MENINGITIS

1. Introduction

Meningitis refers to an inflammatory process of the leptomeninges and CSF within the subarachnoid space. Infectious meningitis is broadly classified into:

(i) Acute pyogenic (usually bacterial)
(ii) Aseptic (usually viral)
(iii) Chronic many infectious agents) on the basis of the characteristics of inflammatory exudate on CSF examination and clinical evolution of the illness.

2. Parameters

2.1 Target Population – 0 – 15 yrs

2.2 Risk factors:
   - Mechanical – CNS trauma, cochlear implants, ventricular shunt placement
   - Medical – Immunodeficiency, asplenia, chronic renal disease, sickle cell disease

3. Definition

Lumbar puncture – procedure in which cerebrospinal fluid (CSF) is withdrawn by means of a hollow needle inserted into the subarachnoid space in the region of the lower back (usually between the 3rd and 4th lumbar vertebrae). The CSF obtained is examined for diagnostic purposes.
### ICP - Intracranial pressure - TABLE 1 Clinical Presentation

<table>
<thead>
<tr>
<th>AGE</th>
<th>HISTORY</th>
<th>PHYSICAL EXAMINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Neonate</strong></td>
<td>Poor feeding</td>
<td>Bulging fontanelle</td>
</tr>
<tr>
<td></td>
<td>Irritability or lethargy</td>
<td>Paradoxic irritability&lt;sup&gt;1&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Fever or hypothermia (temperature instability)</td>
<td>High-pitched cry</td>
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<td></td>
<td>Apnea or seizures</td>
<td>Vesicles (suggest HSV infection)</td>
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<tr>
<td></td>
<td>Vomiting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maternal GBS colonization status &amp; treatment</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>(Constitutional, non-specific signs)</em></td>
<td></td>
</tr>
<tr>
<td><strong>Infant</strong></td>
<td>Seizures</td>
<td>Neck stiffness</td>
</tr>
<tr>
<td></td>
<td>Fever</td>
<td>Bulging fontanelle</td>
</tr>
<tr>
<td><strong>Older child</strong></td>
<td>Seizures</td>
<td>Positive Kernig sign</td>
</tr>
<tr>
<td></td>
<td>Fever</td>
<td>Positive Brudzinki sign</td>
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<tr>
<td></td>
<td>Changes in mental status (confusion/lethargy)</td>
<td>Papilloedema</td>
</tr>
<tr>
<td></td>
<td>Photophobia</td>
<td>Exanthems&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Rash</td>
<td>Joint involvement (GBS or meningococcal infection)</td>
</tr>
<tr>
<td></td>
<td><em>Mechanical &amp; Medical factors</em></td>
<td></td>
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</tbody>
</table>

<sup>1</sup> Sign of meningeal irritation, especially in the young infant, whereby the infant who has meningitis does not wish to be handled, but prefers to remain motionless. Often, the parent has noted this behavior and refrains from holding or rocking the infant.

<sup>2</sup> Exanthems typical for enterovirus, borreliosis (erythema migrans), and invasive meningococcal or pneumococcal disease (petechiae and purpura) may be present.
CHART 1 OUTLINE FOR MANAGEMENT OF MENINGITIS - ALGORITHM

Suspected Bacterial Meningitis based upon history

Rapid physical assessment:
1. Assess ABCs and level of consciousness (esp. if fitting or in post-ictal phase)
2. Initiate cardiorespiratory monitoring

1. Obtain venous access
2. Start haemodynamic support
3. **Basic laboratory investigations:** Full Blood Count, Urea, Creatinine and electrolytes (esp. Sodium), Coagulation Profile (if petechiae or purpura) and Blood Culture

**LUMBAR PUNCTURE**

**CONTRAINDICATIONS PRESENT?***

**YES**
With-hold LP**

Empirical antibiotic therapy +/- Dexamethasone

**NO**

Perform LP

Abnormal CSF

Continue antibiotics

No improvement

Consider Cranial USS/Cranial CT Scan

Repeat Lumbar Puncture

Change antibiotics

If no response, consider TB, fungus or encephalitis

Normal CSF, await culture

Positive

Negative

Improvement

Complete course of antibiotics

Consider discontinuing antibiotics

If good clinical response, complete course of antibiotics
*Contraindications for performing Lumbar Puncture are as follows:

✓ Focal neurological signs
✓ Papilloedema
✓ Rapidly deteriorating consciousness or obtundation (Glasgow Coma Scale < 8)
✓ Signs of raised ICP (bradycardia, hypertension, dilated or poorly reacting pupils)
✓ Continuous seizure activity
✓ Bleeding diathesis
✓ Localised skin infection over lumbar-sacral region

** At this point, if contraindications (increased ICP/coagulopathy/haemodynamic instability) may be corrected, then lumbar puncture may be performed

