SESLHD PROCEDURE COVER SHEET

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KEY TERMS	Lumbar puncture - Adult Procedure
SUMMARY OF DOCUMENT	This SESLHD procedure applies to all clinical staff involved in the care of patients who are undergoing a lumbar puncture. It covers the performance of and pre and post- procedural management of patients undergoing lumbar puncture. It incorporates all adult inpatients and outpatients undergoing lumbar puncture for either diagnostic or therapeutic purpose

Feedback about this document can be sent to SESLHD-Policy@health.nsw.gov.au

1. POLICY STATEMENT

Lumbar puncture is routinely used to access cerebrospinal fluid (CSF) and is a critical procedure in the diagnosis of Central Nervous System (CNS) infections; subarachnoid haemorrhage; inflammatory diseases and the management of CNS malignancy. [3,12,13]

Serious complications associated with lumbar puncture, although rare, are potentially life threatening. Adherence to correct technique and protocol is essential to ensure patient safety and to prevent adverse events. The expected outcome is that the lumbar puncture is successful and is performed in a safe manner, with minimal discomfort to the patient.

This procedure applies to adult patients only. Paediatric and neonatal lumbar puncture policies, procedure and guidelines are located on local policy sites.

2. BACKGROUND

This SESLHD procedure applies to all clinical staff involved in the care of patients who are undergoing a lumbar puncture. It covers the performance of and pre and post-procedural management of patients undergoing lumbar puncture. It incorporates all adult inpatients and outpatients undergoing lumbar puncture for either diagnostic or therapeutic purpose.

3. DEFINITIONS

Lumbar puncture (LP) - a diagnostic/therapeutic test, which involves the insertion of a spinal needle into the lumbar subarachnoid space below the level of the second lumbar vertebra, usually L3/4 or L4/5 for removal and examination of cerebrospinalfluid[4].

Prion - an infective agent thought to be a misfolded protein implicated in a group of rare neurodegenerative diseases. Prions are resistant to normal methods of instrument processing/sterilisation.

4. SKILL LEVEL

Only Medical Officers competent to perform lumbar puncture should undertake the procedure unsupervised. All medical specialties who undertake lumbar punctures should have a process for ensuring that junior doctors under their supervision are competent prior to undertaking the procedure unsupervised. This should include, at a minimum, a direct observation of the junior doctor undertaking the procedure by a Senior Medical Officer from within the department to assure the Head of Department and Term Supervisor that the junior doctor is competent to perform the procedure unsupervised.

Any junior doctor who requests supervision to undertake a lumbar puncture should be afforded it as practicable, regardless of their perceived level of competency.
Teaching of lumbar punctures should only be undertaken by a consultant in an appropriate specialty who is personally competent to undertake the procedure if required, unless specifically delegated to a senior trainee who has been assessed as competent.

A Nurse Practitioner (NP) may perform a lumbar puncture when able to demonstrate competency in the procedure at the facility where they practice. The procedure must appear within the individual's Scope of Practice, which is endorsed by their local Multi-Disciplinary Steering committee[35].

5. RESPONSIBILITIES

Medical staff will:

- Complete a comprehensive assessment of the patient prior to the procedure
- Escalate and refer patients appropriately to specialists (e.g Neurology, Neurosurgery Haematology)
- Documentation of the episode of care, consent, and relevant procedural safetychecklist.
- Ensure they have the relevant training and senior supervision (where required) prior to performing an LP

Clinical Staff will:

- All staff involved with the performing of lumbar punctures (LP) will comply with this policy and ensure escalation occurs to a Senior Medical Officer where appropriate.

District Managers/Service Managers will:

- Review existing procedure annually
- Present local audit results and IIMS data relevant to this procedure to the SESLHD Emergency and Medicine Stream Committee when required.

6. INDICATIONS

Patients with possible contraindications to LP must not have LP performed before consultation with a Senior Medical Officer as specified in 6.2.

LP may be for either diagnostic (to obtain a specimen of CSF) or therapeuticpurposes:

Diagnostic

Examples include (but not restricted to) the following:

- Myelography: The administration of intrathecal Iodinated contrast media for assessment of the nervous system. This is a Radiological guided procedure. Please refer to Medical Imaging Department for specific guidelines or protocols.
- Investigation of the central nervous system (CNS) for infection e.g. Meningitis[21, 33].
- Investigation of CNS malignancies (e.g. Leukaemia, lymphoma[21] and suspectedleptomeningeal metastases in solid tumours).
- Investigation of demyelinating diseases e.g. Multiple Sclerosis[21].
- Suspected Subarachnoid Haemorrhage[21, 33].
- Measurement of CSF pressure.
  Evaluating peripheral neuropathy, carcinomatous meningitis[21], BenignIntracranial Hypertension (BIH) [3] and inflammatory disorders

Therapeutic

Examples include (but not restricted to) the following:

- Spinal anaesthesia:
  Administration of intrathecal medications e.g. antibiotics, antineoplastic agent oranalgesic agents

- Treatment of CSF leak following spinal or transsphenoidal or intracranial procedures
- Removal of CSF in Benign Intracranial Hypertension (BIH) and Normal PressureHydrocephalus (NPH)[3]

Intrathecal chemotherapy administration requires specific safety precautions – refer to local policies for guidance.

