Preparedness and response to bacterial meningitis outbreaks

Toolkit for frontline healthcare workers

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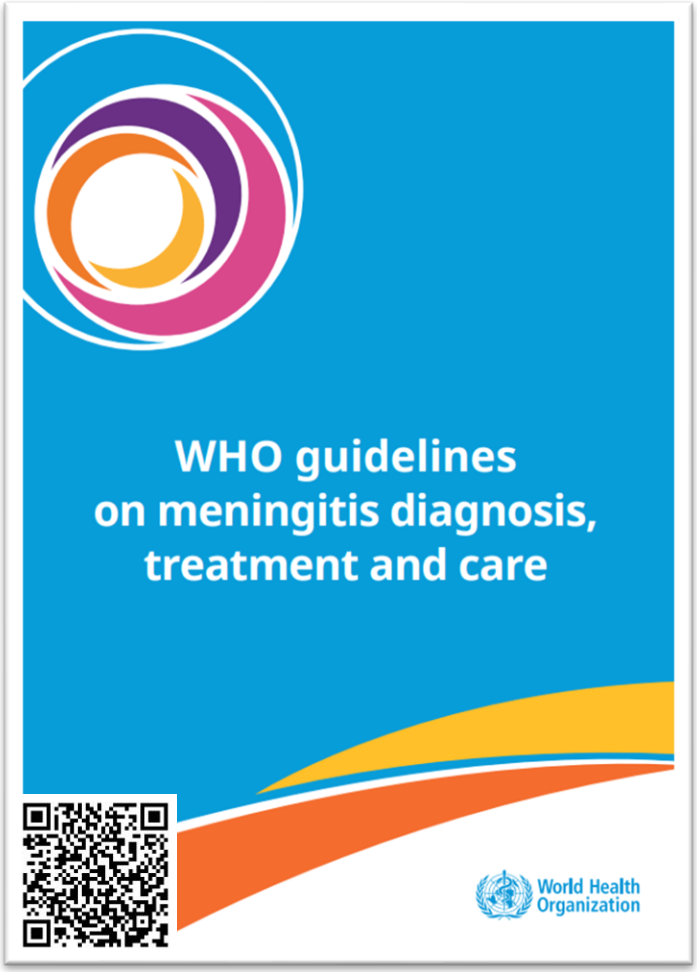
World Health Organization

DEFEATING MENINGITIS BY 2030
A GLOBAL ROAD MAP

WHO clinical guidelines (2025)



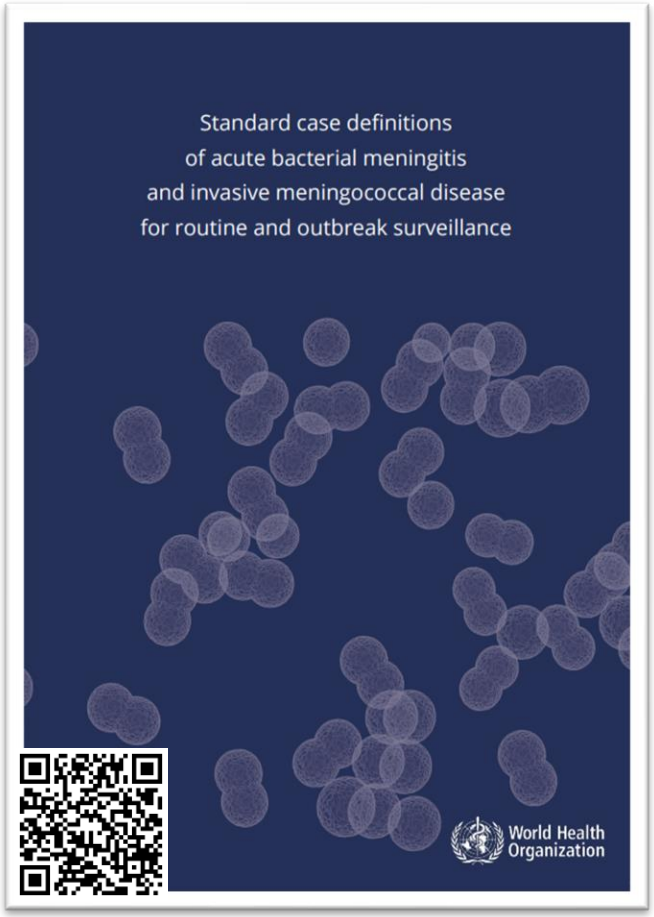
A WHO clinical guideline on meningitis

37 recommendations based on 21 systematic reviews

- Diagnosis (laboratory investigations and cranial imaging)
- Treatment (antibiotic therapy, adjunctive corticosteroids and supportive care)
- Management of sequelae

