Lumbar Puncture and Myelogram Guidelines + Helpful Hints

(Revised October 2011)

Before the procedure (lumbar puncture or myelogram):

1. Ensure that the patient’s laboratory values (PT, APTT, INR, platelets) are within normal limits and that the patient has held any anticoagulant medications (i.e., Coumadin, Lovenox, Pradaxa, heparin, etc.) or medications which may lower the seizure threshold (i.e., MAOIs, TCAs, phenothiazines). Check the PDR if unsure whether a medication lowers the seizure threshold.

2. Lab value parameters:  PT (normal 10-12); <15 is acceptable.  INR must be <1.2.  Platelets (normal 150,000-450,000); > 50,000 is acceptable.  Transfuse platelets if < 50,000.  Transfusions are especially common in patients receiving intrathecal chemotherapy.

3. Ensure that informed consent is documented in the patient’s chart.  Consent may include the following:
   a. A mentally competent patient on whom the procedure is being performed, OR
   b. An immediate family member (spouse, son, daughter, etc.), OR
   c. Two physicians document in the chart that the procedure is medically necessary.

4. Ensure that the risks and benefits of the procedure are explained in full detail to the patient and/or his or her family member(s) (i.e., whoever is providing written consent).

5. Before the procedure begins, explain to the patient and/or his or her family member(s) that the patient is to lie in a seated, reclined, or supine position for the remainder of the day.  No strenuous exercise or heavy lifting is to be performed over the next 24 hours.  The patient may eat and/or get up to use the restroom, but otherwise should recline for the rest of the day (regardless of the time that the procedure is being performed).  Normal activities may be resumed the following day.  The patient should also be told to drink plenty of fluids, including caffeinated beverages.  Caffeine is thought to help close dural hole made from the lumbar puncture.  This information should be repeated to the patient after the procedure to assist in preventing a spinal headache.  This is especially important with outpatients.  The patient should be told to go to the emergency room if he or she experiences any signs/symptoms of meningitis (fever, severe headache with stiff neck).

6. Always introduce yourself to the patient and perform a time-out before the procedure begins.

7. Obtain prior MR, CT, plain film and myelogram images and reports.  It is important to look at the old films prior to starting the procedure.  Determine the level of the suspected pathology; usually you should avoid placing the needle at this level.  Exclude tethered cord or low-lying conus medullaris.  Count ribs from chest x-rays and/or prior myelogram procedures if available.

How to Perform a Lumbar Puncture:

1. There are approximately five primary reasons for performing a lumbar puncture:
   a. Clinical suspicion for infection (meningitis)
   b. Clinical suspicion for multiple sclerosis
   c. As a route of access for a myelogram
   d. Large volume spinal tap performed for clinical suspicion of normal pressure hydrocephalus (20 – 30 cc taken off)
e. Intrathecal chemotherapy administration (i.e., methotrexate)

2. First and foremost, **position the patient.** If the patient is positioned correctly, access to the subarachnoid space is much easier to obtain. Under fluoroscopy, have the patient turn his or her hips so that he or she is in an oblique position. Lateral rotation is achieved by bending the knee and turning the leg outward on the side of desired needle placement. The opposite leg is kept straight. This rotates the spine by a minimal amount (approximately 10 degrees), and is called the “oblique parasagittal technique.”

3. The oblique parasagittal technique is performed by inserting the needle just lateral to the spinous process, below the inferior margin of the upper lamina. The target “hole” is a lucent focus.

4. Under fluoroscopy, locate the L2 – L3 disk interspace. An easy way to locate this space is to count down from the 12th rib. Oblique the patient such that an open space becomes visible directly inferior to the lamina and just lateral to the spinous process of L2. In general, you should always start at the L2 – L3 interspace unless the patient has had lumbar spinal surgery in this area or there is a cutaneous abnormality overlying this disk interspace. Other levels that may be attempted include L3 – L4 or L4 – L5. However, the lower in the spine, the more degenerative the spine becomes and the harder it is to access the thecal sac (subarachnoid space).

5. Once the patient is in the correct position, ensure that he or she is able to stay in this position comfortably for approximately 20 – 30 minutes (the time it takes to collect ~8 cc cerebrospinal fluid). If the patient says “yes,” you may proceed. Mark the cutaneous overlying skin utilizing a “paper clip wand” and a permanent marker.

6. Clean the patient’s lower lumbar area with the provided Betadine solution. Clean a large area in case you need to attempt the lumbar puncture at multiple levels.