6.1 CONTRAINDICATIONS

LP is potentially dangerous in certain situations. A Senior Medical Officer must determine whether the potential benefits of LP outweigh the risks. **Documentation** by a MO in the clinical notes must specify the risks of the procedure as explained to the patient or the person responsible consenting on the patient's behalf. This list is not exhaustive:

Brain herniation

Patients with raised intra cranial pressure (ICP) due to the risk of brain herniation. If there areclinical or radiological indications of raised ICP, LP must not be performed without the documented consent of a neurologist, neurosurgeon, or ED staff specialist.

Coagulopathy and Anti-coagulation Therapy

Before performing a LP on patients receiving anti-coagulants or with a coagulopathy consider consulting or seeking advice about optimising the situation from a haematologist. Ultimately the risk versus benefit decision lies with the treating team.

Sepsis

Patients with local sepsis; concerns about approach sepsis should be raised with a SeniorMedical Officer e.g. Admitting MO or Registrar.

6.2 SPECIAL CONSIDERATIONS

If the Medical Officer fails to enter the lumbar subarachnoid space following two attempts the procedure must be aborted and the assistance/advice sort from a Senior Medical Officer who meets the criteria in Point 4. At this point consideration should be given following consultation with the AMO, to referring the patient to the Medical Imaging Department and the procedure attended under Image Intensifier (II).

If procedural sedation is required to improve comfort and manage agitation, arrangements must be sought to ensure patient safety and compliance with SESLHDPR/528 - Procedural Sedation (Adults, Ward, Clinic and Imaging areas) during a clinical procedure.

In patients with clinical signs or clinical suspicion of increased intracranial pressure (ICP) a lumbar puncture should only be performed following a computerised tomography (CT) scan and after consultation with the AMO of the treating teams to discuss the risks vs the benefits of theprocedure due to potentially fatal complications.

The sitting position has been shown to improve success rates for LP by increasing the interspinous process space and improving the identification of landmarks and maintaining planes. It should be noted that an accurate opening pressure can only be measured in the lyingposition. Difficult lumbar punctures may need to undergo the procedure with ultrasound guidance or fluoroscopic guidance.

Lumbar puncture must not be performed in the presence of local skin infection over the proposed puncture site.

Additional infection control precautions must be used for patients with known or suspected priondisease including Creutzfeld-Jacob disease (CJD), Gerstmann-Scheinker syndrome (GSS), fatal familial insomnia (FFI) or variant Creutzfeld-Jacob disease (vCJD). Items that have been used during a LP that have been exposed to CSF from patients with known or suspected prion disease must be either single use and then incinerated or, if reusable, must be reprocessed separately and quarantined for the exclusive use of that individual patient then incinerated whenno longer required. CSSD must be notified prior to reprocessing of these instruments.

6.2.1 Thrombocytopenia

It is recommended that blood count be performed immediately prior to a planned lumbar puncture. Procedure can proceed provided platelet count > than 50 x 10^9/L and no clinicalplatelet dysfunction. If patient is taking anti-platelet medications refer to 6.3.3 below. Consider administration of platelets if significant thrombocytopenia or on antiplatelet medications or at risk of significant platelet dysfunction.

6.2.2 Patient taking antiplatelet medications prior to lumbar puncture

- The potential risk to the patient of ceasing antiplatelet therapy for lumbar puncture must be considered and if deemed appropriate for it to be ceased. This must be authorised bythe AMO or SMO
- Cessation of antiplatelet therapy seven to ten days prior to procedure is dependent onantiplatelet medication and effect
- For emergency presentations where it is deemed necessary the patient may have a lumbar puncture without their antiplatelet/anticoagulant therapy being ceased. This mustbe authorised by the AMO or SMO. In the Emergency Department setting, the Emergency Physician responsible for the patient should be advised, and the discussion with an SMO appropriately documented.

Aspirin low dose	May be continued
Dipyridamole	May be continued
Clopidogrel	Discontinue seven days pre-procedure
Prasugrel	Discontinue seven days pre-procedure
Ticagrelor	Discontinue five days pre-procedure
Tirofiban, Eptifibatide	Discontinue eight hours pre-procedure
Abciximab	Discontinue for 48 hours pre-procedure
Antiplatelet therapy may be recommenced on the day of lumbar puncture after the lumbar puncture.	

6.3.3 Patients taking anticoagulant therapy prior to lumbar puncture

Lumbar puncture performed by experienced staff is a low-risk procedure for bleeding.

- There is no published data to define recommendations for cessation of anticoagulationprior to lumbar puncture. Minor surgery guidelines are adopted for safety.
- Patient's receiving **prophylaxis doses** of anticoagulation generally should have lumbar puncture performed just prior to the next dose being administered. The prophylaxis can be re-commenced after lumbar puncture according to the tables below provided there isno blood tap. If blood tap delay recommencement for 24 hours.
- Patients receiving **therapeutic doses** of anticoagulants are at higher risk of bleeding andanticoagulant therapy should be reversed prior to lumbar puncture.
- The potential risk to the patient of ceasing antiplatelet or anticoagulant therapy for lumbarpuncture must be considered and if deemed appropriate for it to be ceased this must be authorised by the admitting or Senior Medical Officer.

