Procedure: Lumbar Puncture

Indications:
- Autoimmune Disorder Evaluation
- Brain Cancer Evaluation
- Demyelinating (e.g., Multiple Sclerosis)
- Encephalitis
- Intrathecal Drug Administration
- Meningitis
- Neurosyphilis
- Normal Pressure Hydrocephalus
- Pseudotumor Cerebri (Idiopathic Intracranial Hypertension)
- Spinal Cord Neoplasm
- Subarachnoid Hemorrhage

Contraindications:
- Presences of increased intracranial pressure (ICP), regardless of cause, can increase risk of cerebral or cerebellar brainstem herniation at the level of the foramen magnum.
- Use of anticoagulants (e.g., warfarin, enoxaparin, etc) due to risks of epidural hematoma.
- Evidence of cellulitis or abscess over the area where LP would be performed due to risk of introducing infection into the subarachnoid space.
- Significant degenerative joint disease or prior back surgeries where hardware maybe in place (note: many of these patients may require an LP under fluoroscopy)

Complications:
The following are in order of most concerning to the least:
- Herniation of the brainstem
- Accidental puncture of the aorta or vena cava leading to retroperitoneal hematoma
- Accidental puncture of the spinal cord from being in wrong location
- Infection being introduced into the subarachnoid space
- Pain over the LP site
- Headache from CSF leak
  - Can worsen with sitting up or standing and if lasting longer than 1-2 days may require a blood patch in the area of the LP puncture site

Technique:

Before the Procedure:
- Verify that no contraindications exist.
  - This may include doing a CT head to rule out active bleeding, midline shift, space-occupying lesions or signs of brain swelling.
  - **EBM Topic:** Who needs a head CT prior to LP … *click here*
- Explain the procedure to the patient and answer all questions
- Obtain informed consent with appropriate documentation
- Do a baseline neurologic exam with special notation on the strength, sensation and ability to move extremities
- Place the necessary orders so that the CSF tubes can be labeled after the procedure is completed
- Wash hands, open the lumbar tray kit without compromising sterility and consider any extra supplies (i.e., spinal needles or extra tubes)

During the Procedure:
- Position the patient either in lateral decubitus in a fetal position or sitting up right leaning forward over a small table.
  - If opening pressures are indicated, the patient should start off in the lateral decubitus because they will need to straighten out to accurately measure the opening and closing pressure, which can be falsely increased with when pressure applied to the abdomen in a fetal position.
- Locate the L3/L4 space by locating the superior iliac crests and placing your thumbs midline to the spine. Palpate above and below to determine the widest space and attempt to mark location with the nail of your thumb or create a small indentation with something small.

- Aseptically clean the skin using chlorhexidine skin prep
  - Some clinicians will do this using the skin prep provided in the LP tray once they have their sterile gloves on
  - **EBM Topic:** Chlorhexidine vs. povidone-iodine (Betadine) in procedures … *click here*
- Put on sterile gloves, facemask, and protective gear per institutional policy
- Finish setting the LP tray including opening the CSF tubes in preparation to be easily accessed, and apply the sterile drapes to the patient
- Draw up and inject 10 mL of 1% or 2% lidocaine (preservative free; without epinephrine) to the area
  - Consider injecting some anesthetic a level above or below this area in case an adjustment is needed
- Insert the spinal needle in a slight cephalad angle towards the umbilicus and with the bevel of the needle oriented to the longitudinal fibers in attempt to avoid cutting the fibers and instead separate them.
  - If the patient is lying in lateral decubitus position the bevel should be oriented up
  - If the patient is sitting up right and leaning forward the bevel should be oriented to the left or right
- The entry into the subarachnoid space is commonly described as feeling a "pop" sensation, the needle insert (obturator) is then removed and CSF should begin to drip out
- Have the patient slowly stretch out legs (if in lying in lateral decubitus)
- Attach the sterile manometer to the end of the spinal needle to measure the opening pressure
  - Normal opening pressures: < 20 cm H_2O
  - Measuring opening pressures are very important for evaluation for cryptococcal meningitis or pseudomembrane cerebri
  - If blockage of CSF flow to the spinal subarachnoid space is suspected, the clinician may perform a Queckenstedt-Stookey test
- Empty the manometer into CSF tube #1 and about 10 drops of CSF into tubes #2 – 4 (note: some institutions use only 3 tubes)
- Measure the closing pressure (if indicated)
- Reinsert the needle insert (obturator) and withdraw the spinal needle and immediately apply pressure and an adhesive bandage over the insertion site

After the Procedure:

- Have the patient lay flat for at least 1 hour to prevent the risk of post-LP headache.
  - Many patient can lay in supine position and rotate side to side but without elevating the head
  - Some clinicians will have the patient lay prone with a pillow under the abdomen to increase the pressure on the tissues around the area of the LP to prevent CSF leaking.
- Encourage and counsel the patient to drink extra fluids to help replace the CSF drained off and prevent a headache (or give the patient IV fluids if warranted)
- Immediately label the CSF tubes have the tubes hand carried/delivered to the lab for analysis
- If meningitis is suspected, initiate empiric antibiotics with or without steroids based on the clinical scenario
- Repeat neurologic assessment to evaluate for any changes post-LP
- Document the procedure, number of attempts, opening and closing pressure (if applicable), total amount of CSF drained

Counseling Points for Patient:

- Before the procedure, no fasting needed
- During the procedure, encourage the patient to not move and try to remain calm
- After the procedure, encourage fluid intake to prevent headache and consider resting and lying flat for first 12 hours to help prevent possible headaches while things heal