LUMBAR PUNCTURE

PRACTICE GUIDELINE ©

DOCUMENT SUMMARY/KEY POINTS

- A lumbar puncture (LP) is a procedure whereby a needle with a stylet is introduced into the lumbar subarachnoid space in order to obtain a specimen of cerebrospinal fluid (CSF).
- LP may be contraindicated if raised intracranial pressure is suspected because of altered level of consciousness, focal neurological signs, bulging fontanelle or papilloedema. In such cases a CT brain scan should be performed first and the safety of LP should be considered and discussed by the treating team. If unsure, an LP should be deferred for further consideration.
- The presence of bulging fontanelle and papilloedema may be suggestive of significantly raised intracranial pressure. If a lumbar puncture is performed in this situation, there is a risk of brain herniation syndrome which may lead to significant neurological sequelae or even death. An exception to this would be children with idiopathic intracranial hypertension
- In this patient group LP is both diagnostic and therapeutic.
- Administration of nitrous oxide is known to increase cerebral blood flow and therefore increase intracranial pressure. It may be important to consider this if the only purpose of the lumbar puncture is to measure intracranial pressure.
- It is important for CSF specimens to be transported to pathology as soon as they are collected.
- Body fluids (CSF and blood) are potential biohazards. Staff at risk of splash exposure should wear appropriate PPE during the procedure.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
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Team Leader:	Clinical Nurse Consultant	**Area/Dept:** Neurology (CHW)

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CHANGE SUMMARY

- This SCHN document supersedes and replaces:
  - CHW document: Lumbar Puncture (2008-8116)
  - SCH document: Lumbar Puncture (C.8.L.1)
- Written consent is required before performing a LP.
- Surgical masks are mandatory when performing a LP.

READ ACKNOWLEDGEMENT

- **Training:** Medical officers performing this procedure should have observed the procedure performed by a senior clinician and had direct supervision performing the procedure before performing the procedure unsupervised. An eLearning Lumbar Puncture module is available via **SkIP programme** at http://www.doh.edmore.com.au
- All clinical staff performing or assisting a lumbar puncture procedure are to read this document and acknowledge they understand the contents.

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1 General Principles

A lumbar puncture is a procedure whereby a needle with a stylet is introduced into the lumbar subarachnoid space. The spinal cord terminates at the level of L1- L2, and in order to prevent damage to the spinal cord the needle is introduced at the level of L3 - L4 or L4 - L5.

Indications for lumbar punctures are:

- To collect a specimen of CSF for diagnostic studies. (microbiologic, serologic, cytologic or chemical analysis). E.g. febrile unwell patient with no obvious focus of infection.
- To obtain a measurement of the cerebrospinal fluid (CSF) pressure.
- To evaluate cerebrospinal fluid (CSF) flow dynamics and pressure
- Intracranial pressure monitoring (*at CHW*, refer to Intracranial Pressure (ICP) Monitoring via Rickham Reservoir, Codman Monitor or Lumbar Catheter - CHW).
- Administration of intrathecal medications. (e.g. antibiotics and cancer chemotherapy).
- To introduce spinal anaesthesia.

2 Special Precautions

- Lumbar puncture is contraindicated in children who are shocked or significantly unwell as they may not tolerate the procedure.
- Performance of a lumbar puncture when a child is suspected of having raised intracranial pressure may be contraindicated. Neuroimaging should be considered for any child with papilloedema, altered conscious level or focal neurologic signs prior to lumbar puncture.

  The presence of bulging fontanelle and papilloedema is suggestive of significantly raised intracranial pressure. If a lumbar puncture is performed in the presence of papilloedema there is a risk of brain herniation syndrome which may lead to significant neurological sequelae or even death. The exception to this is children with idiopathic intracranial hypertension.
- Altered conscious level and/or the presence of new neurological signs such as pupil abnormality may also indicate increased intracranial pressure. The presence of any cutaneous or osseous infection at the LP site including lesions of meningococcaemia is a contraindication to lumbar puncture. This is due to the risk of infection spreading to the CSF.
- Unless the benefits outweigh the risks, lumbar puncture should not be performed in the child who is receiving anticoagulant therapy or has other coagulation defects e.g. thrombocytopenia.

