

Meningitis



RAYMOND OFORI



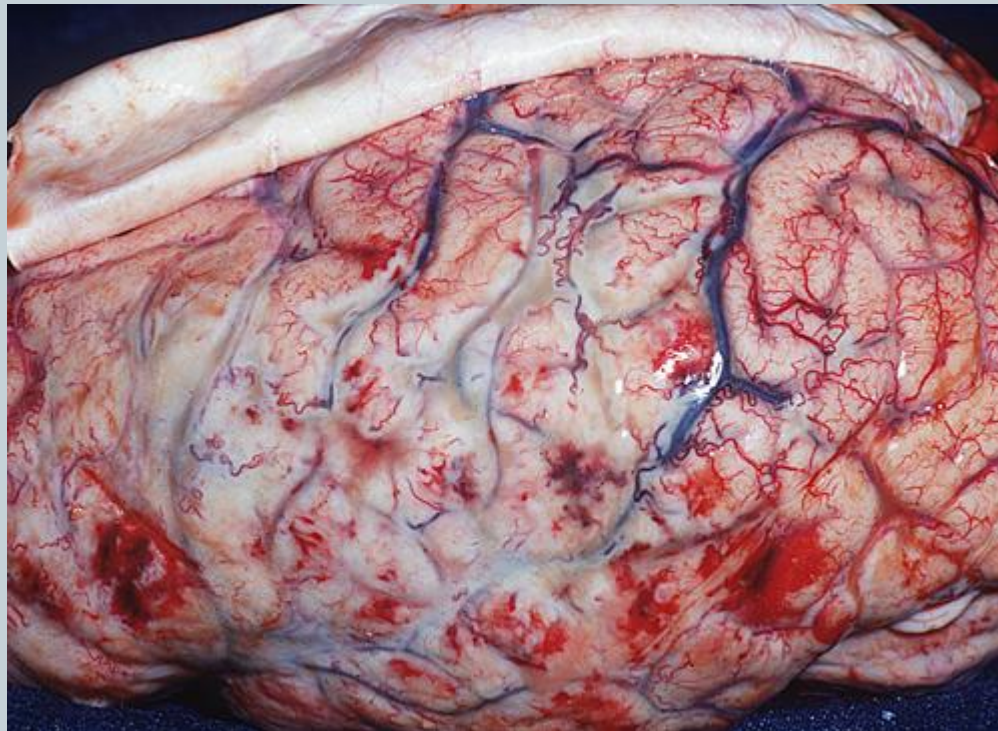
Definition



- Meningitis is an infection of the pia-arachanoid and the CSF fluid that surrounds the brain.
- Meningitis is usually caused by an infection with a virus, bacteria or fungi

Areas with frequent epidemics of meningococcal meningitis





Why do we think Weather is a Risk Factor for Meningitis?



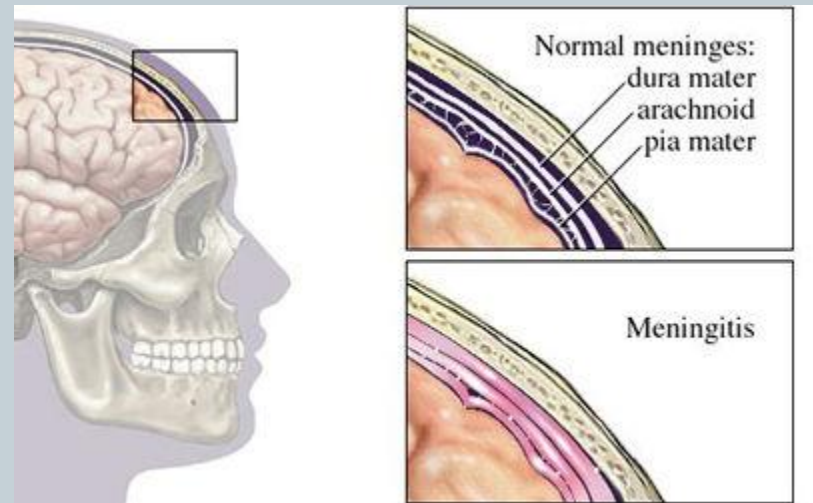
- Meningitis in Africa is largely, though not entirely, confined to regions with a defined dry season
 - Meningitis epidemics always occur in the dry season
- Meningitis is culturally associated with dust, which is seasonal (in fact, in many languages the name for meningitis is “sand disease”)
- Meningitis epidemics end abruptly with the start of the rainy season