<table>
<tr><td>Warfarin</td><td>- Warfarin should be reversed to achieve INR <1.5 prior to procedure. This may require vitamin K and fresh frozen plasma (FFP)/Prothrombinex
- Recommencement of warfarin will require case by case assessment.</td></tr>
<tr><td>Apixaban</td><td>- Therapeutic apixaban must be ceased at least 24 hours (as per table below) prior to procedure.
- Apixaban at prophylaxis or therapeutic dose can be recommenced no sooner than 6 hours after procedure (24 hours if blood tap).

Cease apixaban prior to lumbar puncture as follows:
<table>
<tr><th>Calculated Creatinine Clearance (CrCl)</th><th>Time to cease apixaban prior to lumbar puncture</th></tr>
<tr><td>≥ 50mL/min</td><td>24 hours before
(miss two doses)</td></tr>
<tr><td>25-50mL/min</td><td>48 hours before
(miss four doses)</td></tr>
<tr><td>< 25mL/min</td><td>Apixaban assay and consult Haematology</td></tr>
<tr><td>Hepatic Function
(Child-Pugh score)</td><td></td></tr>
<tr><td>Mild impairment (Child-Pugh A)</td><td>24 hours
(miss two doses)</td></tr>
<tr><td>Mod impairment
(Child-Pugh B)</td><td>48 hours before
(miss four doses)</td></tr>
<tr><td>Severe impairment(Child-Pugh C)</td><td>Apixaban assay and consult Haematology</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Dabigatran</td><td>Cease dabigatran prior to lumbar puncture as follows:
<table>
<tr><th>Calculated Creatinine Clearance (CrCl)</th><th>Time to cease dabigatran prior to lumbar puncture</th></tr>
<tr><td>≥80mL/min</td><td>24 hours before
(miss two doses)</td></tr>
<tr><td>≥51-80mL/min</td><td>48 hours before
(miss four doses)</td></tr>
<tr><td>≥30-50mL/min</td><td>72 hours before
(miss six doses)</td></tr>
<tr><td><30 mL/min</td><td>APTT, TT & Dabigatran assay and consult Haematology</td></tr>
</table>
- Dabigatran at prophylaxis or therapeutic dose can be recommenced no sooner than six hours after procedure (24 hours if blood tap).</td></tr>
<tr><td>Rivaroxaban</td><td>- Rivaroxaban may be dosed as one or two doses daily.
- Must be ceased at least 24 hours prior to procedure.
- Discontinuation for 48 hours or longer is recommended for patients with renal or hepatic impairment.
- Rivaroxaban at prophylaxis or therapeutic dose can be recommenced no sooner than six hours after procedure (24 hours if blood tap).

Cease rivaroxaban prior to lumbar puncture as follows:
<table>
<tr><th>Calculated Creatinine Clearance (CrCl)</th><th>Time to cease rivaroxaban prior to lumbar puncture</th></tr>
<tr><td>≥ 50mL/min</td><td>24 hours before</td></tr>
<tr><td>< 30-50mL/min</td><td>48 hours before</td></tr>
<tr><td>< 30 mL/min</td><td>APTT PT & rivaroxaban assay and consult Haematology</td></tr>
<tr><td>Hepatic Function
(Child-Pugh score)</td><td></td></tr>
<tr><td>Mild impairment
(Child-Pugh A)</td><td>24 hours before</td></tr>
<tr><td>Mod impairment
(Child-Pugh B)</td><td>48 days before</td></tr>
<tr><td>Severe impairment
(Child-Pugh C)</td><td>APTT PT & rivaroxaban assay and consult Haematology</td></tr>
</table></td></tr>
<tr><td>Heparin</td><td>- Must be ceased ≥ six hours pre procedure if most recent aPTT (activated Partial Thromboplastin Time) is within the therapeutic range.
- Heparin prophylaxis or infusion (without bolus) may be recommenced > two hours following procedure provided no blood on needle.
- If traumatic lumbar puncture, anticoagulant may need to be delayed for up to 24 hours depending on clinical context</td></tr>
</table>

Low Molecular weight heparin (LMWH)	- Prophylactic daily dosing-cease 12 hours per-procedure. - Therapeutic twice daily or daily dosing-cease 24 hours pre-procedure. - Prophylaxis dose LMWH may be recommenced > two hours andtherapeutic dose LMWH > six hours following lumbar puncture provided no blood on needle otherwise delay for 24 hours.

The above information is taken from the:

POWH Services Haematology Antithrombotic Management[30 31] and surgical guidelines[22,23]

Check with the on-call Haematologist if clarification is required or site-specific Clinical BusinessRules.

7. POTENTIAL COMPLICATIONS

Common:

Post lumbar puncture low pressure headache has been associated with large bore needles [4, 5, 10, 13]

Per eTG, initial treatment may include rehydration with intravenous fluids, strictly horizontal (head not raised) bed rest for 24 hours, and caffeine (300 mg orally). eTG - Low Cerebrospinal Fluid Pressure Headache & Guideline[36].

