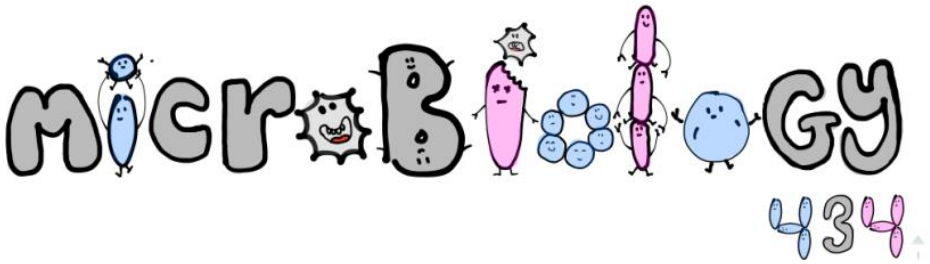
Acute Pyogenic Meningitis



- **Important**
- Extra explanation

Pyogenic meningitis: Produces pus

- It's an inflammation of the meninges affecting Pia, Arachnoid and subarachnoid space.
- May be preceded by **URTI** [upper respiratory tract infection]
- Usually caused by **bacterial** infections.
- Acute onset, **serious** infection ,associated with marked **inflammatory exudation**. [chronic – subacute → fungal]
- Can be fatal if untreated.

Epidemiology:

- There are **1.2** million cases annually worldwide.
- 135,000 **deaths**.
- Bacterial meningitis is 1 of the **top 10** infections causes **death** worldwide.
- **Half** of the survivals suffer **neurological damage**, and /or **permanent** side effects.

Three main capsulated bacterial species :

- **Neisseria meningitidis**
- **Sterptococcus pneumoniae**
- **Hemophilus influenzae**

Common causative agents:

Age Group	Common Causative Agents
New born [0 -1m]	Group **B** Streptococcus - E.coli (and other gram negative bacilli) - Listeria monocytogenes
Infant /children [>1m]	S.Pneuomiae - N.meningitidis - H.influenzae
Adults	S.Pneumoniae - N.meningitidis
Special circumstances	S.Aureus - S.Epidermidis - S.pneumoniae anaerobes - P.aeruginosa associated w/special history

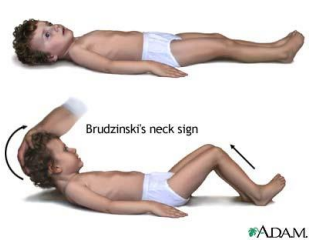
Pathogenesis:

- The organisms that cause bacterial meningitis colonize the nasopharynx.
- From there, they get into the blood stream and enter the subarachnoid space through complex interactions with endothelial cells.
- choroid plexus facilitates their spillage into the CSF.
- The CSF is an ideal medium for the spread of bacteria because it provides enough nutrients for their multiplication and has few phagocytic cells, and low levels of antibodies and complement.
- Initially, bacteria multiply uninhibited and can be identified in smears, cultures, or by ELISA detection of their antigens before there is any inflammation.

[colonization of nasopharynx [or birth canal in the mother] → septicaemia → Cross BBB → widespread endothelial damage → coagulation activation → thrombosis and platelet aggregation]

- **Bleeding : skin rash – adrenal hemorrhage**

Signs & symptoms of acute meningitis		
Most common [progressing]	Infants [atypical]	Advanced cases
Fever – headache – stiff neck – nausea – vomiting – light sensitivity – confusion	Inactivity – irritability – vomiting – poor feeding	Under skin bruises – rapidly spreading – brain damage – coma – death



Brudziniski sign

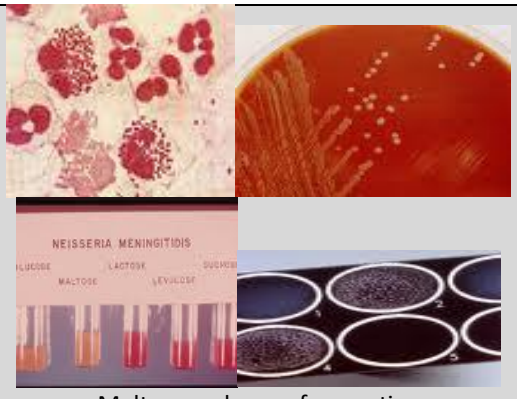
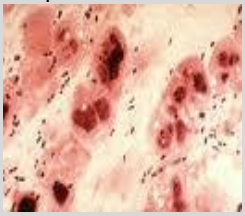
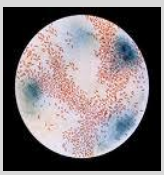
Flx head → knee flx

[not specific]

Kernig's sign

Cant extend knee when the hip is flexed

[not specific]

