CONDITION

Bacterial meningitis

Learn about bacterial meningitis symptoms, causes, emergency diagnosis and treatment, possible complications, prevention, and follow-up care.

WHAT IT IS
Serious bacterial infection of the meninges

BODY SYSTEM
Nervous system

MAIN SYMPTOMS
Fever, severe headache, stiff neck, confusion

WHAT CAUSES IT
Bacterial infection

HOW IT IS DIAGNOSED
Lumbar puncture with spinal fluid culture or PCR

MAIN TREATMENT
Hospital treatment with intravenous antibiotics

CAN IT BE CURED?
Sometimes - many recover after prompt treatment

IS IT AN EMERGENCY?
Yes - if meningitis symptoms are possible

LONG-TERM OUTLOOK
Many recover, but lasting effects can occur

Overview

Bacterial meningitis is a serious infection of the meninges, the thin layers of tissue surrounding the brain and spinal cord. Several types of bacteria can cause it. The infection may also enter the bloodstream and cause sepsis, a dangerous whole-body response to infection.

Bacterial meningitis can worsen quickly. Early symptoms may look like flu or another common illness, but a person can become severely unwell within hours. Prompt hospital assessment and antibiotic treatment can reduce the risk of death and long-term complications.

Anyone with symptoms that could indicate bacterial meningitis needs emergency medical care. Do not wait for every typical symptom to appear. A rash is not always present, and its absence does not rule out meningitis.

Vaccines help prevent several major causes, including meningococcal, pneumococcal, and Haemophilus influenzae type b disease. However, vaccination does not prevent every case.

Symptoms

Symptoms vary with age and may develop in any order. Adults and older children may have:

The well-known combination of fever, neck stiffness, and altered mental state does not occur in everyone. A person may also be unable to describe their symptoms clearly.

Babies may not develop obvious neck stiffness. Possible signs include:

A non-fading rash can occur with meningococcal infection, especially when the bacteria have entered the bloodstream. On darker skin, the rash may be easier to see inside the eyelids or mouth, or on the palms and soles. Do not wait for a rash before seeking help.

Call emergency services if someone has possible meningitis symptoms, particularly confusion, marked drowsiness, a seizure, breathing difficulty, a non-fading rash, or rapid worsening. A baby who is difficult to wake, feeding poorly, unusually floppy or stiff, or having a seizure also needs emergency care.

- Fever
- Severe headache
- A stiff or painful neck
- Nausea or vomiting
- Sensitivity to bright light
- Confusion, unusual sleepiness, or difficulty waking
- Seizures
- Rapid breathing
- Cold hands or feet, pale or blotchy skin, or severe muscle pain
- A red or purple rash that does not fade when pressed
- Fever or an unusually low temperature
- Poor feeding
- Vomiting
- Irritability, especially when handled
- Weakness, reduced movement, or unusual sleepiness

- A high-pitched or unusual cry
- Seizures
- A bulging soft spot on the head
- A stiff or floppy body
- Breathing difficulty or pale, blotchy skin

Causes and risk factors

Bacterial meningitis usually begins when bacteria enter the bloodstream and travel to the tissues around the brain and spinal cord. Less often, bacteria spread directly from a nearby infection, a skull injury, surgery, or a leak of the fluid surrounding the brain and spinal cord.

Important bacterial causes include:

The most likely cause depends on age, vaccination history, health conditions, and how the infection was acquired.

Meningococcal bacteria can spread through close or prolonged contact with respiratory and throat secretions. Transmission may occur among household members or through direct exposure to saliva. Brief, casual contact usually does not carry the same risk.

Pneumococcal bacteria commonly live in the nose and throat. They can cause meningitis after spreading from the respiratory tract or from infections such as pneumonia, sinusitis, or a middle-ear infection. Hib also spreads through respiratory droplets, although routine childhood vaccination has greatly reduced serious Hib disease in many countries.

Factors that can increase risk include:

Risk factors do not mean that a person has or will develop meningitis. Some people who develop the infection have no obvious risk factor.

- Streptococcus pneumoniae , also called pneumococcus
- Neisseria meningitidis , also called meningococcus
- Group B Streptococcus , particularly in newborns
- Escherichia coli and other gram-negative bacteria, particularly in newborns
- Haemophilus influenzae type b, or Hib
- Listeria monocytogenes , especially in older adults and people with weakened immune systems

- Being a newborn, an adolescent or young adult, or an older adult
- Missing recommended meningitis-related vaccines
- Living in close quarters, such as a college residence or military setting
- Having no spleen or a spleen that does not work normally
- Having a weakened immune system
- Taking a medicine that blocks part of the immune system called the complement pathway
- Having a cochlear implant or a leak of cerebrospinal fluid
- Recent brain or spinal surgery, a penetrating head injury, or certain skull fractures
- Travel to, or residence in, an area with a meningococcal outbreak

Diagnosis

Doctors assess suspected bacterial meningitis as an emergency. The first steps include checking breathing, circulation, alertness, temperature, and signs of sepsis. Treatment may begin while testing is still underway.

Blood cultures are usually collected to look for bacteria in the bloodstream. Other blood tests can assess inflammation, organ function, blood clotting, and the effects of severe infection. Blood test results alone cannot reliably confirm or exclude meningitis.

A lumbar puncture, sometimes called a spinal tap, is a central part of diagnosis. A clinician places a needle into the lower back to collect cerebrospinal fluid, the clear fluid around the brain and spinal cord. The sample may be tested for:

A lumbar puncture is not performed immediately if there are signs that it may be unsafe, such as certain problems with pressure inside the skull, severe instability, or a serious bleeding risk. Brain imaging may be needed first in selected cases. A CT scan is not routinely required before every lumbar puncture.