Rare:

Meningitis/Infection
Back/leg pain/paraesthesia
Epidural Haematoma[2,4]
Tentorial herniation[6]
Cauda equina compression due to epidural haemorrhage[2]
Abscess formation
Sinus tract formation
Diplopia secondary to extraocular muscle paralysis
Complete spinal block/cord compression[4]

8 PRE PROCEDURE

8.2 Consent and Preparation Prior to Lumbar Puncture

- A MO must explain the procedure, risks and potential complications (refer to Section 7) and obtain written consent according to NSW Health Consent to Medical and Healthcare Treatment Manual
- A Level 2 procedure safety checklist (unless procedural sedation is required it becomes a level 3) must be completed prior to the commencement of the procedure as per NSW Ministry of Heath PD 2017_032 Clinical Procedure Safety.
- Advise patient to empty bladder.
- Perform baseline observations, blood pressure (BP), pulse rate (PR), respiratoryrate (RR), oxygen saturations, temperature, and Glasgow Coma Score (GCS).
- Activate emergency response call as per local site procedures if observations breach normal observation parameters prior to proceeding[29]
- Ensure patient is adequately hydrated.
- Ensure patient privacy.

- Position patient Refer to Section 9.
- Light sedation e.g. lorazepam 1mg orally should be considered in patients requiring serial lumbar punctures or who are extremely anxious.

9 PROCEDURE

Strong evidence[34] supports that the preferred needle type should be the atraumatic (pencil-point) needle and the smallest gauge possible to successfully perform the required procedure be used[10,11,12,13]. It is thought that rather than cutting the elastic fibresin the dura (like the bevelled needle), the atraumatic needle temporarily separates the fibres allowing them to more easily close on withdrawal of the needle. The use of theatraumatic needle may minimise the risk of persisting CSF leak and subsequent postpuncture headache.

9.1 Equipment (Diagnostic and Therapeutic)

1. Trolley with waste disposal bag and sharps container
2. Protective sheet
3. Dressing pack
4. Chlorhexidine 0.5% with alcohol pre-packaged swabs (non-sterile). **Bottled antiseptic, poured into containers, on the procedure set-up trolley is strictly forbidden.**
5. Sterile gloves (appropriate size)
6. Sterile gown x one
7. Protective eyewear
8. Protective mask
9. Sterile fenestrated drape
10. Spinal needles x two, 22 gauge (or smaller if clinically indicated) nine cm in length
11. Disposable manometer
12. Collection tubes x three (if PCRs are requested then a fourth separate dedicated tube is required)
13. Local anaesthetic e.g. 1% lignocaine (prescribed by MO)
16. 10ml syringe Needles - one x blunt drawing up needle; one x 23 gauge and 25 gauge
17. Transparent dressing e.g. Opsite

9.2 Method

a) Patient Positioning

Positioning of the patient is one of the most critical aspects of the procedure.[1]A primary reason for a dry tap is poor positioning.
There are two primary positions: sitting and lying.

Sitting:

1. Preferred position for dehydrated or obese patients.
   The patient sits with their lower back towards the clinician and the patient must be allowed to “slump” over a pillow on their lap, To optimize opening the space the patient can place their feet on a chair so that the thigh is greater than 90 degrees, this makes the space much better and enhances success This position assists in determining if the spine is straight and maintains the lumbar needle at midline whenit is being inserted.

Lying: Ensure the shoulders and hips are parallel to each other and perpendicular to thebed.

1. Place patient in the left lateral position with the lumbosacral region close to theedge of the bed.
2. Ask the patient to curl up to the maximum extent possible and clasp hands around knees and hug them as close to the chest as possible (fetal position).
3. Place a pillow under the head and another between the legs.

Procedure *(Diagnostic)*

NOTE: This procedure is a high-risk procedure and requires strict adherence to aseptic technique and the maintenance of a sterile field:

1. Carry out applicable general preparation.
2. Wash hands for at least 15 seconds.
3. Prepare sterile work field and open up all equipment.
4. Prepare patient, ensuring they are in an appropriate position.
5. Locate the interspace between L3 and L4, which lies at the intercristal line (across the tops of the iliac crests) with the patient in the flexed position. The needle is inserted at this level or one level below, between L4 and L5. (Refer to Diagram 1)[6]. An ultrasound can identify landmarks in patients who are difficult to assess, such as obese patients.[20]
6. Clean the region of the spine using Chlorhexidine 0.5% with **alcohol pre-packaged swabs**, working outward in concentric circles. Discard the swabs.
7. **Note: chlorhexidine is toxic to neurologic tissues. Do not allow antiseptic swabs to come in contact with LP equipment. Do not allow swabs to come incontact with the sterile work field. Ensure the region cleaned is completely dry before inserting the LP needle through the skin.**
8. Don protective eyewear and mask.
9. Wash hands for a minimum of three minutes with surgical hand wash.
10. Don sterile gown.
11. Don sterile gloves.
12. Apply sterile fenestrated drape.
13. Draw up the local anesthetic directly from its original packaging (i.e.do not decanter into receptacle on sterile field) and inject into the area allowing adequate time to take effect.

    NB: Once drawn up do not place the syringe back onto the sterile field. The contents must be immediately injected. If the syringe with its contents is placed back on to the sterile field it must have a sterile label applied identifying the content. Refer to NSW Health Medication Handling PD2022_032.

14. Assemble the atraumatic (pencil-point) needle
15. Insertion of the LP needle has 2 steps:
    a) Insert the introducer needle orientated towards the umbilicus (Refer to Diagram 2) and not so deep as to puncture the ligamentum flavum (only a risk in the very small or young patient);
    b) Then insert the LP needle through the introducer needle. You will feel resistance as the LP needle leaves the introducer needle and then a slight give. Slowly remove the stylet and wait for CSF flow.

