



ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2018; 4(10): 167-170
www.allresearchjournal.com
Received: 16-08-2018
Accepted: 18-09-2018

Yevandge Nagin Sambhaj
Clinical Instructor, Tilak
Maharashtra Vidyapeeth,
Pune, Maharashtra, India

Lumbar puncture

Yevandge Nagin Sambhaj

Abstract

Lumbar Puncture is essential or extremely useful in the diagnosis of bacterial, fungal, mycobacterial, and viral CNS infections and, in certain settings, for help in the diagnosis of subarachnoid haemorrhage, CNS malignancies, demyelinating diseases, and Guillain-Barré syndrome, caution should be used in patients with Possible raised intracranial pressure, Thrombocytopenia or other bleeding diathesis (including ongoing anticoagulant therapy) Suspected spinal epidural abscess Procedure technique The spinal needle may be advanced slowly, angling slightly toward the head, as if aiming towards the umbilicus. The flat surface of the bevel of the needle should be positioned to face the patient's flanks to allow the needle to spread rather than cut the dural sac (the fibers of which run parallel to the spinal axis). These complications include: Post-LP headache, Infection, Bleeding Cerebral herniation, Minor neurologic symptoms such as radicular pain or numbness, Late onset of epidermoid tumors of the thecal sac, Back pain.

Keywords: Lumbar Puncture, Indications, Contraindications, Procedure Technique

Introduction

Quince performed the first lumbar puncture (LP) in 1891 to relieve increased intracranial pressure in children with tuberculous meningitis

This technique subsequently became important in the diagnosis of a variety of infectious and non-infectious neurologic conditions. However, its relative value for diagnosing central nervous system (CNS) conditions other than infection has diminished as new testing methods, especially imaging techniques, have appear

Definition

A lumbar puncture (LP), also known as a spinal tap, is a diagnostic and/or therapeutic procedure performed by a doctor. The procedure is performed by inserting a hollow needle into the subarachnoid space in the lumbar area (lower back) of the spinal column. The subarachnoid space is the canal in the spinal column that carries cerebrospinal fluid (CSF) between the brain and the spinal cord.

CSF is a clear fluid that bathes the brain and spinal cord while protecting it, like a cushion, from exterior injury. The fluid is produced and reabsorbed in the brain on a continuous basis. CSF is composed of cells, water, proteins, sugars, and other vital substances that are essential to maintain equilibrium in the nervous system.

Indications

LP is essential or extremely useful in the diagnosis of bacterial, fungal, mycobacterial, and viral CNS infections and, in certain settings, for help in the diagnosis of subarachnoid haemorrhage, CNS malignancies, demyelinating diseases, and Guillain-Barré syndrome.

Urgent-The number of definite indications for LP has decreased with the advent of better neuroimaging procedures including CT scans and MRI, but urgent LP is still indicated to diagnose two serious conditions.

- Suspected CNS infection (with the exception of brain abscess or a par meningeal process).
- Suspected subarachnoid haemorrhage (SAH) in a patient with a negative CT scan
- The use of CSF examination in the evaluation of a patient with suspected SAH is discussed in detail separately

Correspondence

Yevandge Nagin Sambhaj
Clinical Instructor, Tilak
Maharashtra Vidyapeeth,
Pune, Maharashtra, India

- The most common use of the LP is to diagnose or exclude meningitis in patients presenting with some combination of fever, altered mental status, headache, or meningeal signs. Examination of the CSF has a high sensitivity and specificity for determining the presence of bacterial and fungal meningitis.
- The findings on CSF analysis also may help distinguish bacterial meningitis from viral infections of the central nervous system. However, there is often substantial overlap.

Nonurgent: A nonurgent LP is indicated in the diagnosis of the following conditions. The findings are discussed in the appropriate topic reviews.

