Meningitis – Emergency management in children

Purpose

This document provides clinical guidance for all staff involved in the care and management of a child presenting to an Emergency Department (ED) with suspected acute meningitis in Queensland.

It has been developed by senior ED clinicians and Paediatricians across Queensland and endorsed for use across Queensland by the Statewide Emergency Care of Children Working Group in partnership with the Queensland Emergency Department Strategic Advisory Panel and the Healthcare Improvement Unit, Clinical Excellence Division.

Key points

- Meningitis does not always present with the classic triad of fever, headache and nuchal rigidity, and often presents with nonspecific symptoms, especially in young infants.
- Bacterial meningitis is less common than viral meningitis but is a more serious disease that can result in neurological sequelae or even death.
- Laboratory testing (blood and CSF) is required to definitively differentiate between viral and bacterial meningitis.
- If meningitis is clinically suspected and lumbar puncture is contraindicated, or delayed for more than 30 minutes, give empiric antibiotics IV.

Introduction

Meningitis describes the inflammation of the membranes that surround the brain and spinal cord and may be caused by a variety of different microorganisms, including both viruses and bacteria.¹

Bacterial meningitis

Analysis of ED data in Queensland found that acute bacterial meningitis represented approximately 0.06% of all paediatric ED presentations. While this is not a common diagnosis, the sequelae can be devastating. The mortality rate from bacterial meningitis ranges from 2% in infants and children to 20% in neonates with up to a third of survivors experiencing neurological sequelae (either transient or permanent).² Approximately 90% of bacterial meningitis occurs in children < 5 years of age.²

Bacterial infection in infants up to 3 months of age (corrected for prematurity) is typically acquired during birth through aspiration of intestinal and genital tract secretions from the mother (vertical transmission).³ Group B streptococci (subtype III), gram-negative enteric bacilli (Escherichia coli, Klebsiella and Enterobacter), and Listeria monocytogenes (serotype IVb) are the most common causes of bacterial meningitis in this age group.
In the older child, the rates of meningitis are much lower with an estimated incidence of 1 per 5,901 febrile children aged 2 to 24 months. In older infants and children, bacterial meningitis usually develops after encapsulated bacteria (that have colonised the nasopharynx) are disseminated in the bloodstream. The most common pathogens in children aged over 3 months are *Streptococcus pneumoniae* and *Neisseria meningitidis*. The incidence of bacterial meningitis has markedly declined in Australia with the introduction of the Hib and pneumococcal vaccinations in the National Immunisation Program.

**Viral meningitis**

Viral meningitis is usually diagnosed following exclusion of bacterial meningitis, with enterovirus and coxsackie virus being the major causes. Parechovirus is also common in infants ≤ 3 months of age. Herpes simplex virus meningitis without encephalitis is an infrequent cause of viral meningitis in children and usually has an excellent outcome even without antiviral therapy. HSV encephalitis however is a particularly devastating form of herpes infection (especially in neonates) with significant morbidity and mortality if not treated appropriately. Patients may have a history of HSV in close contacts.

Patients with HSV meningoencephalitis can have disseminated disease, but specific features include:

- focal neurological signs e.g. dysphasia or hemiparesis
- focal seizures
- predominance of lymphocytes in the CSF
- skin lesions (may not be present)

**Assessment**

The aim of the assessment (history and clinical examination) is to identify cases of meningitis promptly to enable appropriate management. Distinguishing between viral and bacterial meningitis on initial assessment can be difficult. Given the importance of early antibiotic treatment, it is safest to assume a bacterial cause until proven otherwise, especially in children < 5 years.

Consider seeking senior emergency/paediatric advice as per local escalation protocols if meningitis is suspected

Seek urgent senior emergency/paediatric assistance as per local escalation protocols for a child with suspected meningitis who is unstable or toxic.

**History**

The clinical presentation of bacterial meningitis may be acute (hours to 1 - 2 days) or insidious (over a few days). A history of preceding upper respiratory tract infection is can be present in up to 75% of patients. Apparent improvement with paracetamol should not be used to exclude the diagnosis.