- A characteristic feature of the first epidemics of meningococcal disease seen in West Africa was the way in which they almost always started around the middle of the dry season, rapidly built up to a peak at the end of the dry season and then subsided abruptly with the coming of the rains, only to start again in neighbouring areas in the dry season of the following year.
- This pattern has persisted with almost no exceptions but there is still no explanation for this remarkable seasonality. Outbreaks are seen at the time of the year when absolute humidity is low and when a hot, dusty wind (the harmattan) blows from the Sahara.

The brain and spinal cord are covered by 3 connective tissue layers collectively called the meninges which form the blood-brain barrier.

- the pia mater (closest to the CNS)
 - the arachnoid mater
 - the dura mater (farthest from the CNS).
- The meninges contain cerebrospinal fluid (CSF).
 - Meningitis is an inflammation of the meninges, which, if severe, may become encephalitis, an inflammation of the brain



Causes of meningitis



- contagious, spread via tiny drops of fluid from the throat and nose of someone who is infected.
- The drops may become airborne when the person coughs, laughs, talks, or sneezes.
- They then can infect others when people breathe them in or touch the drops and then touch their own noses or mouths

Epidemiology



- There are 1.2 million cases annually worldwide, approximately 135,000 deaths.
- Bacterial meningitis is 1 of the top 10 infectious causes of death worldwide, according to the CDC.
- Half of survivors suffer neurological damage, and/or other permanent side effects.

Causes of meningitis



- spread between people who are in close contact, such as those who live together or people who are exposed by kissing
- *N. meningitidis* cause epidemics of meningitis. In particular in a crowded day-care situation or a military recruit in a crowded training camp, schools, colleges has fallen ill with meningococcal meningitis

Causes of meningitis



- Most of the viruses that cause meningitis live in the intestines and tend to be passed on as a result of poor hygiene.
- Many different viruses can cause viral meningitis, most commonly enteroviruses that normally live harmlessly in people's bowels
- Caused through a person's stool, and someone who comes in contact with the stool — such as a child in day care .

Causes of meningitis



- Hematogenous
- Many of the bacteria and viruses that cause meningitis are fairly common and are typically associated with other routine illnesses
- infection of the skin, urinary system, gastrointestinal or respiratory tract can spread by the bloodstream

Causes of meningitis



- Direct infection
- skull fractures possess abnormal openings to the sinuses, nasal passages, and middle ears
- Organisms can pass through openings and cause infection.
- surgical procedures or who have had foreign bodies surgically placed within their skulls (such as tubes to drain abnormal amounts of accumulated CSF) have an increased risk of meningitis



- otitis media
- mastoiditis
- Osteomyelitic foci in the skull sinusitis
- Penetrating cranial injuries
- Brain or spine surgery
- Ventriculoperitoneal shun lumbar puncture.

Causes of meningitis



- Neurotropic - via an uncommon but interesting method called intraneural spread.
- This involves an organism invading the body at a considerable distance away from the head
- spreading along a nerve, and using that nerve as a kind of ladder into the skull, where the organism can multiply and cause meningitis.
- Herpes simplex virus is known to use this type of spread, as is the rabies virus. Rabies HSV

Causes of meningitis



- Immune-compromised
- Patients are also prone for fungal infections
- Fungal infections that can result in meningitis are
 - Aspergillus
 - Candida
 - Mucor
- Protozoal,
 - Ameba infections,
 - Toxoplasma