- Idiopathic intracranial hypertension (pseudo tumor cerebri)
- Carcinomatous meningitis
- Tuberculous meningitis
- Normal pressure hydrocephalus
- CNS syphilis
- CNS vasculitis

Conditions in which LP is rarely diagnostic but still useful include

- Multiple sclerosis
- Guillain-Barré syndrome
- Paraneoplastic syndromes

LP is also required as a therapeutic or diagnostic manoeuvre in the following site

- Spinal anaesthesia
- Intrathecal administration of chemotherapy
- Intrathecal administration of antibiotics
- Injection of contrast media for myelography or for cisternography

Contraindications

Although there are no absolute contraindications to performing the procedure, caution should be used in patients with.

- Possible raised intracranial pressure
- Thrombocytopenia or other bleeding diathesis (including ongoing anticoagulant therapy)
- Suspected spinal epidural abscess

Technique

Preparation

- An LP can be performed with the patient in the lateral recumbent or prone positions or sitting upright. The lateral recumbent or prone positions are preferred over the upright position because they allow more accurate measurement of the opening pressure. The prone position is generally used for LPs performed under fluoroscopic guidance.
- The choice of needle type (cutting versus atraumatic) and bore size can influence the risk of a post-LP headache, but also may increase the technical difficulty of the procedure. This is discussed in detail separately.
- The correct level of entry of the spinal needle is most easily determined with the patient sitting upright or standing. The highest points of the iliac crests should be identified visually and confirmed by palpation; a direct line joining these is a guide to the fourth lumbar

vertebral body. However, this line may intersect the spine at points ranging from L1-L2 to L4-L5 and tends to point to a higher spinal level in women and in obese patients [3]. The lumbar spinous processes of L3, L4, and L5, and the interspaces between can usually be directly identified by palpation. The spinal needle can be safely inserted into the subarachnoid space at the L3/4 or L4/5 interspace, since this is well below the termination of the spinal cord.

- Correct patient positioning is an important determinant of success in obtaining CSF. The patient is instructed to remain in the fetal position with the neck, back, and limbs held in flexion. The lower lumbar spine should be flexed with the back perfectly perpendicular to the edge of a bed or examining table. The hips and legs should be parallel to each other and perpendicular to the table. Pillows placed under the head and between the knees may improve patient comfort.
- The overlying skin should be cleaned with alcohol and a disinfectant such as povidone-iodine or chlorhexidine (0.5 percent in alcohol 70 percent)
- The antiseptic should be allowed to dry before the procedure is begun. Many product inserts of chlorhexidine-containing solutions warn against use of chlorhexidine prior to lumbar puncture because of a concern that it can cause Arachnoiditis.
- The evidence that it does so is very limited, and many experts believe that chlorhexidine has an advantage over povidone-iodine because of its onset, efficacy, and potency Due to specific labeling prohibiting use, a formal institutional policy to support such use may be indicated.
- After the skin is cleaned and allowed to dry, a sterile drape with an opening over the lumbar spine is placed on the patient. Local anesthesia (eg, lidocaine) is infiltrated into the previously identified lumbar intervertebral space and a 20 or 22 gauge spinal needle containing a stylet is inserted into the lumbar intervertebral space.

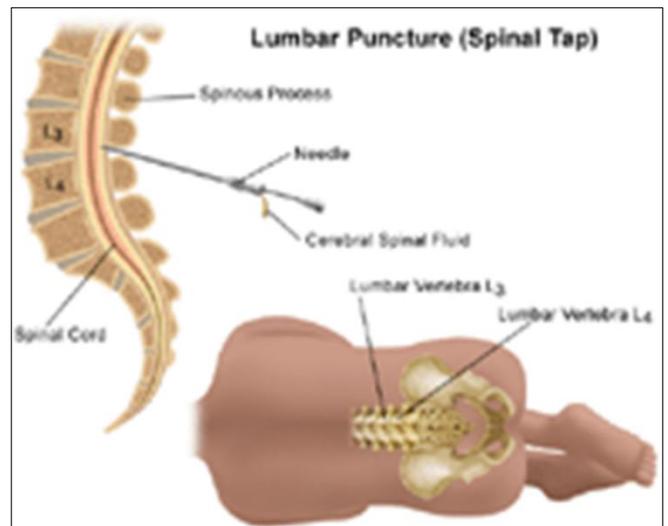


Fig 1

Procedure technique

- The spinal needle may be advanced slowly, angling slightly toward the head, as if aiming towards the umbilicus. The flat surface of the bevel of the needle should be positioned to face the patient's flanks to allow

the needle to spread rather than cut the dural sac (the fibers of which run parallel to the spinal axis).