Globally applicable, including in resource-limited and emergency settings

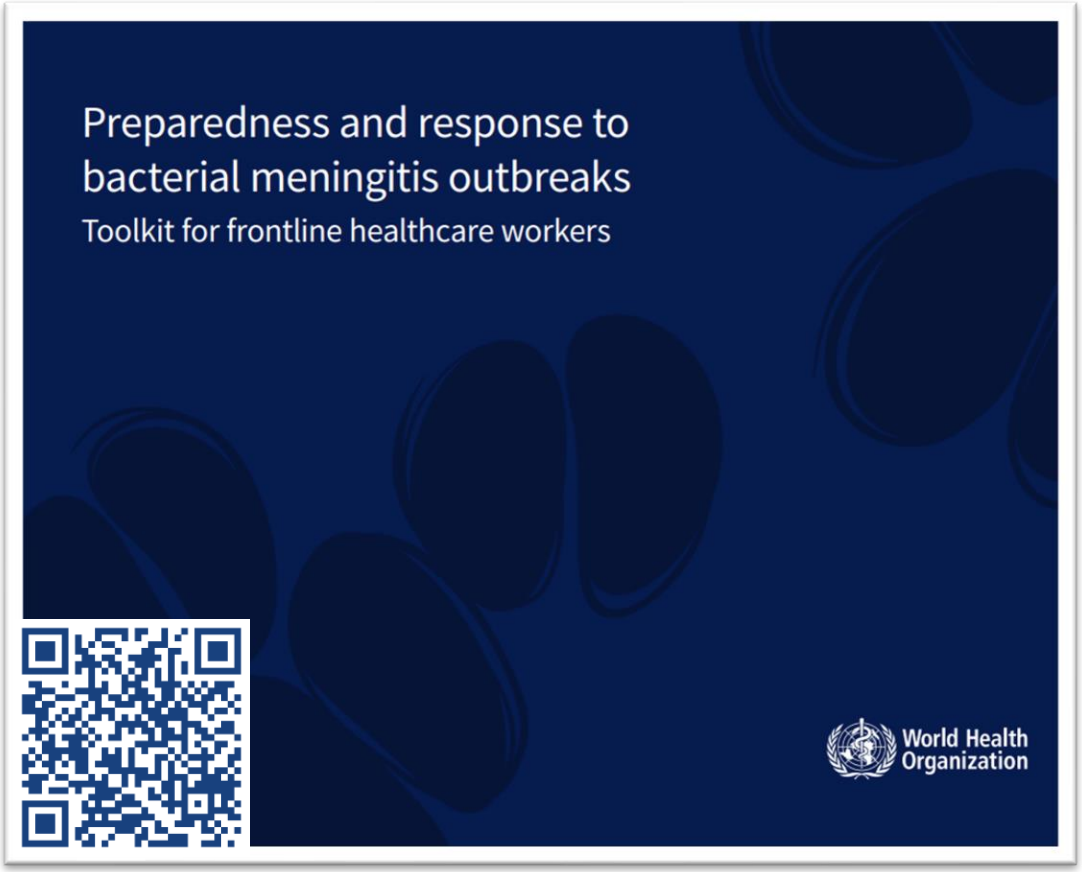
WHO standard case definitions (2025)



Case definitions of acute bacterial meningitis and meningococcal disease developed with a global perspective through an evidence-based approach.

Designed primarily for use by Ministries of Health, national public health institutions, national and international organizations engaged in routine surveillance, outbreak investigations and response, and humanitarian emergencies.

Toolkit for frontline healthcare workers (2026)



New practical guidance for implementation at the point of care

Suite of job aids for HCWs

- Causative pathogens
- Clinical manifestations
- Diagnostic investigations
- Antibiotic therapy
- Adjunctive treatment
- Supportive care
- Post-exposure antibiotic prophylaxis
- IPC in healthcare settings

Causative pathogens

Bacterial pathogen	Transmission mode	Epidemic potential
Neisseria meningitidis	Person-to-person via infectious respiratory particles	High
Streptococcus pneumoniae	Person-to-person via infectious respiratory particles	Moderate
Haemophilus influenzae	Person-to-person via infectious respiratory particles	Moderate
Listeria monocytogenes	Foodborne	Moderate
Streptococcus agalactiae	Intrapartum or postpartum Person-to-person through direct contact	Low
Non-typhoidal *Salmonella*	Fecal-oral (foodborne, waterborne, person-to-person)	Moderate

Causative pathogens

Bacterial pathogen	Age groups
Neisseria meningitidis	All ages – Leading cause in children and young adults
Streptococcus pneumoniae	All ages - Most common cause in adults
Haemophilus influenzae type b*	Children <5 years
Listeria monocytogenes	Neonates and older adults
Streptococcus agalactiae	Infants <3 months and older adults
Non-typhoidal *Salmonella*	Infants ≤12 months

* Non-typeable and non-b encapsulated strains of *H. influenzae* can cause meningitis across all age groups, particularly in young children and older adults.

