

# FINAL DRAFT Paediatric Clinical Protocol

## DRAFT Protocol/Guideline Name: MENINGITIS IN CHILDREN: HOSPITAL LEVEL

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### Main authors:

Adapted for Western Cape provincial DOH use from:

The 2010 NICE guideline on Bacterial Meningitis and Meningococcal Septicaemia (2010), 2010 Metro West Meningitis protocol; **Antimicrobial Recommendations for Red Cross War Memorial Children's Hospital (2012), and the SA adaptation of the WHO Pocket Book of Hospital Care for Children (2016)**. Cognisance and guidance has also been taken of the FIDSSA Meningitis working group document of 2013 (Boyles et al.).

This management protocol covers emergency and urgent care for meningitis in children, and provides guidelines for ongoing assessment and care for the period until most children with meningitis are discharged from hospital.

This protocol is compatible with the

- IMCI system that is often used at PHC sites that may refer patients to hospitals for ongoing care.

Other protocols in this series cover

- Meningococcaemia (National Guideline)

Its contents can be adapted for use in specific environments in the province, but the following essentials of care must be followed:

- Perform a lumbar puncture (unless contra-indicated) when meningitis is suspected
- Consider the likelihood of viral meningitis or tuberculous meningitis based on clinical and CSF features.
- Treat initially with ceftriaxone 50mg/kg/dose 12hrly IVI (preferred in critically ill patients) or 100mg/kg/dose daily. In children under 1 month, use cefotaxime and add ampicillin (see dosages on page 6 of this guideline).
- If TB meningitis suspected, add anti-tuberculous therapy immediately. Do not wait until a definitive diagnosis is made.
- Perform a CT scan if depressed OR fluctuating level of consciousness (Glasgow Coma Scale score less than 9 or a drop of 3 or more), or focal neurological signs
- Do not perform a CT scan simply to exclude raised intracranial pressure. CT is not reliable in detecting raised intracranial pressure.
- Notify *H influenzae* type B, meningococcal and *Listeria* infections, and TB meningitis
- Provide chemoprophylaxis for contacts of meningococcal infection

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### MENINGITIS MANAGEMENT PROTOCOL: PAEDIATRICS AND FAMILY MEDICINE

#### **PREAMBLE:**

Meningitis is caused by many different organisms that are often difficult to tell apart without examining the CSF. Bacterial and tuberculous meningitis cause most of the suffering and death, but viral meningitis is the most common form, especially beyond infancy. In a 2017 study (see linked Evidence document) at a referral hospital in Cape Town, 4% of abnormal CSFs were associated with bacterial infection. Only 10% of children diagnosed clinically as bacterial meningitis had bacterial DNA in their CSF, suggesting over-diagnosis of bacterial meningitis. In children under 3 months of age, the most important bacteria are Group B Streptococcus, *Listeria monocytogenes* and *E coli*. Over 3 months, they are usually *S pneumoniae*, *N meningitidis* and *H influenza*.

#### History and Examination

- **Classical signs of meningitis are often absent in young children, and symptoms and signs are often non-specific.**
- The younger the child, the less specific the signs and symptoms.
- **A non-blanching rash suggests meningococcaemia.**

##### ***Newborns:***

Unwell, poor feeding, apathy or lethargy, jaundice, apnoea or cyanotic attacks, full fontanelle, fever or hypothermia.

*Neck stiffness is usually absent* and so is a bulging fontanelle.

##### ***Infants:***

Irritability and drowsiness, poor feeding, high pitched cry, high fever

*Vomiting* is an important clue, especially if it is severe or lasting longer than a day or two, or getting worse.

##### ***Toddlers and older children***

Similar to adults i.e. headache, fever, vomiting, photophobia, neck stiffness.