History should include specific information on:

- immunisations (reduces but not eliminates risk of infection)
- prior use of oral antibiotics (may modify clinical features and CSF findings resulting in a delay in diagnosis)
- risk factors for infection
Examination

While the classic triad of fever, neck stiffness and headache is suggestive of meningitis, it is found in less than 50% of cases in older children and adolescents. Older children may present with any combination of these and/or other symptoms including rash, upper or lower respiratory tract, myalgia and abdominal pain. In preverbal children, symptoms are even more non-specific and a high index of suspicion is required to avoid missing cases. A collection of non-specific symptoms that include fever, neck stiffness and headache are more common in viral meningitis while neurological complications (including seizures and coma) rarely occur. The presence of an apparent explanation for fever such as pharyngitis, UTI or otitis media does not rule out diagnosis. A high index of suspicion for meningitis is required for:

- all sick, febrile or hypothermic neonates (with or without the features described)
- all children presenting with fever and convulsions especially if aged < 2 years.

Whilst the presentation varies with age, bacterial meningitis should be considered for any child with the clinical features outlined in the table below.

Fever and rash

The presence of a rash in a febrile child is often nonspecific and more likely to be caused by a viral illness than acute bacterial meningitis. Clinical judgement and decision making should be based on the entire clinical presentation and not just the rash. The rash associated with meningococcal disease may be maculopapular (in the earlier stages), petechial, or purpuric.

Risk factors for meningitis:
- recent contact with a case of bacterial meningitis (especially in family)
- recent contact with HSV “cold sores” or confirmed enterovirus infection
- (risk for HSV or EV71 encephalitis)
- recent overseas travel
- maternal GBS colonisation (in infants < 3 months)
- immunocompromised (if so consider cryptococci and mycobacteria)
- recent history of neurosurgical procedure or penetrating head injury
- VP shunt
- cochlear implant
Clinical features suggestive of bacterial meningitis

<table>
<thead>
<tr>
<th>ANY of the following clinical features</th>
<th>Clinical features more commonly seen in infants &lt; 3 months*</th>
</tr>
</thead>
<tbody>
<tr>
<td>• fever</td>
<td>• bulging fontanelle</td>
</tr>
<tr>
<td>• vomiting and/or nausea</td>
<td>• high pitched cry</td>
</tr>
<tr>
<td>• lethargy or irritability</td>
<td>• poor feeding</td>
</tr>
<tr>
<td>• photophobia and/or headaches</td>
<td>• apnoea</td>
</tr>
<tr>
<td>• anorexia</td>
<td>• seizures</td>
</tr>
<tr>
<td>• nuchal rigidity (often not present, especially in young children and infants)</td>
<td>• vomiting</td>
</tr>
<tr>
<td>• positive Kernig’s or Brudzinski’s sign</td>
<td>• hypothermia or temperature instability</td>
</tr>
<tr>
<td>• altered mental status</td>
<td>• fever in child &lt; 28 days old</td>
</tr>
<tr>
<td>• shock</td>
<td></td>
</tr>
<tr>
<td>• seizures</td>
<td></td>
</tr>
<tr>
<td>• focal neurological deficit</td>
<td></td>
</tr>
<tr>
<td>• petechial rash (an erythematous maculopapular eruption may be present initially)</td>
<td></td>
</tr>
</tbody>
</table>

*May also occur in infants > 3 months.

