Lecture 5

Microbiology of Acute Pyogenic Meningitis

- Additional Notes
- Important
- Explanation
- Examples

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Intro:

- Pyogenic meningitis is an inflammation of the meninges affecting Pia, Arachnoid and subarachnoid space.
- 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.

- Acute in onset, serious infection ,associated with marked inflammatory exudation.
- Usually caused by bacterial infections.
- May be preceded by URTI.
- Can be fatal if untreated.

Signs and Symptoms of Acute Meningitis

- Fever
- Headache
- Stiff neck "Pain, itchy nick"
- Nausea & vomiting
- Sensitivity to light, Confusion.
- bruises under skin & spread rapidly in advanced cases.

✓In infants:

- Inactivity
- Irritability
- Vomiting
- Poor feeding

Common Causative Agents

Age Group	Common Causative Agents
Newborns (under 1 month)	Group B Streptococcus E.coli (and other gram negative bacilli) Listeria monocytogenes
Infants / Children	S.Pneuomiae N.meningitidis H.influenzae
Adults	S.Pneumoniae N.meningitidis
Eldrly people	N.meningitidis H.influenzae Listeria monocytogenes
Special circumstances	S.Aureus S.Epidermidis S.pneumoniae anaerobes P.aeruginosa

Pathogenesis

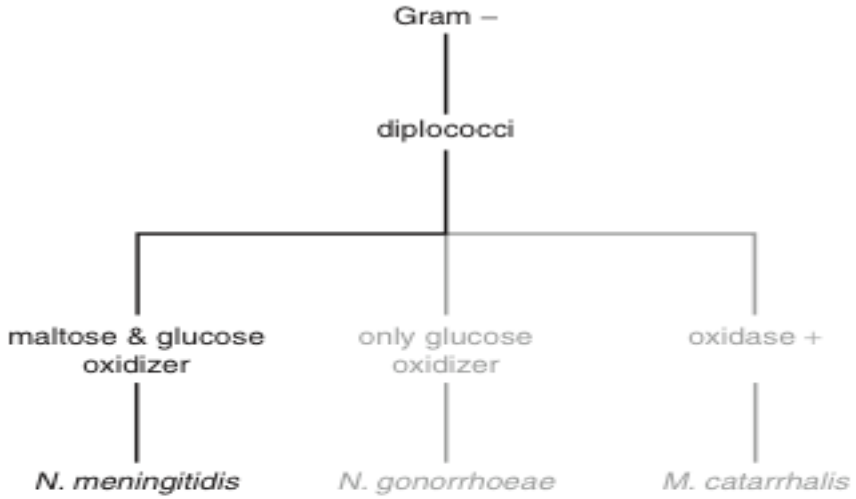
- The organisms that cause bacterial meningitis colonize the nasopharynx.
- From there, they get into the blood stream and enter the subarachnoid space through complex interactions with endothelial cells.
- choroid plexus facilitates their spillage into the CSF.
- The CSF is an ideal medium for the spread 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.