If testing or imaging would delay treatment, clinicians generally start antibiotics like amoxicillin or doxycycline first. Antibiotics can make later cultures less likely to grow bacteria, but treatment should not be postponed to preserve a test result. Doctors interpret all findings together, including symptoms, examination results, blood tests, spinal fluid findings, and any antibiotics already received.

- White blood cells, which increase with inflammation
- Glucose and protein levels

- Bacteria seen under a microscope
- Bacterial growth in a laboratory culture
- Bacterial genetic material using a PCR test

Treatment and management

Bacterial meningitis is treated in a hospital with antibiotics given into a vein. Because the exact bacterium is often unknown at first, doctors begin antibiotics that cover the likely causes for the person's age and medical circumstances. Treatment is adjusted when laboratory results identify the bacterium and show which antibiotics are effective.

The choice and length of antibiotic treatment depend on the organism, the response to treatment, and whether complications are present. This requires individualized hospital care rather than treatment with leftover or oral antibiotics at home.

A corticosteroid medicine, often dexamethasone, may be given shortly before or with the first antibiotic dose in appropriate cases. It reduces inflammation caused by the immune response and may lower the risk of certain complications, particularly hearing loss in some forms of meningitis. Whether it is continued depends on the suspected or confirmed cause and the treating team's assessment.

Supportive care may include:

People with suspected meningococcal disease are usually placed under respiratory droplet precautions at first to reduce spread.

Public health teams may identify close contacts who need preventive antibiotics after meningococcal disease. Certain contacts of a person with Hib disease may also need them. Preventive treatment is time-sensitive, but it is not usually recommended for everyone who briefly shared a room or building with the person. Health professionals determine who qualifies based on the type and closeness of contact.

Vaccination is an important part of prevention. Depending on age, health conditions, travel plans, and local schedules, vaccines may protect against meningococcal, pneumococcal, and Hib disease. People taking complement-blocking medicines or living without a functioning spleen may need specific vaccine planning with their clinical team.

- Intravenous fluids and careful monitoring of salt and fluid balance
- Oxygen or breathing support
- Medicines for seizures, fever, pain, or nausea

- Treatment for low blood pressure or sepsis
- Monitoring and treatment of increased pressure around the brain
- Intensive care when breathing, circulation, or consciousness is severely affected

Complications

Many people recover, especially when treatment begins promptly, but bacterial meningitis can cause lasting effects. Inflammation, reduced blood flow, seizures, or infection in the bloodstream may injure the brain, nerves, or other organs.

Possible complications include:

Children may have developmental or learning effects that become noticeable only as tasks become more complex. Adults may experience fatigue, headaches, sleep problems, emotional changes, or difficulty returning to work even when no major neurological injury is found.

The risk and type of complications vary. Follow-up assessment helps identify problems that may benefit from treatment, rehabilitation, educational support, or hearing devices.

- Partial or complete hearing loss
- Seizures or epilepsy
- Difficulties with memory, attention, learning, or behavior
- Problems with balance, coordination, speech, or movement
- Vision problems
- Weakness or paralysis
- Fluid buildup around the brain, called hydrocephalus
- Stroke or injury to brain tissue
- Kidney, lung, or heart problems related to severe infection
- Skin scarring or limb damage after severe meningococcal bloodstream infection

Follow up

Before hospital discharge, the care team should explain the suspected or confirmed cause, treatment received, and warning signs that require further care. Follow-up needs depend on age, illness severity, and any ongoing symptoms.

Hearing should be assessed after bacterial meningitis because hearing loss may not be

obvious at first. Babies and children may also need developmental review. Some people need follow-up with neurology, audiology, infectious disease, rehabilitation, psychology, or other specialists.

Routine follow-up is appropriate for ongoing fatigue, headaches, sleep changes, hearing concerns, mood changes, memory problems, or difficulty at school or work. Rehabilitation may include physical therapy, occupational therapy, speech therapy, or cognitive support.

Seek urgent medical advice for new or worsening headaches, repeated vomiting, increasing sleepiness, behavior changes, new weakness, balance problems, or possible seizures. Call emergency services for a seizure that does not stop promptly, severe breathing difficulty, collapse, inability to wake, or rapidly worsening confusion.

People recovering from meningitis should ask when they can return to school, work, driving, exercise, and other activities. The answer depends on recovery, seizure history, complications, and local driving or workplace rules.

Sources

- National Institute for Health and Care Excellence. Meningitis (bacterial) and meningococcal disease: recognition, diagnosis and management . NICE Guideline NG240. Published March 2024.
- Centers for Disease Control and Prevention. About Bacterial Meningitis . National Center for Immunization and Respiratory Diseases. Updated July 2024.
- Centers for Disease Control and Prevention. Clinical Overview of Meningococcal Disease . National Center for Immunization and Respiratory Diseases. Updated February 2024.
- World Health Organization. Meningitis . Fact sheet. Updated March 2023.
- van de Beek D, Brouwer MC, Koedel U, Wall EC. Community-acquired bacterial meningitis. The Lancet . 2021;398(10306):1171-1183. doi:10.1016/S0140-6736(21)00883-7.
- Tunkel AR, Hartman BJ, Kaplan SL, et al. Practice guidelines for the management of bacterial meningitis. Clinical Infectious Diseases . 2004;39(9):1267-1284. doi:10.1086/425368.