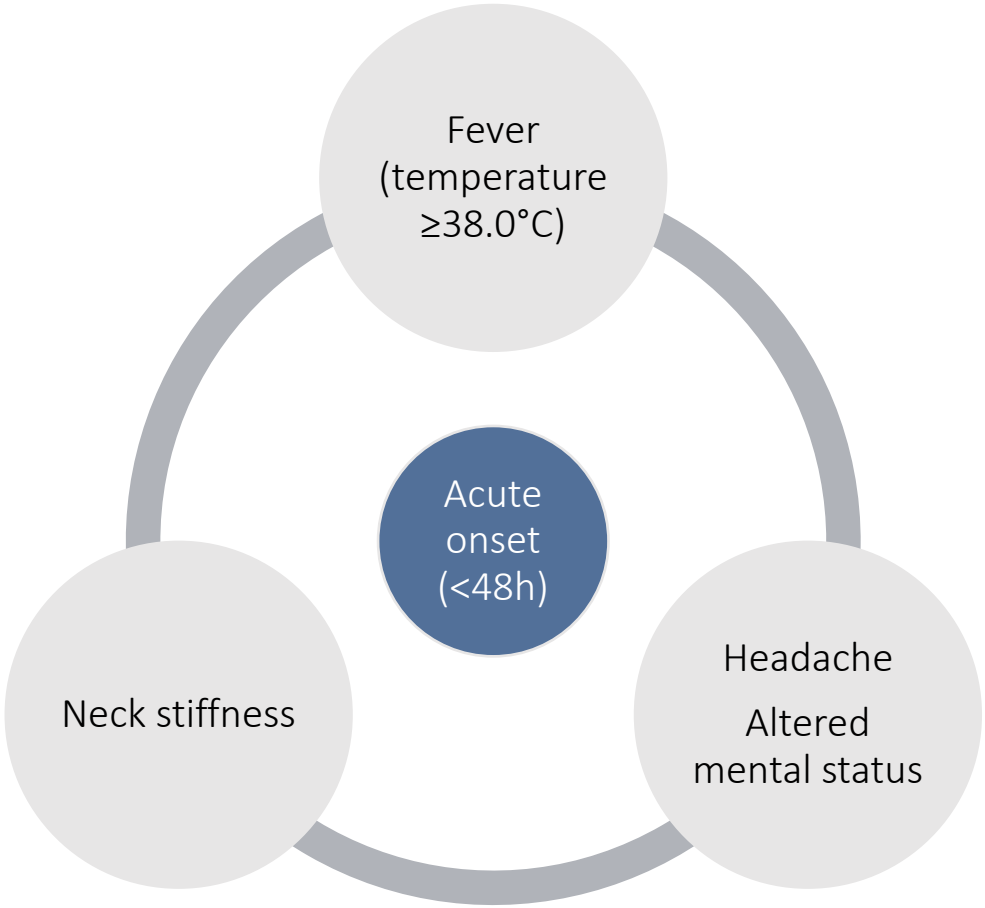
Clinical presentation

Acute bacterial meningitis is a life-threatening condition that presents abruptly and can be rapidly evolving.

Differential diagnosis with other CNS infections, including viral meningitis and encephalitis, may be challenging.

Clinical manifestations may be more difficult to identify in infants and young children.

Bacterial meningitis triad



Strongly suspect bacterial meningitis in the presence of all 3 manifestations.

Rule out (bacterial) meningitis in the absence of all 3 manifestations.

Signs of meningeal irritation

Signs of meningeal irritation include:

- Neck stiffness (nuchal rigidity)
- Meningeal signs (e.g. Brudzinski's sign, Kernig's sign)
- Photophobia (sensitivity to light)

Always investigate the presence of meningeal irritation if suspecting acute (bacterial) meningitis.

Suspect bacterial meningitis in any patient presenting with fever and ≥1 sign of meningeal irritation.

Do not rule out (bacterial) meningitis in the absence of signs of meningeal irritation.

Infants and young children

The clinical presentation is variable and less characteristic.

Neck stiffness and headache are harder to identify.

Common manifestations include:

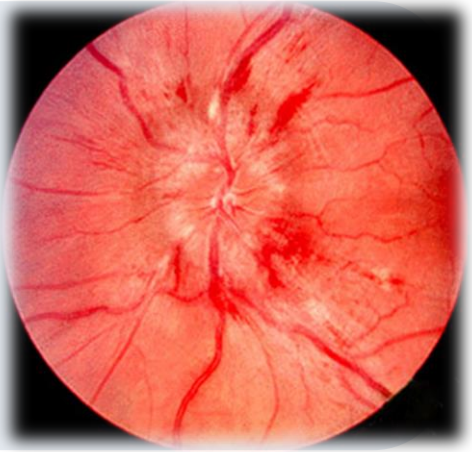
- Fever or hypothermia
- Bulging fontanelle
- Seizures
- Abnormal cry, irritability, lethargy
- Reduced feeding or vomiting
- Diarrhea
- Respiratory distress (e.g. apnea, tachypnoea, grunting).

Increased intracranial pressure

Some patients with bacterial meningitis may present with symptoms and signs of increased intracranial pressure.

Common manifestations include:

- Headache
- Vomiting
- Impaired consciousness
- Papilledema (optic disc swelling)
- Cushing's triad (hypertension, bradycardia and irregular breathing)



Sepsis and septic shock

Bacterial meningitis may occur at the same time as, or rapidly progress to, sepsis.

Common manifestations include:

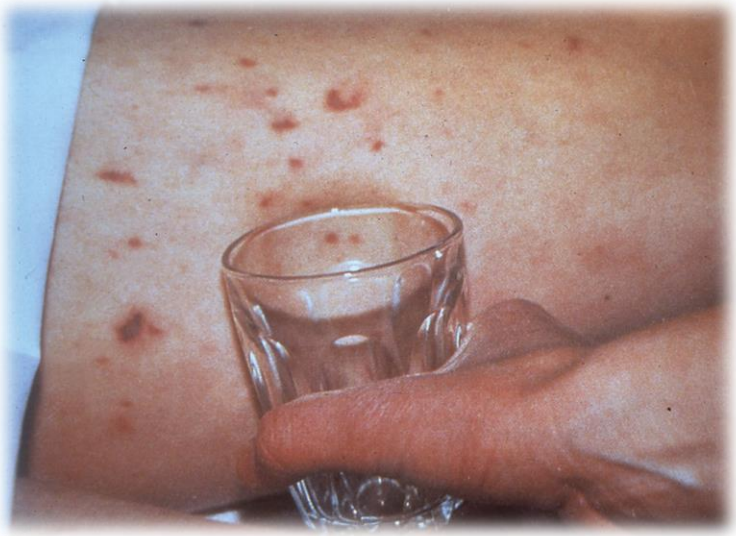
- Fever or hypothermia
- Tachycardia
- Tachypnea
- Hypotension
- Cold hands and feet
- Capillary refill time ≥3s

In severe cases, septic shock, multiorgan failure or disseminated intravascular coagulation can occur.

