



PAEDIATRIC ACUTE CARE GUIDELINE

Lumbar Puncture

Scope (Staff):	All Emergency Department Clinicians
Scope (Area):	Emergency Department

This document should be read in conjunction with this DISCLAIMER
<http://kidshealthwa.com/about/disclaimer/>

Lumbar Puncture

Aim

To guide staff in performing lumbar puncture in children and to:

1. Ensure the safety and comfort of the infant or child whilst obtaining a cerebrospinal fluid (CSF) sample.
2. Collect an adequate CSF sample to enable the diagnosis of central nervous system infections, inflammation and metabolic disorders without contaminating the specimen.

Risk

Failure to follow this guideline may lead to:

- Complications associated with lumbar punctures due to incorrect procedure or patient selection.
- Increased risk of CSF sample contamination which may lead to a child receiving unnecessary antimicrobial therapy.

Pre-Procedure

- Patients who require a lumbar puncture (LP) must be discussed with a Consultant or Senior Doctor before commencing the procedure.
- A lumbar puncture should never delay potentially lifesaving interventions such as the administration of antibiotics to patients with suspected bacterial meningitis.
- Informed verbal consent from patient and parent/guardian is required prior to

commencement of an LP and should be documented in the patient record. This should include discussion and explanations about the diagnostic benefits of the procedure and the potential complications.

- A lumbar puncture [health fact sheet](#) should be provided to parents to assist with consent and education.

General¹

- Lumbar puncture is the procedure used to obtain cerebral spinal fluid (CSF)
- CSF samples must be obtained with strict adherence to [Aseptic Technique](#).
 - For comparison with CSF glucose a BGL should be obtained immediately before the procedure
- An LP is only conducted after a thorough neurological examination and raised intracranial pressure (ICP) or other contraindications have been excluded.
- A normal CT scan does **not** exclude raised ICP and is not a substitute for a thorough examination.
- **Difficult LP** - where a non-urgent lumbar puncture is perceived to be difficult (e.g. patient body mass index > 30), consideration should be given at the outset as to whether the procedure would be better performed under image guidance.
- If a lumbar puncture is attempted unsuccessfully on two occasions, the patient should be referred to a more senior clinician to either perform the procedure or refer for it to be done under image guidance
- For therapeutic lumbar puncture with intrathecal chemotherapy administration, refer to the Department of Oncology guidelines

Indications

- Suspected meningitis or encephalitis
- Suspected sub-arachnoid haemorrhage with a normal CT
- Measurement of opening pressure in suspected benign intracranial hypertension
- Therapeutic reduction in ICP in benign intracranial hypertension
- Disease staging and instillation of chemotherapy in oncology patients
- To assist with the diagnosis of other central nervous system pathologies including demyelinating, neuroinflammatory and neurometabolic conditions.

Contraindications


- Coma or decreased conscious state: absent/non-purposeful response to painful stimuli
- Signs of raised intracranial pressure (ICP):
 - Altered pupillary responses
 - Absent Doll's eye reflexes
 - Decerebrate or decorticate posturing
 - Papilloedema
 - Abnormal respiratory pattern, hypertension, bradycardia (Cushing's Triad)
- Within 30 minutes of seizure or if normal conscious level has not returned post seizure
- New focal neurological signs – hemiparesis, extensor plantar responses, ocular palsies
- Strong suspicion of meningococcal infection with risk of Disseminated Intravascular Coagulation (typical purpuric rash in an unwell child)
- Local infection at the needle insertion site
- Coagulation defects
- Thrombocytopaenia - if platelets < 50 discuss with consultant
- Cardiovascular compromise/ shock
- Respiratory compromise – e.g. baby with apnoeas

Preparation

Staff

- Doctor performing the lumbar puncture
- One to two assistants will be required to assist with holding the patient and preparing the equipment – at least one should be a nurse / doctor experienced in clinical holding for a LP.

Equipment

- Dressing trolley
 - Large dressing pack
 - Sterile: gown, gloves, hand towel, fenestrated drape, gauze.
 - Appropriate skin antiseptic:
 - Infants, children, adolescents: 2% chlorhexidine & 70% isopropyl alcohol (e.g. Maxi swabstick) or
 - povidone iodine if known sensitivity to chlorhexidine
 - Neonates \geq 28 weeks gestation: 1% chlorhexidine & 70% isopropyl alcohol (swab stick preferable)
 - Preterm neonates $<$ 28 weeks gestation: Povidone iodine solution
 - 3 sterile CSF specimen containers.
 - More than 3 containers may be required if multiple tests are required on the CSF sample.
 - Minimum required volumes for each test are indicated in the PathWest test directory (<http://pathlines.health.wa.gov.au/testdirectory/>). Discuss with the Clinical Microbiologist prior to sample collection, if necessary.
 - Small transparent, semi permeable, occlusive dressing.
 - Spinal lumbar puncture needles (length depends on age).
 - 22G or 25G bevelled spinal needles with stylet. Needle length and gauge depend on the age and size of the child and the indication for lumbar puncture. Pencil point is preferred in older children to reduced risk of headache.
- [caption id="attachment_4889" align="aligncenter" width="300"] Picture for illustration of equipment only - this is not an aseptic set up.[/caption]

