# Meningitis

## *Executive summary*

## Introduction

## Meningitis is defined as inflammation of the pia and arachnoid meninges and the cerebrospinal fluid (CSF) that surrounds the brain and spinal cord. The main infectious causes are viral, bacterial and fungal.

## Meningitis is classified clinically as either acute or chronic. Acute meningitis occurs within hours or days, whereas chronic meningitis evolves over weeks. Acute meningitis is classified as

## aseptic (which is mostly viral in origin) or

## septic or pyogenic which is caused by bacteria.

## Chronic meningitis is a complex entity with both infectious and noninfectious causes.

### Target users

* Doctors

### Target area of use

* Ward

### Key areas of focus / New additions / Changes

This guideline addresses the management of the infective causes of meningitisin children and in adults. It provides advice on empirical antibiotic therapy.

The treatment of infective chronic meningitis has been added to this guideline and the management of meningitis in the immunocompromised has been adopted in this new version.

Antibiotic therapy is for two weeks at least.

## Limitations

## None.

## Pathogens

**1) Bacterial:**

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| **Age range** | **Organism** | **Site of entry** | **Predisposing conditions** |
| All ages | *Neisseria meningitidis* | Nasopharynx | Usually none, rarely complement deficiency |
| All ages | *Streptococcus pneumoniae* | Nasopharynx,  direct extension across skull fracture, or from contiguous or distant foci of infection | All conditions that predispose to pneumococcal bacteremia, fracture of cribriform plate, cochlear implants, cerebrospinal fluid otorrhea from basilar skull fracture, defects of the ear ossicle |
| All ages | *Coagulase-negative staphylococci* | Foreign body | Surgery and foreign body, especially ventricular drains |
| All ages | *Staphylococcus aureus* | Bacteremia, foreign body, skin | Endocarditis, surgery and foreign body, especially ventricular drains; cellulitis, decubitus ulcer |
| Older adult (>50yrs) and neonates | *Listeria monocytogenes* | Gastrointestinal tract, placenta | Glucocorticoids, Transplantation (especially renal transplantation), Pregnancy, Liver disease, Alcoholism, Malignancy |
| Older adults and neonates | *Gram-negative bacilli* | Various | Advanced medical illness, neurosurgery, ventricular drains, disseminated strongyloidiasis |
| Adults; infants and children if not vaccinated | *Haemophilus influenzae* | Nasopharynx, contiguous spread from local infection | Diminished humoral immunity |

**2) Viral:**

A number of viruses produce aseptic meningitis including enteroviruses, herpes simplex virus (HSV), human immunodeficiency virus (HIV), West Nile virus, varicella-zoster virus, mumps, and lymphocytic choriomeningitis virus.

**3) Chronic meningitis:**

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| **Age range** | **Organism** | **Site of entry** | **Predisposing conditions** |
| All ages | Mycobacterium tuberculosis | Pulmonary TB | Acute complication of pulmonary TB or as a reactivation of extra pulmonary TB.  HIV significantly increases the risk. |
| All ages | Cryptococcus neoformans |  | CD4 counts < 100 cells/mm3. |

## Presenting symptoms and signs

The main clinical features of acute bacterial meningitis (ABM) are headache, fever and meningism. When this triad is accompanied by alteration in consciousness or seizures, the diagnosis is usually not in doubt. Other symptoms include photophobia, nausea, vomiting, backache and lethargy. Progression occurs rapidly over 1-3 days but a smaller number may have an acute fulminant course lasting hours. However patients with HIV infection may present with only one or two of these main features.

TB Meningitis is a difficult condition to diagnose and confirm clinically. The clinical features are those of slowly progressive. Constitutional TB symptoms including fever, night sweats, weight loss and malaise may be present for a week or more early on but these may also be absent or are not specific for TB. The main neurological symptoms suggestive of TB meningitis are headache, nausea, vomiting, irritability, behaviour change and meningism of gradual onset usually for a period of one week or usually longer in adults. However, headaches may be less prominent in children, fever may be absent in 10-20% of adults and the signs of meningitis are generally less prominent as compared to acute bacterial meningitis.

## Examination findings

## Management

**Investigations**:

**1) Blood culture** are often positive and can be useful in the event that cerebrospinal fluid (CSF) cannot be obtained before the administration of antimicrobials. Approximately 50 to 90 percent of patients with bacterial meningitis have positive blood cultures.

**2) Lumbar puncture (LP)** is the key investigation and is an overall simple and very safe test.

\*CONTRAINDICATIONS- Increased intracranial pressure; Thrombocytopenia or other bleeding diathesis; Cardiopulmonary instability; Soft tissue infection at the puncture site.

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|  | **Acute bacterial meningitis** | **Tuberculous** | **Cryptococcal** | **Viral** |
| **Appearance** | cloudy, purulent | yellow/cloudy | clear/cloudy | Clear (cloudy) |
| **Cell/mm3** | high  > 2000/mm3  neutrophils | increased  50-500/mm3  lymphocytes | normal/increased  0-100/mm3  lymphocytes | normal/increased  0-500/mm3  lymphocytes |
| **Glucose**  **(n=> 50% of plasma level)** | very low/absent  <1mmol/L | low | normal/low | normal |
| **Protein**  **(n=< 0.5 mg/l)** | elevated  1-2 mg/L | high/very high  1-5 mg/L | normal/elevated  0.5-2 mg/L | normal/elevated  0.5-1 mg/L |
| **Diagnosis confirmed** | Gram stain & culture | ZN stain & culture | India ink stain/ Cryptococcal Antigen/Culture | PCR |

**Treatment:**

**Bacterial** — The mainstay of management of ABM is prompt diagnosis and early treatment with antimicrobials. It is important that antimicrobials should be given straight away (within 20-30 mins of first seeing the patient) and not to delay treatment because of ongoing investigations including a LP. In adults ceftriaxone is now the drug of first choice. In adult, the dose is 4g/day while in children, 100 mg/kg/day IV (maximum dose 4 g/day) in 1 or 2 divided doses. The use of steroids in the treatment of ABM in adults is currently not recommended in Africa.

