

Suspected Meningitis

Key Points

- Meningitis is a potentially fatal condition with high morbidity requiring emergency treatment.

These guidelines are **NOT** to be used for the following patients – these cases should be discussed with Microbiology:

- Post-operative or shunt related meningitis
- Suspected TB meningitis
- Known or high clinical suspicion of immunosuppression, e.g., HIV
- Neonates, infants or children – if there is [suspicion of encephalitis, please refer to specific guideline](#).

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Abbreviations

AIDS/HIV	Acquired Immunodeficiency Virus / Human Immunodeficiency Virus
CNS	Central nervous system
CSF	Cerebrospinal fluid
CT	Computed Tomography
EDTA	Ethylenediaminetetraacetic acid
FBC; U+Es; CRP; LFTs	Full Blood Count, Urea & Electrolytes, C-reactive protein, Liver Function Tests
GCS	Glasgow Coma Scale
HSA	Health Security Agency
ICP	Intracranial pressure
LDH	Lactate dehydrogenase
LP	Lumbar puncture
MET	Metabolic equivalent
PCR	Polymerase chain reaction
RBC	Red blood cell
TB	Tuberculosis
VP	Ventriculoperitoneal
WBC	White blood cell

Summary

Meningitis remains relatively a common and potentially fatal condition. Optimal management requires early consideration of the diagnosis, investigation and initiation of appropriate treatment.

1. Causative pathogens in adults

• Common

- *Neisseria meningitidis* (particularly children, adolescents and young adults) Can cause meningitis or septicaemia, or a combination of these diseases.
- *Streptococcus pneumoniae* is probably now the most common cause of bacterial meningitis in the UK due to effective meningococcus vaccines.
- Viral (e.g., *Enterovirus*, *Herpes Simplex Virus*, *Varicella Zoster Virus*) - usually benign, with symptoms of meningism (headache, neck stiffness and photophobia); almost never life threatening if no features of encephalitis (e.g., reduced conscious level, confusion, seizures, focal neurological signs) and most people quickly make a full recovery.

• Less common

- *Haemophilus influenzae* type B – less common since routine childhood vaccination introduced; consider if unvaccinated)
- *Mycobacterium tuberculosis* – rare but should be considered in immunocompromised individuals, in patients with a past history of TB and in those from areas of endemic TB
- Mumps and measles virus if unvaccinated

• In immunosuppressed, diabetic and the elderly, pregnant, also

- *Listeria monocytogenes* - particularly associated with relative immunocompromise of pregnancy
- Fungi, e.g., *Cryptococcus spp.* in those with AIDS/HIV
- Meningitis related to direct spread from VP shunts or spinal procedures have a very wide list of possible pathogens including Staphylococci and Gram-negative bacilli and these patients should be discussed with the regional neurosurgical centre at St. George's Hospital if meningitis is a possible diagnosis.

2. Clinical features

- Most patients have a headache and a fever, but variably have photophobia, vomiting, neck stiffness, pain on extension of the leg (Kernig's sign), seizures (30% of patients), focal neurological signs (20% of patients)
 - Only 44% of adults with bacterial meningitis exhibit the classic triad of fever, headache, and neck stiffness and so a high index of suspicion is needed.
 - Early features of meningococcal sepsis may include leg pain, cold hands/feet, abnormal skin colour.
 - A rash is not necessarily part of the presenting features of bacterial meningitis. If meningitis is due to *Neisseria meningitidis* a rapid spreading purpuric rash may be present but may also be absent or atypical, e.g., blanching rash. The rash goes with meningococcal sepsis.
- Patients with bacterial meningitis are more unwell than those with viral meningitis, and the infection can progress quickly causing drowsiness, confusion, irritability and coma.
- Be vigilant for features of encephalitis (confusion, reduced Glasgow Coma Scale [GCS], seizures).

