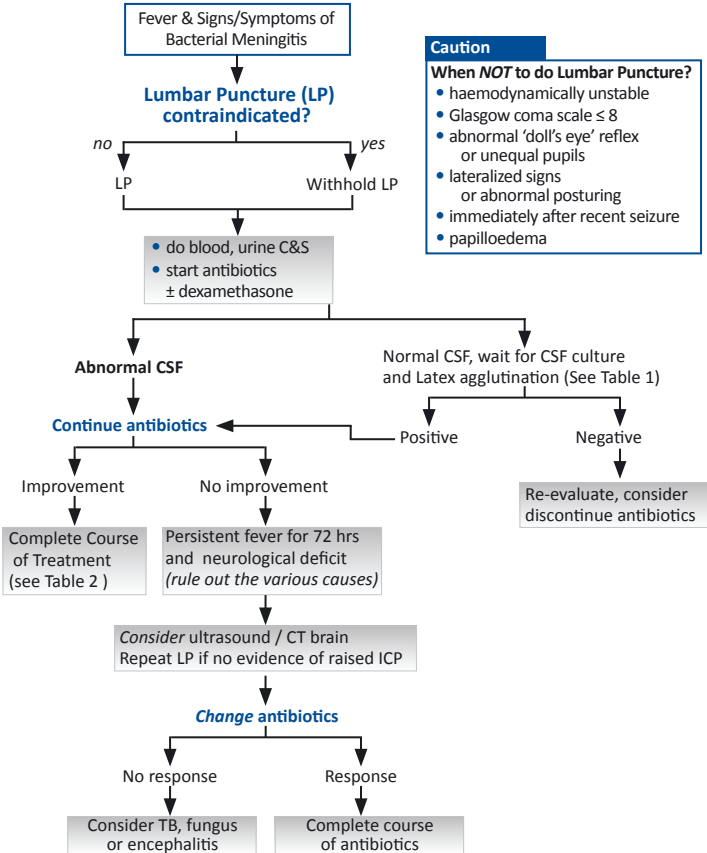


# MENINGITIS

## Introduction

Meningitis is still a major and sometimes fatal problem in Paediatrics. Morbidity is also high. About 30% of survivors have some sequelae of their disease. However, these complications can be reduced if meningitis is treated early.

Figure 1. Approach to children with fever and signs / symptoms of bacterial meningitis



Note: In cases of aseptic meningitis or encephalitis please send CSF and serum for viral serology e.g. for JE IgM and HSV CSF PCR.

**Table 1. Cerebrospinal fluid values in neurological disorders with fever**

Condition	Leukocytes (mm <sup>3</sup> )	Protein (g/l)	Glucose (mmol/l)	Comments
Acute bacterial meningitis	100 - >50,000	Usually 1- 5	<0.5 - 1.5	Gram stain may be positive
Partially treated bacterial meningitis	1 - 10,000 usually ↑PMN, but may have lymphocytes	> 1	low	CSF may be sterile in pneumococcal, meningococcal meningitis
Tuberculous meningitis	10 - 500 early PMN, later ↑ lymphocytes	1 - 5	0 - 2.0	Smear for AFB, TB PCR positive in CSF. ESR ↑
Fungal meningitis	50 – 500 lymphocytes	0.5 - 2	normal or low	CSF for Indian ink / cryptococcal antigen
Encephalitis	10 - 1,000	normal / 0.5-1	normal	Send for CSF virology
Encephalopathy	<10 lymphocytes	normal	normal	May not be febrile

**Table 2. Recommended antibiotic therapy according to likely pathogen**

Age Group	Initial Antibiotic	Likely Organism	Duration (if uncomplicated)
< 1 month	C Penicillin + Cefotaxime	Group B <i>Streptococcus</i> <i>E. coli</i>	21 days
1 - 3 months	C Penicillin + Cefotaxime	Group B <i>Streptococcus</i> <i>E. coli</i> <i>H. influenzae</i> <i>Strep. pneumoniae</i>	10 – 21 days
> 3 months	C Penicillin + Cefotaxime or Ceftriaxone	<i>H. influenzae</i>	7 – 10 days
		<i>Strep. pneumoniae</i> <i>N. meningitidis</i>	10 – 14 days 7 days