  NB: Although rare, these patients are at risk of epidural, subdural and subarachnoid haemorrhage.
- Administration of nitrous oxide is known to increase cerebral blood flow and therefore increase intracranial pressure. It may be important to consider this if the only purpose of the lumbar puncture is to measure intracranial pressure.

3 Lumbar Puncture Procedure

Note 1: An eLearning Lumbar Puncture module is available via SkIP [Skills in Paediatrics] programme at http://www.doh.edmore.com.au

Note 2: When performing a lumbar puncture **hand hygiene** and aseptic non touch technique **principles must be adhered to**. "*The aim of aseptic non touch technique is to prevent the transmission of micro-organisms to wounds or susceptible sites, to reduce the risk of infection.*" [1]

- Aseptic non touch technique refers to the identification of 'key parts' by not touching them either directly or indirectly. This is the single most important step in achieving asepsis[2].
- Key parts refer to the parts that if contaminated with micro-organisms increase the risk of infection.
- Aseptic non touch technique is achieved by using sterile equipment and ensuring that the sterile component of the product does not come into contact with a non-sterile surface.[3]
- Aseptic technique includes performing hand hygiene at the following times:
  - *prior* to setting up for the procedure and
  - *prior* to application of non-sterile/sterile gloves[4] and
  - At completion of procedure

  This is to protect the practitioner and patient from cross-contamination as per standard precautions.

3.1 Team Time Out

As a Level 2 or 3 Procedure as noted in the (*draft*) Ministry of Health "*Clinical Procedure Safety*" Policy Directive[6], the team must STOP and confirm the following **prior** to the procedure:

i. Proceduralist and assistant/s introduce themselves to the patient/parents/carers.
ii. Written consent[7] must be obtained by the Medical Officer if procedure is performed under sedation or general anaesthetic.
iii. Patient's identification.
iv. Positioning of the patient.
v. Essential imaging is available (if necessary)
vi. Allergy / adverse reaction check
vii. Special medications have been given
viii. Implants and special equipment (if any)
ix. Consider anticipated critical events

3.2 Equipment Required

- Sterile gloves and surgical mask[1]
- Lumbar puncture kit: includes manometer, dressing pack, aperture drape, 3 way tap, 2mL syringe, 25G needle, 22G spinal needle with stylet, CSF tubes and adhesive dressing, e.g. "Band-Aid spot".
- Appropriate size lumbar puncture needle. Match the length of the needle to the depth of subcutaneous tissue at the injection site. For Neonates/newborns, use 25Gx25 mm.

- Injectable local anaesthetic: for neonates or children - Lignocaine 1% [50mg/5mL], maximum dose 4.5mg/kg/dose.
- Alcoholic chlorhexidine 0.5% in 70% alcohol (or *aqueous* chlorhexidine for neonates)
- CSF tubes
- Topical anaesthetic cream [to be applied at least 30 minutes prior to the procedure in children older than newborns].
- Clear occlusive dressing.
- Sedation/analgesia as determined by Medical Officer.

