Lumbar Puncture (LP) Clinical Guideline

V1.0

July 2020
Summary

Decision to perform a lumbar puncture (LP) – this must be made by a consultant or registrar caring for the patient.

Performing a lumbar puncture – this must be done by, or under the direct supervision of, someone competent in performing lumbar puncture.

The Clinician who performs the lumbar puncture is responsible for gaining informed consent, adherence to best practice for the procedure and post procedural care including thorough handover of procedure and aftercare to the nurse looking after the patient.

The nursing team should monitor the patient’s position, absence or presence and severity of headache and pain-score. They must escalate any concerns to the clinician who performed the LP or, if unavailable, another senior doctor.

Preparation checklist:

- Indication confirmed and documented in patient notes.
- Review of Contra-indications
- Coagulopathy Screen reviewed & drug-chart checked:
- Consent form and patient information sheet printed and written consent obtained  
  SEE DOCUMENTS LIBRARY – CHA4084: Lumbar Puncture
- LP equipment pack obtained
  Plus: local anaesthetic, sterile gloves and Chlorhexidine 0.5% spray.
- Procedure documentation using the standardised proforma (in pack/ see appendix)
1. **Aim/Purpose of this Guideline**

1.1. This guideline is to aid a suitably trained clinician in performing a lumbar puncture. The standardisation of the procedure with this guideline provides framework for informed consent, reducing the risks associated with the procedure and promotes good documentation.

1.2. Some of the guidance for this guideline is provided from the anaesthetic literature with relation to Central neural blockade (spinal anaesthesia) because of the lack of large studies from the medical forum. It is appropriate to extrapolate these studies to the medical field because the anaesthetic practice is evidence based recommendations for intended breach of the dura as also occurs in performing a LP.

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DPA18 is applicable to all staff; this includes those working as contractors and providers of services.

For more information about your obligations under the DPA18 please see the *Information Use Framework Policy* or contact the Information Governance Team rch-tr.infogov@nhs.net

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2. **The Guidance**

2.1. **Indications for LP**

- Suspected Subarachnoid haemorrhage with a negative CT scan SAH (LP must be >12 hours post-onset headache)
- Suspected CNS infection- bacterial, fungal, mycobacterial and viral
- Idiopathic Intracranial Hypertension - Diagnostic / Therapeutic
- Rarer- Suspected MS / Gillian-Barre / CNS Malignancy / CNS Vasculitis

2.2. **Contraindications**

- Presence of infected skin over the needle entry site
- Features of raised intracranial pressure on brain imaging at risk of brain herniation
- Suspected spinal/ epidural abscess or infected metalwork
- Untreated thrombocytopenia or bleeding diathesis
- Patient refusal

2.3. **Review coagulation/ anticoagulation**

2.3.1. A patients bleeding risk should be considered on an individual basis, informed by personal and family history, comorbidity and medications.
Patients with a high bleeding risk have an increased risk of spinal and epidural haematoma formation following LP.

2.3.2. Routine screening of anticoagulation is not recommended on unselected patients. Those considered to be at risk should be discussed with the haematology team prior to the procedure. Coagulation tests may be considered for patients with a personal or family history of unexplained bleeding, currently on anticoagulant drugs, liver or renal failure, disseminated intravascular coagulation, haematological disorders or inherited causes of coagulopathy.

2.3.3. Plts<40, INR>1.4 or APTR>1.4 may need correcting, consider discussion with haematology if appropriate.

2.3.4. Performing an LP outside of these recommendations confers a higher risk of complication, particularly spinal or epidural haematoma formation. Deviation is not recommended but if clinically indicated and
benefit outweighs risk then this decision should include a consultant-level discussion. The decision may be to avoid or postpone the LP.

2.4. Asepsis for the Lumbar Puncture

2.4.1. The Association of Anaesthetists of Great Britain and Ireland have issued guidance on asepsis for Spinal anaesthesia. These include thorough hand washing with surgical scrub, wearing of a hat, mask, sterile gown and gloves and the use of a large sterile drape. When asepsis has been suboptimal epidural abscesses have occurred.

2.4.2. Chlorhexidine in 70% isopropyl alcohol has been shown to be superior in halting growth of Staphylococcus aureus, in comparison to both aqueous Chlorhexidine and povidone iodine. It is a potent broad spectrum active against most bacteria and yeasts.