Hemorrhagic skin rash

Some clinical manifestations can provide insights into the most likely causative pathogen.

A non-blanching petechial or purpuric skin rash is suggestive of meningococcal infection (meningococcal sepsis, also known as meningococcemia).



Check for a hemorrhagic skin rash all over the body and look for petechiae in the conjunctivae in all patients with suspected bacterial meningitis.

Image credit: Meningitis Research Foundation

Management of acute bacterial meningitis

Management of acute bacterial meningitis

Individuals with suspected acute meningitis should be immediately admitted or urgently transferred to an appropriate health-care facility for further management.

An appropriate health-care facility is defined as a health-care facility where:

1. Lumbar puncture can be performed.
2. Adequate monitoring and management of severe illness can be ensured.

Management of acute bacterial meningitis

Scenario A

Patient admitted to an appropriate health-care facility with readily accessible cranial imaging (e.g. tertiary care hospital)

Scenario B

Patient admitted to an appropriate health-care facility without readily accessible cranial imaging

Scenario C

Patient admitted in a health-care facility where lumbar puncture cannot be performed and management of severe illness cannot be ensured (e.g. primary health care center)

Scenario A – Appropriate HCF with cranial imaging

Adult or child with suspected acute bacterial meningitis
in an appropriate health-care facility with readily accessible cranial imaging

Assess and stabilize (ABCDE)
Start managing acute illness and acute complications

Collect blood samples for cultures, HIV test and appropriate diagnostic investigations
Assess for lumbar puncture contraindications (absolute and relative)

Lumbar puncture contraindications

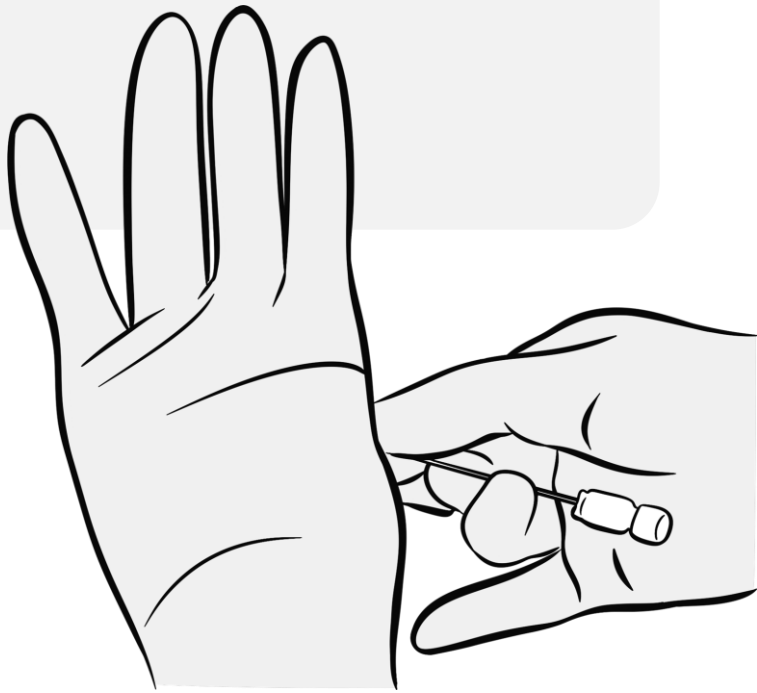
Absolute contraindications

Do not perform lumbar puncture.

Relative contraindications (reasons for deferral)

Do not perform lumbar puncture immediately.

Reassess lumbar puncture indication after cranial imaging or if reasons for deferral resolve (if no cranial imaging).



Lumbar puncture contraindications

Absolute contraindications

- Ongoing haemodynamic compromise (until stabilized)
- Ongoing respiratory failure (until stabilized)
- Severe bleeding disorder
- Skin or soft tissue infection overlying or close to puncture site
- Epidural abscess close to puncture site

Relative contraindications (reasons for deferral)

- Glasgow Coma Scale (GCS) < 10
- Focal neurological signs
- Cranial nerve deficits
- Papilledema
- New-onset seizures (in adults)
- Severe immunocompromised state

Scenario A – Appropriate HCF with cranial imaging

Adult or child with suspected acute bacterial meningitis
in an appropriate health-care facility with readily accessible cranial imaging

Assess and stabilize (ABCDE)
Start managing acute illness and acute complications

Collect blood samples for cultures, HIV test and appropriate diagnostic investigations
Assess for lumbar puncture contraindications (absolute and relative)

No absolute or relative contraindications

Perform lumbar puncture and test CSF samples

Start IV treatment as soon as possible and within 1 hour of admission

No absolute contraindications but any relative contraindication (reasons for deferral)

Start IV treatment as soon as possible and within 1 hour of admission

Perform cranial imaging

Are there radiological signs of increased risk of brain herniation?