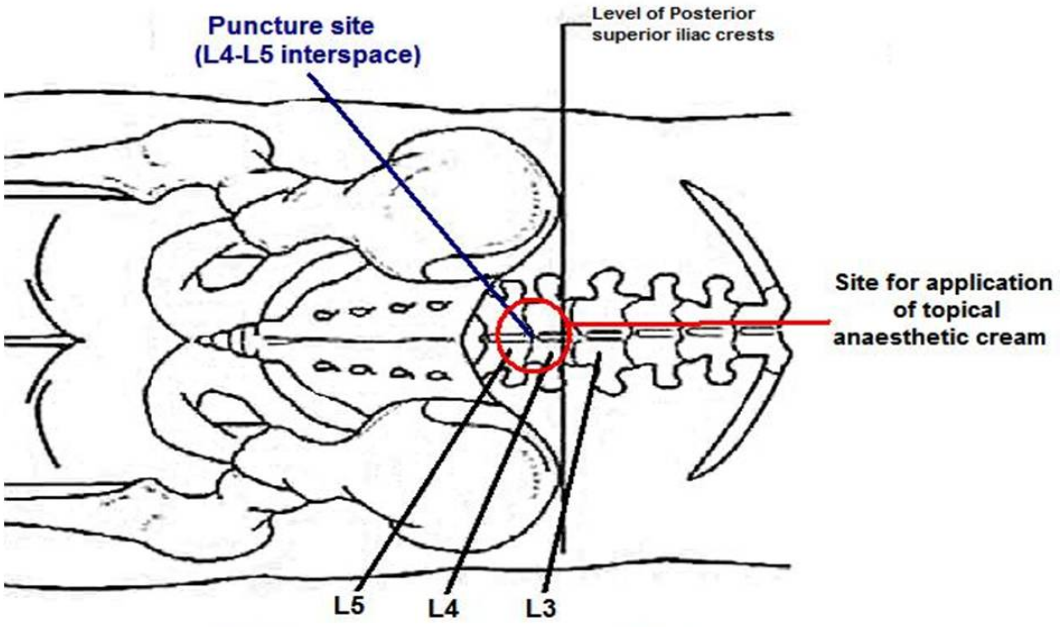
3.3 Preparation

- Ensure privacy is maintained.
- Ensure the Procedure has been fully explained to the parents/carers and the child as appropriate. In addition, provide them with the SCHN Lumbar Puncture Factsheet. Parent/carer's involvement should be encouraged and are permitted to remain with the child where appropriate.

3.4 Pain management

1. Apply topical anaesthetic cream to the LP region between the 3rd and 4th lumbar vertebrae half an hour prior to procedure.
   (refer to **Picture 1** and local guidelines for administering Topical Anaesthetic Agents)

Picture 1



Anatomy of lumbar spine showing sites for dural puncture

2. In order to assist with the minimisation of procedural pain in infants, sucrose may be administered. Apply 25% sucrose onto the tongue 2 minutes prior to procedure and

during the procedure as required. Refer to Sucrose: Management of Short Procedural Pain in Infants Practice Guideline.

3. Medical Officer (MO) assesses prior to commencement regarding the need for sedation. Sedation must be ordered by the MO prior to use (if required).
4. If an accredited nurse is not available and if necessary, the pain team should be consulted for use of nitrous oxide on the ward if appropriate (noting that nitrous oxide is known to increase cerebral blood flow therefore increasing intracranial pressure).