#### Complications

- Raised intracranial pressure
  - reduced or fluctuating level of consciousness (Glasgow Coma Scale score less than 9/15 or a drop of 3 or more)
  - relative bradycardia and hypertension
  - focal neurological signs
  - abnormal posture or posturing
  - unequal, dilated or poorly responsive pupils
  - papilloedema
  - abnormal 'doll's eye' movements
- Seizures

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- SIADH
- Focal neurologic deficits
- Subdural effusion/empyema and brain abscess
- Sensorineural deafness

## Special investigations

**LUMBAR PUNCTURE UNLESS** any of the following contraindications are present:

- signs suggesting raised intracranial pressure
    - reduced or fluctuating level of consciousness (Glasgow Coma Scale score less than 9 or a drop of 3 or more)
    - relative bradycardia and hypertension
    - focal neurological signs
    - abnormal posture or posturing
    - unequal, dilated or poorly responsive pupils
    - papilloedema
    - abnormal ‘doll’s eye’ movements
  - shock
  - extensive or spreading purpura. Watch small lesions carefully (unless petechiae <2mm diameter)
  - after convulsions (until stabilised)
  - coagulation abnormalities
    - coagulation results (if obtained) outside the normal range
    - platelet count below 100 x 10<sup>9</sup>/litre (a platelet count is not essential before doing an LP)
    - receiving anticoagulant therapy
  - local superficial infection at the lumbar puncture site
  - respiratory insufficiency or history of apnoea (lumbar puncture can cause respiratory failure in this situation).
- Always consider other causes of headache and stiff neck (e.g. brain tumour, cerebral abscess), especially if headache more than a few days, before doing a lumbar puncture.
  - If there are contraindications, delay the lumbar puncture until they are no longer present, and/or arrange CT scan if indicated (see below).
  - **Do not allow lumbar puncture to delay the administration of parenteral antibiotics or empiric TBM treatment if indicated clinically.**

### INDICATIONS FOR CT SCAN:

- depressed or fluctuating level of consciousness (Glasgow Coma Scale score less than 9/15 or a drop of 3 or more), or focal neurological signs i.e. to exclude intracranial pathology.
- **do not perform a CT scan to exclude raised intracranial pressure.** It is not reliable in doing so.
- however, if a CT scan has been performed, do not perform a lumbar puncture if the CT scan shows radiological evidence of raised intracranial pressure.
- do not delay treatment to undertake a CT scan.

### BLOOD

If available

- blood culture

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- blood glucose
- full blood count

If seizures or depressed level of consciousness (in addition to the above)

- serum sodium, urea. Consider calcium and magnesium.

## Diagnosis

- **Regard as meningitis if the following CSF findings:**

Neonates:  $\geq 20$  cells/mm<sup>3</sup> (if  $< 20$  cells/mm<sup>3</sup> consider bacterial meningitis if the clinical picture and other CSF findings suggest meningitis)

In older children:  $> 5$  cells/mm<sup>3</sup> or  $> 1$  neutrophil/mm<sup>3</sup>

**Interpretation of CSF findings in suspected meningitis:**

- In bacterial meningitis, CSF protein concentrations and WBC counts are usually higher than in viral meningitis, and neutrophils usually predominate
- Neutrophils may however be the dominant cell line in early viral meningitis but CSF protein and glucose are usually normal (see also below re absolute numbers of neutrophils).
- A decreased CSF glucose concentration may be due to bacterial meningitis, including TB. Compare this level with the serum glucose (CSF glucose is approximately 2/3 of the serum glucose level.).
- In neonates and babies in the first months of life, who were born preterm, CSF protein levels are often  $>0.4$ g/l (the upper limit of normal for older infants and children). Upper limit is 1.7 g/dl in neonates..
- Formulae for adjusting WBC counts for RBC counts in CSF are not reliable. Some authorities use 1 WBC/750 RBCs.

Note: No clinical thresholds have been identified that, on their own, reliably distinguish bacterial meningitis from other causes. The **Bacterial Meningitis Score** that takes into account some clinical features in conjunction with the CSF findings may help in excluding bacterial meningitis. Thus:

**In well-looking children  $>3$  months of age without prior antibiotics, consider bacterial meningitis if:**

- purpura (not petechiae)  
or
- positive CSF Gram stain  
or
- CSF absolute white cell count  $\geq 1\ 000$  cells/mm<sup>3</sup>  
or
- CSF protein  $\geq 0.8$  g/l  
or
- history of seizures before or at the time of presentation

If none of these is present and especially if the child is immunised against *S pneumoniae* and *H influenzae*, the chance of the child  $>3$  months of age having bacterial meningitis is very small. There is thus very little indication to initiate or continue an IV antibiotic in these cases if the child is otherwise clinically stable. Ceftriaxone or a dose of oral antibiotics given at PHC level a few hours before lumbar puncture will not change the cell count significantly, but may sterilise the CSF.

