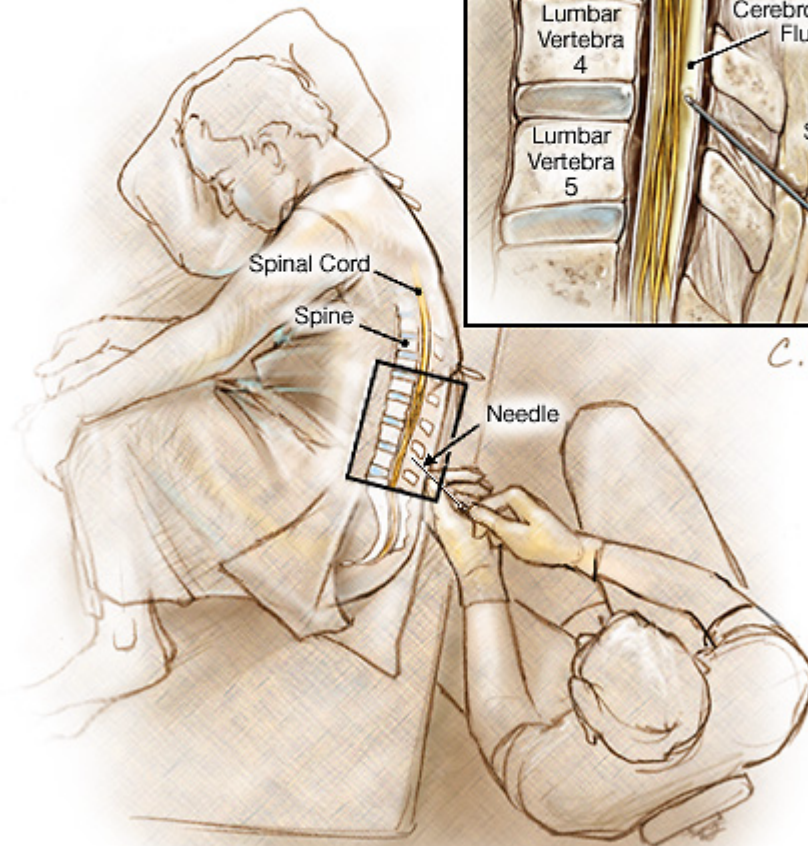
Increases in ICP

- Although radiographic screening identifies patients with intracranial mass lesions (with possible associated increased ICP), ICP increases may be due to cerebral edema secondary to causes such as infection, tumor cell infiltration, and benign intracranial hypertension.
- Detection of increased CSF pressure (ie, >220 mm H₂O) permits treatment (eg, mannitol, corticosteroids, hyperventilation) even before the etiology is identified.

Procedure

- Close stopcock to the manometer
- Open stopcock to allow 2 -10 cc of CSF to flow into each of the sterile tubes.
- Send the
 - first for glucose and protein,
 - second for Gram stain and culture and sensitivity (C&S),
 - third for cell count and differential, and
 - fourth tube, when indicated, is collected for viral titer or cultures, India ink preparation, Cryptococcus antigen, VDRL, or cytology

Lumbar Puncture
TOP VIEW



C. Lynn

Bloody specimen

- If the fluid appears to be bloody, several specimens should be collected. If the blood clears in successive tubes then the blood, at least in part, was traumatic in origin. Unfortunately, this sign is neither specific nor sensitive, as in some traumatic taps the amount of blood increases in subsequent tubes.

Closing Pressures

- Turn stop cock to open manometer
- Measure closing pressures prior to withdrawal of the needle.
- A large difference between the opening and closing pressure in the majority of instances suggest the presence of a partial or complete block

Procedure

- Withdraw the needle without replacing the stylet
- Dress the puncture site with a bandage.
Have the patient lie in bed for a few hours
- Document the procedure