If no flow then further insertion of the LP needle without the stylette can occur until flow. If no flow or a hard point is encountered reinsert the stylette and remove LP needle leaving the introducer in situ. Then pull the introducer needle back until in the subcutaneous tissue and re-orientate either caudally or cephalad and repeat[1,3].

16. Remove the stylet from the needle slowly to avoid sucking a nerve rootlet into the lumen and subsequent radicular pain[6].
17. With initiation of CSF flow attach the manometer if required.
18. Ask patient to uncurl their legs to reduce abdominal pressure and increase CSF pressure[1].
19. Measure the CSF opening pressure and record in the medical record in cm H_20.
20. Remove the manometer and collect three specimens of CSF with a minimum of CSF to 1cm in each tube. More CSF or specimens may be required in some circumstances e.g. treating BIH.
21. After collection replace the stylet and remove needle and stylet together. This has been shown to reduce the likelihood of post LP headache.
22. Apply appropriate occlusive dressing e.g. Opsite®, Tegaderm®
23. Document the procedure including the position of patient, opening pressure if indicated and clarity/colour of the CSF.
24. Send the CSF specimens with the correct request form to the laboratory immediately.

NOTE: CSF pressure should be measured with the patient in the horizontal lateral decubital position. The pressure reading will be inaccurate if the patient is in the sitting position.

DIAGRAM 1

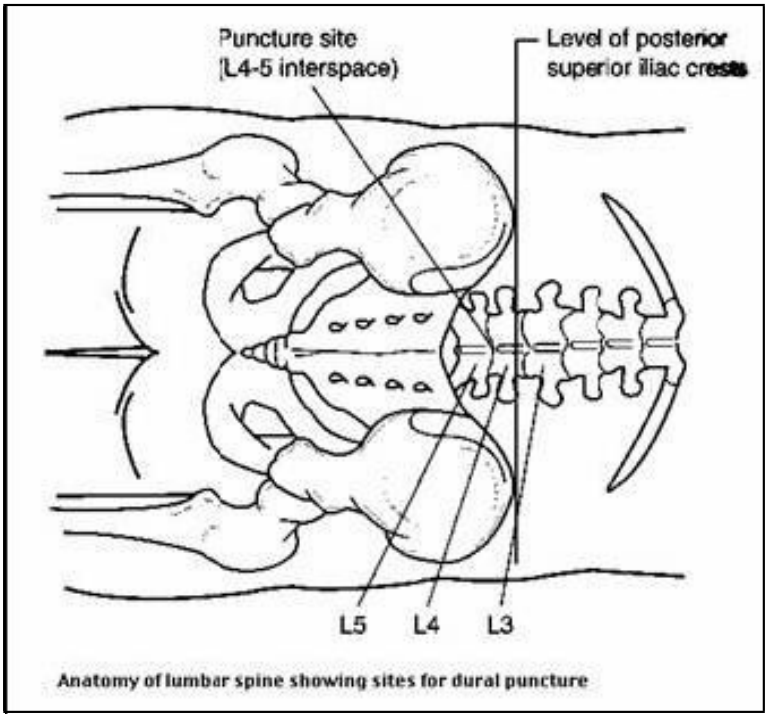
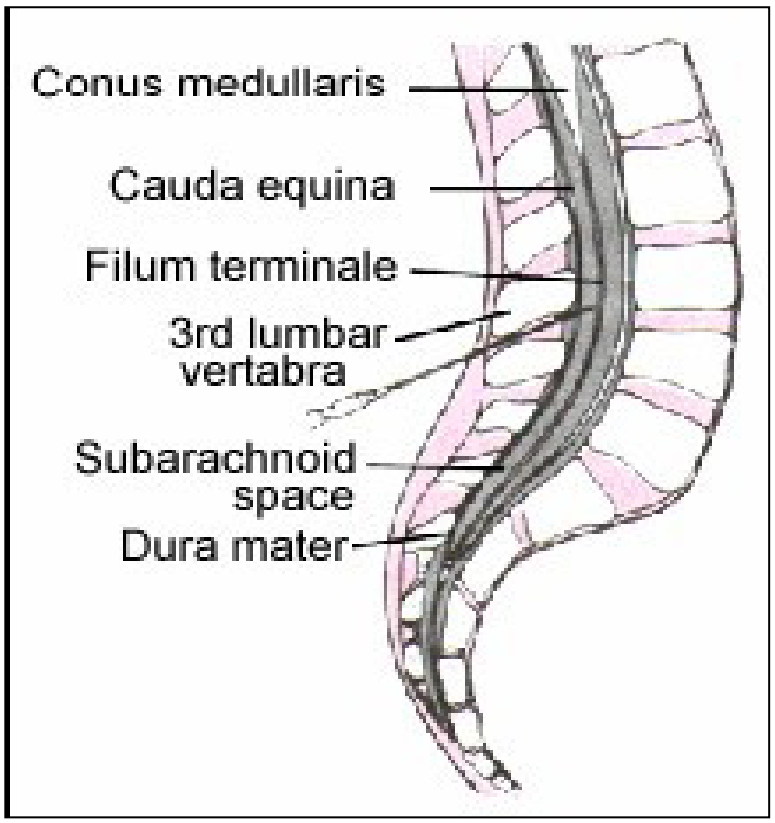