**Viral** — Most patients with viral meningitis require only supportive care. Patients who are elderly, immunocompromised, or have received antibiotics prior to presentation may be considered for empiric antibacterial therapy for 48 hours, even if viral meningitis is the suspected diagnosis.

If HIV is a diagnostic consideration, then blood testing for HIV RNA and HIV antibody should be performed.

If aseptic meningitis due to HSV is suspected, empiric therapy with intravenous acyclovir (for adult and children: 10-15 mg/kg every 8 hours, for neonates: 60 mg/kg per day divided every 8 hours) can be considered for hospitalized patients.

**TB** — All four TB drugs are given for the first 2 months after which isoniazid and rifampicin are continued usually for another 10 months. In practice the standard total period of treatment is 12 months for tuberculous meningitis and longer for tuberculoma.

In general, glucocorticoid therapy is warranted for all patients (including those with HIV) with convincing epidemiologic or clinical evidence for tuberculous meningitis. The regimen consists of oral prednisolone: children: 2 to 4 mg/kg per day; adolescents and adults: 60 mg/day. Administer initial dose for two weeks, then taper gradually over the next six weeks (ie, reduce daily dose by 10 mg each week); total duration is approximately eight weeks.

Starting ART is recommended after the first 2 weeks of TB meningitis treatment in HIV.

**Cryptococcal** — The treatment of Cryptococcal meningitis (CM) in Africa is mostly based on fluconazole alone. There are three phases: induction phase, consolidation phase and maintenance phase. In the induction phase, fluconazole (1200 mg orally per day) may be administered for at least 10 weeks or until CSF culture results are negative, followed by consolidation therapy with fluconazole (400 mg orally daily). The maintenance or prophylaxis phase uses fluconazole 200 mg daily until the CD4 count is > 200/mm3 for >6 months. Multiple lumbar punctures may be needed to relieve raised ICP.

A delay in initiation of ART until at least 4 weeks after the start of the treatment phase appears to have a better outcome in fluconazole treated patients. Long-term mortality in CM is high (> 50%) even with ART.

**Unclear etiology** — When it is not clear whether the patient has a viral or bacterial process, we recommend empirical antibiotics after obtaining blood and CSF cultures or observation with repeat lumbar puncture in 6 to 24 hours. If the patient is symptomatically improved and culture results are negative, then antibiotics can generally be stopped without a repeat LP. However, repeat LPs may be indicated in patients with persistent symptoms who do not have a clear diagnosis.

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|  | **Acute bacterial meningitis** | **Tuberculous** | **Cryptococcal** | **HSV** |
| **Medication dose**  **(*in children*)** | Ceftriaxone  4 g *(100 mg/kg*) OD | 1)TB4  2)Prednisolone 60 mg *(2-4 mg/kg)* OD | Fluconazole  1)1200 mg *(18 mg/kg)* OD  2)400 mg *(6 mg/k*g) OD  3)200 mg *(3 mg/kg)* OD | Acyclovir  10-15 mg/kg TDS  *(neonate: 60 mg/kg divided every 8 hours*) |
| **Duration**  **(*in children*)** | 2 weeks  *(3 weeks)* | 1) 12 months  2) 2 weeks, then taper gradually over the next six weeks | 1)10 weeks  2)8 weeks  3)until the CD4 count is >200/mm3 for > 6 months | 2 weeks |

## Key Issues for Nursing care

## Deterioration in clinical status can occur rapidly, so frequently assess the patient's neurologic status, especially level of consciousness and vital signs. Report new focal signs immediately.

## Try to minimize increases in the patient's ICP. Appropriate measures may include keeping the patient's head of bed elevated to 30 degrees, keeping the head midline, minimizing suctioning, using sedation, keeping the room quiet and dark, and avoiding hypercapnia.

## Patients with bacterial meningitis may develop dehydration, shock, syndrome of inappropriate secretion of antidiuretic hormone, and/or intracranial hypertension. Closely monitor for fluid and electrolyte imbalances.

## Analgesics may be required to treat headache. Darkening the room may help if the patient complains of photophobia.

## The patient's hearing should be assessed before discharge because hearing loss is a common late complication of bacterial meningitis.

## Keep in mind that because *N. meningitidis* is easily spread from person to person, secondary cases need to be prevented. Suspected meningococcal disease should be reported to the local public health department. People in close contact with an infected person should receive chemoprophylaxis with single dose of oral ciprofloxacin 500 mg daily (adults only) or oral rifampicin 10 mg/kg twice daily (up to 1200 mg/day) for 4 days

## References

NEUROLOGY IN AFRICA; William Howlett: Updated Oct 17,.2018 (First published: Aug 16, 2012)

Up To Date: Central nervous system tuberculosis: last updated: Oct 26, 2018.

Up To Date: Epidemiology of bacterial meningitis in adults: last updated: Sep 26, 2018.

Up To Date: Lumbar puncture: Indications, contraindications, technique, and complications: last updated: Sep 26, 2018.

Up To Date: Fluconazole: Drug information

Up To Date: Aseptic meningitis in adults: last updated: Sep 26, 2018.

Up To Date: Clinical features and diagnosis of acute bacterial meningitis: This topic last updated: Aug 30, 2018

Fire up to beat the threat of bacterial meningitis; Miller A, Nursing2013: December 2013 - Volume 43 - Issue 12 - p 52,58–58

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