American Society of Neuroradiology  
Practice Audit Survey Discussion Points – Module B

1. **Was there a proper indication for the procedure?**

   Common indications for lumbar puncture include: headache with or without fever, suspected CNS infection or leptomeningeal metastasis, suspected subarachnoid hemorrhage, meningeal signs, altered mental status, CNS malignancy with need for intrathecal chemotherapy, idiopathic intracranial hypertension and normal pressure hydrocephalus. Failure rate of bedside lumbar punctures (BLP) is estimated to be between 16-36% [1]. Traditionally, fluoroscopic-guided lumbar puncture (FGLP) is performed only after failed bedside attempt by a trained clinician. Depending on the clinical situation, BLP may not be feasible and a direct referral to radiology may be considered in challenging cases including morbid obesity, cerebral palsy, prior spinal surgery, the presence of orthopedic hardware and severe scoliosis.

2. **Did you review the patient’s medical history and labs?**

   Once an appropriate indication is confirmed, a full evaluation of the patient’s past medical history is necessary to properly evaluate the risks and benefits for lumbar puncture.

   **Allergies**
   Although rare, allergies to equipment (Latex gloves) or medication (including Versed, Benadryl and/or lidocaine) should be excluded prior to the procedure. Decreasing the usage of non-essential medications, such as sedation, will theoretically decrease the incidence of idiopathic allergic reactions.

   **Pregnancy**
   Radiologic interventions involving direct radiation exposure to the female pelvis requires pregnancy status as part of the required history. Screening for pregnancy status may include a pregnancy test [2, 3], verbal screening [4], written documentation and consent prior to the procedure [5]. If the patient is pregnant, all attempts at performing the lumbar puncture without ionizing radiation should be attempted. Further discussion on potential radiation risks to the fetus are described in the ACR-SPR PRACTICE PARAMETERS referenced below.

   **Bleeding risk**
   Any coagulopathies, anticoagulation or antiplatelet medication use should be fully excluded to prevent the development of hematoma. Clotting abnormalities should be corrected before performing lumbar puncture [6]. Guidelines regarding performing lumbar punctures in the anticoagulated patient are described by the
ASRA Consensus Conference on Neuraxial Anesthesia and Anticoagulation [7]. Specific contraindications for performing a lumbar puncture include:

- Platelet count <40-50 x10⁹/L
- INR >1.5
- Local skin infection
- Local developmental abnormality (ex: myelomeningocele)

Current Medications
Medications used in anticoagulation therapy should be evaluated prior to the procedure. Any decision to temporarily hold a medication should be discussed with the physician who prescribed the medication [8].

Past Medical History
Developmental abnormalities at the site of puncture may preclude preforming FGLP. Congenital abnormalities such as myelomeningoceles have high rate of tethered spinal cord and would have a higher risk of complications during a FGLP [9]. Procedure time and difficulty increases in the presence of spinal fusion hardware, bony hypertrophy, scarring, fibrosis, laminectomy, obesity, epidural lipomatosis, lumbar drain and venous congestion [10].

3. Did you instruct the patient to temporarily discontinue any medications prior to the procedure?

Epidural, subdural or subarachnoid hemorrhage is a rare but potentially devastating complication of lumbar puncture. Studies have shown that aspirin is not a risk factor for development of bleeding after lumbar puncture. Risk of potential heart attack or stroke should be balanced against low risk of bleeding (Category IIB). If the risks of discontinuing the anticoagulation therapy is greater than the risk of bleeding from lumbar puncture, consider bridging with intravenous heparin [8]. No randomized controlled trials have evaluated stopping heparin or warfarin before lumbar puncture. Coumadin is generally stopped 5-7 days before LP. Guidelines suggest stopping low-molecular weight heparin 12-24 hours before spinal procedures (Category IIB) [6]. LMWH should not be administered within 24 hours following the procedure. Specific recommendations for discontinuing anticoagulant medications prior to LP are described further in Table 1 in the article “Recommendation for Anticoagulated Patients Undergoing Image-Guided Spinal Procedures” [11].

4. Did you review the patient’s prior available imaging (including cranial or spine imaging)?

Prior to lumbar puncture, review of prior pertinent imaging studies (cranial/spinal radiographs, CT or MRI) is desirable, when available, to evaluate for any potential contraindication to lumbar puncture [8]. Although practice parameters have been established for myelography, identification of potential contraindications for lumbar
Puncture is essentially the same (see below). A review of the medical record, including any prior medical imaging, prior to any procedure demonstrates due diligence. When available, it is prudent to identify the positioning of the conus medularis and assess for lumbar stenosis, scoliosis, operative hardware, intracranial masses or imaging findings of impending herniation [8, 12].

