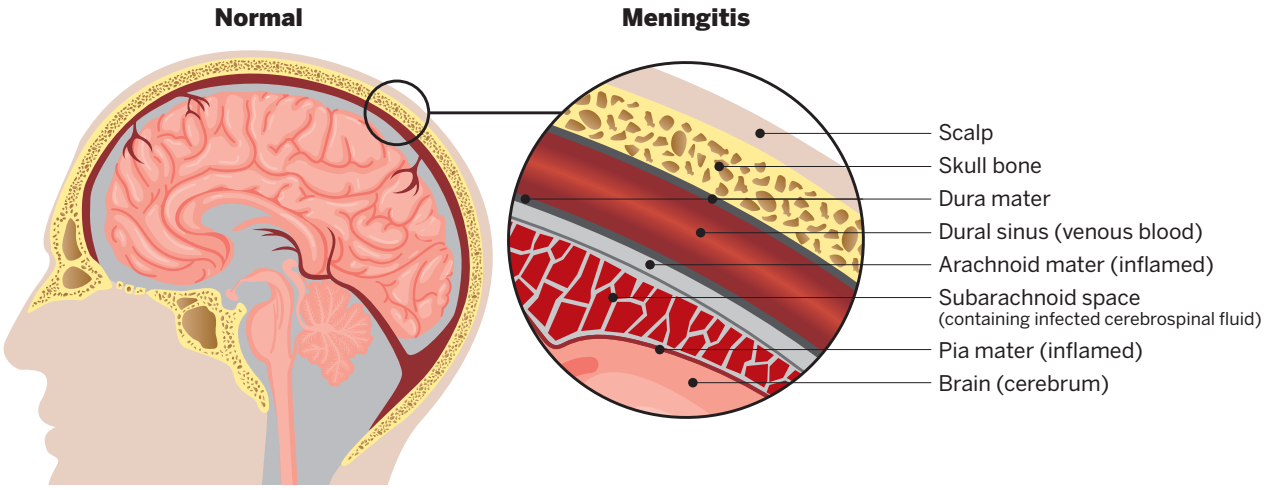
# MENINGITIS

## KEY FACTS ABOUT MENINGITIS [1,2,3,4]

- Meningitis is a **severe infection of the central nervous system**. It occurs when bacteria, viruses, or fungi infect the meninges, or tissue membranes that cover the brain and spinal cord. This causes inflammation of the membranes and accumulation of purulence within the cerebrospinal fluid (see illustration below).
- Meningitis most commonly affects **young children, the elderly, and immunocompromised people**.
- **Viral meningitis** is the most common form and is usually a self-limited illness, although some viruses do respond to specific antiviral treatment.
- **Bacterial or fungal meningitis is a medical emergency** which, if not treated rapidly, can lead to irreversible brain damage and death.
- **Meningococcal meningitis**, a rapidly progressing form of community-acquired meningitis caused by *Neisseria meningitidis*, also has an elevated risk in adolescents and young adults in group settings, such as college dormitories, military barracks, or refugee camps and also in certain geographic regions such as sub-Saharan Africa.




## THE BURDEN OF MENINGITIS [5,6,7,8,9,10]

- Meningitis represents a **heavy health burden** for both patients and society.
- It is especially prevalent in an area of sub-Saharan Africa known as the "**meningitis belt**" that stretches across 26 countries from Senegal to Ethiopia.

### GLOBAL BURDEN

- 2.5 million cases per year
  - 0.7-0.9 per 100,000 in US/Europe
- 250,000 deaths per year
- ~50% of cases and deaths in children <5 years old
- 1 in 5 survivors have permanent disability such as cognitive impairment, hearing loss, motor weakness or paralysis, incoordination, and epilepsy

### BURDEN IN AFRICA

- 30,000 cases per year
  - 10 – 40 per 100,000
  - Epidemics of meningococcal meningitis up to 250,000 cases per year
- 2,000 deaths per year (up to 25,000 during epidemics)
- Many cases go undiagnosed