**TABLE 2 INTERPRETATIONS OF CSF VALUES IN NEUROLOGICAL DISEASE**

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>LEUCOCYTES (mm³)</th>
<th>PROTEIN (g/L)</th>
<th>GLUCOSE (mmol/L)</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute bacterial meningitis</td>
<td>100 - &gt;50 000</td>
<td>1-5</td>
<td>&lt; 0.5 – 1.5</td>
<td>Gram stain may be positive</td>
</tr>
<tr>
<td>Partially treated meningitis</td>
<td>1 – 10 000 usually ↑ PMN. May have lymphocytes</td>
<td>&gt;1</td>
<td>Low</td>
<td>CSF may be sterile in pneumococcal, meningococcal meningitis</td>
</tr>
<tr>
<td>Tuberculous meningitis</td>
<td>10 – 500 early PMN, later lymphocytes</td>
<td>1 – 5</td>
<td>0 - 2.0</td>
<td>Smear for AFB, TB PCR positive in CSF. ESR ↑</td>
</tr>
<tr>
<td>Fungal meningitis</td>
<td>50 - 500 lymphocytes</td>
<td>0.5 -2</td>
<td>Normal/low</td>
<td>CSF for Indian ink/cryptococcal antigen</td>
</tr>
<tr>
<td>Encephalitis</td>
<td>10 – 1 000</td>
<td>Normal/0.5 -1</td>
<td>Normal</td>
<td>Send CSF for virology</td>
</tr>
<tr>
<td>Encephalopathy</td>
<td>&lt;10 lymphocytes</td>
<td>Normal</td>
<td>Normal</td>
<td>May not be febrile</td>
</tr>
</tbody>
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Gram’s iodine stain (Gram stain) demonstrates bacteria in 60-90% of patients with bacterial meningitis who have not received prior antibiotics, and has a specificity >97%.
### Antibiotics

<table>
<thead>
<tr>
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<th>Likely Organism</th>
<th>Empirical Antibiotic Regime</th>
<th>Duration of therapy</th>
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<tbody>
<tr>
<td><strong>Neonates</strong></td>
<td>Group B streptococcus, streptococcus faecalis, E.coli, proteus, K. pneumonia, Listeria monocytogenes</td>
<td>IV Ceftriaxone + IV Ampicillin</td>
<td>21 days (neonates)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Infants &lt; 3 months old</strong></td>
<td></td>
<td></td>
<td>14 days</td>
</tr>
<tr>
<td><strong>Infant &amp; Older Children</strong></td>
<td>S. pneumoniae, H.influenza, N.meningitidis</td>
<td>Ceftriaxone</td>
<td>14 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ceftriaxone</td>
<td>10 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Penicillin</td>
<td>7</td>
</tr>
</tbody>
</table>

In clinically suspected meningitis but not confirmed by CSF
- Neonates treat for 21 days
- < 3 months treat for 14 days
- > 3 months treat for 10 days

**Corticosteroids:**
- Not indicated in < 3 months
- Dexamethasone 0.15mg/kg (max 10 mg) qid for 4 days
- Given prior to antibiotics. If missed before first dose of antibiotics, give within 4 hours
- Do not give after 12 hours of antibiotics
**SUPPORTIVE CARE IN THE PATIENT WITH MENINGITIS**

1. Best effect if steroid (Dexamethasone) is given before or with first antibiotic dose

2. Monitor temperature, pulse, blood pressure, respiratory rate 4 hourly

3. Fluid restriction not recommended for children with bacterial meningitis except in:
   a) Evidence of increased ICP
   b) SIADH (usually indicated by low serum sodium < 130 mmol/L)

4. Daily head circumference to be measured (if fontanelle still open)

5. Daily CNS assessment is essential (further seizures, focal neurological signs, decreasing GCS)

**CHEMOPROPHYLAXIS**

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<thead>
<tr>
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<th>Rifampicin</th>
<th>Alternatives</th>
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<tr>
<td><strong>N. meningitidis</strong></td>
<td>10 mg/kg daily (neonate)</td>
<td>Ciprofloxacinill</td>
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<tr>
<td></td>
<td>10 mg/kg max 600 mg 12 H For 2 days</td>
<td>Child 12.5 mg/kg max 500 mg stat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>➢ 12 year 500 mg stat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ceftriazone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Child 125 mg IMI stat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;12 years 250 mg stat</td>
</tr>
<tr>
<td><strong>H. influenza</strong></td>
<td>10 mg/kg (neonate)</td>
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</tr>
<tr>
<td></td>
<td>20 mg/kg max 600 mg daily For 4 days</td>
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**Acute Complications**

Monitor for development of the following:
- Subdural effusion
- Cerebral abscesses
- Acute hydrocephalus

Refer to surgeons immediately for further management

**Follow up**
- 4 – 6 weeks after discharge
- Monitor for:
  - Hearing loss
  - Hydrocephalus
  - Seizure Disorders
  - Developmental Delay
  - Learning Disabilities
REFERENCES


Scope and Application | This CPG is intended for use by all health care workers in their daily care of paediatric patients
---|---
Effective Date | 2010
Supercedes Policy Number | Not applicable
Review Responsibilities | The Chairperson of the Paediatric CSN will initiate the review of this guidelines every 3 years from the date of issue or as required.
Further Information | Paediatric CSN Chairperson

RESPONSIBILITY:

**CPG Owner:** National Paediatric CSN

**CPG Writer:** Ministry of Health **Date:** 2010

Endorsed:

National Medicines & Therapeutic Committee, MOH **Date:** 23 November 2010

Endorsed:

National Health Executive Committee, MOH **Date:** 25 November 2010