Note:

1. Terminate inappropriate antibiotics when infective organism has been identified.
2. Ceftriaxone gives more rapid sterilisation of CSF than either Cefotaxime or Cefuroxime.
3. Ideally, MIC of the antibiotics for susceptible organisms (especially *S. pneumoniae*) is required to decide on the antibiotic of choice. For example:-
 

MIC level	Drug of choice:
• MIC < 0.1 mg/L (sensitive strain)	<i>C Penicillin</i>
• MIC 0.1- < 2 mg/L (relatively resistant)	<i>Ceftriaxone</i> or <i>Cefotaxime</i>
• MIC > 2 mg/L (resistant strain)	<i>Vancomycin</i> + <i>Ceftriaxone</i> or <i>Cefotaxime</i>
4. Penicillin resistance in community acquired *S. pneumoniae* in Hospital Kuala Lumpur is 16.9 %
5. Extend duration of treatment if complications e.g. subdural empyema, brain abscess.

**Table 3. Normal cerebrospinal (CSF) values**

	Neonates	Infants	Older children
Cells/mm <sup>3</sup>	< 30	< 10	< 5
Glucose mmol/l*	1.1 – 3.3	3.9 – 5.0	2.8 – 4.4
Protein g/l	0.2 – 1.5**	0.15 – 0.45	0.2 – 0.4

\* RBS must be taken before LP. Normal CSF glucose ≥ 60% RBS

\*\* CSF protein: values up to 3g/l may be found in preterm infants

**Table 4. Gram stain characteristics**

<i>Streptococcus pneumoniae</i>	gram positive extracellular diplococci.
<i>Neisseria meningitidis</i>	gram negative intracellular diplococci
<i>Haemophilus influenzae</i>	gram negative coccobacilli

### Use of Steroids to decrease the sequelae of bacterial meningitis

- best effect achieved if the steroid is given before or with the first antibiotic dose
- dose: Dexamethasone 0.15 mg/kg 6 hly for 4 days or 0.4 mg/kg 12 hly for 2 days
- give steroids if CSF at LP is turbid and the patient has not received prior antibiotics

### Supportive measures

- monitor temperature, pulse, B/P and respiration 4 hourly and input/output
- nil by mouth if unconscious
- careful fluid balance required. Often, maintenance IV fluids is sufficient. However, if SIADH occurs, reduce to 2/3 maintenance for the initial 24 hours. Patient may need more fluid if dehydrated.
- if fontanel is still open, note the head circumference daily. Consider cranial ultrasound or CT scan if effusion or hydrocephalus is suspected
- fit chart
- daily CNS assessment is essential
- observe for 24 hours after stopping therapy and if there is no complication, patient can be discharged

*If persistent fever in a patient on treatment for meningitis, consider:*

- thrombophlebitis and injection sites e.g. intramuscular abscess
- intercurrent infection e.g. pneumonia, UTI or nosocomial infection
- resistant organisms. Inappropriate antibiotics or inadequate dosage
- subdural effusion, empyema or brain abscess
- antibiotic fever

**Follow up** (Long term follow up is important)

- note development of child at home and in school.
- note head circumference.
- ask for any occurrence of fits or any behavioural abnormalities.
- assess vision, hearing and speech
- request for a formal hearing assessment in cases of proven meningitis
- until child speaks normally or speaks intelligibly to others (usually until 4 years old)

### Prognosis depends on

- age: worse in younger patients
- duration of illness prior to effective antibiotics treatment
- causative organism: more complications with *H. influenzae* and *S. pneumoniae*
- presence of focal signs

**Table 5. Indication for cranial CT scan**

*Useful to detect complications*

- prolonged depression of consciousness
- prolonged focal or late seizures
- focal neurological abnormalities
- enlarging head circumference
- suspected subdural effusion or empyema

**Table 6. Indications for subdural drainage**

- rapid increase in head circumference with no hydrocephalus
  - focal neurological signs
  - increased intracranial pressure
  - suspected subdural empyema
- Most do not need treatment*