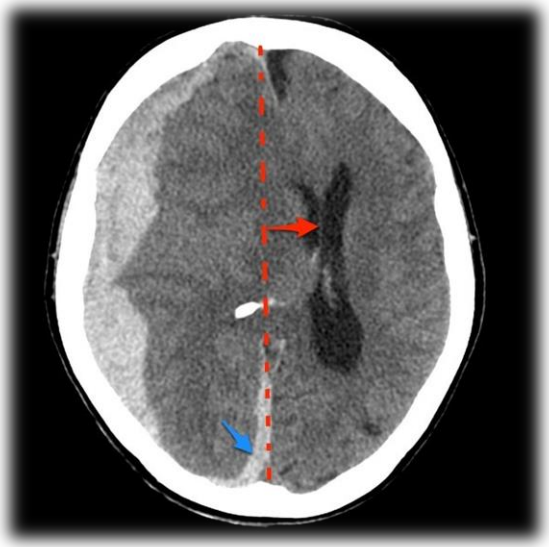
Any absolute contraindication

Start IV treatment as soon as possible and within 1 hour of admission

Cranial imaging

Radiological signs of increased risk of brain herniation following lumbar puncture

- Brain space-occupying lesions with midline shift
- Diffuse and/or severe cerebral oedema
- Obstructive hydrocephalus



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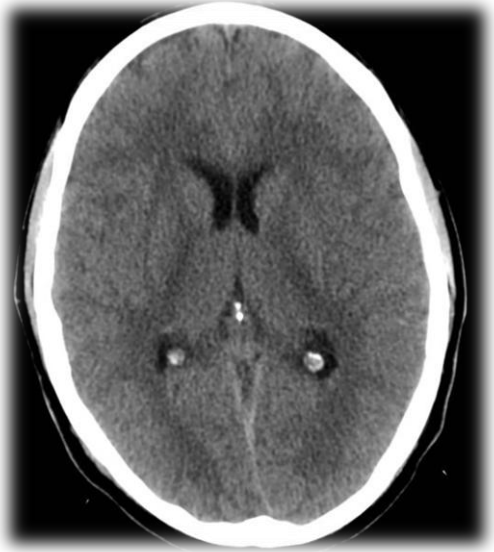

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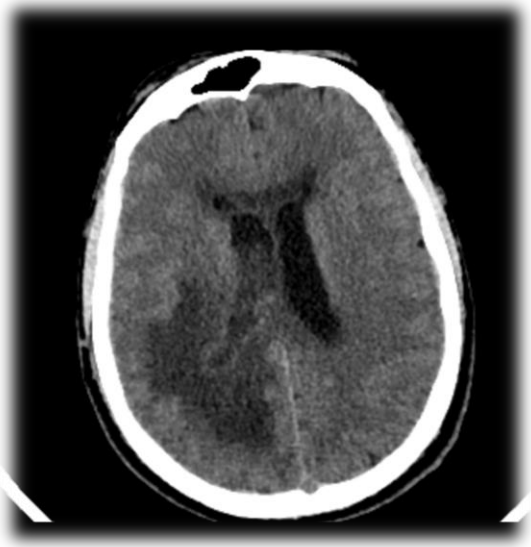

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Scenario A – Appropriate HCF with cranial imaging

Adult or child with suspected acute bacterial meningitis
in an appropriate health-care facility with readily accessible cranial imaging

Assess and stabilize (ABCDE)
Start managing acute illness and acute complications

Collect blood samples for cultures, HIV test and appropriate diagnostic investigations
Assess for lumbar puncture contraindications (absolute and relative)

No absolute or relative contraindications

Perform lumbar puncture and test CSF samples

Start IV treatment as soon as possible and within 1 hour of admission

No absolute contraindications but any relative contraindication (reasons for deferral)

Start IV treatment as soon as possible and within 1 hour of admission

Perform cranial imaging

Are there radiological signs of increased risk of brain herniation?

Yes

Do not perform lumbar puncture

No

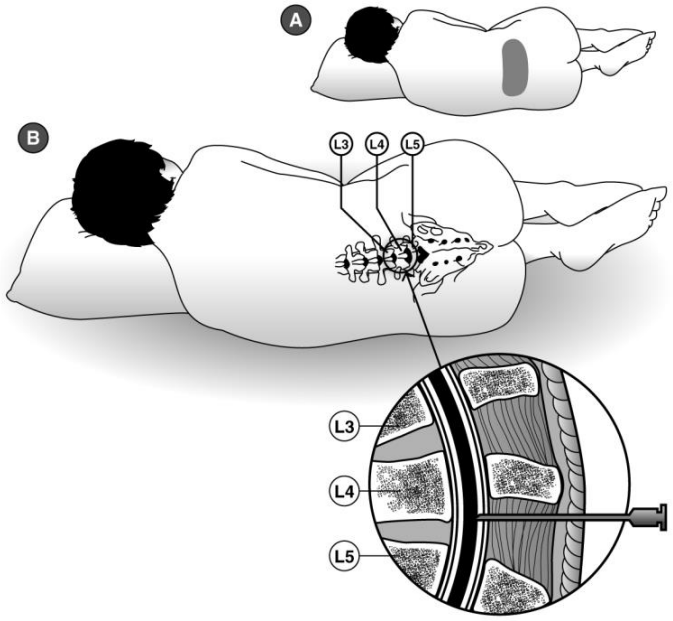
Perform lumbar puncture and test CSF samples