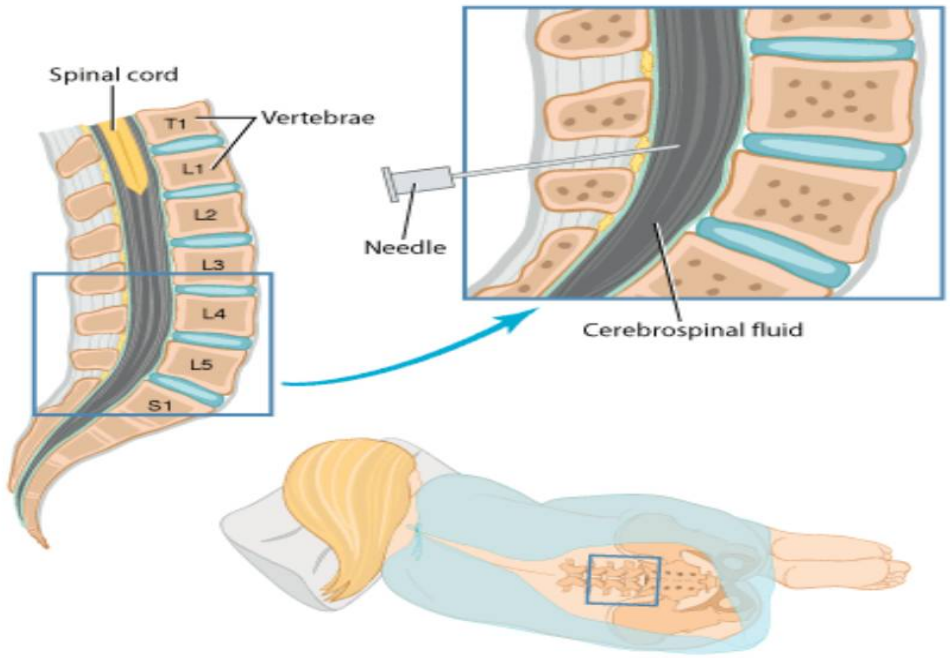
3.5 Procedure

Hand hygiene and aseptic non-touch technique principles must be adhered to.

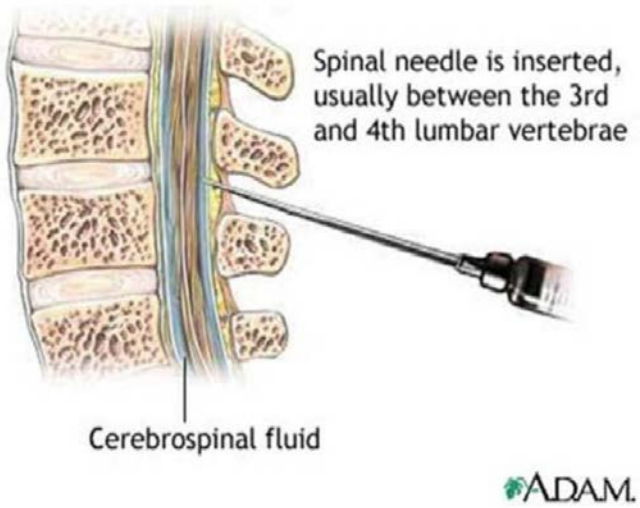
1. Assistant washes hands for one minute and prepares trolley and equipment (refer to Hand Hygiene Policy)
2. Medical officer dons surgical mask, washes hands for three minutes and dons gloves in approved manner.
3. Assistant removes the clear occlusive dressing and wipes away the residual topical anaesthetic cream from the child's skin. The medical officer then prepares the skin at the site with alcoholic chlorhexidine 0.5%.
4. The aperture drape is placed over the site.
5. **Positioning the patient:**
   - **Infants:** refer to Picture 1 and note the following:
     - **i.** Avoid over flexing of neck as can lead to respiratory compromise.
     - **ii.** Avoid pushing down on back of head as this will upset the baby who will arch backwards.
     - **iii.** The baby will then be out of the correct position for this to be a successful tap.
     - **iv.** The risk of there being trauma to site and or spine will also increase if needle is insitu when baby moves/wriggles etc.

- **Child:** Assistant positions child in the lateral recumbent position with hips and knees flexed and drawn up towards their chin, and their head flexed towards their knees. Gentle assistance is required to restrain the child's arms. Positioning in this way facilitates access to the lumbar subarachnoid space and minimises the child's movement throughout the procedure.

NB: The degree of restraint and flexed positioning required for an infant will be less than in the older child. In addition to this it is sometimes necessary to alter the child's position slightly during the procedure in order to facilitate the drainage of CSF.



6. Local anaesthetic injection is checked and the appropriate dosage administered to the skin at the site. *Remove antiseptic solution from set-up prior to preparing medication for injection into spine*. [MoH Safety Notice 010/10]
7. The medical officer identifies the correct site at L3 - L4 or L4 - L5.
8. Ensure the child is correctly positioned and the local anaesthetic has had adequate time to take effect.
9. The medical officer selects appropriate lumbar puncture needle size. Grasping spinal needle with bevel facing upwards. Ensure that the patient's back is perpendicular to the bed.
10. Insert the needle slowly through the skin in to the subarachnoid space, aiming towards the umbilicus.
11. Continue advancing the needle until there is decreased resistance or the needle has been inserted half its length.