- The approximate distance of the epidural space from the skin is 45 to 55 mm
- Many physicians choose to advance the needle incrementally, removing the stylet periodically to check for CSF flow, then reinserting the stylet until the subarachnoid space is entered. However, others report a higher rate of successful LP when the stylet is removed, just after the skin is punctured and before it is passed into the subarachnoid space in order to better observe the flow of CSF upon entry of the subarachnoid space
- Once CSF appears and begins to flow through the needle, the patient should be instructed to slowly straighten or extend the legs to allow free flow of CSF within the subarachnoid space. While the pressure measurement is affected by the position of the legs, the available evidence suggests that the effect is likely to be small. In one review, pressures were elevated by only 1 to 2 cm H₂O in four of five studies studying this effect; however, in one study, changing position from a straight to a fully flexed position resulted in an increase in pressure of 6.4 mm Hg (approximately 8.7 cm H₂O). Opening pressure does not appear to be significantly different if measured in the prone or lateral recumbent position. A manometer should then be placed over the hub of the needle and the opening pressure should be measured
- Fluid is then serially collected in sterile plastic tubes. A total of 8 to 15 mL of CSF is typically removed during routine LP. However, when special studies are required, such as cytology or cultures for organisms that grow less readily (eg, fungi or mycobacteria), 40 mL of fluid can safely be removed. Aspiration of CSF should not be attempted as it may increase the risk of bleeding
- The stylet should be replaced before the spinal needle is removed, as this can reduce the risk of post-lumbar puncture headache. No trials have shown that bed rest following LP significantly decreases the risk of post LP headache compared with immediate mobilization
- The Queckenstedt maneuver can be used to demonstrate that there is free flow of fluid from the ventricles to the lumbar space. This maneuver is performed by measuring the CSF pressure and then observing the change in pressure after manual compression of both jugular veins. However, this test is rarely useful in modern practice, since newer techniques such as magnetic resonance imaging (MRI) and computed tomography (CT) readily identify most obstructing spinal or basilar lesions.

Imaging guidance

Fluoroscopy: Fluoroscopic guidance for LP may be required if attempts without imaging are unsuccessful. This is also suggested for patients who are obese or have difficult anatomy because of prior spine surgery or other reasons. Most neuroradiologists perform fluoroscopically guided LPs in the L2-L3 or L3-L4 intervertebral space with the patient in the prone position and rotate the patient to their side for measurement of opening pressure

In addition to improving success rates, fluoroscopic guidance may reduce the incidence of traumatic LP

Ultrasound - Imaging guidance may also be obtained with ultrasound

A meta-analysis of 14 randomized trials (1334 patients) that compared LPs and epidural catheterizations performed with ultrasound to those performed without imaging found that ultrasound guidance reduced the risk of failed and traumatic procedures (RR = 21 and 0.27 respectively), as well as the number of needle insertions and redirections.

A subsequently published randomized trial involving 100 adult patients found no significant difference in outcomes with ultrasound guidance

Complications

LP is a relatively safe procedure, but minor and major complications can occur even when standard infection control measures and good technique are used. These complications include.

- Post-LP headache
- Infection
- Bleeding
- Cerebral herniation
- Minor neurologic symptoms such as radicular pain or numbness
- Late onset of epidermoid tumors of the thecal sac
- Back pain

Post LP headache: Headache, which occurs in 10 to 30 percent of patients, is one of the most common complications following LP. Post-LP headache is caused by leakage of CSF from the dura and traction on pain-sensitive structures. Patients characteristically present with frontal or occipital headache within 24 to 48 hours of the procedure, which is exacerbated in an upright position and improved in the supine position. Associated symptoms may include nausea, vomiting, dizziness, tinnitus, and visual changes.

Infection

Meningitis

An LP through a spinal epidural abscess can result in the spread of bacteria into the subarachnoid space. Because an LP is not needed for diagnosis, the procedure should NOT be performed in most patients with suspected epidural abscess in the lumbar region.

