Version 2.1

Lumbar Puncture (LP)

18/05/2014

Indications

- Suspected CNS infection
- ?SAH after normal CT scan (<3% SAH missed by CT).
- Demyelinating conditions: Guillain Barre, MS
- Benign intracranial hypertension (therapeutic)
- Rarely used to establish diagnosis following meningeal malignancies, CNS vasculitis

Contraindications

- Skin infection overlying puncture area.
- Mass lesion or ?↑ICP (obtunded/GCS<8 or falling rapidly, Cushing reflex, IIIn palsy, focal neuro deficit, papilloedema, etc)
- Fitting
- Bleeding tendency - thrombocytopenia <$50x10^9$/L

Procedure

Preparation

- Documented neuro exam (incl lower imbs)
- Explain procedure to patient
- Get equipment – PPE, skin prep, drape, LA, spinal needle, collecting tubes x 3, band aid
- Need 1 assistant (essential if child)
- Consider sedation/analgesia

Technique

- Position patient: Fully flexed lying lateral or sitting. Can't measure pressure if sitting.
- Choose intervertebral space: below iliac crests (L3/4). SC ends L1/2 (adults),L3 (child)
- Gown+glove, clean & drape. chlorhexadine or povudine.
- Infiltrate LA: 1% lignocaine.
- Insert spinal needle: 22-25G, angle sl. Cephalad towards umbilicus, in midline, bevel parallel to dural fibres, feel for pop (lig flavum) & loss of resistance (subarach space).
- Wait for flow, may need to rotate needle by 90°
- Measure pressure (if supine) with small vol manometer+3 way tap. Norm 10-20cmH_2O.
- Collect drops 10 x 3 tubes labeled 1,2 & 3. Manometer CSF can be used for first tube.
- Re-insert stylet (reduces headache) & withdraw. Apply pressure + Band Aid.
- Send tubes 1 & 3 to Micro for cell count, Gram stain, India ink staining (Cryptococcus), culture ± PCR or antigen testing (already on ABx). Tube 2 to biochem for glucose & protein. Also can check for xanthochromia (SAH, sev. J, hypercarotenaemia), oligoclonal bands (MS, syphilis), Zeihl-Nielsen staining (TB).
- Document procedure & any complications.
- Patient may ambulate as no evidence that bed rest reduces headache incidence.

Antigen studies available

Bacteria - Pneumococcus, Hib, meningococcus, GBS, E.Coli
Fungal - Cryptococcus

PCR studies available

Viruses – HSV, Enterovirus, EBV, CMV

Evaluation of Cerebrospinal fluid (CSF)

CSF produced by the choroid plexus in the ventricles of the brain and the cerebral vessels at the rate of 500ml/day. In an adult the average volume of CSF is about 150ml.

If a clearing bloody tap, cell count can be corrected based on RCC:WCC ratio in FBC. Protein will also be raised ~1mg/dL per 1000 RBC/ml.

See table below for CSF characteristics in different conditions:

	Appearance	Protein	Glucose	Cell Count (per mm^3)	Additional
Normal	Clear and colourless	0.2-0.4 g/l (neonate <1.7g/l)	2.5-3.5mmol/L 60-80% of BSL	<5 lymphocytes (<20 in neonates)	May see organisms. Opening pressure 10-20 cm H2O
Bacterial Meningitis	Cloudy and turbid (if sev.)	Raised >1.5 g/l	Low <2.2mmol/L	Cell count high (>100, mean 800) 80% PMNs.	Opening pressure high
Viral / Aseptic Meningitis	Clear	Raised or high end of normal	Normal (low with HSV, mumps)	Cell count high (<500, mean 80) and 70% have mostly lymphocytes unless early.	PCR or special stains may help identify organism.
Fungal/TB meningitis	Clear or fibrin web	Normal-high (in TB may be v. high >2g/l)	Low	Cell count is high (<2000, mean 100-200) pleocytosis with lymphocytes>PMN	PCR can identify TB quickly, India ink or antigen for Cryptococcus neoformans.
SAH	Often non-clearing bloody	Raised or high end of normal	Usually low.	High number of RBCs	xanthochromia after spinning
Guillain-Barre	Clear	Markedly raised	Usually low.	Normal	
MS	Clear	Raised	Normal	Mild pleocytosis with mononuclear cells.	Oligoclonal bands may be present on CSF protein electrophoresis
Neoplastic	Clear	Raised	Low	Lymphocytosis	Cytology for neoplastic cells

Complications of lumbar puncture

- Uncal or tentorial herniation if elevated ICP.
- Low pressure headache
    - Occurs in 2-15% (risk in younger age, F, lower BMI) lasting 2-8 days.
    - Typically worse in upright position/coughing and relieved by lying down.
    - The CSF leak can be reduced by using smaller bore needle, rounded bevel needle tip, aligning bevel with dural fibres, re-inserting stylet before withdrawal.
    - Dx can be confirmed by slowly squeezing the waist of the patient from behind when sitting, which quickly relieves the headache by compressing the IVC. This causes the epidural veins to become engorged and displaces CSF into the head.
    - Treat with bed rest & pain relief, oral/IV fluids. Caffeine is anecdotally reported to be helpful (IV>PO).
    - If still persists use extradural blood patch. 10-20ml autologous blood injected into the extradural space.
- Spinal epidural haematoma from anterior/lateral epidural veous plexus
- Intraspinal epidermoid cyst – if non-styletted needle used
- Rarely: infection, laceration of intravertebral disc, nerve root puncture/graze.