Chapter 5

Lumbar Puncture

Dr Chandra Vaidyanath

Cerebrospinal fluid (CSF) is a body fluid found in the subarachnoid space. Lumbar puncture is a procedure performed using a spinal needle which is inserted through the interspinous area into the subarachnoid space to obtain CSF for analysis or to inject drugs into the subarachnoid space. It can also be used to record CSF pressure and very rarely as a treatment to relieve increased intracranial pressure.

Applied Anatomy:

The most important anatomical landmark is inter-cristal line or Tuffier's line. This is the line drawn by joining the iliac crests on either side. It would roughly correspond to the interspace between 3rd and 4th lumbar spines. The spinal cord commonly terminates at the level of L1/L2 lumbar spinemin adults and at the level of L3 in infants. Thus it would be safe to approach the subarachnoid space below this level as the possibility of causing spinal cord damage less likely. The subarachnoid space ends at S2 in adults and lies further lower in children.

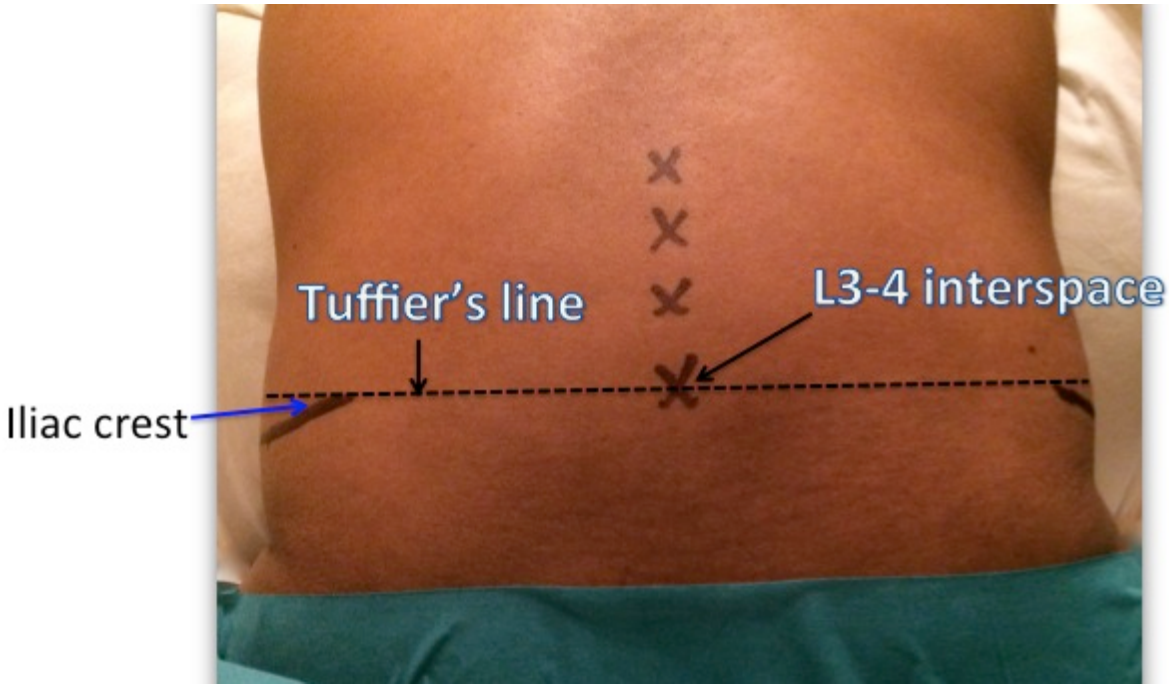

Figure1: Tuffier's line: Line joining the iliac crests on either side

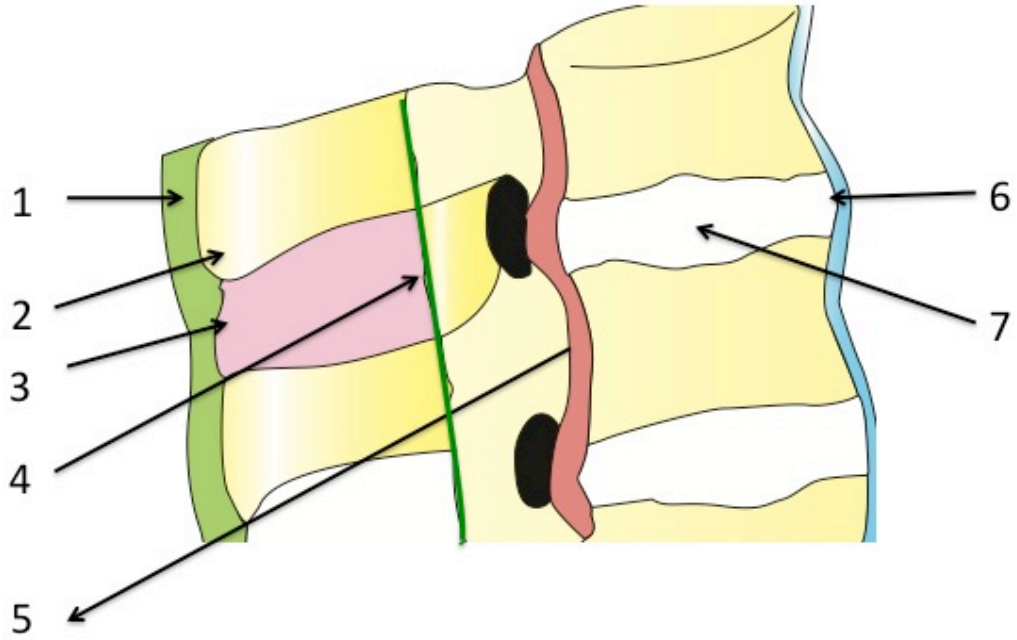

Figure 2: Sagital section demonstrating the anatomical structures.
1.Suprasoinous ligament, 2. Spinous process, 3. Inter-spinous ligament, 4. Ligamentum flavum, 5. Anterior longitudinal ligament, 6. Posterior longitudinal ligament. 7, Inter-vertebral disc.

Figure 3: MRI scan demonstrates the termination of spinal cord

1.Termination of spinal cord, 2. L1 vertebral body, 3. L5 vertebral body

Indications

Indications for lumbar puncture can be broadly classified into diagnostic and therapeutic. In an acutely ill patient, lumbar puncture may be performed as an urgent procedure to help in the diagnosis of meningitis.

Diagnostic

Urgent	Clinical suspicion of meningitis (bacterial, viral or fungal) Subarachnoid haemorrhage in the presence of a negative CT scan
Semi-urgent	Idiopathic intracranial hypertension Meningitis Syphilis Para neoplastic syndromes Guillain-Barre syndrome Multiple sclerosis
Therapeutic	Injection of contrast media for myelography Spinal anaesthesia Intrathecal administration of chemotherapy or antibiotics