Gower et al[13] suggest that lumbar puncture is contraindicated by imaging when there is:

1) CT evidence of unequal pressures across the midline (lateral shift of midline structures)

2) CT evidence of unequal pressure between the supratentorial and infratentorial compartments (herniation of structures through tentorial incisura or foramen magnum)

Despite these suggested contraindications, the presence of a normal head CT does not reliably mean a LP is safe [12]

5. Did you require imaging prior to performing the lumbar puncture?

Although routinely reviewing available imaging of the brain and spine prior to performing lumbar puncture is useful for identifying contraindications, a normal CT of the head does not mean an LP is safe [12]. Clinical exam is not perfect either, as brain herniation or midline shift may have a normal neurologic examination [14].

In some cases, imaging prior to LP may significantly delay antibiotic therapy and is associated with adverse outcomes [6]. In the setting of acute bacterial meningitis, herniation has been strongly associated with LP and usually occurs shortly after [12]. Additionally, herniation after LP may be a gradual process from slow CSF leak or cerebral vascular congestion and edema. Opinions regarding the necessity of cranial imaging prior to lumbar puncture (LP) in adults have changed recently to favor risk stratification rather than absolute indication. If certain clinical signs and symptoms are absent, then LP can be safely performed without pre-procedure imaging [6, 9, 12, 13, 15, 16]. A CT of the head is recommended prior to lumbar puncture for patients with:

- New onset seizures
- Immunocompromised state
- History of CNS mass lesion
- Signs of space-occupying lesion (focal deficits or papilledema)
- Moderate to severe impairment of consciousness
- Dilated or fixed pupils
- Decorticate or decerebrate posturing or hemiparesis
- Papilledema
- Respiratory abnormalities
Again, although a CT of the head can be useful to identifying gross contraindications to LP, a normal CT scan does not necessarily mean an LP is safe [12]. The above listed clinical signs of “impending” herniation are the best predictors of when to delay or avoid an LP [12]. The ultimate decision for performing a lumbar puncture should be made on a case-by-case basis after discussion with referring clinicians.

In cases of elevated intracranial pressures within the entire CNS, such as idiopathic intracranial hypertension, there are no internal pressure gradients and thus lumbar puncture is safe to perform [9].

6. **Did you document the following parameters in your procedure report?**

   Based on ACR-SIR recommendations for procedure reporting [17], the report should contain the following information:
   1. Procedure
   2. Date
   3. Indication
   4. Anesthesia/Sedation
   5. Procedure/technique – Should include access site, imaging guidance modality, needles used and hemostasis.
   6. Estimated radiation dose
   7. Opening pressures (when requested by clinician)
   8. Findings
   9. Complications
   10. Post-procedure disposition

7. **How long did you observe the patient after the procedure?**

   No post-procedure observation is necessary in LP despite 95% of radiologists restricting activity to bed rest in a recent survey [18]. The patient is able to resume normal activities after uncomplicated LP and bed rest is no longer recommended [6]. A 2013 meta-analysis failed to find significant reduction in post-LP headache among patients given bed rest regardless of position or duration [19]. Although rare, clinical follow-up for delayed skin reactions is indicated in patients who received greater than 60 minutes in fluoroscopic time [20].

8. **What discharge instructions did you provide for the patient?**

   Information and instructions should be provided at discharge regarding:
   a. Wound care
   b. Activity/limitations
   c. Diet
   d. Medications
   e. Contact information
f. Warning signs

Duration of keeping LP site clean and dry is subject to institutional policies. Avoiding lifting and strenuous activity is generally recommended following FGLP for 24 hours. The patient may immediately return to a regular diet unless the patient has been sedated.

Prescribed medications can be restarted but is at discretion of the radiologist. Briefly, intravenous heparin should not be administered for 1 hour following the procedure and LMWH should be avoided for 18-24 hours. Also, thrombolytic drugs avoidance is recommended for 10 days following lumbar puncture. Specifics recommendations regarding restarting anticoagulation therapy can be found in “Recommendation for Anticoagulated Patients Undergoing Image-Guided Spinal Procedures” [11] however consider consultation with a qualified pharmacologist for specific questions.

Contact information and telephone numbers should be provided on discharge documentation.

Information regarding when contact a physician or seek help at emergency department should be included in the discharge instructions. Warning signs of complications include but are not limited to:

a. Severe pain in back or legs
b. Excessive bleeding from lumbar puncture site
c. Fever greater than 101°F
d. Headaches lasting > 24-48 hours
e. New numbness and tingling in legs

Post-LP headache should be described to the patient as an expected side-effect, but they should be advised to follow-up if disabling or if persistent beyond a few days. Although rare, the patient should also be advised to immediately follow-up if there are signs of infection at the puncture site. A joint initiative between the ACR and RSNA, RadiologyInfo.org has a layperson description of post-LP complications, as well as information about the procedure in general. Patients may find this information useful after discharge (http://www.radiologyinfo.org/en/info.cfm?pg=SpinalTap).
REFERENCES