Adapted from van de Beek et al\textsuperscript{10} and Oostenbrink et al\textsuperscript{13} and Feigin et al\textsuperscript{14}

**Differential diagnosis**

Other causes of meningitis signs and symptoms:
- viral encephalitis
- viremia
- sepsis
- intracranial collections e.g. subdural empyema and brain abscess
- eosinophilic meningitis
- acute disseminated encephalomyelitis
- other infectious diseases e.g. pneumonia, otitis media, gastroenteritis, sinusitis and pharyngitis

**Investigations**

The definitive diagnosis of acute bacterial or viral meningitis is made on analysis of cerebrospinal fluid (CSF) obtained via lumbar puncture (LP). Where a LP is contraindicated or clinically unsafe (see box Page 6), investigations such as blood cultures and PCR testing on blood may be useful to diagnose meningococcal, pneumococcal or Hib infection.
## Laboratory investigations for suspected meningitis

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CSF analysis</strong></td>
<td>Positive CSF gram stain and culture results seen in 70 - 80% of untreated acute bacterial meningitis cases. CSF cell count, protein and glucose do not change appreciably with antibiotics.(^{3,15}) Meningococcus PCR has 89% sensitivity and 100% specificity(^{16}) Meningococcus or pneumococcus PCR may be positive despite antibiotic treatment. Viral PCR will guide treatment if clinical picture or CSF cell count suggests a viral aetiology.</td>
</tr>
<tr>
<td><strong>Blood cultures</strong></td>
<td>Especially valuable if LP not done. Positive in 74% of untreated acute bacterial meningitis patients and &lt;50% of treated patients.</td>
</tr>
<tr>
<td><strong>Biochemistry</strong></td>
<td>Serum electrolytes - seizures may be secondary to low sodium, calcium or magnesium; hyponatraemia in SIADH. BSL – check for hypoglycaemia especially in infants aged &lt; 3 months. UEC, LFT and VBG may suggest sepsis. CRP – may be high in bacterial meningitis but is nonspecific.</td>
</tr>
<tr>
<td><strong>Full blood count</strong></td>
<td>May be high in bacterial meningitis but is nonspecific</td>
</tr>
<tr>
<td><strong>Serum for bacterial PCR (Whole blood - EDTA sample)</strong></td>
<td>Consider collection with initial venepuncture and bloods. Seek senior advice prior to request. Meningococcal PCR has a high sensitivity and specificity. Pneumococcal PCR may be performed at some laboratories. Sensitivity higher with earlier time of collection but may remain positive up to 72 hours post antibiotics.(^{17})</td>
</tr>
</tbody>
</table>

Consider a clotting profile prior to LP if any clinical concerns around pre-existing coagulopathy e.g. sepsis, thrombocytopenia.
Lumbar puncture

Reasons for delaying a LP may include:
- patient instability such as respiratory or cardiovascular compromise
- persistently reduced level of consciousness
- continuing seizures
- suspicion of space-occupying lesion or raised ICP (i.e. Cushing sign, focal seizures, focal neurological defect, irregular breathing and papilloedema; relative bradycardia and hypertension)
- skin infection at the site of LP
- coagulopathy/thrombocytopenia

For these cases, antibiotics should not be delayed and treatment should be continued until clinical improvement is evident, at which time a LP may be safely performed.

Neither the absence of papilloedema or presence of a normal head CT scan rules out raised ICP (and the associated risk of subsequent brain herniation). Transportation out of ED for radiological investigations may put the unstable child at greater risk.\(^{18}\)

Laboratory request

Request urgent CSF microscopy (includes Gram stain, WCC and differential), CSF protein and glucose, culture & sensitivity and PCR studies. In addition, if suspect viral aetiology, request viral PCR for enterovirus (and parechovirus if < 3 months) and HSV plus VZV PCR (varicella zoster virus is suspected).

CSF analysis

Consider seeking senior emergency/paediatric advice as per local escalation protocols if unsure of CSF interpretation

No single CSF test parameter reliably distinguishes bacterial from non-bacterial meningitis. Normal CSF findings can very uncommonly result in culture proven bacterial meningitis. It is important to correlate with clinical findings.

