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Lumbar Puncture: Guideline for the Emergency Department

Aim

The aim of this guideline is to direct clinical staff in the optimal performance of a lumbar puncture.

Definition of terms

CSF, cerebrospinal fluid; LP, lumbar puncture

Target patient population

Children in whom a LP is necessary for either diagnostic or therapeutic indications.

Target Users

This guide is applicable to all clinical staff tasked with performing a LP on a child.

Introduction

In children, a LP may be required as a diagnostic intervention in the management of the acutely ill child/infant (Meningitis) or as a planned procedure, for example, in the oncology patient.

When planning and delivering care, the urgency of the procedure and the condition of the child should be the key considerations. It is the role of the nurse to prepare and comfort the child and family before, during and after the lumbar puncture procedure which will be performed by a doctor. Assisting the doctor by ensuring the correct positioning and holding of the child safely during the procedure is a crucial factor in obtaining a successful outcome. It is the responsibility of the nurse to make sure that the procedure is performed in an appropriate environment and the safety of the child is of paramount importance (Gough 2006).

Indications

Lumbar punctures are performed for many reasons, including:

- to obtain a specimen of CSF for diagnostic purposes:
 - to confirm the diagnosis of meningitis and to identify the organism and its antibiotic sensitivity (ALSG 2014)
 - to assist with the diagnosis of immunological infection such as Lyme disease (Sucholeiki and Waldman 2006)
 - the diagnosis of subarachnoid haemorrhage (Farley and McLafferty 2008)
- to measure the pressure of the lumbar CSF (Gough 2006)
- to instil therapeutic agents such as antibiotics and cytotoxic chemotherapy (Farley and McLafferty 2008)
- the introduction of anaesthetic or contrast agents into the spinal canal (Farley and McLafferty 2008)

Complications

An understanding of the risks and potential complications of the procedure provides a basis for the nursing care of a child prior to, during and after a lumbar puncture, this should be discussed with the parents. Most risks associated with the procedure can be minimised by good preparation and by following the correct procedural and post-procedural care (Wojner and Malkoff 2007). This should include a discussion of the benefits of the procedure in terms of possible diagnoses and potential complications.

Complications of lumbar puncture include:

- Pain and anxiety
 - Infection
 - Leakage of CSF
 - Failure to obtain a specimen / need to repeat LP / traumatic tap
 - Post-dural puncture headache
 - Transient / persistent paraesthesia / numbness
 - Herniation
 - Cardiorespiratory compromise and respiratory arrest
 - Spinal haematoma or abscess
- (Trigg and Mohammed, 2013)

Contraindications

Lumbar puncture should not be performed in a child in a coma or with depressed level of consciousness.

There is a risk of coning and death if a lumbar puncture is performed in a child with significantly raised intracranial pressure. A lumbar puncture can be performed some days later when the child's condition allows, to confirm or refute the diagnosis (ALSG 2014). Where uncertainty exists, discuss with the consultant in charge of the patient's care.

Relative contraindications to lumbar puncture (ALSG 2014) include:

- prolonged or focal seizures;
- focal neurological signs, e.g. asymmetry of limb movement and reflexes, ocular palsies;
- a widespread purpuric rash in an ill child – in this case intravenous antibiotics should be given immediately after a blood culture;
- Glasgow Coma Score of less than 13;
- Pupillary dilatation;
- Impaired oculocephalic reflexes ("doll's eye" reflexes);
- Abnormal posture or movement, abnormal flexion / extension, cycling movements of the limbs;
- Inappropriately low pulse, elevated blood pressure, and irregular respirations (i.e. signs of impending brain herniation);
- Thrombocytopenia or coagulation disorder;
- Papilloedema;
- Hypertension;
- Local infection at site of lumbar puncture (Welch 2005)(ALSG 2014)

Equipment

- Emergency equipment, e.g. oxygen, suction and age-appropriate airway adjuncts (oropharyngeal airway, bag- valve-mask) and emergency drugs
- Patient monitoring equipment, e.g. oxygen saturation monitor
- At least two trained staff to assist the doctor with the procedure – the first to collect and label the specimens and the second to care directly for the child and monitor him/her throughout the procedure (this should be a nurse with experience holding a child for lumbar puncture)
- Dressing trolley (for aseptic technique)
- Apron
- Topical local anaesthetic and cover dressing, if possible to be applied allowing time for effect
- Sterile drape to provide sterile field
- Dressing pack and Hand towel 50cmx 50cm (Product code 220140)(For hand drying)
- Two spinal needles with stylets (one spare) [see Table 1 below]
- Sterile gloves
- Sterile drape with hole cut in the middle or minor surgery drape
- "Body wash" Soft and Gentle Sponge for skin cleansing
- Antiseptic cleansing solution (0.5% chlorhexidine gluconate for children < 2 months or 2%

chlorhexidine gluconate in 70% isopropyl alcohol for children > 2 months) (SARI Guidelines 2009)