Contraindications: Increased intracranial pressure is a absolute contraindication for

Absolute	Patient refusal Raised intracranial pressure Localised sepsis
Relative	Bleeding disorder Generalized sepsis Vertebral anomalies

Complications

Immediate	Nausea Headache Paraesthesia
Delayed	Arachnoiditis Spinal / Epidural bleeding Spinal cord injury

Performing the procedure:

Preparation

Decision-making: As this is a invasive procedure and can be associated with serious complications, prior to deciding to perform lumbar puncture, a careful risk and benefit analysis should be performed. When it is performed for the purpose of diagnosis, all possible non-invasive alternative investigations should be considered first.

Lumbar puncture (LP) may be carried depending on a diagnostic or therapeutic indication. It can usually be carried out in the procedure room in a controlled setting with strict aseptic precautions. LP can be done with the patient in a lateral or sitting position.

The approach to the subarachnoid space can either be midline or paramedian depending on the anatomical landmarks and the ease of identification. This does have its bearing on the interpretation of the CSF opening pressure as this changes from lateral position (10 to 18 cm H_2O) to sitting position (20 to 30 cm H_2O).

Consent

A written consent is required after explaining the risks and benefits associated with this procedure.

Equipment set up: The key equipment required are chlorhexidine skin spray, sterile gauze, lumbar puncture needle, sterile drape, sterile dressing, manometer, lignocaine 1% and syringes.

Figure 4: Equipment set up for lumbar puncture

Patient position

This procedure can be done with the patient either in sitting or lateral position. Also the approach can be midline or para-median.

Peripheral venous access

A venous access must be secured and connected to a drip prior to positioning the patient.

Operator (Clinician)

Strict aseptic technique is required when inserting a CVC and so the clinician must clean their hands using a surgical scrub technique and wear a hat, face mask, sterile gown and sterile gloves.