Commonest Meningitis-Causing Bacteria according to Patient Age



Age	Common bacteria causing meningitis
Birth to one month of age	<i>S. agalactiae</i> , subtypes III <i>E. coli</i> , (carrying K1 antigen). <i>Listeria monocytogenes</i> , (serotype IVb)
One to three months	<i>S. agalactiae</i> , <i>E. coli</i> , <i>L. Monocytogenes</i> <i>H. influenzae</i> , type B <i>S. pneumoniae</i> , (serotypes 6, 9, 14, 18 and 23) <i>N. meningitidis</i>
Three months to over 15 years	<i>H. influenzae</i> , <i>N. meningitidis</i> , <i>S. pneumoniae</i>

Classification



- 1. acute pyogenic (bacterial) meningitis
- 2. acute aseptic (viral) meningitis
- 3. acute focal suppurative infection (brain abscess, subdural and extradural empyema)
- 4. chronic bacterial infection (tuberculosis).

Clinical Manifestations



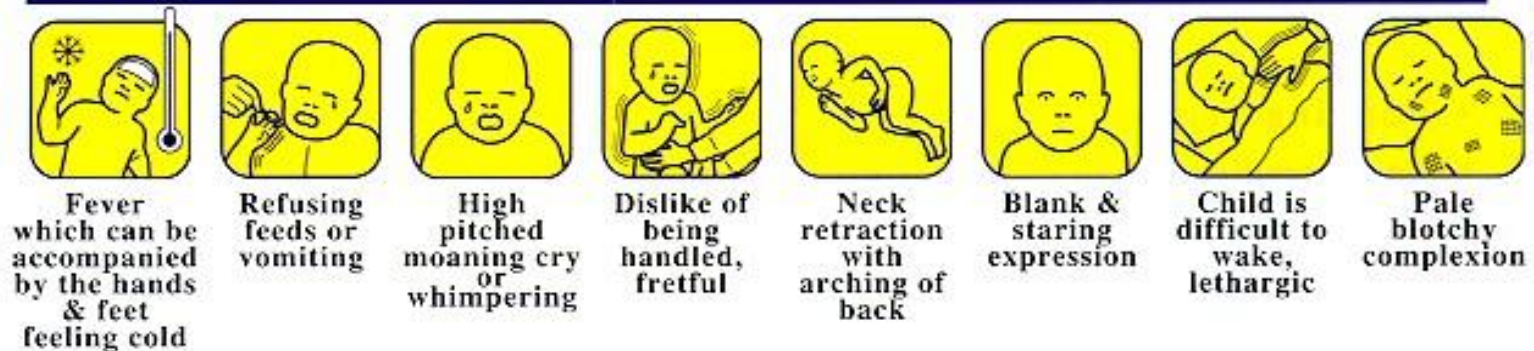
- **Fever**
- **Headache**
- **Neckpain or stiffness**
- **Infants:**
 - May exhibit irritability, vomiting, poor feeding
 - Nuchal rigidity or bulging fontanelle present in roughly 50% of infants and young children
- **Other:**
 - N&V, photophobia, irritability, altered mental status, diffuse rash, petechia, purpura