	N. meningitidis	S.pneumoniae	H.influenzae
Organism	A Gram **negative** diploococci	A Gram **positive** diplococcic [cause pneumonia – OM]	small Gram **negative** coccobacilli
Location	present in the **nasopharynx** of 10 % of people [Cariers]	--	Found in the **nasopharynx** normal flora
Capsule	Capsule resists phagocytosis. [virulent organism]	Capsule is polysaccharide polymer	H.Influenzae **type b** most virulent has a **PRP** [polyribosyl ribitol phosphate] polymer capsule → cause acute life threatening invasive infections **[other species has no capsule]**
General	• **Risk factor :** susceptible individuals. [not vaccinated] • Common in children **< 6 y & adults especially in Hajj**	--	• Need **blood** for optimal growth, Hematin **(factor X)** and NAD **(factor V)** For diagnosis • Major cause of **lower RTI** • occasionally invade deeper tissues and cause bacteremia → goes to CNS – bones & other • common from age 2y – 5y because before 5y the baby has only maternal antibodies
Serotype	• Serotypes: **B,C,Y,W135** → isolated ,**sporadic** small epidemics in close population. • **Serotype A** → epidemic potential in sub-saharan Africa (meningitis belt) a geographical band across the middle of Africa	--	Many serotypes **[a-f]**
Pathogenesis and development	• **Pathogenesis:** • Carriers stimulate **antibody** production • In some pili attach to microvilli of nasopharynx [invasion] → bacteremia **endotoxin** (LipoPolySaccaride) produced → meninges. • Transmitted by **inhalation** of aerosolized droplets [from cough] , **close contact**	• May develop after: ○ **trauma** to the skull. ○ pneumococcal **pneumonia** • **Pneumolysin** produced by the capsule **decreases** inflammatory immune response→ severe infection. Infection rate **decreases** due to vaccination .	Infection rate decreases since the routine use of **Hib [H.influanzi b] vaccine**
outcome	11-20 % of **recovered** patients suffer **permanent** hearing loss, mental retardation.	Recovered cases develop **sustained** learning disabilities	1/3 of survivals have significant neurological **sequelae**
Mortality	10-14% of cases are fatal	High mortality rate >30% due to invasive disease	3-6% mortality rate
Pictures	 Maltose + glucose fermenting agglutination w/ antibodies	 Optician sensitive 	  X & V factors → showing growth

	Group B Streptococcus [Agalactea]	E.coli	Listeria monocytogenes
Organism	Gram **positive** cocci in chains	A Gram **negative** bacilli	Gram **positive** rods
Location	• Resident in **GIT & vagina (** 10-30%) Gain access to amniotic fluid **during delivery** or colonize newborn as it passes birth canal	• **Most common cause of neonatal meningitis** • **Vagina**	• Wide spread among **animals** in nature including those associated with **food supply**. Human **intestinal** colonization (2-12%) this is normal but in pregnant women and ↓ immunity it serves as a risk for developing meningitis
Pathogenesis and development	**premature** rupture of membrane, prematurity, low infant innate immunity Cause **sepsis** & meningitis in the first few days of life or after 4 weeks To prevent this now they do screening for the mother and monitor the baby carefully **[Premature delivery]**	• Failure of preterm maternal IgM to cross placenta& special susceptibility of newborn. • Vaginal E.coli colonize infant via rupture of amniotic membrane or during birth. **K1 sialic** acid **capsule** of some strains → invade brain micro vascular endothelial cells → **meningitis**	Spread to fetus following hematogenous dissemination in mother or from birth canal
Notes		Many features similar to GBS .	Has troposim [affinity]for CNS

Diagnosis of meningitis :

1- **Clinically.**
2- **Specimen:** CSF acquired through **lumber puncture** [Lying or sitting position- Between L3-4]
3- **Blood for** : analysis of cells, protein, glucose, culture and antimicrobial susceptibility testing.
1st take the samples then give antibiotics to prevent having false negative tests

Findings of CNS analysis:-

Case	Normal			Pyogenic meningitis
	Adult	Neonate [full term]	Neonate [preterm]	
WBC	0-5 /cmm3	0-32 /cmm3	0-29/cmm3	5 - 5000/cmm3 [↑]
PMN	0	>60 %	< 60 %	> 60%
Glucose	> 60 % of blood			< 45 % of blood [↓]
Protein	< 30 mg/dl	20-170 mg/dl	60-150 mg/dl	>60 mg/dl
Chloride	115-130 mmol/l	--		110 mmol/l [↓]

If Lymphocytes → TB or Viral [Aseptic meningitis]

Management: [Urgent , A MEDICAL EMERGENCY] 1st take the samples then give antibiotics to prevent having false negative tests

- **Parenteral administration**: [Ceftriaxone or Cefotaxime] + Vancomycin (**cover the main 3 pathogens**)
- **Neonates**: **Amplicillin** for group b sterpt & listeria + [**Gentamicin or Cefotaxime**] Gentamicin treat gram negative bacteria but some types of E.coli has resistance ,so we use Cefotaxime
- **Duration: 10-14 days (or more)** according to the medical condition
- **Prevention: vaccination , prophylaxis** w/rifampicin **of contacts (against Hib & N.meningitidis)**

MCQ's : " Doctor said in the exam you might be given scenario of case with morphology of organism "

1.A 6-week neonate presented with fever and loss of appetite. LP has revealed the following: presence of cocci gram positive organism in chain. Which one of the following is the most likely causative organism:

a. Group B Streptococcus
b. E.coli
c. Listeria
d. Streptococcus Pneumoniae .

2.For the previous scenario, what is the most appropriate antibiotic:

a. Gentamycin + Ampicillin
b. Gentamycin + Vancomycin
c. Ceftrixone + Vancomycin
d. Amoxacillin + Ceftrixone

3.A 24-years old presented to the ER with neck stiffness and fever. From the history he performed his pilgrimage "HAJJ" by illegal way. LP confirmed that he had meningitis with the result of: gram negative diplococci. Which one of the following is the most likely causative organism. :

a. H.infleunzae
b. Streptococcus pnemoniae
c. Nesseria meningitidis
d. Lesteria

4.From the previous scenario. What is the most appropriate antibiotic:

a. Gentamycin + Ceftrixone
b. Gentamycin + Vancomycin
c. Ceftrixone + Vancomycin
d. Amoxacillin + Ceftrixone

ANS :

1-A 2-A 3-C 4-C

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