Additional equipment that may be required:

- Local anaesthetic, 2ml / 5ml syringe, needles
- Surgical face mask (in peri-operative environment or for intrathecal chemotherapy)
- Protective eye goggles
- Manometer set

Procedural Sedation and Analgesia

- Apply topical anaesthetic cream (e.g. EMLA) to insertion site and cover with occlusive dressing for 45-60 minutes (except where specimens are urgent)

During the procedure options are:

- Local anaesthetic (1% lignocaine) infiltration
- Oral sucrose for infants $<$ 3 months old
- [Nitrous oxide](#) for children older than 3 years with a normal conscious state
- [Oral Conscious Sedation](#) may be considered
- Non-pharmacological techniques
- Distraction, parental presence

Monitoring

- All seriously ill children require continuous pulse oximetry monitoring
- Consider cardiac monitoring where appropriate
- When sedation has been used follow the relevant protocol/ guideline
- A minimum of hourly neurological observations are required for all patients post procedure

Procedure

Prepare the trolley

- Perform hand hygiene.
- Decontaminate dressing trolley with a detergent wipe and allow it to dry prior to procedure set up.
- Open sterile equipment onto sterile field.

Position of Patient

- Perform hand hygiene before touching the patient.
- Appropriate positioning increases the interspinous distance, facilitating access to meninges and CSF
 - Position the patient in a lateral position, patient facing the holding nurse
 - Patient knees and chin are to be drawn to the chest, and body well flexed (foetal position)
 - The hips should be vertical to align the iliac crests i.e. back should be 90 degrees to the bed.
 - The patient's back should be close to the edge of the bed.



Alternatively:

- Older patients may prefer to remain in a sitting position. Have the patient slouch shoulders over a pillow without bending at the hips and maintaining the 90 degree back to bed position.
- **Avoid over-flexion of the neck**, especially in infants as respiratory compromise may result

Preparation

- Perform hand hygiene (Moment 1) before touching the patient.
- Identify the LP site – a line between the top of the iliac crest intersects the spine at approximately the L3/L4 interspace:
 - Site for needle insertion should be L3/L4 or L4/L5 interspace
- Wash hands using aseptic technique and don sterile gown and gloves
- Prepare skin with antiseptic swab sticks or sterile forceps and gauze:
 - Wipe antiseptic swab in a circular motion commencing at the proposed insertion site
 - Repeat with second swab stick or sterile forceps and gauze
- Drape the patient with the fenestrated sterile drape ensuring the airway is visible at all times
- Remove caps from the CSF specimen containers
- Identify the landmarks and palpate the needle insertion point
- If using local anaesthetic:
 - Infiltrate the skin with 1% lignocaine (allow 1-2 minutes for anaesthetic effect)
- Ensure the skin is dry prior to the needle insertion
- Reconfirm the land marks and LP site prior to the needle insertion

Spinal Needle Insertion

- Hold the spinal needle so that bevel is in the superior position (facing up)
- With the stylet in position, insert the needle through the skin and wait for any patient movement to stop
- Aiming for the umbilicus, advance the needle in the spinous ligament until there is a decrease in resistance
- ✖
- Remove the stylet and check for CSF appearing at the needle hub:
 - - **If CSF is not flowing:**
 - Replace stylet and advance the needle slightly and recheck for CSF
 - **If CSF is flowing:**
 - If opening pressure required, connect manometer to spinal needle
 - Collect 10 drops in each (2) sterile containers. (Note which container holds the first collection)
 - Minimum required volumes for each test are indicated in the PathWest test directory (<http://pathlines.health.wa.gov.au/testdirectory/>). Discuss with the Clinical Microbiologist prior to sample collection, if necessary.
 - When sample collection is complete, reinsert the stylet
 - Remove the needle and stylet
 - Use sterile gauze to apply gentle pressure to the insertion site
 - Cover the insertion site with a transparent occlusive dressing (e.g. Tegaderm), which should remain in situ for 24 hours
 - Remove personal protective equipment and perform hand hygiene (Moment 3)

Specimens

- Label the CSF containers with the patient's name, date of birth, UMRN and date and time of specimen collection.
- Place labelled containers in a biohazard bag and send urgently to the laboratory for cell count, protein, glucose, microscopy and culture. CSF PCR (herpes simplex, enterovirus etc should be requested as indicated).
- If specimen collection occurs outside of laboratory opening hours, contact the on-call microbiology scientist via switchboard to perform an urgent microscopy.