Any absolute contraindication

Start IV treatment as soon as possible and within 1 hour of admission

Lumbar puncture

Procedure: step by step
Explain the procedure to the person (or the caregiver) and obtain consent.
Position the person in the sitting position or lying on their side.
Label the collection tubes with relevant ID information and date and time of collection.
Wear a surgical mask, wash your hands and put on sterile gloves.
Ensure that the person is comfortable and unlikely to move during the procedure.
Clean the skin with povidone-iodine or chlorhexidine (0.5% in 70% alcohol).
Identify the right and left posterior superior iliac crests by palpation.
Locate the puncture site at the midline, between L4 and L5 or L3 and L4 intervertebral spaces.
Consider infiltrating the skin and subcutaneous tissue with local anesthetic (e.g. 1% lidocaine).
Insert the needle into the skin between the two vertebral spines with the bevel facing up.
Advance the needle incrementally while periodically removing the stylet to check for CSF flow.
If the person is lying on their side, consider attaching a manometer to the hub of the needle.
Remove a total of approximately 3 to 5 mL of CSF (if possible) into collection tubes.
Slowly withdraw the needle.
Cover the insertion site with adhesive dressing and instruct the person to lie flat for 30 minutes.
Discard the needle in a puncture-resistant, autoclavable container.



Cerebrospinal fluid testing

Core CSF investigations	Purpose of the test
Macroscopic appearance	To support the differential diagnosis
Opening pressure (where possible)	To support the differential diagnosis
White blood cell count	To support the differential diagnosis
Red blood cell count	To detect traumatic lumbar puncture or cerebral hemorrhage
Total protein concentration	To support the differential diagnosis
Glucose concentration	To support the differential diagnosis
Lactate levels	To support the differential diagnosis (prior to antibiotic therapy)
Gram stain	To diagnose bacterial meningitis and assess bacterial morphology
Culture and AST	To identify bacterial and fungal pathogens, confirm diagnosis, detect antimicrobial resistance and enable targeted treatment
Molecular tests (PCR)	To identify the causative pathogen and confirm diagnosis

Empiric antibiotic therapy

Acute bacterial meningitis is a medical emergency.

Treat for acute bacterial meningitis all suspected cases until the diagnosis has been excluded.

Give antibiotics intravenously.

Start IV empiric antibiotic therapy as soon as possible and within 1 hour of admission into an appropriate healthcare facility.

Any delay in diagnostic investigations should not delay therapy administration.

Empiric antibiotic therapy outside epidemics

Administer IV ceftriaxone or cefotaxime to all suspected cases.

Add IV vancomycin in areas with high prevalence of penicillin- or 3rd generation cephalosporin-resistant *S. pneumoniae.*

Add IV ampicillin in cases with ≥1 risk factor for *Listeria monocytogenes* infection:

- Age >60 years
- Pregnancy
- Advanced HIV disease
- Alcohol use disease
- Diabetes mellitus
- End-stage kidney disease
- Immunosuppressive therapy
- Liver cirrhosis
- Malignancy
- Organ transplantation

Empiric antibiotic therapy outside epidemics

Adult or child with suspected acute bacterial meningitis
admitted to an appropriate health-care facility outside epidemic settings

Start IV empiric antibiotic therapy as soon as possible and within 1 hour of admission
Do not delay treatment in case of any delay in diagnostic investigations

Start IV ceftriaxone or cefotaxime

High baseline prevalence of 3rd-generation cephalosporin resistant *S. pneumoniae*

Add IV vancomycin

≥1 risk factor for *Listeria monocytogenes* infection

Add IV ampicillin

Review and optimize antibiotic therapy as soon as the causative pathogen is isolated and antimicrobial susceptibility testing results are known

Empiric antibiotic therapy during epidemics

Adult or child with suspected or probable acute bacterial meningitis
during a confirmed meningococcal disease epidemic

Start IV ceftriaxone as soon as possible (2 g every 12 hours in adults; 50 mg/kg every 12 hours in children)
Do not delay treatment in case of any delay in diagnostic investigations

Is the causative pathogen isolated?

Yes

Review antibiotic therapy and select the narrowest spectrum antibiotic appropriate

No

Continue ceftriaxone for a total duration of 5 days

Specific antibiotic therapy

Antimicrobial stewardship

Review and optimize antibiotic therapy as soon as the causative pathogen is isolated and antimicrobial susceptibility testing results are known.

Specific antibiotic therapy

Pathogen	Specific antibiotic therapy (IV)	Overall duration
Streptococcus pneumoniae		10-14 days
Penicillin-susceptible	Penicillin G / Ampicillin / Amoxicillin	
Penicillin-resistant	Ceftriaxone / Cefotaxime	
Cephalosporin-resistant	Vancomycin + Ceftriaxone / Cefotaxime *or*	
	Vancomycin + Levofloxacin / Moxifloxacin *or*	
	Vancomycin + Rifampicin *or*	
	Rifampicin + Ceftriaxone / Cefotaxime	
Neisseria meningitidis		5-7 days
Penicillin-susceptible	Penicillin G / Ampicillin / Amoxicillin	
Penicillin-resistant	Ceftriaxone / Cefotaxime	
Haemophilus influenzae		7-10 days
Beta-lactamase-negative	Ampicillin / Amoxicillin	
Beta-lactamase-positive	Ceftriaxone / Cefotaxime	
Listeria monocytogenes	Penicillin G / Ampicillin / Amoxicillin	21 days
Streptococcus agalactiae	Penicillin G / Ampicillin / Amoxicillin	14-21 days
Viruses	Discontinue antibiotic therapy	-