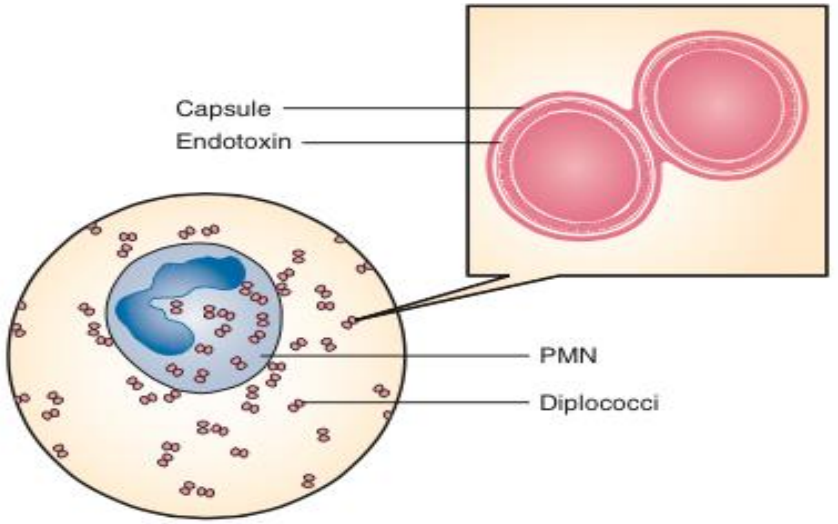
- Direct Invasion: Fracture in skull can lead to Meningitis
- Colonization in Pharynx ➔Invasion ➔ Bacteremia ➔ Blood Brain Barrier ➔ Meningitis.
- Infection in an organ " Lung " ➔ Bacteremia ➔ Blood Brain Barrier ➔ Meningitis.
- In Neonates: From birth canal, or thru the blood by placenta ➔ Bacteremia ➔ Blood Brain Barrier ➔ Meningitis.
- When Meningitis happen, Severe Inflammatory process can lead to edema ➔ Intracranial pressure or/and thrombosis ➔ Can lead to CVA ➔ Can lead to death.

From 432 team work. Many thanks.

N. meningitidis

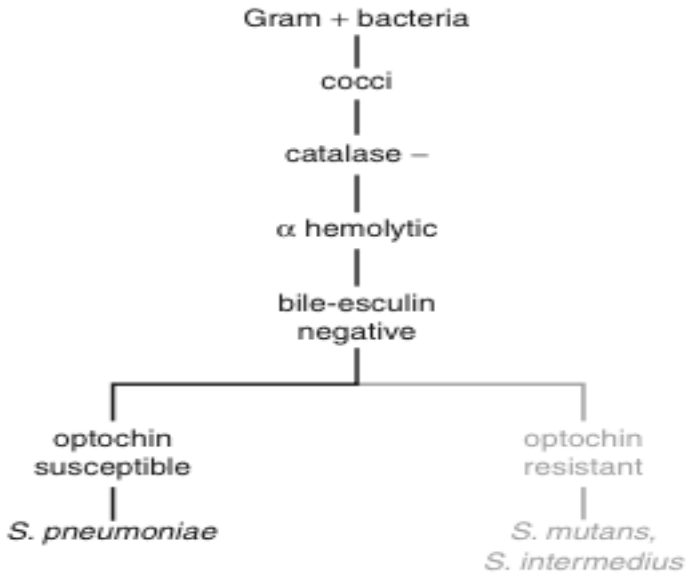
- A Gram negative diploococci present in the nasopharynx of 10 % of people.
- Transmitted by inhalation of aerosolized droplets, close contact.
- Common in children less than 6 years