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It is very likely that the diagnosis in these cases is viral meningitis. Discharging the child on symptomatic treatment and reduced activity for a few days may be all that is required.

NB: The Bacterial Meningitis Score should be used to assist, not replace, clinical decision-making

- **Consider tuberculous meningitis if:**

- less acute history: growth faltering, cough for 14 days, non-specific neurologic/systemic symptoms
- prolonged intermittent fever for more than 7 days
- there may be a household contact with tuberculosis
- a chest X-ray suggests tuberculosis (but CXR can be normal)
- the patient remains unconscious
- lymphocyte predominant meningitis with low glucose and raised protein

*A high index of suspicion is essential for early diagnosis TB of meningitis. CSF protein levels are usually 1.0-5.0 g/l, and cell counts 50-500 per mm<sup>3</sup>, but these typical changes are not always present.*

- **Consider herpes simplex encephalitis if fever and any of the following features:**

- focal neurological signs
- focal seizures
- decreased level of consciousness

NB significant encephalopathy is usual with herpes meningoencephalitis

- **Consider Cryptococcal meningitis if:**

- Older, immunocompromised child<sup>1</sup>
- *Early:* insidious presentation, non-specific clinical features (headache, nausea, vomiting, apathy), symptoms may wax and wane over a few weeks
- *Late:* confusion, unsteady gait, cranial nerve palsies

- **Special situations (also see algorithm in Appendix 1):**

- **Abnormal CSF in a baby under 3 months of age without a positive culture at 72 hours:**
  - If the presentation of the infant was such that severe bacterial sepsis including meningitis was highly unlikely (low inflammatory markers, fever not significant), request enterovirus PCR on the CSF. A positive result will reduce the duration of hospitalisation.
- **Unable to obtain adequate CSF (e.g. repeated bloody taps) in a baby under 3 months of age in whom meningitis is suspected:**
  - If the baby did not have symptoms or signs of severe illness on presentation and other bacterial cultures were negative, +/- inflammatory markers (CRP and/or WBC) low, bacterial meningitis is unlikely. The closer the baby is to 3 months of age, the more likely this is to be the case. Repeat CRP at 48 hours may help - a normal level makes bacterial infection very unlikely. Discuss with senior doctor as indicated.

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<sup>1</sup> Cryptococcal meningitis has been described presenting rapidly in some African countries.

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## Treatment

### Immediate

If no CSF is obtainable, or the CSF findings are difficult to interpret, manage as bacterial meningitis, and cover for tuberculous meningitis if the clinical picture is suggestive. Consider repeating the LP after at least one week – TBM would not have resolved.

### Antimicrobials

- **Neonate**

CEFOTAXIME 50mg/kg/dose 12 hourly 1<sup>st</sup> week of life; 8 hourly weeks 1-3 of life; 6 hourly after that

Add AMPICILLIN 100mg/kg/dose 8hrly 1<sup>st</sup> week of life ; 6 hourly weeks 1-3 of life IVI for at least 48 hours until *Listeria* infection is excluded. (NB. For neonates with birth weight <2kg, consult neonatal guidelines for dosages.)

- **If an organism is isolated<sup>2</sup>**, and the organism is susceptible

- Group B streptococcus continue IVI PENICILLIN G for at least 14 days  
<1 week of age 100 000u/kg/dose 8hrly; > one week 100 000u/kg/dose 6hrly
- *Listeria monocytogenes* continue IVI AMPICILLIN for 21 days in total and add IVI gentamicin 7.5mg/kg/dose daily for at least the first week (discuss duration with ID and Microbiology)
- Gram-negative bacilli continue IVI CEFOTAXIME for at least 21 days

- **Over 28 days to 90 days**

CEFTRIAZONE<sup>3 4</sup> 50mg/kg/dose 12hrly IVI (preferred in critically ill patients) or 100mg/kg once daily IVI for 10 days.