Symptoms of meningitis

Adults and children



THE SYMPTOMS MAY NOT ALL APPEAR AT THE SAME TIME



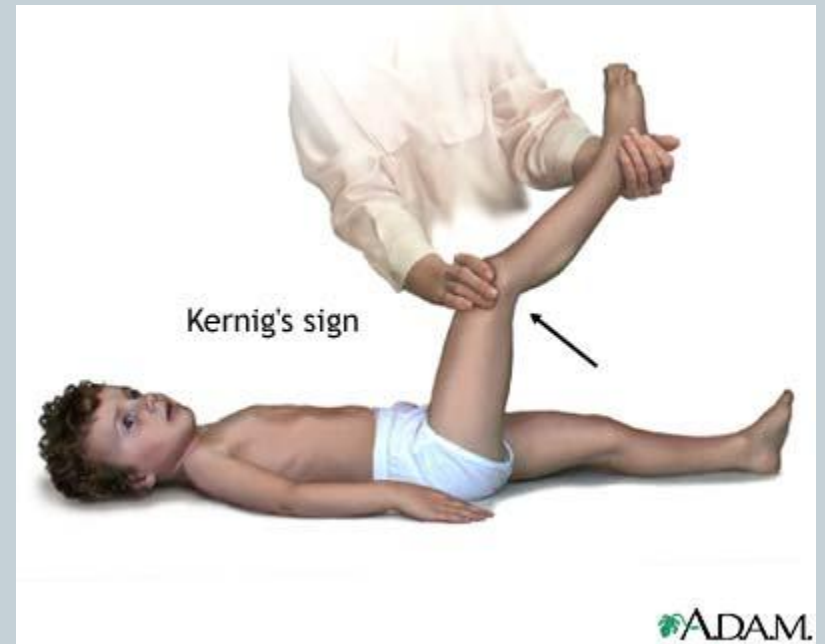
Babies

Neonates and the elderly often present atypically

Kernig's Signs

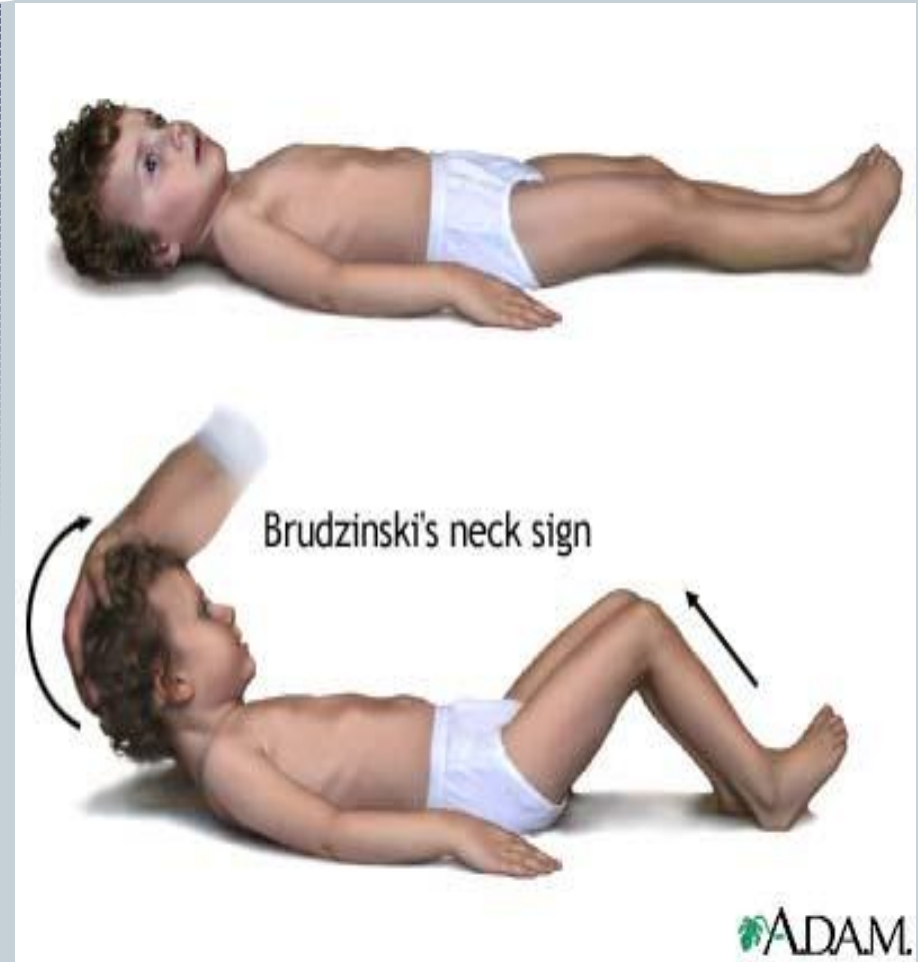


- Patient placed supine with hips flexed 90 degrees. Examiner attempts to extend the leg at the knee
- Positive test elicited when there is resistance to knee extension, or pain in the lower back or thigh with knee extension