Other infections: There are rare anecdotal case reports of discitis and vertebral osteomyelitis following LP. Most cases were due to normal skin flora such as *Propionibacterium* species and coagulase negative staphylococci. These complications presumably result from direct inoculation of bacteria into the vertebral bone.

Bleeding: The CSF is normally acellular, although up to five red blood cells (RBCs) are considered normal after LP due to incidental trauma to a capillary or venule. A higher number of RBCs is seen in some patients in whom calculation of the white blood cell (WBC) to RBC ratio and the presence or absence of xanthochromia may differentiate LP-induced from true CNS bleeding.

Management: The diagnosis of spinal hematoma is complicated by the concealed nature of the bleeding; thus, a high index of suspicion must be maintained. Patients who have persistent back pain or neurologic findings (eg, weakness, decreased sensation, or incontinence) after undergoing LP require urgent evaluation (usually spinal magnetic resonance imaging (MRI)) for possible spinal

hematoma. The appropriate treatment for patients with significant or progressing neurologic deficits is prompt surgical intervention, usually a laminectomy, and evacuation of the blood. Timely decompression of the hematoma is essential to avoid permanent loss of neurologic function. Patients with mild symptoms or early signs of recovery may be managed conservatively with vigilant monitoring; dexamethasone may be administered to mitigate against neurologic injury.

Cerebral herniation: The most serious complication of LP is cerebral herniation. Suspected increased intracranial pressure (ICP) is a relative contraindication to performance of an LP and also requires independent assessment and treatment.

Based upon these observations, we do NOT perform a CT scan before an LP in patients with suspected bacterial meningitis unless one or more risk factors is present:

- Altered mentation
- Focal neurologic signs
- Papilledema
- Seizure within the previous week
- Impaired cellular immunity

Patients with these clinical risk factors should have a CT scan to identify possible mass lesion and other causes of increased ICP. Mass lesions causing elevated ICP are usually easily identified on CT scan. However, the CT scan should also be scrutinized for more subtle signs including diffuse brain swelling as manifest by loss of differentiation between gray and white matter and effacement of sulci, as well as ventricular enlargement and effacement of the basal cisterns.

Independent of the decision to perform LP, patients with possible elevated ICP based upon the above clinical features may require urgent life-saving interventions to lower ICP that may include head elevation, hyperventilation to a PCO₂ of 26 to 30 mmHg, and intravenous mannitol (1 to 1.5 g/kg). When indicated, these should NOT await CT scan. The evaluation and management of patients with elevated ICP is discussed in detail separately. When the LP is delayed or deferred in the setting of suspected bacterial meningitis, it is important to obtain blood cultures (which reveal the pathogen in more than half of patients) and promptly institute antibiotic therapy. Urgent evaluation and treatment of increased intracranial pressure, along with the administration of antibiotics and steroids, should be instituted promptly when this is suspected. Specific treatments are discussed separately. Others

Epidermoid tumor: The formation of an epidermoid spinal cord tumor is a rare complication of LP that may become evident years after the procedure is performance.

Most reported cases are children ages 5 to 12 years who had a LP in infancy; however this has also been described in adults.

It may be caused by epidermoid tissue that is transplanted into the spinal canal during LP without a stylet, or with one that is poorly fitting. This complication probably can be avoided by using spinal needles with tight-fitting stylets during LP.

Abducens palsy: Both unilateral and bilateral abducens palsy are reported complications of LP. This is believed to

Result from intracranial hypotension and is generally accompanied by other clinical features of post LP headache. Most patients recover completely within days to weeks. Other cranial nerve palsies are rarely reported.

Radicular symptoms and low back pain: It is not uncommon (13 percent in one series) for patients to experience transient electrical-type pain in one leg during the procedure; however, more sustained radicular symptoms or radicular injury appear to be rare.

Up to one-third of patients complain of localized back pain after LP; this may persist for several days, but rarely beyond

References

1. Joice M. Medical Surgical Nursing, 8th edition, Noida: Elsevier, 1974.
2. Lewis. Medical Surgical Nursing, 7th edition, New Delhi Elsevier, 1978.