DIAGRAM 2



10 POST-PROCEDURE MANAGEMENT

- The aim of management post lumbar puncture is to minimise post-dural puncture headache.
- Bed rest is not required[19, 20, 21]
- Repeat routine observations, blood pressure (BP), pulse rate (PR), respiratory rate (RR), oxygen saturations, temperature and Glasgow Coma Score (GCS) on completion of procedure for four hours following the procedure.
- Follow normal escalation procedures such as a clinical review or emergency response call if observations breach normal parameters on the Standard Adult Observation chart.
- Hydration should be maintained. Encourage oral fluids. If a patient is Nil by Mouth (NBM) then intravenous therapy should be considered[5,7].
- Avoid strenuous activity for 24 hours post procedure.
- If a patient is having a lumbar puncture in an Outpatient setting, they should remain in for at least four hours post puncture for observation but can leave earlier as directed by a medical officer.
- Advise patient to report any new or increasing headache (particularly on arising), numbness, tingling, involuntary lower limb movement or leakage of fluid or blood from puncture site.
- The presence of any of these symptoms and/or raised temperature must be immediately reported to a Medical Officer. If a patient does exhibit any of these symptoms they must not be discharged prior to authorisation by the relevant Medical Officer.

11 CEREBROSPINAL FLUID ANALYSIS

CSF fluid collection guide:

Label specimens sequentially:

- First specimen: 0.5mL CSF (approximately 10 drops) placed in a sterile universal CSF container for measurement of glucose and protein
- Second/third specimens: 5mL of CSF divided into two sterile universal containers collected sequentially for microbiology. This volume is provided as a guide and is sufficient for commonly required tests, however for more specialised tests, or where this volume is not able to be collected please refer to the required volume for individual tests (Appendix 1) or contact microbiology.
- Fourth specimen (if xanthochromia testing required): 1mL CSF (approximately 20 drops) in a sterile universal container for xanthochromia and protect it from light (wrap sample in aluminium foil).

Examination of CSF should include the following where required[4]:

- Cell count (2mL)
- Protein and glucose analysis (2mL)
- Gram Stain and culture (2mL)
- Polymerase chain reaction (PCR) (dedicated tube - 1mL)
- Cytology for malignant cells (at time of diagnosis or to monitor progress following chemotherapy) (1.0m)

- Flow cytometry for Haematology patients, pre- and post-treatment (1.0ml), see NOTE
- See Appendix 1 for expanded test list and required volumes of CSF.

NOTE:

Haematology patients:

Flow Cytometry: samples from haematology patients should be sent to the haematology laboratory for cytospin examination and, if flow cytometry is requested, RPMI should be added to the tube and clearly marked as "RPMI added for flow cytometry".

Xanthochromia testing for suspected subarachnoid haemorrhage:

- CSF for xanthochromia testing should be collected a minimum of 12 hours after suspected event.
- To avoid contamination from red cells as a result of the trauma from the lumbar puncture, CSF taken for xanthochromia should be collected into a separate container to those in which the first few mL of fluid is placed. This should be at least the third, or ideally the fourth sample. Protect this sample from the light.
- A simultaneous blood specimen should be taken for serum bilirubin and total protein measurement as these are needed to assist in interpretation.
- Additional investigations are determined by clinical presentation and provisional diagnosis. Check with the laboratory at the time of the procedure if unclear.

12 DOCUMENTATION

- Patient healthcare record and electronic medical record (eMR)
- SESLHD consent form
- MOH clinical procedure safety checklist (electronic level 2 checklist for inpatients and level 2 checklist sticker for outpatients) Include level 3 if procedural sedation has been used
- NSW Health standard observation/ eMR
- SESLHD neurological observation chart/ eMR
- National inpatient medication chart – eMR
- eMR request for specimen investigation/analysis.

13 MONITORING and COMPLIANCE

- IIMS recording and investigation as required.