Brudzinski's Sign

- Sign Patient placed in supine position and neck is passively flexed towards the chest
- Positive test is elicited when flexion of neck causes flexion at knees and/or hips of the patient

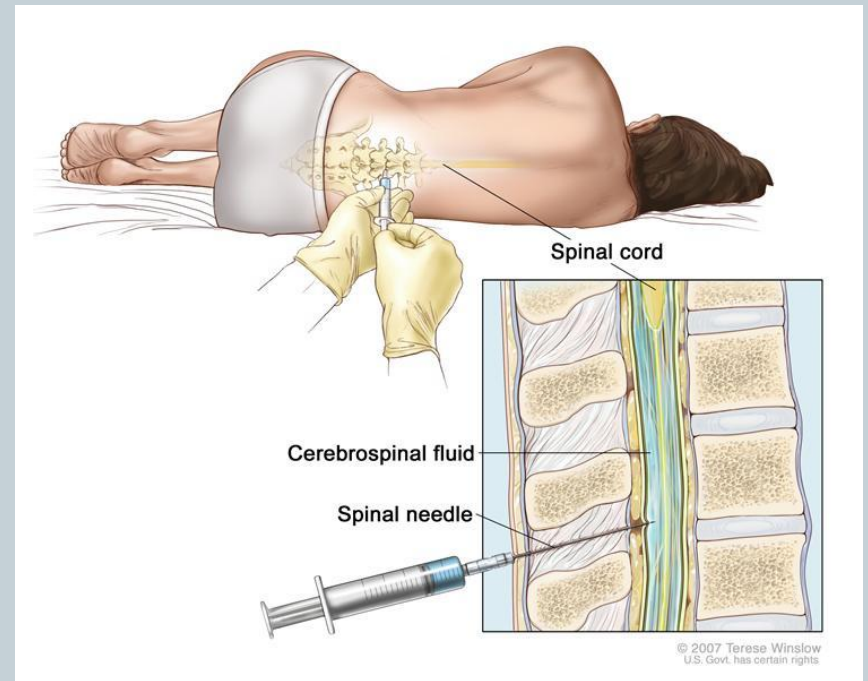




- Signs & symptoms of Meningitis Is due to small skin bleed
- All parts of the body are affected
- The rashes do not fade under pressure Pathogenesis:
 - a. Septicemia
 - b. wide spread endothelial damage
 - c. activation of coagulation
 - d. thrombosis and platelets aggregation

CSF & LUMBER PUNCTURE

- Local anesthesia infiltrated
- 20 or 22 gauge spinal needle with stylet
- Advance spinal needle slowly, angling slightly toward the head
- Flat surface of bevel of needle positioned to face patient's flanks



Laboratory Diagnosis



- **Lumbar puncture**
 - Cell count with differential
 - Protein
 - Glucose
 - Gram stain of CSF
- **Cultures of CSF, blood and urine**

CSF findings in different forms of meningitis



Type of meningitis	<u>Glucose</u>	<u>Protein</u>	<u>Cells</u>
Acute bacterial	low	high	<u>PMNs</u> , often > 300/mm ³
Acute viral	normal	normal or high	<u>mononuclear</u> , < 300/mm ³
Tuberculous	low	high	mononuclear and PMNs, < 300/mm ³
Fungal	low	high	< 300/mm ³
<u>Malignant</u>	low	high	usually mononuclear

Bacterial Meningitis: Treatment



- Empiric treatment of meningitis should be started immediately after the LP is performed. You cannot delay treatment if there is a contraindication or inability to perform an LP. For example, if the LP is delayed due to a need for imaging, blood cultures should be obtained and antibiotics started before the imaging study.
- Empiric treatment consists of *bactericidal* antibiotics that have *good CSF penetrance*, usually a third-generation cephalosporin (e.g. cefotaxime, ceftriaxone) and vancomycin.