7. Allow the Betadine to dry, and then place a sterile drape over the patient’s back.

8. Draw up Lidocaine from the sterile bottles provided by the fluoroscopy technician using the appropriate thicker “drawing up” needle.

9. Switch to the thinner lidocaine injection needle. First, make a large skin wheal in the location of the skin marking, and then penetrate the deeper tissues, making sure to draw back as you inject (this is to prevent injecting lidocaine into the small surrounding vessels).

10. Once the patient’s lower back is anesthetized, use a 22 gauge Whitacre needle (an atraumatic, non-cutting needle) to approach the thecal sac (subarachnoid space). In more difficult patients (obese, post-surgical, or with extensive degenerative changes), use a 22 gauge regular cutting needle. Initially place the needle about 2 cm deep, enough to stabilize the position so that it does not flop to the side. Readjust the needle start position until the fluoro beam looks "down the barrel". The needle has a plastic hub. When the needle is correctly positioned it should appear to be a dense “target sign.” Once the correct start position has been achieved, advance the needle in small increments and intermittently check the needle position using fluoroscopy. You should feel a small “pop” as you travel through spinal ligaments and into the thecal sac. With time, you will easily be able to differentiate between hitting ligament and hitting bone. Once you think you have entered the thecal sac, it is usually helpful to tilt the table upwards (approximately 30 degrees) so that the column of cerebrospinal fluid rises above the hub of the needle. If you still do not get CSF return, you can have the patient cough or “bear down” to facilitate CSF flow.

11. Upon return of cerebrospinal fluid, some physicians will require that an opening pressure be measured with a manometer. You can do this in one of two ways:
a. Leave the patient in the prone position. Place the manometer directly over the needle hub and observe the CSF traveling up the manometer until it stops. To accurately measure the pressure from the prone position, add the reading on the manometer to the length of the needle in centimeters. For example, for a 3.5 inch needle (which is ~11 cm), you would add 11 to the manometer reading.

b. A more accurate (but potentially more difficult) method for measuring cerebrospinal pressure is to turn the patient on his or her side and attach the stopcock to the manometer. Measure the pressure by opening the stopcock so that CSF may flow into the manometer. No addition of the needle length is needed if using this method.

12. Before collecting CSF, take an overhead fluoroscopy picture while the spinal needle is still in. Remember to cone the field of view down but make sure that the vertebral level is identifiable.

13. After measuring cerebrospinal pressure, collect approximately 8 cc of CSF into four labeled collection tubes. This is made easier by hooking up the provided tubing to the hub of the needle while the patient is in the prone position.

14. If chemotherapy is being administered, inject the chemotherapy directly into the needle hub (without connection tubing) SLOWLY over 3 – 4 minutes. All chemotherapy trash must be dispensed into a special yellow chemotherapy trash can.

15. Though it may be tempting, DO NOT use a syringe to draw fluid into the collection tubes. This could potentially suck up small nerve roots and result in spinal nerve root damage.

16. Once you are finished collecting cerebrospinal fluid, replace the stylet and remove the needle from the patient’s lower spine.

17. Cover with a bandage (though patients will hardly ever bleed upon needle removal).

18. Write a procedure note in the chart, and make sure that the cerebrospinal pressure is documented if ordered by the clinician. A procedure note must also be dictated on PACS/RIS.

**How to Perform a Myelogram:**

1. Myelography refers to the examination of the contents of the thecal sac after administration of intrathecal radiographic contrast. The examination is done with both plain films (both fluoroscopic and overhead images) and CT.

2. This examination is typically performed to assess for HNP, spinal stenosis, and arachnoiditis. It is less often used to determine the level of spinal cord compression from metastatic disease or trauma. Myelography can usually provide more detail about the bony structures than can MRI. However, MRI is an alternative procedure.

3. Follow the same procedure guidelines as if you were performing a lumbar puncture.

4. There are several reasons for performing a myelogram:
   a. Detect pathology of the spinal cord, including spinal cord injury, cysts, or tumors
   b. Detect and define location for the compression of spinal nerve roots to explain patient’s symptoms
   c. Myelograms are often, but not exclusively, obtained in patients who cannot get an MRI (pacemaker, severe claustrophobia, etc.)