Technique

1. Clean the skin overlying the insertion site with Chlorhexidine solution
2. Position the sterile drape over the patient with the insertion site exposed through the aperture of the drape
3. Local anaesthesia (1% lignocaine) should be infiltrated at the puncture site prior to LP needle insertion. The needle is inserted between the spinous process of L3 and L4 with the stylet in place holding in between the thumb and the index finger and directed rostrally. The needle passes through the supraspinous ligament, interspinous ligaments, ligamentum flavum and finally the dura when a "pop" sensation is felt. On withdrawing the stylet now CSF should flow back.

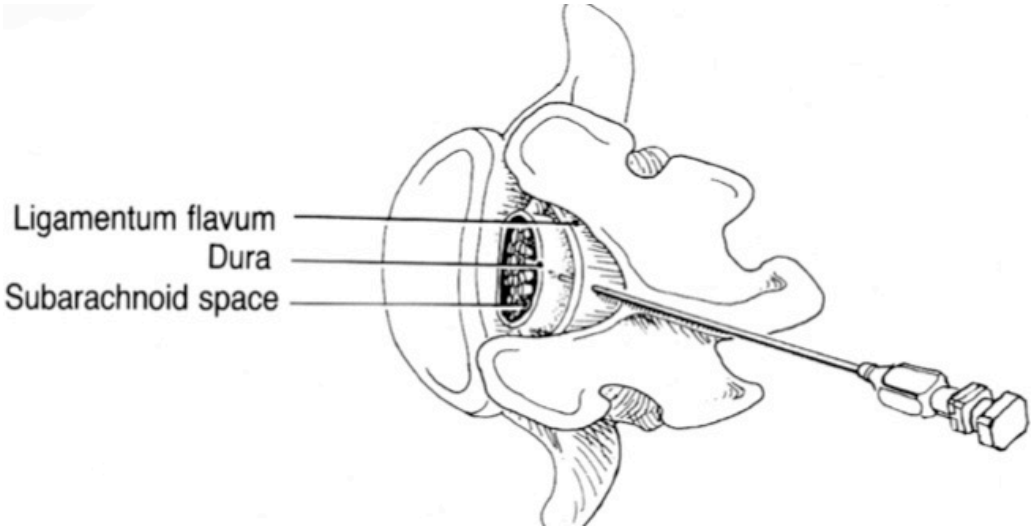

Figure 5: Spinal needle placed in the subarachnoid space

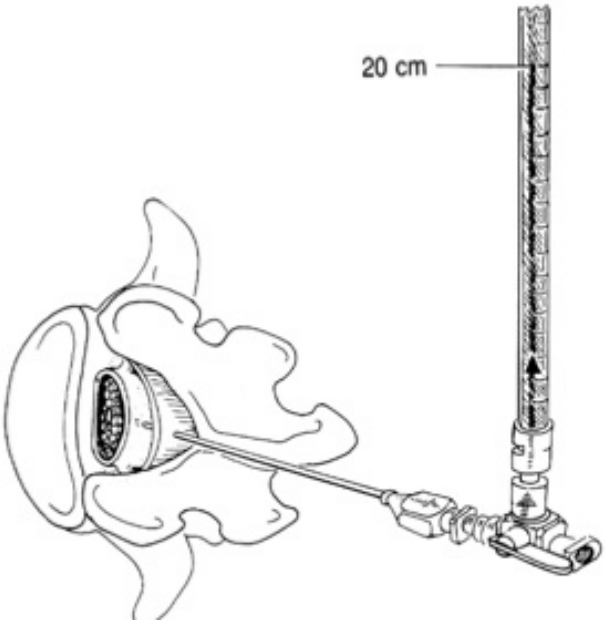

Figure 6: Spinal needle connected to manometer to measure the pressure.

When CSF appears in the LP needle it should be connected to the manometer tubing with the stopcock to measure CSF opening pressure and then the sample should be collected. CSF is collected for cell count, biochemistry (protein and glucose) and bacteriology (gram stain, culture, antibiotic sensitivity).

Post procedure care

The LP site must be covered with a sterile dressing.
Watch for any evidence of oozing or bleeding from the puncture site.
Patient should be non-ambulatory and take bed rest for a period of at least 4-6 hrs.

Further reading

1. Roberts JR, Hedges JR. *Clinical Procedures in Emergency Medicine*. 5th ed. 2009.
2. Lenelle L, Lahaye-Goffart B, Dewandre PY, Brichant JF. [Post-dural puncture headache: treatment and prevention]. *Rev Med Liege*. Nov 2011; 66(11): 575-80.
3. Tung CE, So YT, Lansberg MG. Cost comparison between the atraumatic and cutting lumbar puncture needles. *Neurology*. Jan 10 2012; 78(2): 109-13.