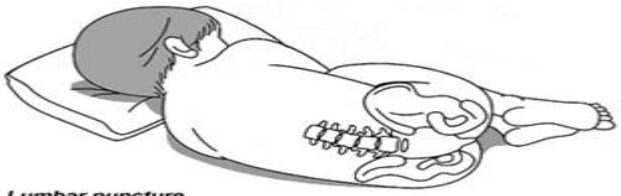
- If required, local anaesthetic with syringe and two needles
- CSF specimen collection tubes (three separate samples for microscopy / culture and sensitivity) labelled 1, 2 and 3 in the order the specimens are obtained +/- one glucose bottle.
- Waterproof plaster or other suitable waterproof covering, e.g. Opsite.

See here for [Equipment required for a Lumbar Puncture](#) and [Equipment on Sterile Field](#)

Guideline

Table 1. Sizes of spinal needles commonly used - the doctor will decide the size to use (Gough 2006)			
	Infants < 1 year	Children > 1 year	Adult-sized or > 40kg
Gauge of needle	22G	22G	18-20G
Length of needle	38mm	63mm	60-90mm

ACTION	RATIONALE & REFERENCE
Before the procedure starts, the nurse caring for the child should continue to offer reassurance in a calm, warm and confident manner.	This helps to promote feelings of security at an anxious time and facilitates cooperation (Gough 2006).
For non-emergency cases, local <i>Ametop</i> ® (Tetracaine 4%) cream may be applied to skin prior to lumbar puncture (> 1 month of age only – see Analgesia Guidelines). The cream should cover the area to be used and must only be applied onto intact skin.	To reduce pain and discomfort associated with the procedure (Schechter 2003). Ametop® cream takes 30-60 minutes to provide local anaesthesia. Effective skin anaesthesia will last approx 4-6 hrs after removal (OLCHC 2015a).
Administration of oral sucrose solution (24%) should be considered prior to and during lumbar puncture (0–6 months of age – see Analgesia Guidelines).	To reduce pain and discomfort (OLCHC 2015a) Sucrose lasts approximately 3-5 minutes with a peak action at 2 minutes (Stevens et al. 2004, Lefrack et al. 2006).
A full set of vital sign observations should be taken and recorded prior to the procedure. Oxygen saturation ± 3-lead ECG monitoring (dependent on the child's clinical condition) should continue throughout the procedure.	To establish a baseline to reference against during and after the procedure.
The unwell child should have an intravenous cannula inserted. This should be flushed and checked for patency immediately before the procedure.	To allow the prompt administration of IV fluid or medication in the event of deterioration (ALSG 2014).
Where infection is suspected, a 0.5ml sample of blood should be taken (fluoride oxalate tube) as close as possible to the time of the procedure to determine serum glucose.	Differences between CSF glucose and blood/plasma glucose can assist in differential diagnosis.

<p>The child should have an empty bladder or have a clean nappy before beginning.</p>	<p>To promote comfort (Gough 2006, Farley and McLafferty 2008).</p>
<p>Clean the dressing trolley with the recommended cleaning (Brial) product and the with Alcohol Wipe (2% Chlorhexidine) or Azo wipe (70% Alcohol) cover with a sterile drape and open all sterile equipment onto trolley.</p>	<p>To safely prepare the sterile field (OLCHC 2012).</p>
<p>The assisting nurse will open the sterile dressing pack on to the dressing trolley. In additional the chlorhexidine solution, sterile gloves, Spinal needle of appropriate size and additional hand prep towel should be placed on to the sterile field.</p>	<p>Practical Approach 5th Edition, Wiley Blackwell, Oxford</p>
<p>The doctor will don the apron and perform a clinical hand wash as per Hospital policy. The doctor will dry their hands with the sterile prep towel provided and will apply sterile gloves.</p>	<p>(OLCHC 2013a)</p>
<p>Do not position the child until everyone is completely ready and then perform the procedure in as short a time as possible without compromising safety</p>	<p>The posture of the child during the procedure is very uncomfortable, particularly if the child has meningism (Dougherty, Lister and Oram, 2015).</p>
<p>The infant/younger child should be positioned on his /her side, at the very edge of the bed, with knees drawn up towards the chest and the head flexed forward and held in this position by the nurse. The spine should be kept parallel to the edge of the bed.</p>	<p>The lumbar area is exposed and this flexing widens the intervertebral spaces to enable better access to the CSF (Trigg and Mohammed 2010).</p>
<p>Care should be taken not to compress the trachea or compromise lung expansion when positioning and holding, particularly in the infant with a softer airway (Smith 1995).</p>	 <p><i>Lumbar puncture</i></p>
<p>The older child may sit leaning forward over a chair or bed – propped with a pillow if necessary – with his/her head and chest bent forward towards his/her knees.</p>	<p>The lumbar area is exposed and this flexing widens the intervertebral spaces to enable better access to the CSF (Gough 2006).</p>
<p>It is crucial that the child is held securely.</p>	<p>Sudden movement could result in the needle moving and damaging nerve roots when in the subarachnoid space (Trigg and Mohammed 2010)</p>