14 REFERENCES

1.	Lederman, RJ. 1996. Lumbar Puncture: Essential steps to a safe and valid procedure. Geriatrics Advisor, 51(6):51-58.
2.	Waldman, W. 1999. Precautions for lumbar puncture: A survey of neurologic educators. Neurology, 52(6):1296-1298.
3.	Normal Pressure Hydrocephalus (NPH), Benign Intracranial Hypertension (BIH) , and idiopathic intracranial hypertension (IIH). https://dizziness-and-balance.com/disorders/central/nph.html
4.	Marshall, RS & Mayer, SA. 2001. 2nd Edition, Diagnostic Studies, On Call Neurology: 31-33.
5.	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 Syst Rev. 2016 Mar 7;3(3):CD009199. doi: 10.1002/14651858.CD009199.pub3. PMID: 26950232; PMCID: PMC6682345. https://pubmed.ncbi.nlm.nih.gov/26950232/
6.	Adams, R; Victor, M & Ropper, A. 1997. 6th Edition, Special Techniques for Neurologic Diagnosis, Principles of Neurology:12- 18
7.	Thoennissen, J; Herkner, H; Lang, W; Domanovits, H; Laggner, AN & Mullner, M. 2001. Does bed rest after cervical or lumbar puncture prevent headache? A systematic review and meta-analysis. Canadian Medical Association Journal, 165(10):1311- 1323.
8.	Horlocker, T; Wedel, D; Benzon, H; Brown, D; Enneking, K; Heit, J; Mulroy, M; Rosenquist, R; Rowlingson, J; Tryba, M & Yuan, C. 2003. Regional Anaethesia in the Anticoagulated Patient: Defining the Risks (The Second ASRA Consensus Conference on Neuraxial Anesthesia and Anticoagulation). Regional Anesthesia And Pain Medicine, 28(3): 172-197.
9.	NSW Health Consent to Medical and Healthcare Treatment Manual
10.	Shah, P & Thomas, S. Post-puncture Headache. Hospital Physician. 2007; June: 51-55
11.	O'Connor, G, Gingrich, R & Moffat, M. The effect of spinal needle design, size, and penetration angle on dura puncture cerebral spinal fluid loss. American Association of Nurse Anesthetists Journal, 2007, 75 (2), April: 111-116
12.	Williams, J, Lye, DCB & Umapathi, T. Diagnostic lumbar puncture: minimizing complications. Internal Medicine Journal, 2008, 38: 587-591
13.	Cooper, N. Evidence-based lumbar puncture: best practice to prevent headache. Hospital Medicine. 63 (10), October 2002: 598-599
14.	Drug Product Information. MIMS Australia Pty Ltd. UBM Medica 2012. MIMS Online
15.	Mallory, P; Grassi, C; Kundu, S; Gervais, D; Miller, D; Onis, R; Postoak, D; Rajan, D, Sacks, D; Schwartzberg, M, Zuckerman, D and Cardella, J. Consensus Guidelines for Periprocedural Management of Coagulation Status and Hemostasis Risk in Percutaneous Image-guided Interventions. Journal Vascular Interventional Radiology, 2009 s240-s249
16.	Australian Commission on Safety and Quality in Health Care. Credentialling for health professionals. Accessed October 2, 2013.
17.	Drug Product Information. MIMS Australia Pty Ltd. UBM Medica 2014. MIMS Online

18.	Tran H, Joseph J, Young L. New Oral Anticoagulant –A Practical guide on behalf of the Australian Society of Thrombosis and Haemostasis (ASTH). Internal Medicine Journal 2014(44): 1-23
19.	Bateman, B.T, Cole, C, Edelstein, C and Lay, C, 2022 Post-Lumbar Puncture Headache accessed via UptoDate, 23/02/2023 https://www.uptodate.com.acs.hcn.com.au/contents/post-dural-puncture-headache?search=post%20lumbar%20puncture%20headache%20-%20edelstein%20and%20lay&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1
20.	ACI Emergency Care Institute Patient Fact Sheet Lumbar puncture
21.	Johnson, K.S, and Sexton, D.J. 2021, Lumbar puncture: technique, indications,contraindications and complications in adults. Accessed 23/02/2023 via UpToDate: https://www.uptodate.com.acs.hcn.com.au/contents/lumbar-puncture-technique-indications-contraindications-and-complications-in-adults?search=lumbar%20puncture&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1
22.	RAUK (2013). Regional Anaesthesia and Patients with Abnormalities of Coagulation. The Association of Anaesthetists of Great Britain & Ireland, TheObstetric Anaesthetists' Association, Regional Anaesthesia UK.
23.	Benson, H. (2003) Regional Anaesthesia in the Anticoag*u*lated Patient. NYSORA The New York School of Regional Anesthesia
24.	National Blood Authority Australia. Patient BloodManagement Guidelines.2011
25.	NSW Health Medication Handling PD2022_032
26.	National Recommendations for User-applied Labelling of Injectable Medicines, Fluids and Lines February 2015 Australian Commission on Safety and Quality inHealthcare https://www.safetyandquality.gov.au/wp-content/uploads/2015/09/National-Standard-for-User-Applied-Labelling-Aug-2015.pdf
27.	NSW Health PD2012_069 Health Care Records - Documentation and Management
28.	NSW Health Clinical Procedure Safety PD2017_032
29.	NSW Health Recognition and management of patients who are deteriorating PD2020_018
30.	Prince of Wales Hospital and Community Health Services Haematology Services antithrombotic management March 2022 http://seslhdweb.seslhd.health.nsw.gov.au/powh/Services/Haematology/Antithrombotic_Management/
31.	Prince of Wales Hospital and Community Health Services Clin099 Intrathecal Cytotoxic Drug Administration via Lumbar Puncture http://seslhdweb.seslhd.health.nsw.gov.au/powh/documents/policies/mosaiq/IntrathecalCytotoxicDrugAdministrationviaLumbarPuncture.pdf

32.	POWH Clinical Business Rule. Blood Component Management and Administration POWH CLIN018 published November 2022 http://seslhdweb.seslhd.health.nsw.gov.au/POWH/documents/cpm/Section04/Blood-Component-Management-AdministrationPOWHCLIN018.pdf
33.	ACI Emergency Care Institute Clinical Procedures Microbiology - Lumbar Puncture
34.	Bram Rochwerg et al, Atraumatic (pencil-point) versus conventional needles for lumbar puncture: a clinical practice guideline. BMJMay2008:1-6
35.	NSW Health Nurse Practitioners PD2022_057
36.	Therapeutic Guidelines > Neurology > Low cerebrospinal fluid pressure headache. November 2017. eTG - Low Cerebrospinal Fluid Pressure Headache & Guideline.