2.4.3. Both Chlorhexidine and alcohol have been proven to cause irreversible neurotoxicity. All patients affected developed a chronic adhesive arachnoiditis leading to paraplegia. There has been no additional antimicrobial benefit demonstrated by use of 2% compared to 0.5% and the National Working Party of Obstetric, Regional, Paediatric under the umbrella of the Association of Anaesthetists of Great Britain and Ireland recommends that the safest compromise between the risk of infection and neurotoxicity.

2.4.4. The clinician must pay meticulous attention to application of the antiseptic, allowing it to dry completely prior to start the procedure. Chlorhexidine must be kept away from the sterile field and needle at all times. The most practical method to achieve this, which is adopted by all anaesthetists, is to spray 0.5% chlorhexidine in alcohol prior to opening the sterile field thereby reducing any chance of contamination.

2.4.5. As with all antimicrobials both hypersensitivity and anaphylaxis to Chlorhexidine is well described and should be checked prior to application. (4.1)

2.5. Complications

- Cerebral herniation, Cardiorespiratory collapse, loss of consciousness and death
- Epidural/subdural infection or abscess
- Post LP meningitis has been attributed to contamination instruments, poor aseptic technique, aerosoled secretions from the operator, inoculation of skin flora into the vertebral bone resulting in osteomyelitis or discitis
- Epidural/subdural haematoma
- Persistent back pain or neurological findings e.g. weakness, decreased sensation or incontinence
- Post Dural Puncture Headache (PDPH)

2.5.1. PDPH is classically fronto-occipital and is often associated with neck stiffness. Sometimes the pain radiates to both temples, may be felt behind the eyes, or is more diffuse than localised. The headache typically has a postural element, with the pain exacerbated by sitting or
standing and alleviated by lying flat. The postural feature of the headache differentiates it from other serious intracranial causes of headache such as a subdural haematoma. The headache may be associated with other symptoms such as nausea, vomiting, hearing loss, tinnitus, vertigo and dizziness. Visual disturbances such as diplopia and photophobia may also occur. 90% of headaches will occur within 3 days of procedure and two thirds within the first 48 hours. It can rarely develop immediately or up to 14 days of the procedure. Most cases of PDPH left untreated will resolve spontaneously within 7 days. In a minority of patients, the headache can persist even for years.

Symptoms of a postural headache and a history of dural puncture are usually sufficient to make a diagnosis. If in doubt, additional investigations such as MRI may be needed to confirm the clinical findings and rule out other causes of headache. MRI scanning of the brain may demonstrate evidence of reduced CSF pressure.

2.5.2. Myelography or thin-section MRI can be used to locate the source of the CSF leak. Doppler ultrasound reveals higher flow velocities in cerebral vessels in patients with PDPH. Bed rest may relieve the symptoms of PDPH, though it does not affect the outcome following PDP. Patients should be encouraged to adopt the position which they find most comfortable. Patients whose headache is severe enough to make them bedridden should be given elasticated stockings and prescribed LMWH, around 6pm, in order not to delay a possible Epidural blood patch the next day. Early discussion with Consultant on CEPOD is important to discuss whether this is appropriate. Although there is no evidence to support the therapeutic effect of vigorous hydration, no patient with PDPH should be allowed to become dehydrated and adequate fluid intake should be encouraged. Regular paracetamol and NSAIDS (if not contraindicated) may be enough in mild cases. A weak opioid such as codeine is usually needed as well in moderate and severe cases. Laxatives should be prescribed in conjunction with codeine to prevent constipation. Epidural blood patch (EBP), performed by a Consultant anaesthetist has a success rate of 68-90% after first patch and 97% after the second. The low incidence of complications has established it as the definitive treatment of PDPH. EBP in the first 24 hours after dural puncture has a lower success rate and a higher risk of bacteraemia, and therefore not recommended. Prophylactic EBP is also not recommended.