<p>The nurse caring for the child should talk to and reassure him/her in an age-appropriate manner throughout the procedure and continuously monitor his/her vital signs and visually observe his/her respiratory, cardiovascular and neurological status.</p>	<p>This promotes calm, reassurance and as much comfort as possible in a difficult situation and ensures prompt identification of serious and potentially life-threatening event (Trigg and Mohammed 2010)).</p>
<p>Should any serious or potentially life-threatening event occur, the procedure must be abandoned and appropriate action taken.</p>	<p>The safety of the child is paramount (ALSG 2014).</p>
<p>The area should be cleaned using the pre-impregnated "BODY WASH" Soft & Gentle Bath sponge, and the skin dried thoroughly, prior to the procedural aseptic clean of the lumbar area.</p>	<p>To prevent the contamination as per Dr. Niamh O'Sullivan (Consultant Microbiologist)</p>
<p>The doctor should carry out the procedure using aseptic non-touch technique (level 3). The area of skin over the lumbar region should be cleansed with an age-appropriate aseptic cleansing solution and sterile drapes placed around the exposed lumbar area.</p>	<p>To prevent the risk of cross-infection (OLCHC 2013b)</p>
<p>If required, local anaesthetic may be injected by the doctor over the lumbar space to be accessed, allowing sufficient time to take effect.</p>	<p>To reduce pain and discomfort associated with the procedure (Trigg and Mohammed 2010).</p>
<p>The doctor will insert the needle into the lumbar space between either the 3rd and 4th or the 4th and 5th lumbar vertebrae (Trigg and Mohammed 2013).</p>	<p>This point of entry is selected to avoid damage to the spinal cord, which terminates higher up at the level of the first lumbar vertebra (Tortora and Derrickson, 2012)</p>
<p>Once the needle is in place, the stylet which blocks its core is removed and CSF can be observed to drip from the end of the needle.</p>	<p>If CSF is not obtained, the stylet should be replaced and the needle advanced slightly and rechecked for CSF (RCH 2015).</p>
<p>CSF samples are obtained by removing the stylet and allowing the CSF to drip into the labelled specimen bottle, held underneath by the nurse assisting the doctor.</p>	<p>To reduce the risk of introducing bacteria into the CSF.</p>
<p>CSF should not be aspirated.</p>	<p>A nerve root may be trapped against the needle and injured (Reis 2007).</p>
<p>Between taking the samples (usually 8-10 drops of CSF per sample bottle), the stylet should be replaced.</p>	<p>To prevent excess CSF being lost (Trigg and Mohammed 2010)</p>

Three samples are commonly taken and labelled '1', '2' and '3' in the order they are obtained.	The first sample may be contaminated with blood as the needle is introduced (Gough 2006)
A 0.5ml sample of CSF can be taken (Fluoride Oxalate tube) to determine CSF glucose.	Differences between CSF glucose and blood/plasma glucose can assist in differential diagnosis. (OLCHC 2015b).
To finish the procedure, the doctor reinserts the stylet and removes the needle, immediately applying firm pressure on the lumbar puncture site with a gauze pad for about 30 seconds.	This reduces the risk of post-lumbar puncture headache and prevents CSF leakage (Trigg and Mohammed, 2010)
A plaster or waterproof dressing is then placed over the site – this should be removed after 24 hours.	To prevent infection (Trigg and Mohammed 2010).
Time should be provided for the child to recover from the procedure in a position comfortable and safe for the child. Extended periods of bedrest are not currently recommended.	The incidence of post-lumbar puncture headache is not reduced by prolonged bed rest (Fuller and Manford 2006, Ahmed et al. 2006).
Vital signs should be monitored after the lumbar puncture and compared with baseline recordings taken before the procedure.	To allow ongoing evaluation of child's condition.
If parents have not been present, they should now be encouraged to be with their child.	To give comfort, support and praise (Gough 2006).
Dispose of all equipment safely and correctly.	(OLCHC 2014)
Ensure all samples are correctly labelled and sent to the laboratory, which may need notifying if results are required urgently.	(OLCHC 2015b)
Nursing documentation should be completed detailing the procedure, the condition of the child and providing a description of the CSF obtained.	To maintain accountability through accurate recording of nursing care (ABA 2002)
The puncture site should be monitored for signs of blood and CSF leakage.	To prevent excess CSF being lost (Gough 2006).
Appropriate discharge advice (verbal and written) should be provided to the child and parents.	To ensure that the child and family are aware of post-lumbar puncture care and to allow any concerns or questions to be addressed (Gough 2006).

[Link to References](#)