<table>
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<th>White cell count</th>
<th>Biochemistry</th>
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<tr>
<td>Neutrophils ((x 10^6/L))</td>
<td>Lymphocytes ((x 10^6/L))</td>
</tr>
<tr>
<td>Normal (&gt;1 month of age)</td>
<td>0</td>
</tr>
<tr>
<td>Normal neonate (&lt;1 month of age)</td>
<td>0</td>
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</table>

Traumatic tap

Some guidelines suggest that in traumatic taps you can allow 1 white blood cell for every 500 to 700 red blood cells and 0.01g/L protein for every 1000 red cells. However, rules based on a ‘predicted’ white cell count in the CSF are not reliable.
In order not to miss any patients with meningitis, guidelines relating to decisions about who not to treat for possible meningitis need to be conservative. The safest interpretation of a traumatic tap is to **count the total number of white cells and disregard the red cell count**. If there are more white cells than the normal range for age, then the safest option is to treat.

Taken from The Royal Children’s Hospital, Melbourne, Australia, Clinical Practice Guideline on *CSF Interpretation*, [Internet; cited June 18], Available from: [https://www.rch.org.au/clinicalguide/](https://www.rch.org.au/clinicalguide/)

**Management**

Refer to Appendix 1 and 2 for a summary of the recommended emergency management and medications for children with suspected meningitis.

- Consider seeking senior emergency/paediatric advice as per local escalation protocols if meningitis is suspected.
- Seek urgent senior emergency/paediatric assistance as per local escalation protocols for a child with suspected meningitis who is unstable or toxic.
- Contact paediatric critical care specialist (onsite or via RSQ) for a child with signs/symptoms of shock not responding to initial treatment.

The absence of early appropriate senior input (including the absence of consultant supervision) during the first 24 hours in hospital is an independent risk factor for death.\(^{19}\)

The initial management for a child suspected of having meningitis is the same as for any serious illness. The assessment and management should be performed simultaneously and the child moved into the resuscitation area for stabilisation of airway, breathing, circulation, and disability (seizures/hypoglycaemia). This assessment and stabilisation should be prioritised above any illness-specific diagnostic assessment or treatment.

**Antibiotics**

**ALERT** – If meningitis is clinically suspected, but LP cannot be done within 30 minutes, antibiotics should be administered.

Early use of appropriate IV antibiotic (and antiviral where HSV meningoencephalitis is considered, especially in neonates) has been shown to improve outcome.

Empiric antibiotic regimens are selected to cover the most likely pathogens for the selected age group. For empirical therapy for treatment of suspected meningitis see [CHQ Antibiocard](#) or follow local guidelines.

As per the CHQ Antibiocard, vancomycin should be added for:

- children with gram positive cocci in CSF depending on age and illness severity
- critically ill children with suspected *Streptococcus pneumoniae* infection

The child should be admitted and empiric antibiotics continued until culture results are known to be negative or an organism and its sensitivity pattern are identified. Multi-resistant *Streptococcus pneumoniae* is on the rise (20-45% of all strains world-wide have been reported to be resistant to penicillin) and many are also resistant to the third-generation cephalosporins.\(^{20,21}\)
Antivirals

Aciclovir is not routinely required in children with meningitis. It is recommended for all children with suspected encephalitis and may be considered in other children if suspect a viral aetiology. For antiviral dosages refer to the CHQ Antibiocard.

Corticosteroids

Corticosteroids should be considered in all suspected bacterial meningitis cases, with administration ideally prior to or immediately following the first IV antibiotic dose.

Corticosteroids potentially improve patient outcome in acute bacterial meningitis by modulating the response to inflammatory mediators. The inflammatory response may be initiated in response to lysis of bacterial cell walls after the first dose of antibiotics. However, there is no evidence of benefit in viral meningitis, neonatal bacterial meningitis, Gram-negative bacterial meningitis, or in children already on antibiotics (partially-treated meningitis).22

A Cochrane review concluded that the use of corticosteroids (in conjunction with antibiotics) significantly reduces hearing loss (but not overall mortality) in children with acute bacterial meningitis.23

<table>
<thead>
<tr>
<th>Dexamethasone IV dosing for the treatment for meningitis in children</th>
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</table>
| **Dexamethasone (IV)** | For children >3 months of age:  
0.15 mg/kg/dose (maximum 10mg/dose), 6 hourly for 4 days if able to start prior to  
or within 1 hour of first antibiotic IV dose.  
Do not delay antibiotic therapy if steroids are not available. |