3. Initial Investigation and Management

- See Figure 1.
- If patient has predominantly meningococcal sepsis (rather than meningococcal meningitis), no lumbar puncture is required; patient should be treated with Antibiotics as per microbiology guidelines and monitored closely for warning signs (see Figure 1, Box A).
- While a normal CRP and normal peripheral blood white blood cell count mean bacterial meningitis is less likely, they do not rule it out. The CRP may be normal and the white blood cell count normal or low, even in severe meningococcal disease.

Figure 1. Early Management of Suspected Bacterial Meningitis in Immunocompetent Adults

Adapted from: British Infection Association 2003 guideline: **Early Management of Suspected Bacterial Meningitis and Meningococcal Septicaemia in Immunocompetent Adults**¹

Early Recognition

- Signs of meningitis – fever, headache, photophobia, vomiting, neck stiffness (seizures, altered GCS)
- A rash may be absent or atypical (e.g. blanching) or the typical meningococcal petechial rash
- Prior antibiotics may mask the severity of the illness

Assess Severity & Stabilise

- Secure airway, high flow oxygen, large bore cannula +/- fluid resuscitation
- **Involve seniors – SpR or Consultant & MET CALL if score ≥ 4 or any warning signs - Box A**
- Assess neurology (focal signs?) and GCS.
- Call critical care team if any features of raised intracranial pressure (ICP), shock or respiratory failure
- Continue to monitor and stabilise circulation

Early Investigations:

- FBC; U+Es; CRP; LFTs
- Blood sugar
- Clotting profile
- Blood gas
- Blood culture

When stabilised:

- Throat swab
- EDTA blood for *N. meningitidis* PCR
- Early CT head if indicated (**Box B**)

No Raised ICP

No Shock

No Respiratory failure

Raised ICP

Shock or

respiratory failure

Lumbar Puncture (LP)

(contra-indications

Box C & Section 3.1)

- IV Antibiotics contemporaneously with LP (**Box D**)
- Consider corticosteroids – **Box E**
- if LP will be delayed for more than 30 minutes, give IV Antibiotics first

Involve seniors

- Secure airway / Oxygen
- Defer lumbar puncture
- IV Antibiotics (**Box D**)
- Consider corticosteroids – **Box E**
- Careful fluid resuscitation
- 30° head elevation
- Management in critical care unit if signs of shock or raised ICP (low threshold for elective Intubation + Ventilation).

Box A

Warning Signs

The following warn of worsening clinical condition and require **urgent senior review**:

- Rapidly progressive rash
- Poor peripheral perfusion, Capillary refill time > 4 secs, oliguria and systolic BP < 90
- RR < 8 or > 30 or • Pulse rate < 40 or > 140
- Acidosis pH < 7.3 or BE worse than -5
- WBC < 4
- Reduced or fluctuating conscious level (GCS < 12 or fall in GCS > 2)
- Focal neurology or seizures
- Bradycardia and hypertension
- Papilloedema

Box B

CT scan and meningitis

- Indicated if focal neurology /reduced GCS
- A normal CT scan does not exclude raised intracranial pressure (ICP)
- If there are no contraindications to LP (Box C), a CT scan is not necessary beforehand

If uncertain, involve seniors

Box C

Contraindications to lumbar puncture (LP)

- Evidence of raised intracranial pressure (ICP) – reduced or fluctuating GCS, focal neurology, seizures, bradycardia/hypertension, papilloedema)
- Clotting abnormalities or anticoagulant therapy
- Evidence of infection at LP site
- Shock; caution in respiratory compromise
- Caution - extensive or spreading purpura

If uncertain, involve seniors.

Box D

IV antibiotics should be given as soon as possible and should not be unnecessarily delayed in order to perform other investigations, e.g., lumbar puncture. Ascertain allergy status and follow Trust guidelines. See **Section 3.3** for further guidance.