Post-Procedure

Complications

- Failure to obtain specimen, repeated attempts (common)
- Headaches^{2,4} (common, up to 15%)
- Backaches
- Transient/ persistent paraesthesiae/ numbness
- Cerebral herniation
- Intracranial subdural haemorrhage
- Spinal epidural haemorrhage
- Paraplegia
- Infection
- Cardiorespiratory compromise due to positioning
- Spinal epidermoid tumours associated with needles without a stylet (rare)

Aftercare

- A minimum of hourly neurological observations are required for all patients post procedure, including checking of LP site
- Routine bed rest after a lumbar puncture is not required², and patients should be allowed to mobilise as soon as it is safe to do so and, if applicable, recovered from sedating medication.

CSF Interpretation

- All CSF should be sent for urgent cell count, protein, glucose, microscopy and culture.
- Normal CSF should not contain neutrophils but may have variable WBC depending on age.
- The table below can be used as a guide for CSF interpretation:

	Neutrophils	Lymphocytes	Protein	Glucose
Normal Term Neonate	0	<20	<1.0g/L	>2/3 Serum glucose or >2.0mmol/L
Normal (>1 month age)	0	<5	<0.4g/L	>2/3 Serum glucose or >2.5mmol/L
Bacterial Meningitis	Very High	Usually <100	>1.0g/L	low
Viral Meningitis	Usually <100	10-1000	Normal	Normal

- Partially treated bacterial meningitis may have a CSF picture of bacterial meningitis, viral meningitis or a combination of both.
- Blood stained CSF from a traumatic procedure can be more difficult to interpret.
- There are various methods to calculate whether WCC is significant in a traumatic tap:
 - A ratio of 1 WBC to 750 RBC in CSF is normal if a patient's FBC is normal
 - A calculation may be used to correct CSF WBC counts which are falsely increased due to a traumatic tap:
 - $\text{WBCs added} = \text{WBC}(\text{blood}) \times \text{RBC}(\text{CSF}) / \text{RBC}(\text{blood})$

Evidence points

- Current available evidence does not support bed rest over immediate mobilisation in the reduction of postural headaches; therefore routine bed rest is not required.²⁻⁴


Tags

csf, encephalitis, fever, haemorrhage, headache, icp, infection, intracranial, lp, lumbar puncture, meningitis, neck stiffness, needle, neuro, neurological, photophobia, pressure, spinal, sub-arachnoid, tap

References

1. Bonadio W. [Pediatric Lumbar Puncture and Cerebrospinal Fluid Analysis](#). *J Emerg Med* 2014; 46: 141-150
 2. Arevalo-Rodriguez I, Ciapponi A, Roqué i Figuls M, Muñoz L & Bonfill Cosp X. Posture and fluids for preventing post-dural puncture headache. *Cochrane Database of Systematic Reviews* 2016, Issue 3. Art. No.: CD009199. DOI: [10.1002/14651858.CD009199.pub3](#).
 3. Evans RW, Armon C, Frohman EM & Goodin DS. Assessment: prevention of post-lumbar puncture headaches. Report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. *Neurology* 2000; 55(7): 909-14.
 4. E, Aerssens P, Alliet P, Gillis P & Raes M. Post-dural puncture headaches in children. A literature review. *European Journal of Pediatrics* 2003; 162: 117-21.
- Endorsed by Clinical Practice Advisory Committee November 2017

This document can be made available in alternative formats on request for a person with a disability.

File Path:			
Document Owner:	Dr Meredith Borland HoD, PMH Emergency Department		
Reviewer / Team:	Kids Health WA Guidelines Team		
Date First Issued:	27 March, 2014	Version:	
Last Reviewed:	7 November, 2017	Review Date:	7 November, 2020
Approved by:	Dr Meredith Borland	Date:	7 November, 2017
Endorsed by:	Medical Advisory Committee	Date:	7 November, 2017
Standards Applicable:	NSQHS Standards: 		
Printed or personally saved electronic copies of this document are considered uncontrolled			