Fluid management

Children with meningitis may require initial fluid resuscitation as clinically indicated. Careful fluid management and electrolyte balance is important. Children with meningitis are at high risk of developing hyponatraemia associated with increased secretion of ADH.3 In the first 48 hours, it is recommended that children are not fluid restricted. There is no current evidence to support that fluid restriction reduces the incidence of cerebral oedema in children with bacterial meningitis.1

<table>
<thead>
<tr>
<th>Fluid resuscitation (IV) for the management of shocked children</th>
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</table>
| **Bolus dose** | Normal saline (0.9% NaCl) administered in 20 mL/kg bolus to treat shock.  
Repeat in 20 mL/kg boluses as clinically indicated. |
| **Maintenance Fluid** | 0.9% NaCl + 5% glucose preferred. |

Infection control measures

Standard precautions and droplet precautions should be observed during the care of a child with suspected or confirmed acute bacterial meningitis. Appropriate personal protective equipment must be worn when undertaking any procedure where there is a risk of exposure to blood or body fluids. All cases of suspected bacterial meningitis should be initially isolated in a single room until cleared or confirmed and ongoing isolation requirements discussed with the local hospital infection control team.
Public health notification

Under the Public Health Act 2005 (Qld) a provisional diagnosis (i.e. prior to laboratory confirmation) of N. meningitidis or Hib meningitis requires urgent notification to your local Public Health Unit to enable timely chemoprophylaxis for identified contacts.

Chemoprophylaxis

Chemoprophylaxis aims to eradicate asymptomatic carriage in contacts so that susceptible members of the group do not acquire the organism from the original carrier and develop an invasive infection. In meningococcal meningitis and Hib cases, chemoprophylaxis is offered to close (usually household) contacts of the primary index case. Despite prophylaxis, disease may still occur. Parent education regarding frequent, careful observation and the need for examination by a medical practitioner at the first signs of any unexplained illness is essential.

Prophylaxis for health care workers is not usually recommended unless they have had direct contact with nasopharyngeal secretions of a child with suspected (or proven) meningococcal meningitis or are in close contact nursing a patient for more than 6 hours.

This may occur in circumstances where appropriate personal protective equipment was not used e.g. endotracheal intubation (without using a face mask) or mouth-to-mouth resuscitation.

When to escalate care

Follow your local facility escalation protocols for children of concern. Transfer is recommended if the child requires care beyond the level of comfort of the treating hospital. Clinicians can contact the services outlined below to escalate the care of a paediatric patient.

<table>
<thead>
<tr>
<th>Service</th>
<th>Reason for contact by clinician</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Paediatric service</td>
<td>For specialist paediatric advice and assistance with local transfers as per local arrangements.</td>
<td>As per local arrangements</td>
</tr>
<tr>
<td>Children’s Advice and Transport Coordination Hub (CATCH)</td>
<td>For access to specialist paediatric advice and assistance with inter-hospital transfer of non-critical patients into and out of Lady Cilento Children’s Hospital. For assistance with decision making regarding safe and appropriate inter-hospital transfer of children in Queensland. For QH staff, <a href="#">click here</a> for the QH Inter-hospital transfer request form (access via intranet).</td>
<td>(07) 3068 4510 CATCH website</td>
</tr>
<tr>
<td>Telehealth Emergency Management Support Unit (TEMSU)</td>
<td>For access to generalist and specialist acute support and advice via videoconferencing, as per locally agreed pathways, in regional, rural and remote areas in Queensland.</td>
<td>TEMSU QHEPS website 24 hours</td>
</tr>
<tr>
<td>Retrieval Services Queensland (RSQ)</td>
<td>For access to telehealth support for, and to notify of, critically unwell patients requiring retrieval in Queensland. For any patients potentially requiring aeromedical retrieval or transfer in Queensland.</td>
<td>RSQ QHEPS website 24 hours</td>
</tr>
</tbody>
</table>
When to consider discharge

Seek senior emergency/paediatric advice prior to considering discharge for all children given antibiotic IV treatment for suspected meningitis who had the diagnosis subsequently excluded on CSF.