IV antibiotic dosing

Antibiotic	IV dose in adults[a]	IV dose in children (>1 month)[a]	Maximum daily dose[a]	AWaRe
Amoxicillin	2 g every 4 hours *or* 3 g every 6 hours	50 mg/kg every 4 hours (max 2 g every 4 hours) *or* 75 mg/kg every 6 hours (max 3 g every 6 hours)	12 g/day	Access
Ampicillin	2 g every 4 hours *or* 3 g every 6 hours	50 mg/kg every 4 hours (max 2 g every 4 hours) *or* 75 mg/kg every 6 hours (max 3 g every 6 hours)	12 g/day	Access
Cefotaxime	2 g every 4 hours *or* 3 g every 6 hours	50 mg/kg every 4 hours (max 2 g every 4 hours) *or* 75 mg/kg every 6 hours (max 3 g every 6 hours)	12 g/day	Watch
Ceftriaxone	2 g every 12 hours[b]	50 mg/kg every 12 hours (max 2 g every 12 hours)[b]	4 g/day	Watch
Levofloxacin	750 mg every 24 hours	-	750 mg/day	Watch
Moxifloxacin	400 mg every 24 hours	-	400 mg/day	Watch
Penicillin G (Benzylpenicillin)	4 million IU or 2.4 g every 4-6 hours	50 000 IU/kg or 30 mg/kg every 4 hours (max 4 million IU or 2.4 g/dose) *or* 100 000 IU/Kg or 60 mg/kg every 6 hours (max 4 million IU or 2.4 g/dose)	24 million IU or 14.4 g/day	Access
Rifampicin	300 mg every 12 hours *or* 600 mg every 24 hours	10 mg/kg every 12 hours (max 300 mg every 12 hours)	-	Watch
Vancomycin[c]	15-20 mg/kg every 8-12 hours	15-20 mg/kg every 6-8 hours[d]	4 g/day	Watch

[a] The doses presented in the table apply to individuals with normal renal and hepatic function. In the presence of renal impairment, dosing adjustments are required for amoxicillin, ampicillin, cefotaxime, levofloxacin, penicillin G, rifampicin (end-stage kidney disease) and vancomycin.

[b] In selected circumstances where twice daily administration cannot be operationalized, once daily administration is possible: 4 g every 24 hours in adults; 100 mg/kg (max 4 g) every 24 hours in children.

[c] The risk of toxicity, including acute kidney injury, increases as a function of trough vancomycin concentration, especially when trough is consistently above 15 to 20 mg/L. Therefore, where feasible, trough vancomycin concentration should be regularly monitored and dose adjusted accordingly.

[d] When monitoring of trough vancomycin concentration is not feasible, a total of 3 g per day should not be exceeded in adults and 750 mg per dose should not be exceeded in children.

Adjunctive corticosteroids

Adult or child with suspected acute bacterial meningitis where IV empiric antibiotic therapy is initiated

Assess need for IV adjunctive corticosteroids based on epidemiological context

No ongoing epidemic of bacterial meningitis	Meningococcal disease epidemic	Pneumococcal disease epidemic
Start IV corticosteroids with first antibiotic dose	Do not routinely administer IV corticosteroids	Start IV corticosteroids with first antibiotic dose

Re-assess need for IV adjunctive corticosteroids based on initial CSF findings

Bacterial meningitis unlikely	Bacterial meningitis likely	Lumbar puncture not performed
Stop IV corticosteroids	Continue IV corticosteroids	Consider IV corticosteroids for up to 4 days

Re-assess need for IV adjunctive corticosteroids based on isolated pathogens (when feasible)

Streptococcus pneumoniae *Haemophilus influenzae* type b	Any other bacterial pathogen*
Continue IV corticosteroids for up to 4 days	Stop IV corticosteroids

* If *Mycobacterium tuberculosis* is isolated, corticosteroid doses should be adjusted and tapered over 6-8 weeks.

Adjunctive corticosteroids

When recommended, administer corticosteroids intravenously.

When recommended, administer corticosteroids with the first dose of antibiotics or as soon as possible after the first dose and no later than 12 hours.

When recommended, continue corticosteroids for a total of up to 4 days or until discontinuation is indicated.

Use dexamethasone (10 mg every 6 hours in adults; 0.15 mg/kg [max 10 mg] every 6 hours in children).

When dexamethasone cannot be administered, consider hydrocortisone or methylprednisolone at equivalent doses.

Do not give corticosteroids in patients with suspected or confirmed invasive fungal infection (e.g. cryptococcal meningitis) or cerebral malaria.