12. REVISION AND APPROVAL HISTORY

Date	Revision No.	Author and Approval
September 2018	DRAFT	Catherine Molihan
October 2018	DRAFT	Draft for Comment period.
November 2018	DRAFT	Final draft endorsed by Executive Sponsor.
November 2018	DRAFT	Processed by Executive Services prior to Clinical and Quality Council approval.
December 2018	0	Approved by Clinical and Quality Council
April 2019	0	Updated information included in Section 4. Approved by Clinical and Quality Council
May 2019	0	Updated information regarding Chlorhexidine included in Section 9. Formatted by Executive Services and published.
April - December 2022	1	Section 5: Medical staff will; added dot point: • Ensure they have the relevant training and senior supervision (where required) prior to performing an LP • Section 6: diagnostic and the references reviewed and updated Updated information in 6.1, 6.2.1, 9.2 Method and Post Procedure Management. Section 6.2.2; Asasantin SR, Ticlopidine and Cangrelor discontinued and deleted from the table. Section 7; added Per eTG, initial treatment may include rehydration with intravenous fluids, strictly horizontal (head not raised) bed rest for 24 hours, and caffeine (300 mg orally) eTG - Low Cerebrospinal Fluid Pressure Headache & Guideline.

		Section 9 – confirmed with IPC, CEC & SGH Anaesthetics that best practice is 0.5% chlorhexidine gluconate in 70% isopropyl alcohol swab sticks as skin asepsis Section 9.2 Method Procedure (Diagnostic), minor changes to 15(b) **Deleted** *with stylet feeling initial resistance and then give and* **added** *through the introducer needle. You will feel resistance as the LP needle leaves the introducer needle and then a slight give* and Deleted previous point number 20 *If CSF flow is not evident or you strike bone, withdraw the* *needle partially, recheck the landmarks and re advance.* References updated.
April 2023	1	Approved by Executive Sponsor.
May 2023	1	Approved at SESLHD Drug and Therapeutics Committee.

APPENDIX 1

Volumes of CSF required by test requested and testing laboratory

	Volume (50µL~1 drop)	Testing site	Comment
ACE	300µL	RPAH	
Adenovirus PCR	250µL	POWH	
Amino Acid	250µL	CHW	CSF and plasma must be a paired collection within one hour. CSF must be red cell free and frozen within 20 minutes.
AMPA Receptor	400µL	RBH	
Anti-Neuronal Ab	250µL	RPAH	
Anti-VGKC	200µL	RBH	
CJD 14-3-3 Protein	1000µL	Melbourne University	Only tested if CSF RBC< 500, WBC <10 and not macroscopically blood-stained nor xanthochromic.
Cryptococcal Ag	250µL	SGH or POWH	
Culture, Gram stain, India ink & cell count	500µL	SGH or POWH	
Cytology	1000µL	SGH or POWH	
Cytospin - Haematology	200µL	SGH or POWH	
Flow Cytometry	1000µL	SGH or POWH	Deliver to lab ASAP. Must be processed within 4hrs.
GABA (Gamma-aminobutyric acid)	400µL	RBH	
Glucose	200µL	SGH or POWH	
HIV Viral Load	500µL	POWH	Must have a positive serum HIV antigen/antibody.
JC Polyoma virus PCR	250µL	POWH	
IgG Albumin ratio	100µL	TSH	
Lactate	100µL	POWH	Collect on ice. Lab must centrifuge and freeze immediately.
Listeria monocytogenes PCR	250µL	SGH	
Meningococcal PCR	250µL	SGH	
Neurotransmitters	200µL	CHW	Obtain special collection tubes & protocol from Pathology. Deliver to Pathology within 5 min. on ice.
NMDA Receptor Ab (N-methyl-D-aspartate Ab)	200µL	RBH	
Oligoclonal bands Protein EPG (CSF)	200µL	TSH	300µL of serum must be sent at same time.
Parechovirus PCR	250µL	POWH	
Pneumococcal antigen Strep pneumo antigen	100µL	SGH or POWH	
Pneumococcal PCR Strep pneumo PCR	250µL	SGH	

	Volume (50µL~1 drop)	Testing site	Comment
Protein	200µL	SGH or POWH	
Syphilis serology CSF	500µL	Westmead	Only if reactive blood syphilis serology.
Syphilis PCR	250µL	Westmead	Only if reactive blood syphilis serology.
TB or AFB (Microscopy/Culture)	As much as possible	SGH	Ideally 6mL
TB PCR	250µL	SGH	
Toxoplasma PCR	250µL	POWH	
Tropheryma whippelii (Whipple's Disease)PCR	500µL	Westmead	
Viral PCRs (Enterovirus, HSV, VZV, CMV, EBV)	250µL	POWH	
Xanthochromia	1000µL	SGH or POWH	Tube 4 - Protect from light by wrapping in aluminium foil.

Recommended minimum volumes for each test requested determined by on-site and referral laboratories within NSW Health Pathology. All samples should be delivered to the Central Specimen Reception at each facility for distribution to the relevant laboratory.