- Abducens palsy
- Radicular symptoms and low back pain

2.6. Preparation

2.6.1. LP Pack contents
- Examination gown and hand towel
- 5ml & 10ml Luer slip syringe (for LA)
- Aperture drape 80x100cm
- 18G blunt fill filter needle (for drawing up)
- 21G Needle (for LA)
- 25G Needle (for LA)
2.6.2. Extra equipment required:
- Lignocaine 5ml 1% for skin infiltration
- Sterile gloves in your size
- 0.5% Chlorhexidine (pink) spray
- Surgical hat and mask are recommended

2.7. Needles selection

The LP packs contain a 22G Whitacre spinal needle which are associated with a lower incidence of post-dural puncture headache (PDPH). They divide the dural fibres rather than cut them (eg. Quinke). (3,2)

2.8. Assistance

2.8.1. One assistant should be present during the procedure, to help with non-sterile aspects of the procedure, patient positioning, obtaining any additional equipment, and reassuring the patient. This will greatly improve chances of success.

2.8.2. If an assistant is unavailable, it is at the discretion of the clinician to proceed but is not recommended.

2.9. The Procedure

2.9.1. Positioning:

Both lateral positioning and sitting positioning have their advantages. A sitting position may be less likely to rotate the spine, whilst lateral positioning may be more comfortable for the patient. Lateral positioning can create a positional scoliosis, especially in women.

If an accurate opening pressure is required, the patient must be in lateral positioning with their legs straight at the time of measuring the opening pressure.

Positioning is key to a successful dural puncture – ensure the patient is:
- Shrugging their shoulders
- Chin to chest
- Pushing out their lumbar back.
- Pulling their knees up to flex their hips as much as possible.
2.9.2. Identifying the correct intervertebral space:

The clinician should aim to access the L3/4. The intercristal line (Tuffier's line) joins the iliac crests and passes through the fourth lumbar vertebra (L4). This allows identification of the L3/4 interspace. Dural puncture above L2/L3 should not be undertaken as the cord terminates at the level of L1-2 in adults and inserting a needle above the termination of the cord may damage the conus medullaris.

2.9.3. Clean a wide area around the insertion site with 0.5% Chlorhexidine spray and allow the skin to dry. Care must be taken not to spray the sterile equipment tray. See 2.4.

2.9.4. Drape the patient with a sterile aperture drape.

2.9.5. Scrub and don a sterile gown and sterile gloves (surgical hat and mask are also recommended).

2.9.6. Infiltrate the skin and subcutaneous tissue around the insertion site with 1% lidocaine using a 25G (orange) then 21G needle (green).

2.9.7. Maximum safe doses:
- Lidocaine 1% (10mg/ml): Max infiltration 3mg/kg = 0.3ml/kg
- Lidocaine 2% (20mg/ml): Max infiltration 3mg/kg = 0.15ml/kg

2.9.8. Usually 3-5ml is sufficient. It is unlikely to be possible to infiltrate the ligamentum due to resistance. Beware - Large volumes of LA may distort anatomy.

2.9.9. Steady the patient and insert the introducer. It is often not necessary to insert this introducer to the hub. Aiming towards the umbilicus, slowly pass the spinal needle paying particular attention to the resistance offered.

2.9.10. The resistance should ‘give way’ at the point beyond the ligamentum flavum. At this point remove the stylet and check for the appearance of CSF at the hub.

2.9.11. Free-flowing CSF droplets must be seen before correct placement is confirmed.

2.9.12. Reinsert the stylet in order to advance further, if required.

2.9.13. The interspinous ligament may be calcified in the elderly and often presents resistance, osteoporosis and osteophytes will also pose problems in accessing the dural space.

2.10. Collecting Specimens: 10 drops required in each specimen pot

2.10.1. Specimen Pot #1 (Micro) – Cell Count & Culture

2.10.2. Specimen Pot #2 (Biochemistry) – Glucose & Protein

2.10.3. Specimen Pot #3 (Micro) – Cell count & Culture

2.10.4. +/- Specimen Pot #4 (Biochemistry) – Xanthochromia Protect from direct sunlight by sending in an opaque envelope (Only required in suspected SAH).

2.10.5. Samples should be labelled “1”, “2”, “3”, “4” after they have been collected and are no longer sterile. Be careful to keep them in the correct order. An assistant can label these as they are collected.