- **If an organism is isolated**, discuss with microbiologist and senior doctor.
- **If no organism is isolated**, request enteroviral PCR on the CSF. If negative, complete 10 days. If positive, stop the ceftriazone.

- **3 months of age and over**

CEFTRIAZONE (see footnotes) 50mg/kg/dose 12hrly IVI (preferred in critically ill patients) or 100mg/kg once daily IVI for 5 days.

[NB: Some children will require longer duration of therapy. See “After 5 days” below for these exceptions. Consult senior doctor if unsure.]

- **Adjust antibiotics according to sensitivities**

- **If tuberculous meningitis suspected**

<sup>2</sup> If treating for bacterial meningitis in a neonate without proof of the organism, treat for at least 14 days.

<sup>3</sup> Avoid the use of ceftriazone in patients receiving concomitant intravenous calcium-containing fluids including total parenteral nutrition; cefotaxime 50 mg/kg/dose 6 hourly IV is a suitable alternative.

<sup>4</sup> Ceftriazone should be switched to benzylpenicillin 100 000 u/kg/dose 6 hourly IV **OR** ampicillin 50 mg/kg/dose 6 hourly IV if the organism is susceptible.

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- Add anti-tuberculous therapy immediately as per available weight based dosing charts or doses below. Do not wait until a definitive diagnosis is made. Also prescribe steroids (see below)
  - RIFAMPICIN 20mg/kg PO daily (Maximum 600mg)
  - INH 20mg/kg PO daily (Maximum 500mg)
  - PYRAZINAMIDE 40mg/kg PO daily (Maximum 2g)
  - ETHIONAMIDE 20mg/kg PO daily (Maximum 1g)
- Treat all likely cases for 6 months; some patient may require 9 months. Consult a PID specialist.
- If diagnosis not clear, continue TBM treatment (and also complete bacterial meningitis treatment). Repeat LP after 10-14 days – if CSF still abnormal, most likely TBM – continue treatment.
- **If herpes simplex meningoencephalitis suspected**
  - *0-12 years of age*
    - ACICLOVIR 20mg/kg/dose 8 hourly IVI x 14-21 days
  - *Over 12 years of age*
    - ACICLOVIR 10mg/kg/dose 8 hourly IVI x 14-21 days

## Corticosteroids

- **Not indicated in bacterial meningitis**
- **If tuberculous meningitis is suspected**
  - PREDNISON 2 mg/kg/dose daily (max dose 60mg) PO x 4 weeks
    - then taper over 2 weeks

## Fluid therapy

- Full enteral feeds as soon as tolerated.
- Isotonic fluids if intravenous maintenance is needed e.g. head injury fluid (Normal saline with 5% dextrose. Do not use 1/2DD as it is too hypotonic).
- Do not restrict fluids routinely
- **NB: Fluid and electrolyte management in TBM is difficult. Obtain advice from an experienced paediatrician.**
- Monitor
  - fluid intake
  - urine output
  - electrolytes – if oliguria or worsening symptoms
  - blood glucose

## Notify

- *Haemophilus influenzae* type B
- Meningococcal infection
  - notify telephonically as well as in writing: 24-hour Cape Town number 021 424 7715
- *Listeria meningitis* – use the specific Case Investigation from

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- Tuberculosis of meninges

## Refer immediately to Level 2/3 service if any of the following:

- Neonate (Note: This may not apply in some Level 1 services depending on access to a senior opinion.)
- Suspected raised intracranial pressure
- Suspected TB meningitis
- Focal neurological signs
- Other complications and persistent danger signs e.g. recurrent seizures

## Prophylaxis for contacts

### *Meningococcal prophylaxis*

- o for household contacts, day care centre contacts and close contacts in crowded hostels
- o hospital contacts only if contact intense and intimate e.g. mouth-to-mouth resuscitation
- o school and work contacts do not generally need it.