Box E

Corticosteroids

- For patients with suspected bacterial meningitis
- Dexamethasone (0.15mg/kg, max 10mg) – with or just before the first dose of antibiotics (with subsequent decision to continue or stop)

Not indicated if:

- Suspected viral meningitis/encephalitis
- Patients who have already received antibiotics (including in primary care)
- Immunosuppressed patients
- Meningitis occurring after neurosurgery

See **Section 3.2** for further guidance

3.1 Lumbar Puncture

1. Blood Glucose

- GREY Fluoride oxalate Glucose tube
- Taken immediately before the LP and sent to Biochemistry (crucial in order to interpret CSF glucose)

2. Obtain CSF

- Record opening Pressure using manometer, in cm H₂O
- Try to take at least 1 ml (ideally 2-3ml) of cerebrospinal fluid (CSF) into each of **4 universals** (1ml is approximately 20 drops from Luer connector on needle)

3. Label samples sequentially and send CSF to Microbiology

- Cell count and Gram stain (on the 1st and 3rd samples obtained) – ensure bottles are labelled sequentially correctly
- Request CSF viral PCR on request form if indicated (an aliquot is sent from Microbiology to Virology)
- Microbiology will forward one universal to Biochemistry for Protein and Glucose
 - Also request CSF lactate and LDH – prognostically and diagnostically helpful
- Call Microbiology BMS (x6958 during working hours or oncall via switchboard) to request urgent processing once the sample has been taken
- **CSF samples must be marked as URGENT and immediately hand delivered to specimen reception**
- Testing samples for *Mycobacterium tuberculosis* (stain and culture for Acid Fast Bacilli, AFB) and *Cryptococcus sp.* (Cryptococcal Antigen, CRAG) should be discussed with a Microbiologist once initial CSF findings are known.

If antibiotics have already been started hours or even a few days previously it is often still worthwhile performing a lumbar puncture since the CSF may still have raised white blood cells and a PCR may yield a positive result. Note: the longer the delay in doing an LP, the more likely the white blood cells will be lymphocytes as the inflammatory response becomes more chronic – the protein and glucose will help differentiate bacterial from viral in this case.

Diagnosis based on these may facilitate appropriate ongoing therapy in terms of appropriate selection of antimicrobials and duration.

3.2 Use of Corticosteroids

Corticosteroids have also been shown to reduce mortality in meningitis caused by *Streptococcus pneumoniae*. There is also evidence that corticosteroids reduce the neurological and audiological sequelae that can complicate *Haemophilus influenzae* meningitis ².

For this reason (ahead of knowing the specific bacterial pathogen) it is recommended to give IV Dexamethasone (0.15mg/kg to a maximum of 10mg, four times a day for 4 days). This should be administered as close to the first dose of antibiotic (and up to 12 hours afterwards) if there is a strong provisional diagnosis of bacterial meningitis (even if lumbar puncture is contraindicated).

Adjunctive dexamethasone should NOT be given to adults who have already received antimicrobial therapy because it is unlikely to improve patient outcomes. After the first dose of dexamethasone further discussion amongst seniors involved in the patient's care should determine whether dexamethasone should continue; in particular, it should be stopped if a non-bacterial cause is identified.

The following are contraindications to the use of steroids:

- Suspected or proven viral meningitis/encephalitis

- Patients where the diagnosis is in doubt
- Immunosuppressed patients
- Meningitis following surgery

3.3 Antimicrobial Treatment

Antibiotic therapy should be initiated without delay according to the Trust [Microguide](#). Additional treatment for *Listeria monocytogenes* should be considered in pregnant women, in the immunocompromised, in those over 60 years of age, diabetics or alcoholics (also in infants –not covered by this guideline).

If CSF is culture or PCR positive for a significant organism discuss appropriate choice of antimicrobial and duration with Microbiology or Virology as relevant. Duration of therapy is dependent on the causative organism, sensitivities of that particular organism in laboratory, and patient response.

If the patient has recently travelled outside the UK or has had prolonged or multiple exposure to antibiotics within the past three months, please discuss with the microbiologist as I.V. vancomycin may need to be added to the antibiotic regimen to cover penicillin resistant *Streptococcus pneumoniae*.

