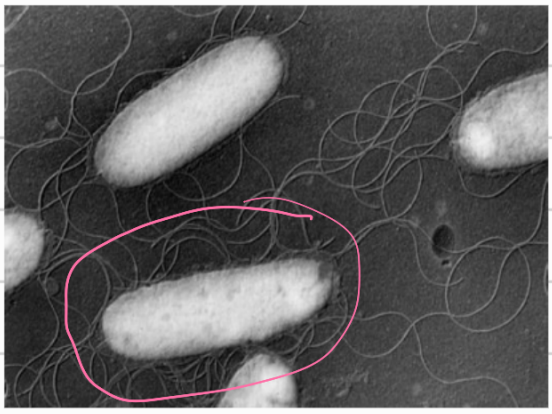
Salmonella



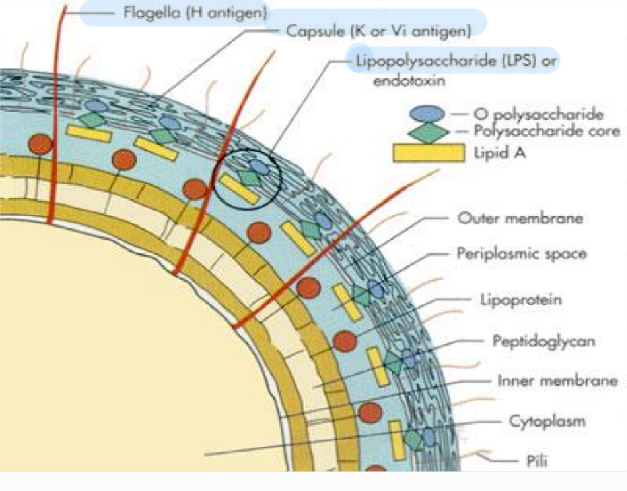
Overview

- Family: enterobacteria (non-lactose fermenters), Genus: Salmonella
- 2 Species → Salmonella bongori / Salmonella enterica : 5 subspecies, 2500 serovars/serotypes
- Salmonella enterica subspecies: Salmonella typhi, paratyphi (A,B,c) → enteric fever
S.enteritidis, S.typhimurium → food poisoning / S. choleraesius → septicemia
- Rod shaped, non spore forming, gram -ve, aerobic and faculative anerobe
- predominantly motile (peritrichous flagella) H antigen
- non capsulated except S.typhi and some paratyphi
- biochemical charecteristics: Glucose fermenters, non lactose + sucrose fermenters

Antigenic Structure

- Kauffmann-White antigenic scheme: Classifation of Salmonella
- Agglutination reactions (specific anti-sera against Salmonella ags)
- The Serotype is determined by distinct O and H ags
- Vi, K ags: Capsular polysaccharides produced by some virulent types of (S.typhi, paratyphi c)
- protects from phagocytosis, least immunogenic

- O antigens: O polysaccride unit in lps (like endotoxin)
- highly variable part where the AB binds to (less than H)
- in S.Typhi only
- H antigen: flagellar ags (proteins), occur in 1 or 2 phase variations
- S.Typhi and Paratyphi



Epidemiology:

Enteric fever (paratyphi + S.typhi) Spread → animals to humans / Person to person / Contamination with human feaces

- Usual vehicle is contaminated water, milk, food (individual who has S.typi usually), flying insects
- infectious disease about 1 million bacteria, much lower when (stomach PH ↑ / infection vehicle is chocolate) → infectious dose becomes 100 bacteria
- carrier state [many weeks - years] due to fecal shedding, asymptomatic carrier → Typhoid mary
- Chronic carrier (asymptomatic) 3% of people infected in S.typi → Mallone

Pathogenesis:

- Enteric fever is caused by S.typhi, S.paratyphi (A,B,c), incubation period → 7-14 days
- Source of infection → injestion of infected water and food

[In the gut]

Organisms attach to epithelial cells of intestinal villi and penetrate to (lamina propia / submucosa) → phagocytosis → resistance of intracellular killing

→ multiplication within cells → they enter the mesentric LNs → multiplication → blood stream → they'll reach internal organs: (liver, Kidney, gall bladder, lungs, Bm, LNs, spleen)