Scenario B – Appropriate HCF with no cranial imaging

Adult or child with suspected acute bacterial meningitis
in an appropriate health-care facility without readily accessible cranial imaging

Assess and stabilize (ABCDE)
Start managing acute illness and acute complications

Collect blood samples for cultures, HIV test and appropriate diagnostic investigations
Assess for lumbar puncture contraindications (absolute and relative)

No absolute or relative contraindications	No absolute contraindications but any relative contraindication (reasons for deferral)	Any absolute contraindication
Perform lumbar puncture and test CSF samples	Start IV treatment as soon as possible and within 1 hour of admission	Start IV treatment as soon as possible and within 1 hour of admission
Start IV treatment as soon as possible and within 1 hour of admission	Defer lumbar puncture and reassess need if relative contraindications resolve	

Scenario C – Pre-referral management

Adult or child with suspected acute bacterial meningitis in a health-care facility
where lumbar puncture cannot be performed and management of severe illness cannot be ensured

Assess and stabilize (ABCDE)
Start managing acute illness and ensure appropriate fluid management

Test for HIV
Organize prompt and safe referral or transfer to an appropriate health-care facility for further management

Is a clinically significant delay in transfer expected (door-to-door time >30 minutes)?

Yes

Administer IV or IM ceftriaxone STAT
(2 g in adults; 50 mg/kg in children)

Consider IV dexamethasone STAT in selected cases
(10 mg in adults; 0.15 mg/kg in children)

Refer the person to an appropriate
health-care facility as soon as possible

No

Refer the person to an appropriate
health-care facility as soon as possible

Pre-referral management

Antibiotic therapy

Do not administer pre-referral antibiotic therapy indiscriminately or when transfer can be swiftly ensured without a clinically significant delay (<30 minutes from door to door).

Administer pre-referral antibiotic therapy when acute bacterial meningitis is strongly suspected and a clinically significant delay in transfer is expected (>30 minutes from door to door).

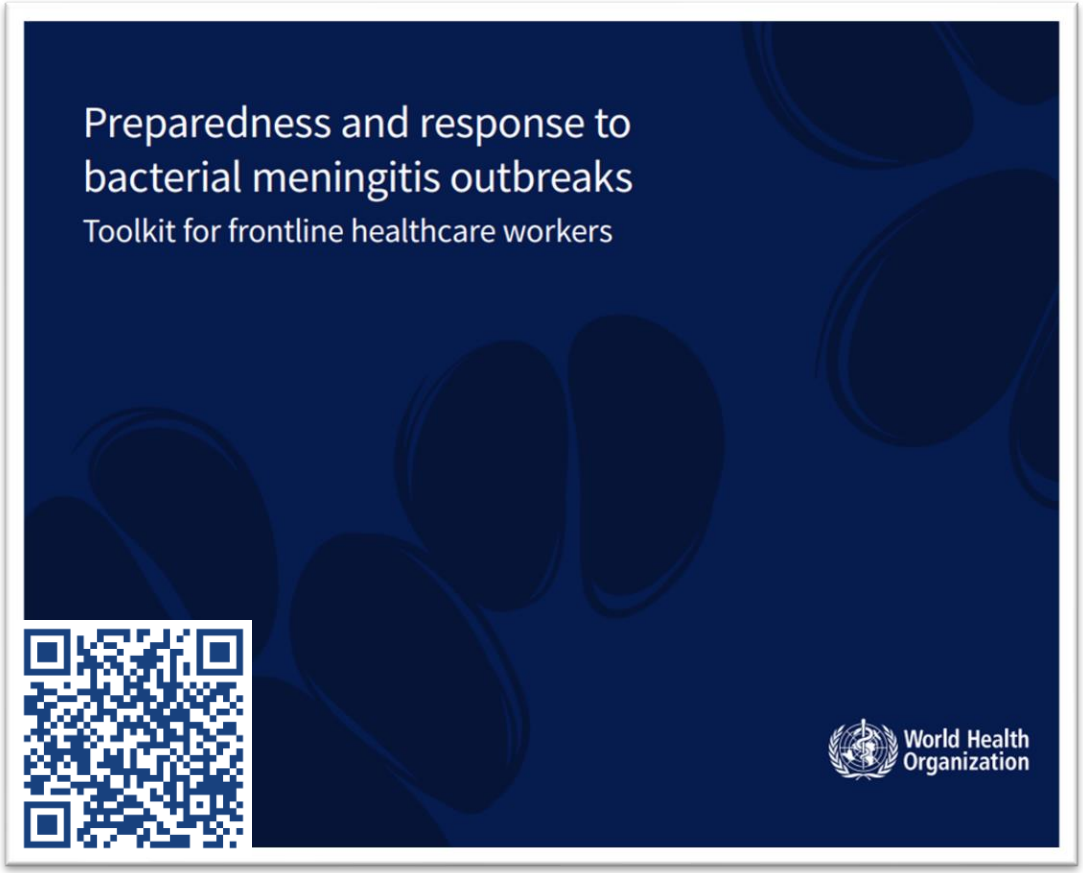
- Administer IV/IM ceftriaxone.
- Consider adding IV vancomycin in the presence of a high baseline prevalence of *S. pneumoniae* resistant to penicillins or 3rd gen. cephalosporins, if no meningococcal disease outbreak is ongoing.
- Consider adding IV/IM ampicillin in patients presenting with ≥1 risk factor for *Listeria monocytogenes* infection (i.e. age >60 years, pregnancy or immunocompromised state) if no meningococcal or pneumococcal disease outbreak is ongoing.

Pre-referral management

Adjunctive corticosteroids

Consider pre-referral adjunctive corticosteroids (dexamethasone) when all of the following conditions apply:

- Pre-referral antibiotic therapy is administered.
- Cerebral malaria is excluded.
- Cryptococcal meningitis is not a likely diagnosis (e.g. the patient is not known or suspected to have advanced HIV disease).
- There is no ongoing meningococcal disease outbreak.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