### *Children*

CEFTRIAXONE single dose IM

- <12 years of age: 125 mg
- ≥12 years of age: 250 mg

or

CIPROFLOXACIN 10mg/kg single dose PO

### *Adults*

CIPROFLOXACIN 500 mg single dose PO

or

CEFTRIAXONE 250 mg single dose IM

## After 5 days

- If clinically well and *no organism* cultured, or *N meningitidis*, *S pneumoniae* or *H influenzae*
  - o Stop ceftriaxone, UNLESS
    - age under 3 months or weight less than 3kg
    - if unwell in any way, or if temperature has not settled for at least 48 hours
    - HIV infection with severe wasting, or other known immunodeficiency states
    - pyogenic brain abscess
    - subdural empyema
    - intracranial suppurative thrombophlebitis
    - cranial fracture
    - cyanotic congenital heart disease
    - other complication

These children will require a longer course of antibiotics - discuss with senior paediatrician/referral hospital.

Consider investigating for immune deficiency or other underlying causes if the child has Pneumococcal or *H influenzae Type B* meningitis despite immunisation.

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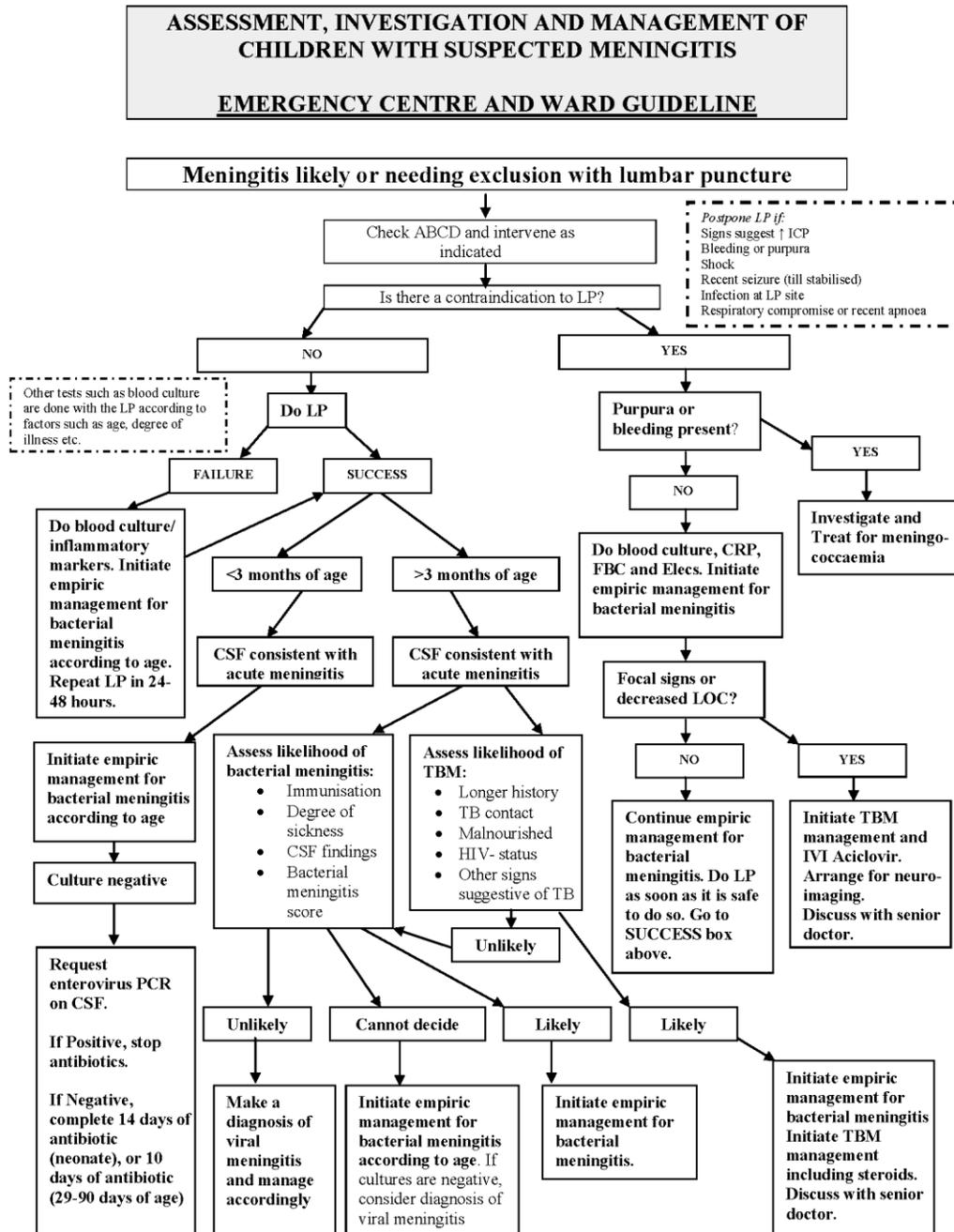
## Other considerations and discharge plan