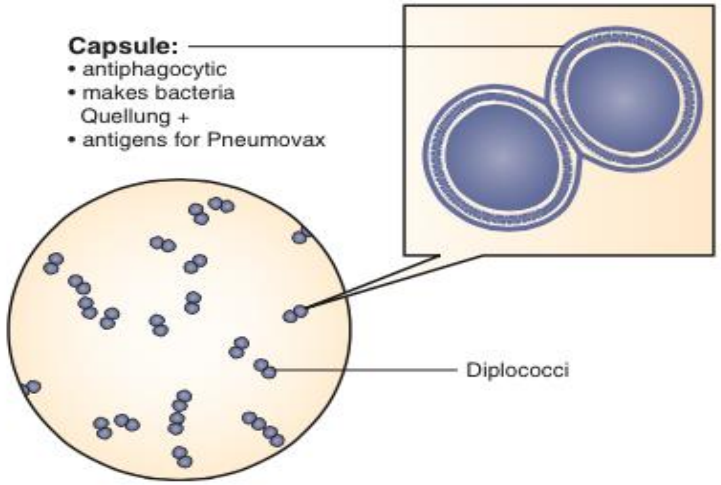




S. pneumoniae

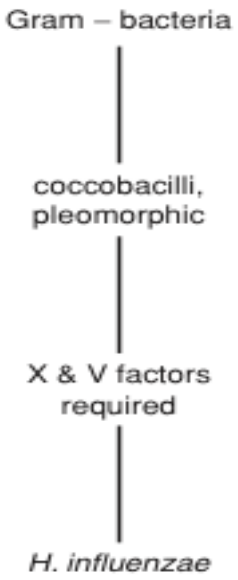
- A Gram positive diplococci ,meningitis may follow pneumococcal pneumonia ,or other site .
- May develop after trauma to the skull.
- High mortality rate >30% due to invasive disease.
- Capsule is polysaccharide polymer Pneumolysin decreases inflammatory immune response ➔ severe infection.
- Infection rate decreases due to vaccination .

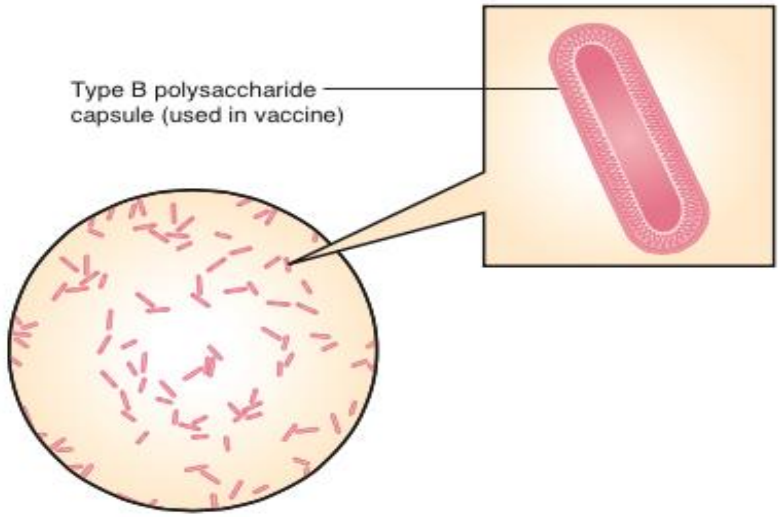




H. influenzae

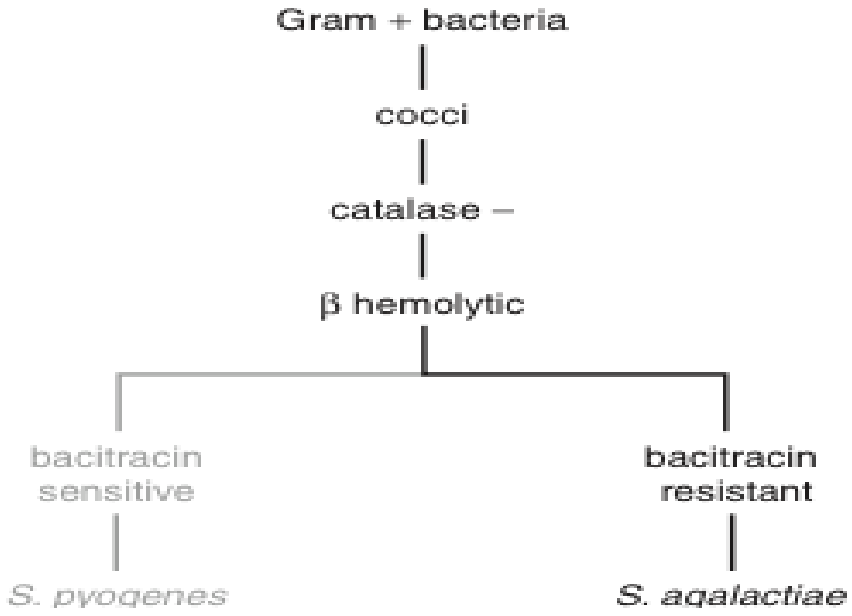
- A small Gram negative coccobacilli
- Found in the nasopharynx normal flora
- Major cause of lower RTI, occasionally invade deeper tissues and cause bacteremia. Bacteremia ➔ CNS, bones or other organs
- 1/3 of survivals have significant neurological sequelae
- Infection rate decreases since the routine use of Hib vaccine .