12. The stylet is gently removed and the presence of CSF indicates correct placement. **CAUTION:** The distance for entry into the theca in infants and particularly neonates is extremely small so the needle must be advanced very slowly (millimetre by millimetre) in order to avoid a traumatic tap.

13. If no CSF is present slowly remove the needle until CSF begins to flow or the needle is almost removed. Consider reassessing patient position and recommence procedure.

NB: A stylet should always be used to prevent the rare occurrence of a spinal epidermoid tumour.

NB: If the first attempt in obtaining CSF is unsuccessful, a second attempt can be made. If that second attempt is unsuccessful, consult a senior colleague for further advice as to the need for pursuing the test. Following this, the procedure should either be abandoned or another more skilful operator (e.g. anaesthetist) is called.

14. CSF pressure is measured with the manometer. For the purposes of accurately measuring CSF pressure, the flexed position needs to be relaxed temporarily by extending the child's legs. In addition to this it is important to ensure that the distal end of the manometer is open to the atmosphere.

15. The CSF specimen is collected by holding the collection tube/s under the needle until a sufficient amount has dripped in (0.5 – 1.0mL) OR the intrathecal medication is administered. Consider whether a paired blood glucose level should be collected e.g. suspected glut1deficiency, CNS infection.

    N.B. *If assistant is to hold specimen tube/s during collection, they should be wearing appropriate P.P.E. (surgical mask and glove/s)*.

16. The specimen is labelled, placed in a biohazard bag and sent to pathology immediately. CSF collected for genetic/metabolic studies needs to be placed on ice and transported immediately to pathology.

17. In order to minimise the risk of post lumbar puncture headache, the stylet is reintroduced prior to withdrawal of the lumbar puncture needle. The lumbar puncture needle is then withdrawn in one quick motion and pressure applied to the site for at least one minute and an adhesive dressing (e.g. Band-Aid or Cutifilm dressing) is then applied.

18. If nitrous oxide has been used it is then discontinued.

19. The drape is removed.

20. Equipment is disposed of appropriately. Refer to:

    - **At CHW:** Waste Management – CHW Policy
    - **At SCH:** Waste Management SESLHD Policy SESLHDPD/140 (shared service))
    - **NETS team:** adhere to local policy when at other NSW hospitals as advised by local staff.

21. Document in patient's health care record the name of procedure and w*here relevant*, advice for clinical handover; equipment problems/issues and or incident/s and notify in IIMS.

3.6 Post Procedure Effects and Care

- Following the procedure bed rest is not required and the child may mobilise as desired.
- **Headache post-LP:** This is best managed with mild analgesia and allowing the child to rest as indicated by the degree of discomfort the child may experience. If the headache becomes severe or persists, the child may need medical review.
- **Leakage of CSF at the LP site may occur:** This is best managed by lying the child down and applying pressure to the site with a sterile piece of gauze. If the leakage persists the child will require medical review.
- **Infection** may occur as a result of the procedure or due to a CSF leak. If the child becomes unwell and/or develops a fever, medical review is required.
- **Tenderness at the LP site** and/or nerve root irritation may occur. This may be managed with mild analgesia and rest as required.

3.7 Troubleshooting

Encountering bone

- If there is firm resistance to advancement of the needle, consider bone may have been encountered. Review landmarks and consider partially withdrawing the needle and re-advancing in a more cranial or caudal direction. Ensure the needle is inserted in the midline perpendicular to the plane of the back.

Poor CSF flow

- If CSF flow is poor, this may be aided by gentle rotation of the lumbar puncture needle.

Traumatic /bloody tap

- If blood is obtained, withdraw the lumbar puncture needle and prepare for another attempt with a new needle.
- If unsuccessful, discourage multiple attempts and request senior medical review.

3.8 Parent/Carer Education

- Discuss the Procedure and the post-procedure effects with the parents/carers and the child as appropriate. Provide them with the SCHN Lumbar Puncture Factsheet.
- Prepare the family or caregiver with strategies to manage the abovementioned potential side effects in the home environment.

4 References

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