5. Notable differences for the myelogram procedure include:
   a. Use a 25 gauge cutting needle. If the patient is either obese or morbidly obese, this small and somewhat flimsy needle will likely bend. A 22 gauge needle may be required.
b. Instead of removing fluid, non-ionic contrast is injected into the thecal sac (subarachnoid space).
c. The non-ionic contrast is injected slowly into the thecal sac. As you inject, intermittently tap the fluoroscopy pedal to monitor where the contrast is flowing. Ensure that there is adequate mixing of contrast and that the contrast is traveling to the bottom of the thecal sac. Also, make sure that you can visualize the nerve roots and that the contrast is flowing centrally rather than peripherally around the injection site. These characteristics help to ensure that you are in the subarachnoid space rather than the subdural space.
d. A subdural collection will pool around the injection site rather than traveling to the bottom of the thecal sac.
e. A split subdural-subarachnoid injection is possible. In this situation, part of the contrast would collect at the bottom of the thecal sac and another part would pool around the injection site.
f. If you recognize that you have performed either a subdural injection or a split subdural-subarachnoid injection, adjust your needle (probably need to advance by a few millimeters) so that it enters the subarachnoid space and that you get good return/flow of CSF.

6. Cervical Myelogram Pictures:
   a. Injection is within the lumbar spine, as above.
   b. Injection is facilitated with the more concentrated version of non-ionic contrast, Isovue – 300.
   c. 10 cc are injected slowly, after which a fluoroscopic picture of the lumbar spine should be taken.
   d. After the injection has finished, the stylet is replaced and the needle removed. The table is tilted so that the patient’s head is facing downwards. The patient holds onto handles attached to the table and both of the patient’s feet are strapped to the table (the techs help with this). This downward tilting facilitates the movement of contrast from the lumbar spine into the cervical spine. The table should be brought back to a neutral position when a “blush” of contrast is seen entering the patient’s cervical region. You want to prevent the contrast from moving intracranially, as this will promote a severe headache.
   e. After the contrast has entered the cervical region, the following pictures are obtained of the cervical spine (by moving the patient’s head to the right or left):
      i. Neutral
      ii. Shallow right oblique
      iii. Steep left oblique
      iv. Shallow left oblique
      v. Steep left oblique
   f. When performing a cervical myelogram, take great care when extending the patient's neck. Prolonged extension or over-extension of the neck in a patient with a high-grade cervical canal stenosis may result in permanent spinal cord damage, and possibly quadriplegia. Obtain and review any previous imaging studies prior to performing the procedure.

7. Lumbar Myelogram Pictures:
   a. Do not strap the patient’s feet to the table for a lumbar myelogram.
b. Injection is facilitated with the less concentrated version of non-ionic contrast, Isovue – 200M.
c. 12 cc are injected slowly, after which a fluoroscopic picture of the lumbar spine should be taken.
d. After the injection is finished, the stylet is replaced and the needle removed. The table is tilted such that the patient ends up in a standing position (there is a platform at the “foot” end of the table). At this time, the following pictures are taken of the lumbar spine:
i. AP or frontal view while standing straight
ii. Lateral spine, standing straight
iii. Flexion, standing straight
iv. Extension, standing straight
e. The table is then brought back to a neutral position, and the following pictures are taken of the lumbar spine:
i. Neutral prone position
ii. Shallow right oblique
iii. Steep right oblique
iv. Shallow left oblique
v. Steep left oblique

8. Hints for Good Myelogram Pictures:
   a. All pictures should be taken such that they are “coned down” but still allow good visualization of the vertebral structures and nerve roots.
   b. All pictures should be taken such that the vertebral level can be identified (do not magnify in too much).

9. NOTE: Make sure to keep a log of your procedures on New Innovations. It is generally a good idea to save stickers from all procedures that you perform (this includes all radiological bases – not just on the Myelo rotation.)

10. Make sure to write a note in the chart AND dictate the study in RIS/PACS.

11. Post dural spinal headache treatment – Occur in 1-30% of patients following a lumbar puncture/myelogram procedure. It is more common in younger patients and up to twice as common in women. The use of Whitacre needle and smaller gauge needles (i.e., 25 gauge needles) can significantly reduce the risk of a post dural spinal headache. Treatment should one occur includes 1) bedrest, 2) analgesics such as Aspirin, ibuprofen, and acetaminophen, 3) caffeine 300 mg po, 4) hydration. If headache lasts for more than 48 hours, an epidural blood patch may be necessary. EBPs are 85-90% effective after the first patch and 95-98% effective after the second patch. Before considering placement of a blood patch, it is very important to ensure that the patient’s headache is not consistent with an infectious process, i.e., meningitis.