2.10.6. Standardized collection forms can be printed via the Maxims Bundle under Place Order → Specialty → General medicine → “CSF for SAH” or “CSF for Micro/Clinical Chem”

2.11. Troubleshooting

2.11.1. Identifying the midline

2.11.2. In the lateral position, the paramedian soft tissues fall with gravity giving a false appearance of a midline. Palpate with two fingers - either side of the vertebrae to identify the bony midline.

2.11.3. Hitting bone superficially

2.11.4. Hitting bone soon after passing beyond the introducer needle (or even with the introducer needle) is likely the tip of the spinous process superficially. This is likely the midline; try to adjust insertion level slightly caudad.

2.11.5. Hitting bone at depth

2.11.6. Hitting bone at approximately half the expected depth to the dura is likely hitting the proximal part of spinous process or vertebral arch. Retract the needle slightly, and then redirect the tip of the needle toward the umbilicus. If bony obstruction is still met, retract further and aim more cephalad.

2.11.7. Hitting bone at a depth you would expect the dura to be, is more likely to be lamina. Ask the patient which side they can feel the needle more, and adjust the introducer and needle to a more midline direction of travel.

2.11.8. Longer needle requirements – 22 G Whitacre needles are also available in 120 mm length
2.12. Escalation of care – SEE APPENDIX 3

2.12.1. For <ST3 level (or equivalent) doctors, after 2 unsuccessful approaches, escalation should be made to ST3 (/equivalent) or above.

2.12.2. Inability to gather a specimen is not a personal failure. It is both in the patients best interests and important as a learning opportunity to involve a more experienced clinician.

2.12.3. Initial escalation should be within the same specialty.

2.12.4. Discussion with the neurology team will be the next escalation.

2.12.5. If it is felt that help from the anaesthetic team is required, a consultant to consultant referral should be made to the CEPOD anaesthetist of the day. Usually they will request the procedure is booked on the theatre list, and will undertake the procedure in theatre recovery or an anaesthetic room. This is, however, at the discretion of the consultant.

2.12.6. If an anaesthetic consultant considers a fluoroscopically guided LP necessary they may request that the patient is referred by the medical team to with IR consultants at RCHT, however referral to Derriford may be required if there is no local availability.

2.13. Post-Procedure care

2.13.1. Ensure that all documentation is complete using the included pro forma (including failed attempts), that the specimens are labelled and have been dispatched to the correct destination.

2.13.2. Perform a detailed handover the nurse caring for the patient about the procedure and explaining to them what monitoring is indicated to observe the patient’s clinical state and for development of a post PDPH.

2.13.3. Ensure the patient is comfortable and has access to a nurse call bell

2.13.4. Advise the patient to lie flat for 30 minutes, of anecdotal benefit

2.13.5. Ensure simple analgesia is prescribed

2.13.6. Anecdotally caffeine may reduce the symptoms from PDPH

2.14. Training and Competency

2.14.1. As a minimum, the following should be undertaken before independent practice.

- Being conversant with these guidelines
- Attendance at RCHT LP teaching session
- Ideally undertaken skills training on a model
- Observed and deemed competent on 2 occasions, with at least one recorded DOPS, by an ST3 (or equivalent) level doctor or above. Competency must include both patient assessment and preparation, ANTT, communication with the patient and assistant during procedure, performance of LP, documentation and post procedural care.
- On an individual basis, some other clinicians (e.g. <ST3 or PA) may have been approved to “sign-off” LP technique.

3. Monitoring compliance and effectiveness

<table>
<thead>
<tr>
<th>Element to be monitored</th>
<th>Adherance to best procedural practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>Dr Mawer</td>
</tr>
<tr>
<td>Tool</td>
<td>Audit of documentation, reflecting adherence to this policy.</td>
</tr>
<tr>
<td>Frequency</td>
<td>1 year after implementation, and then ad-hoc thereafter.</td>
</tr>
<tr>
<td>Reporting arrangements</td>
<td>Multi-team discussion between medicine, neurology and anaesthesia.</td>
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</tbody>
</table>
| Acting on recommendations and Lead(s) | Dr Stewart – Neurology  
Dr Gupta – Medicine  
Dr Mawer - Anaesthetics |
| Change in practice and lessons to be shared | Update to guideline and induction information. Information disseminated to relevant departments. |

4. Equality and Diversity

4.1. This document complies with the Royal Cornwall Hospitals NHS Trust service Equality and Diversity statement which can be found in the ‘Equality, Inclusion & Human Rights Policy’ or the Equality and Diversity website.