→ massive bacteremia

* all these events coincide with fever and other signs
* invasion of intestine from gallbladder
* involvement of peyr patches and gut lymphoid tissue
* fever leads to inflammatory reaction, infiltration of mononuclear cells (necrosis, sloughing) → typhoid ulcers

Clinical features:

Typhoid fever Complications

- Intestinal hemorrhage + perforation (distal ileum) very Scrious & fatal
- Neurophyscatric symptoms (delirium) → caused by dehydration
- Encephalitis, metastatic abcess, cholecystitis, endocarditis, osteitis
- If untreated mortality rate → 30% in the 3rd week

Enteric fever (paratyphoid A)

- incubation : 10-14 days, milder and shorter than TF
- myalgia, headache, fever, splenomegaly/leukopenia
- abdominal pain, constipation, rose spots (macular rash) 30%
- 1% fatal

S.Paratyphi

S.Paratyphi B → diarrhea, vomiting inflamed intestinal tract

S.Paratyphic → septicemia

complications → abcess, arthritis, inflammed gall bladder

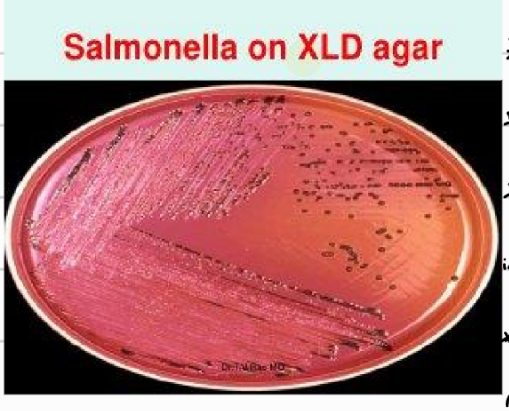
Lab diagnosis

- Blood culture tve in the 1st week for 80-90% of patients, Should be taken before treatment → Culture result is -ve after 3 hours of administration of chloramphenicol
- urine, duodenal and bile culture can be tve, non lactose fermenter
- put the culture in nutrient broth for multiplication → Subculture in macconkey agar ⇒ Colonies are colorless/circular and convex with lactose non fermenting strains
- other selective agars for Salmonella :

Wilson and blair bismuth sulphite medium → Selective medium for Salmonella, colonies are black in color with metalic surface

XLD agar medium → red colonies with black centers in typhi

Deoxycholate citrate medium agar → Selective medium for Salmonella, produces colorless colonies.



* biochemical and serological tests are parallel
* citrobacter may have Similar serological tests
* widal test → detects O.H ags in the patients serum, useful in areas without culture facilities (developing countries), unreliable
* tve in the begining of the 2nd week, Should have 2 positives
maybe false tve in immunization, titer : O 1/80 H > 1/160

Biochemical reactions :

- Macconkey + DCA → pale yellow colonies (non-lactose fermenters)
- S.Typhi ferments glucose, mannitol, sorbitol to produce acid
- Paratyphi A → H2S -ve, citrate -ve / Paratyphi B → H2S tve, citrate tve / typhi → H2S tve, citrate -ve

- XLD → Selective medium for Shigella and salmonella from clinical samples and foods
- Some S.paratyphi ferment glucose, mannitol, sorbitol to produce acid tgss

Biochemical test results :-

-Indole : -ve / methyl Red : +ve / urease : -ve / Voges proskaer : -ve / catalse : tve / Oxidase : -ve

* Some S.Paratyphi C and S.typhomurium and enteritides are Similiar to S.paratyphi B, Serological testing (Slide coagglutination) is used to differentiate between them

Laboratory diagnosis of Enteric Fever

❖ **Biochemical Identification of Isolates-**

Tests	S. typhi	S. Paratyphi
Catalase	+ve	+ve
Oxidase	-ve	-ve
Nitrate Reduction	+ve	+ve
Glucose	+ve (Acid only)	+ve(Acid and Gas)
Mannitol	+ve (Acid only)	+ve(Acid and Gas)
Lactose	-ve	-ve

Laboratory diagnosis of Enteric Fever

❖The test of choice depends on the duration of disease-

Duration of disease	Specimen	Positivity (%)
1st week	Blood culture	90
2nd week	Blood Culture Feaces culture Widal test	75 50 Low titre
3rd week	Widal test Blood culture Feaces culture	80-100 60 80