- **Proven or likely Bacterial meningitis**
  - Plan follow-up *before discharge*.
  - Patients with true bacterial meningitis are at risk for cochlear deafness. This is remediable if caught early. Book Audiology test as soon as the diagnosis is confirmed. See the attached “Guideline for the hospital based management of hearing loss in children due to bacterial meningitis”. [Do not book this test if bacterial meningitis was unlikely, even if treatment was initiated.]
  - Record the child’s head circumference in the notes, in the discharge summary and in the RTHB.
  - Paediatric follow-up for neurodevelopmental problems if under one year of age
  - Counsel parents re likely pattern of recovery and potential long-term effects.
  
- **Proven or likely Viral meningitis**
  - Return to full activity too soon can lead to a recrudescence of meningitis symptoms. The child should not return to full activities e.g. crèche or school for a few days after discharge.
  - No hearing test or neurodevelopmental follow up needed

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## APPENDICES

### Appendix 1: Algorithm



This algorithm is to be used with the Provincial EM Guidelines and Hospital protocols for meningitis (Family Medicine and Paediatrics).  
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### [Appendix 2: Procedure for lumbar puncture \(excerpt from SA Adaptation of WHO Pocketbook for District Hospitals\)](#)

#### **Position the child**

There are two possible positions:

- lying on the left side (particularly for young infants)
- in the sitting position (particularly for older children)

Lumbar puncture when the child is lying on the side

- A hard surface should be used. Place the child on the side so that the vertebral column is parallel to this surface.
- The assistant should flex the back of the child, pull the knees up towards the chest, and hold the child at the upper back between the shoulders and buttocks so that the back is bent. Hold the child firmly in this position. Make sure that the airway is not obstructed and the child can breathe normally. Take particular care in holding young infants. The assistant should not hold a young infant by the neck nor flex the neck to avoid airway obstruction.

#### **Check anatomical landmarks**

Locate the space between the third and fourth or between the fourth and fifth lumbar vertebrae. An imaginary line running between the highest points of the two iliac crests intersects the spine at approximately the L3-4 interspace.

### Prepare the site

- Use aseptic technique. Scrub the hands and wear sterile gloves.
- Prepare the skin around the site with an antiseptic solution.
- Sterile towels may be used.
- In older children who are alert, give a local anaesthetic (1% lignocaine) infiltrated in the skin over the site.

An alternative local anaesthetic is EMLA cream placed over the site 45 minutes to 1 hour before the procedure is to be done. Oral or IV midazolam can be given to very anxious children.

### Perform the lumbar puncture

- Use a lumbar puncture needle with stylet (22-gauge for a young infant, 20-gauge for an older infant or child; if these are not available, hypodermic needles may be used). Insert the needle into the middle of the intervertebral space, and aim the needle towards the umbilicus.
- Advance the needle slowly. The needle will pass easily until it encounters the ligament between the vertebral processes. More pressure is needed to penetrate this ligament, less resistance is felt as the dura is penetrated. In young infants this decrease in resistance is not always felt, so advance the needle very carefully.
- Withdraw the stylet, and drops of CSF will pass out of the needle. If no CSF is obtained, the stylet can be reinserted and the needle advanced slightly.

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- Obtain a sample of 0.5–1ml CSF, and place in a sterile container.
- Withdraw the needle and stylet completely, and put pressure over the site for a few seconds. Put a sterile dressing over the needle puncture site.
- If the needle is introduced too far, a lumbar vein may be punctured. This will result in a ‘traumatic tap’, and the spinal fluid will be bloody. The needle should be withdrawn and the procedure repeated in another disc space. If 2 traumatic taps occur then defer procedure for 24-48 hrs. Treat for meningitis in the meantime if clinically suspected.