4.2. Equality Impact Assessment

The Initial Equality Impact Assessment Screening Form is at Appendix 2.
## Appendix 1. Governance Information

<table>
<thead>
<tr>
<th><strong>Document Title</strong></th>
<th>Lumbar Puncture (LP) Clinical Guideline V1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>This document replaces (exact title of previous version):</strong></td>
<td>New document</td>
</tr>
<tr>
<td><strong>Date Issued/Approved:</strong></td>
<td>June 2020</td>
</tr>
<tr>
<td><strong>Date Valid From:</strong></td>
<td>July 2020</td>
</tr>
<tr>
<td><strong>Date Valid To:</strong></td>
<td>July 2023</td>
</tr>
<tr>
<td><strong>Directorate / Department responsible (author/owner):</strong></td>
<td>Rebecca Mawer, Consultant Anaesthetist Oliver Quick, Anaesthetic Trainee Urgent Emergency and Trauma Care Group</td>
</tr>
<tr>
<td><strong>Contact details:</strong></td>
<td>01872 258195</td>
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<tr>
<td><strong>Brief summary of contents</strong></td>
<td>Policy of undertaking lumbar puncture in hospital for clinicians performing the procedure.</td>
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<tr>
<td><strong>Suggested Keywords:</strong></td>
<td>Fracture clinics - Wounds and injuries - Impact injuries – Fractures – Medical Puncture</td>
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<td><strong>Target Audience</strong></td>
<td>RCHT</td>
</tr>
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<td><strong>Executive Director responsible for Policy:</strong></td>
<td>Medical Director</td>
</tr>
<tr>
<td><strong>Approval route for consultation and ratification:</strong></td>
<td>Anaesthetic Governance Meeting</td>
</tr>
<tr>
<td><strong>General Manager confirming approval processes</strong></td>
<td>Jo Floyd</td>
</tr>
<tr>
<td><strong>Name of Governance Lead confirming approval by specialty and care group management meetings</strong></td>
<td>Paul Evangelista, UET Governance Lead</td>
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<tr>
<td><strong>Links to key external standards</strong></td>
<td>None Required</td>
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<td></td>
<td>Comparison of cutting and pencil-point spinal needle in spinal anesthesia regarding postdural puncture headache: A meta-analysis. Medicine (Baltimore). 2017 Apr;96(14):e6527 Xu H1, Liu Y, Song W,</td>
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</table>
Kan S, Liu F, Zhang D, Ning G, Feng S.

Lumbar Puncture: Technique, indications, contraindications and complications in adults
Up to date Jul 02, 2018, Kimberly S Johnson MD, Daniel J Sexton, MD

<table>
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<th>Training Need Identified?</th>
<th>No</th>
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<td>Publication Location (refer to Policy on Policies – Approvals and Ratification):</td>
<td>Internet &amp; Intranet ✓ Intranet Only</td>
</tr>
<tr>
<td>Document Library Folder/Sub Folder</td>
<td>Clinical / Acute Medical</td>
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### Version Control Table

<table>
<thead>
<tr>
<th>Date</th>
<th>Version No</th>
<th>Summary of Changes</th>
<th>Changes Made by (Name and Job Title)</th>
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<tr>
<td>June 2020</td>
<td>V1.0</td>
<td>Initial issue</td>
<td>Rebecca Mawer (Consultant Anaesthetist) / Oliver Quick (Anaesthetic Trainee)</td>
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All or part of this document can be released under the Freedom of Information Act 2000

This document is to be retained for 10 years from the date of expiry.