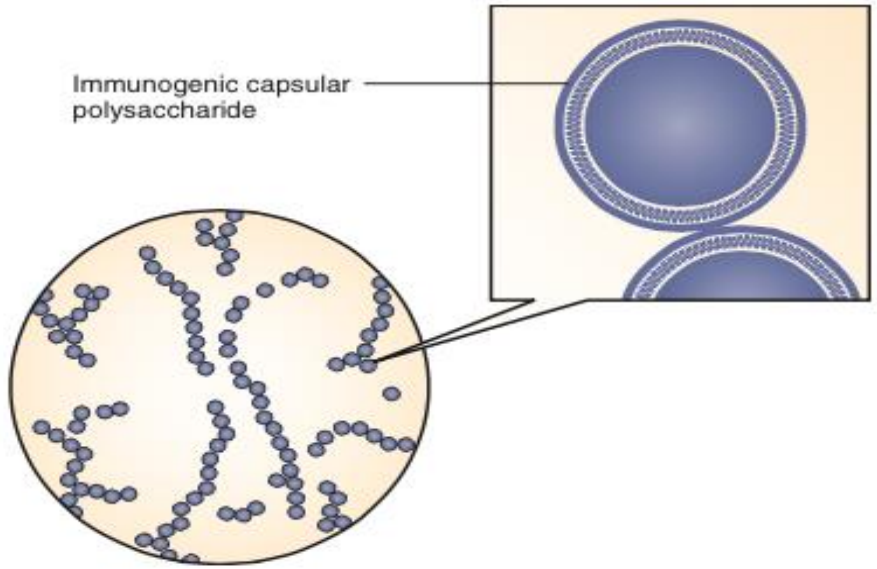




Group B Streptococcus

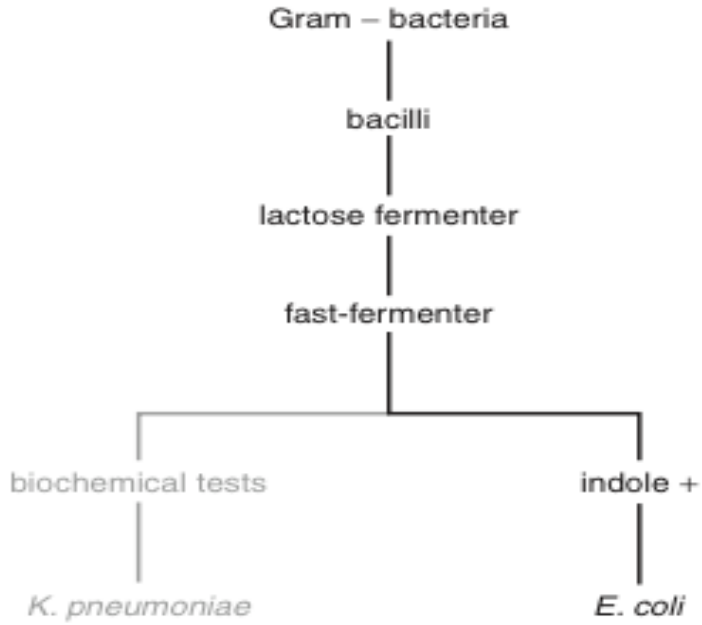
- Gram positive cocci in chains
- Resident in GIT & vagina (10-30%)
- Cause sepsis & meningitis in the first few days of life or after 4 weeks.