## CAUSES AND CLINICAL PRESENTATION OF MENINGITIS [1,2,3,10]

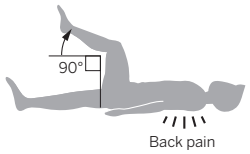
- Meningitis may be due to many different viruses, bacteria, mycobacteria, fungi and, less commonly, parasites.
- The most likely pathogen depends on several factors including a patient's age, immune and vaccination status, and geographic location.
- However, four bacteria are responsible for more than half of the deaths from meningitis globally.
- They are:
  - *Neisseria meningitidis* (meningococcus)
  - *Streptococcus pneumoniae* (pneumococcus)
  - *Haemophilus influenzae* type B (Hib)
  - *Streptococcus agalactiae* (group B streptococcus).

## MOST COMMON SIGNS AND SYMPTOMS

| NEWBORNS AND INFANTS | PATIENTS OLDER THAN 2 YEARS |
|---|---|
| • High fever | • Sudden high fever |
| • Constant crying | • Severe headache |
| • Excessive irritability | • Stiff neck |
| • Lethargy | • Nausea and/or vomiting |
| • A bulging fontanel | • Confusion or difficulty concentrating |
| • Hyper/hypotonia | • Decreased level of consciousness |
| • Poor appetite (refusing food or drink) | • Seizures |
| • Mottled skin | • Photophobia |
| | • Petechial rash for older patients |

**A physical exam may produce a positive Kernig's and/or Brudzinski's signs**

KERNIG'S SIGN




BRUDZINSKI's SIGN

## DIAGNOSTIC APPROACH [11,12,13,14]

- Many guidelines for the diagnosis and management of meningitis are available. They may have some differences based on regional specifics.
- **Blood tests** provide information about the infection and the patient. A **blood culture** may be positive in up to 50% of meningitis cases.
- **A head CT**, when available, is recommended to rule out increased intracranial pressure for some patients. A CT or MRI may also be used to assess the damage to the brain or spinal cord.
- Whenever safely possible, **cerebrospinal fluid (CSF)** should be obtained via a **lumbar puncture** for microscopic and biochemical analysis as well as **pathogen identification** and **potential antimicrobial sensitivity testing**.
- **Molecular diagnostics such as multiplex PCR are emerging as new and powerful diagnostic tools.** The molecular syndromic testing approach enables **rapid accurate identification of multiple target pathogens**. This may be possible even when the patient has been pre-treated with antibiotics.

**PATIENT ASSESSMENT & MANAGEMENT**

BLOOD CULTURES
↓
HEAD CT (when indicated)
↓
LUMBAR PUNCTURE*
↓
EMPIRIC THERAPY
↓
PATHOGEN ID/AST**
↓
TARGETED TREATMENT

* Empiric therapy should be started prior to a head CT and lumbar puncture if there are delays in performing these investigations.
** ID/AST: identification and antimicrobial susceptibility testing.

## TREATMENT STRATEGIES [11,12,13,14]

- **Parenteral antibiotics** should be given within one hour when bacterial meningitis is suspected.
- **Appropriate antimicrobial therapy** should not be postponed for diagnostic delays, such as when a head CT is needed but cannot be obtained quickly.
- **Antimycobacterial regimens** for tuberculosis, **antifungal medication** for cryptococcus or **antivirals** such as acyclovir for herpes simplex virus and varicella zoster virus infection are given when there is an increased suspicion for these pathogens.
- **Ancillary treatments** such as steroids and strict fluid management to reduce inflammation and cerebral edema are sometimes used, but their usefulness is limited.

## PREVENTION [14,15,16]

- **Vaccines** have led to substantial declines in many of the most common causes of bacterial meningitis including *Streptococcus pneumoniae*, *Haemophilus influenzae* type b, and *Neisseria meningitidis*.
- Historically, these vaccines have only been largely available in more developed countries and regions.
- However, recently a mass immunization program using a **conjugate vaccine against group A meningococcus**, which has caused >80% of epidemics in the African meningitis belt, is having a significant and dramatic impact in breaking the cycle of these epidemics.
- Where feasible, **close contacts of cases of meningococcus meningitis** may be given **chemoprophylaxis** with an appropriate antibiotic in order to prevent epidemic spread.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