Discharge may be considered for children who meet the following criteria:

- symptoms such as pain and vomiting are controlled
- meningitis is excluded on CSF analysis and no empiric IV antibiotics administered
- no other investigations necessary for fever or symptoms
- can be safely managed at home and return in event of deterioration (consider time of day, parent/carers comprehension and compliance, access to transport and distance to local hospital)

Children who have meningitis excluded on CSF but had received empiric IV antibiotics will usually require a period of inpatient observation. Disposition of these children will always require discussion with senior emergency/paediatric clinician.

On discharge:

- Advise parent/caregiver to see a doctor if concerned about child prior to scheduled review appointment.
- Provide parent/caregiver with a Fever in children Factsheet.

Follow-up

- with General Practitioner within 24 – 48 hours

When to consider admission

All children with confirmed meningitis should be admitted. Ensure urgent notification to the your local Public Health Unit as appropriate.

Consider admission for children who:

- are aged < 1 year
- have any significant comorbidities
- have ongoing symptoms (e.g. pain and fever) after treatment and minimum of 4 hours observation
- require further investigations to identify cause of symptoms
- are representing within 24 hours following discharge with diagnosis of viral meningitis
- have received antibiotics IV prior to the exclusion of meningitis for ongoing management of illness

Related documents

Statewide emergency guidelines

- Febrile illness
- Sepsis
Fact sheets
• Fever in children

References
Guideline approval

<table>
<thead>
<tr>
<th>Document ID</th>
<th>CHQ-GDL-60008 - Meningitis</th>
<th>Version no.</th>
<th>1.0</th>
<th>Approval date</th>
<th>13/8/18</th>
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<td>Executive Director Medical Services</td>
<td></td>
<td></td>
<td>Effective date</td>
<td>13/8/18</td>
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<tr>
<td>Author/custodian</td>
<td>Statewide Emergency Care Children Working Group</td>
<td></td>
<td></td>
<td>Review date</td>
<td>13/8/21</td>
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<tr>
<td>Supersedes</td>
<td>CHQ-GDL-07448 (CHQ Meningitis Guideline)</td>
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<td>Applicable to</td>
<td>QH Medical and nursing staff</td>
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<tr>
<td>Authorisation</td>
<td>Executive Director Clinical Services LCCH</td>
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Keywords
Paediatric, meningitis; guideline, emergency

Accreditation references
NSQHS Standard: 1, 4, 9

Disclaimer

This guideline is intended as a guide and provided for information purposes only. The information has been prepared using a multidisciplinary approach with reference to the best information and evidence available at the time of preparation. No assurance is given that the information is entirely complete, current, or accurate in every respect.

The guideline is not a substitute for clinical judgement, knowledge and expertise, or medical advice. Variation from the guideline, taking into account individual circumstances may be appropriate.

This guideline does not address all elements of standard practice and accepts that individual clinicians are responsible for:
- Providing care within the context of locally available resources, expertise, and scope of practice
- Supporting consumer rights and informed decision making in partnership with healthcare practitioners including the right to decline intervention or ongoing management
- Advising consumers of their choices in an environment that is culturally appropriate and which enables comfortable and confidential discussion. This includes the use of interpreter services where necessary
- Ensuring informed consent is obtained prior to delivering care
- Meeting all legislative requirements and professional standards
- Applying standard precautions, and additional precautions as necessary, when delivering care
- Documenting all care in accordance with mandatory and local requirements

Queensland Health disclaims, to the maximum extent permitted by law, all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs incurred for any reason associated with the use of this guideline, including the materials within or referred to throughout this document being in any way inaccurate, out of context, incomplete or unavailable.
Appendix 1

Meningitis - Emergency Management in Children - Flowchart

Child presents to ED with symptoms suggestive of meningitis

Assessment

T toxic/unstable?