This document is only valid on the day of printing

**Controlled Document**

This document has been created following the Royal Cornwall Hospitals NHS Trust Policy for the Development and Management of Knowledge, Procedural and Web Documents (The Policy on Policies). It should not be altered in any way without the express permission of the author or their Line Manager.
### Section 1: Equality Impact Assessment Form

<table>
<thead>
<tr>
<th>Name of the strategy / policy / proposal / service function to be assessed</th>
<th>Lumbar Puncture (LP) Clinical Guideline V1.0</th>
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</thead>
<tbody>
<tr>
<td>Directorate and service area:</td>
<td>Is this a new or existing Policy?</td>
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<tr>
<td>Anaesthetics</td>
<td>New</td>
</tr>
<tr>
<td>Name of individual/group completing EIA</td>
<td>Contact details:</td>
</tr>
<tr>
<td>Oliver Quick, Anaesthetic Trainee</td>
<td>Via switchboard</td>
</tr>
</tbody>
</table>

#### 1. Policy Aim
Who is the strategy / policy / proposal / service function aimed at?
Policy of undertaking lumbar puncture in hospital. For clinicians performing the procedure.

#### 2. Policy Objectives
To guide best practice.

#### 3. Policy Intended Outcomes
Safe, correct practice.

#### 4. How will you measure the outcome?
Annual review of practice, documentation and complication rates.

#### 5. Who is intended to benefit from the policy?
Patients having the procedure. Clinicians undertaking procedure. The Trust.

#### 6a). Who did you consult with?

<table>
<thead>
<tr>
<th>Workforce</th>
<th>Patients</th>
<th>Local groups</th>
<th>External organisations</th>
<th>Other</th>
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<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### b). Please list any groups who have been consulted about this procedure.
- Junior doctors surveyed
- Senior doctors interviewed
- National NHS patient information sources
- Patient feedback following Lumbar Puncture

#### c). What was the outcome of the consultation?
Improvement is needed, clear policy will enable consistent best practice.
### 7. The Impact

Please complete the following table. If you are unsure/don’t know if there is a negative impact you need to repeat the consultation step.

Are there concerns that the policy **could** have a positive/negative impact on:

<table>
<thead>
<tr>
<th>Protected Characteristic</th>
<th>Yes</th>
<th>No</th>
<th>Unsure</th>
<th>Rationale for Assessment / Existing Evidence</th>
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<tr>
<td>Sex (male, female non-binary, asexual etc.)</td>
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<tr>
<td>Gender reassignment</td>
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<td>Race/ethnic communities /groups</td>
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<tr>
<td>Disability</td>
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<tr>
<td>(learning disability, physical disability, sensory impairment, mental health problems and some long term health conditions)</td>
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<td>X</td>
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<td>Religion/other beliefs</td>
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<td>Marriage and civil partnership</td>
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<td>Pregnancy and maternity</td>
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<td>Sexual orientation</td>
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<td>(bisexual, gay, heterosexual, lesbian)</td>
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</table>

If all characteristics are ticked ‘no’, and this is not a major working or service change, you can end the assessment here as long as you have a robust rationale in place.

I am confident that section 2 of this EIA does not need completing as there are no highlighted risks of negative impact occurring because of this policy.

**Name of person confirming result of initial impact assessment:** Oliver Quick, Anaesthetic Trainee

If you have ticked ‘yes’ to any characteristic above OR this is a major working or service change, you will need to complete section 2 of the EIA form available here: [Section 2. Full Equality Analysis](#).

For guidance please refer to the Equality Impact Assessments Policy (available from the document library) or contact the Human Rights, Equality and Inclusion Lead [debby.lewis@nhs.net](mailto:debby.lewis@nhs.net)
Appendix 3. Escalation Procedure

Lumbar puncture escalation policy 2020

ED/MAU
2 unsuccessful approaches by doctor <ST3

Medical/Surgical Inpatient
2 unsuccessful approaches by doctor <ST3

Neuro Outpatient
Unsuccessful approach by Specialty Registrar

ED/MAU
2 unsuccessful approaches by doctor >ST3 or equivalent

Medical/Surgical Inpatient
Unsuccessful approach by team Specialty Registrar or equivalent

Neurology Consultant to consider need to admit the patient for anaesthetic / IR assistance

Admit via SDEC under Neurology team

Request Neurology Opinion

Abandon?

Consultant referral to Anaesthetic Consultant on CEPOD
The patient must be booked onto the CEPOD list via NerveCentre

Medical Team to escalate to Interventional Radiology Consultant for fluoroscopically-guided LP if necessary
(It may be requested that the medical team refer directly to Derriford IR if an IR-guided procedure is not available locally)