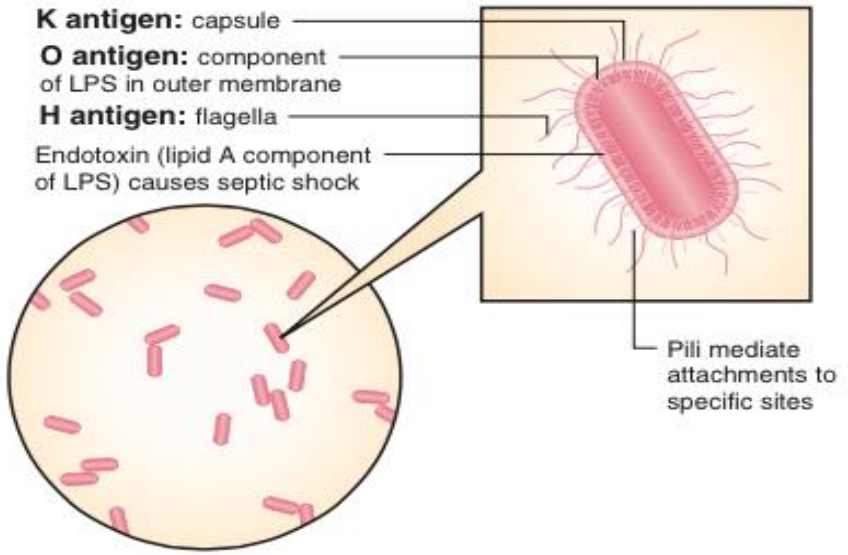




E.coli

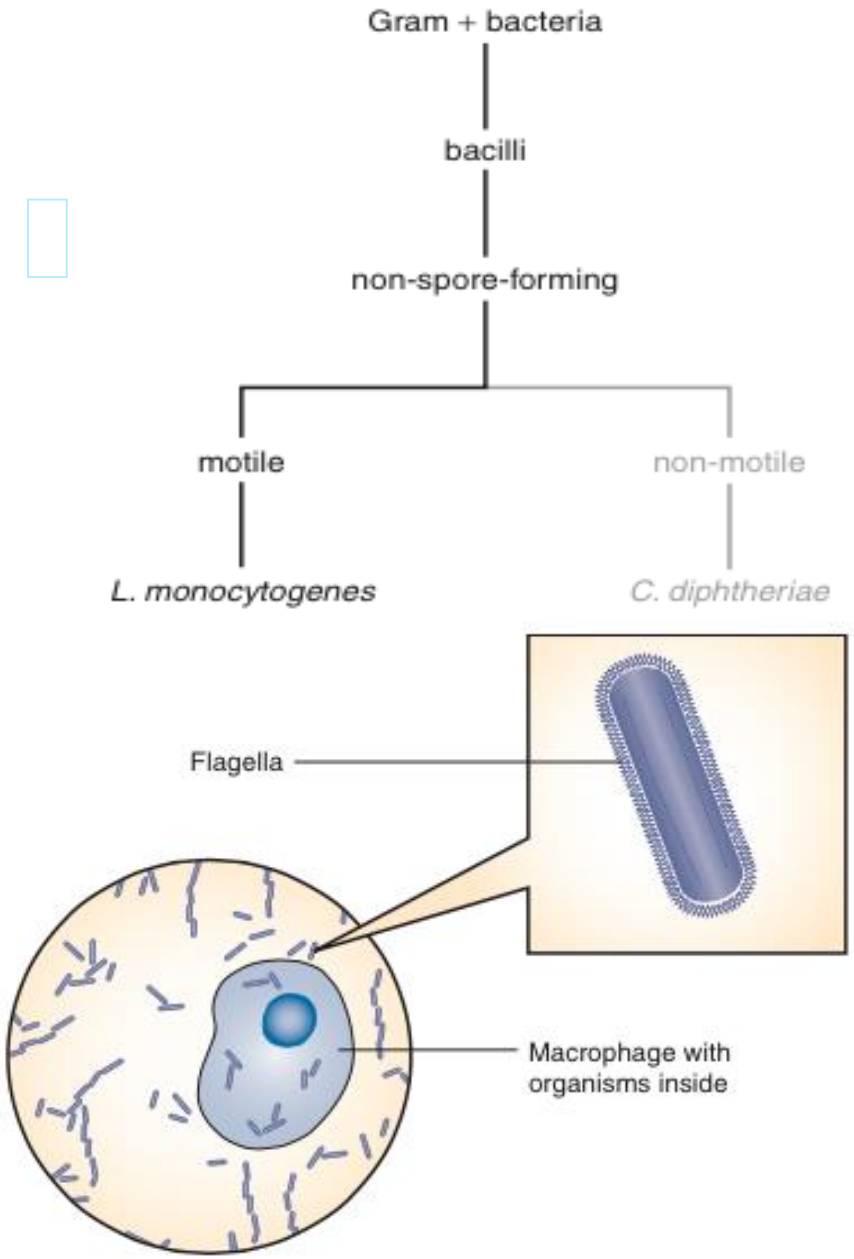
- A Gram negative bacilli
- Most common cause of neonatal meningitis
- Vaginal E.coli colonize infant via rupture of amniotic membrane or during birth.