Bacterial Meningitis: Treatment (Cont)



- Empiric Antibiotics:
- Cefotaxime 2g IV q4hrs
- add Vancomycin 1-2 g IV q8-12 hrs in all patients (till possibility of Penicillin-resistant Strep pneumoniae has been ruled out)
- add Ampicillin 2g IV q4hrs in elderly or immunocompromised patients (for Listeria infections)

Bacterial Meningitis: Treatment (Cont.)



- for patients with serious penicillin allergies, Meropenem 1-2g IV q8hrs as alternative
- Ceftazidime (2g IV q8hr) + Vancomycin for neurosurgical patients,
- those with shunts or CSF leaks - May consider adjunctive Acyclovir (10 mg/kg IV q8hrs if normal renal function)

Complications and Outcome of Meningitis



- Consequences of meningitis can be mild, moderate or severe, with many survivors being left with permanent disability
- Septicaemia and shock can lead to skin grafting and scarring, amputations and in severe cases neurological deficits
- Meningitis can lead to damage in various areas of the brain resulting in loss of sight, hearing and neurodevelopmental deficits

Complications (Cont.)



- Visual impairment and blindness
- Auditory impairment and deafness
- Neuromotor disabilities
- Seizure disorders
- Behaviour problems
- Learning difficulties

Viral meningitis Overview



- Viral, or aseptic, meningitis is the most common type of meningitis. It is defined as:
 - A febrile illness with clinical signs and symptoms of meningeal irritation
 - No associated neurologic dysfunction
 - No evidence of bacterial pathogens in the CSF (in a pt. who hasn't received antibiotics)

Viral Meningitis: Clinical Manifestations



- **Common features include:**
 - Acute onset of fever, headache, nausea, vomiting, stiff neck.
- **Physical findings are generally limited, nonspecific, and not necessarily present. The most prevalent are:**
 - Nuchal rigidity, bulging fontanel, and other signs of viruses such as rash, conjunctivitis, and pharyngitis

Viral Meningitis



- **Organisms**
 - Enteroviruses: > 70 separate viruses
 - ✦ Abrupt onset of symptoms
 - ✦ CSF analysis - cultures are positive in about 60% of patients but requires 4-12 days to become positive
 - ✦ Management – usually resolves without therapy
- Herpesviruses
- Arboviruses
- Influenza

Viral Meningitis: Treatment



- Herpes meningitis in children is treated with Acyclovir 30mg/kg/day, or 10mg/kg/dose IV Q8hrs, for a minimum of 14-21 days
 - Neonatal dosing is 60mg/kg/day, or 20mg/kg/dose IV Q8hrs for 21 days.
- EV infections are treated symptomatically and rarely require hospitalization beyond the neonatal period.
- Treatment for EBV, Arbovirus, and Influenza meningitis is mainly supportive

Prevention



N. meningitidis

- Prophylaxis of close contacts

Rifampin

- < 1 month old: 10 mg/kg q12h x4 doses
- > 1 month old: 20 mg/kg q12h x 4 doses
- Adults: 600 mg q12h x 4 doses

Ceftriaxone 150 mg IM x 1 dose

Ciprofloxacin 500 mg x 1 dose

Immunizations

- Pneumococcal Vaccine for children < 2 yrs
- Meningococcal Vaccine for all 11-12 year olds, unvaccinated adolescents at high school entry, all college freshmen living in dormitories, and ≥ 2 years at high risk

Take Home Message



- Meningitis is an inflammation of the protective membrane lining the brain and spinal cord caused most often by a viral or bacterial infection that crosses the body's blood-brain barrier.
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- Meningitis is diagnosed by a **lumbar puncture**, in which a small amount of fluid is collected from the spinal column.
- There are two main types of meningitis: bacterial and viral. Bacterial meningitis is less common, but more serious.
- Bacterial meningitis is treated with antibiotics and the majority of patients make a full recovery.
- Viral meningitis usually requires no treatment beyond painkillers.
- Most patients make a full recovery from meningitis. A small number of infected people end up with hearing or vision loss or brain damage.
- Vaccinations against some forms of meningitis are available. They are recommended for children under age 5, people in close contact with someone who has developed meningitis, college students, and people travelling to certain overseas destinations.



• Thank You