Yes

Non-toxic

LP contraindicated? (A)

No

LP within 30 minutes?

Yes

• Perform LP
  - CSF MCS (urgent) & biochemistry
  - +/- Viral PCR
  - Blood cultures
  - +/- Meningococcal PCR
  - Seek senior advice re timing of antibiotics

• Blood cultures
  - +/- Meningococcal PCR
  - Dexamethasone (IV)
  - Empirical AB (IV)
  - +/- Aciclovir (IV)
  - +/- Vancomycin (IV)

CSF consistent with meningitis?

No

Empiric antibiotics (IV) given?

No

Consider discharge

Yes

Refer to inpatient team or discharge as indicated

Consider timing of LP

Responding to treatment?

Yes

Treatment as indicated

No

Refer to inpatient team

Refer to critical care

See Sepsis Guideline

Resuscitate using ABCD
• Oxygen 15L/min via NRBM
• Support ventilation (BVM)
• +/- ETT
• IV or IO access
• Bloods with BC + VBG as priority
• IV fluid boluses 20mL/kg 0.9% NaCl as required.
• Check BSL
• Give 10% Dextrose (2mL/kg) as required

Other management
• Blood cultures
• +/- Meningococcal PCR
• Dexamethasone (IV)
• Empirical AB (IV)
• +/- Aciclovir (IV)

No

Toxic or unstable (B)

LP contraindicated (A)

A. Contraindications to Lumbar Puncture (LP)
• Focal neurological signs
• Signs of raised intracranial pressure
• Reduced level of consciousness
• Haemodynamic instability
• Respiratory compromise

B. Toxic or unstable
• Altered level of consciousness or obtundation
• Signs of shock
• Coagulopathy
• Refractory seizures

Call RSQ if no paediatric critical care facility onsite
Seek senior emergency/paediatric advice as per local protocols
Consider seeking senior emergency/paediatric advice as per local protocols

For more information refer to the Statewide Paediatric Guideline: Meningitis - Emergency Management in Children
### Empiric antibiotic therapy for the treatment of meningitis – CHQ Antibiocard*

<table>
<thead>
<tr>
<th>Age</th>
<th>Drug</th>
</tr>
</thead>
</table>
| < 2 months| Cefotaxime (IV) 50mg/kg  
PLUS Ampicillin/Amoxycillin (IV) 50 mg/kg  
See CHQ Antibiocard for subsequent dosing interval  
If encephalitis suspected ADD Aciclovir (IV) 20mg/kg |
| >2 months | Cefotaxime (IV) 50mg/kg (max 2g) every 6 hours  
OR Ceftriaxone (IV) 50 mg/kg (max 2g) every 12 hours  
If gram positive cocci in CSF:  
ADD Vancomycin (IV) 15mg/kg (max 500mg) every 6 hours  
If encephalitis suspected:  
ADD Aciclovir (IV) 10mg/kg every 8 hours |

If documented cephalosporin anaphylaxis:  
Ciprofloxacin (IV) 10mg/kg (max 400 mg)  
PLUS Vancomycin (IV) 15 mg/kg (max 750 mg) and seek specialist ID advice within 24 hours.


### Dexamethasone (IV) dosing for the treatment for meningitis in children > 3 months

| Dexamethasone (IV) | For children > 3months:  
0.15 mg/kg (maximum 10mg/dose), 6 hourly for 4 days if able to start prior to or within 1 hour of antibiotics.  
Do not delay antibiotic therapy if steroids are not available. |

### Fluid resuscitation (IV) for the management of shocked children

| Bolus dose | Normal saline (0.9% NaCl) administered in 20 mL/kg bolus to treat shock.  
Repeat in 20 mL/kg boluses as clinically indicated. |
| Maintenance Fluid | 0.9% NaCl + 5% glucose preferred. |

### Normal CSF values

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<tr>
<td>Neutrophils (x 10^6 /L)</td>
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<td>Normal (&gt;1 month of age)</td>
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