Listeria monocytogenes

- Gram positive rods
- Wide spread among animals in nature including those associated with food supply.
- Spread to fetus following hematognous dessimination in mother or from birth canal



- Diagnosis of Meningitis:
  - ✓Clinically.
  - ✓Specimen: CSF acquired through lumbar puncture (ELP)
  - ✓blood for: analysis of cells, protein, glucose, culture and antimicrobial susceptibility testing.

- Findings of CNS analysis:
  - ✓WBC= 1000 - 5000/cmm3 (Normal= 0-5 /cmm3)
  - ✓PMN= > 60% (Normal: 0%)
  - ✓Glucose =< 45% of blood (Normal >= 60 % of blood)
  - ✓Protein >= 60 mg/dl (Normal =< 30 mg/dl)

Treatment

- Age 0 to 4 weeks: Ampicillin + (cefotaxime or Gentamicin).
- Children and adults: Vancomycin + (cefotaxime or ceftriaxone)
- Age >50 y: Vancomycin + ampicillin + (ceftriaxone or cefotaxime)

- Duration : 10-14 days according to the medical condition
- Prevention: vaccination, prophylaxis of contacts (Hib& N.meningitidis)

Summary

- Newnate:
  - ✓Group B Streptococcus ➔ Gram positive cocci in chains
  - ✓E.coli ➔ A Gram negative bacilli
  - ✓Listeria monocytogenes ➔ Gram positive rods
- Treatment: Ampicillin + cefotaxime

- Children:
  - ✓S.Pneuomiae ➔ A Gram positive diplococci
  - ✓N.meningitidis ➔ A Gram negative diploococci
  - ✓H.influenzae ➔ A small Gram negative coccobacilli
- Treatment: Vancomycin + cefotaxime or ceftriaxone

- Adults:
  - ✓S.Pneumoniae ➔ A Gram positive diplococci
  - ✓N.meningitidis ➔ A Gram negative diploococci
- Treatment: Vancomycin + cefotaxime or ceftriaxone

- Elderly people:
  - ✓N.meningitidis ➔ A Gram negative diploococci
  - ✓H.influenzae ➔ A Gram negative coccobacilli
  - ✓Listeria monocytogenes ➔ Gram positive rods
- Treatment: Vancomycin + ampicillin + ceftriaxone or cefotaxime

Quiz

ANSWERS: 1.A 2.A

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 + Amoxacillin b. Gentamycin + Vancomycin

c. Ceftrixone + Vancomycin d. Amoxacillin + Ceftrixone

Quiz

ANSWERS: 3.C 4.C

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 c. Lesteria

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

a. Gentamycin + Ceftrixone b. Gentamycin + Vancomycin

b. Ceftrixone + Vancomycin d. Amoxacillin + Ceftrixone