Antivirals are not usually indicated for immunocompetent patients with a viral meningitis. If there are features of an encephalitis then will need treatment and appropriate investigation.

3.4 Interpretation of CSF ³

	Bacteria	Viral	TB and Listeria
White blood cells	↑	↑	↑
Protein	↑ ↑	↑	↑ ↑ ↑
Glucose	<50% blood OR <2.2 mmol/L	>50% blood OR >2.2 mmol/L	<50% blood OR <2.2 mmol/L

- It is important to be able to distinguish between bloodstained CSF due to contamination from a subcutaneous blood vessel bloodstained CSF with high white blood cell counts and bloodstained CSF due to subarachnoid haemorrhage.
- Allow a ratio of 1 white blood cell (WBC) for every 600 red blood cells (RBC). However, please note this is an inexact way of interpreting a cell count and repeating the lumbar puncture should be considered.

	Bloodstained normal CSF	Bloodstained CSF with high WBCs	Subarachnoid haemorrhage
1 st CSF sample RBCs compared to 3 rd CSF sample RBCs	1 st > 3 rd	1 st > 3 rd	1 st = 3 rd
Ratio of WBCs to RBCs	1:600	> 1:600	1:600

- A predominance of polymorphs is suggestive of a bacterial cause, and lymphocytes suggest a viral cause. However, polymorph predominance may occur in early viral encephalitis, and lymphocyte predominance may occur very early in bacterial meningitis or if lumbar puncture is performed whilst on antibiotics or delayed.
- A raised protein level can be seen in bacterial meningitis, TB meningitis, tumours, intracranial injury, blood in the CSF, epidural abscesses and any CNS inflammation.

4. Infection Control

If bacterial meningitis is suspected:

- Isolate the patient for at least 24 hours after commencing antibiotic therapy.
- Use standard precautions.
- Use surgical face masks and eye protection for aerosol generating procedures or where there is a risk of secretions splashing into face and eyes (e.g., intubation, suction).
- Inform the Infection Control Team that you have a patient with a possible/confirmed diagnosis of meningitis.

5. Public Health Notification

- All suspected meningitis (or meningococcal septicaemia) should be notified to the Health Security Agency (HSA) 0344 225 3861.
- Prophylaxis is given to household and kissing contacts and healthcare workers who have been exposed to secretions such as during intubation in order to eliminate asymptomatic carriage of the bacterium (decision regarding who should receive prophylaxis and choice of antibiotic should be made with the HSA).

6. Ongoing Care and Investigations

- On-going close monitoring of observations (including respiratory rate, pulse, blood pressure, oxygen saturation, GCS, urine output) including MET score at least 1 hourly until stable.
- Send serology for HIV as if positive this widens the differential a great deal (consent if patient is able to provide this).
- Consider repeat CT head based on clinical picture; it is particularly indicated if clinical concern of sub-dural empyema or intracerebral abscesses – consider if still febrile after 72 hours or new neurology develops.
- If initial investigations do not determine infectious aetiology, consider less common aetiologies:
 - Syphilis may cause a meningitis or meningoencephalitis. Send serology to microbiology if considered (if blood positive serology, discuss with microbiology about testing CSF)
 - Lyme disease may cause a meningitis; ask about tick bites, erythema migrans type rash or having visited a tick infested area. Send serology to microbiology if considered.
 - Reassess travel history
 - Patients with malaria may have meningism or even cerebral malaria with impaired consciousness. Send blood film and malaria antigen to haematology if considered.
 - Various rickettsial diseases may be accompanied by nonspecific meningoencephalitis; in particular, consider Rocky Mountain spotted fever if recent travel to the U.S. Discuss with Microbiology during normal hours if considered.
 - If travel to area where Brucella is endemic (Mediterranean, Middle East, Central Asia, Africa particularly Nigeria) within preceding 3 months consider neurobrucellosis, particularly if exposure to unpasteurised milk or cheese. Label any specimen from such patients as **High Risk**.

References

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Full version control record

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Related Documents

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