BHARATHIDASAN UNIVERSITY

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Programme: M.Sc., Biomedical Science

Course Title : Clinical Microbiology

Course Code: BM36C9

Unit-II

Salmonella

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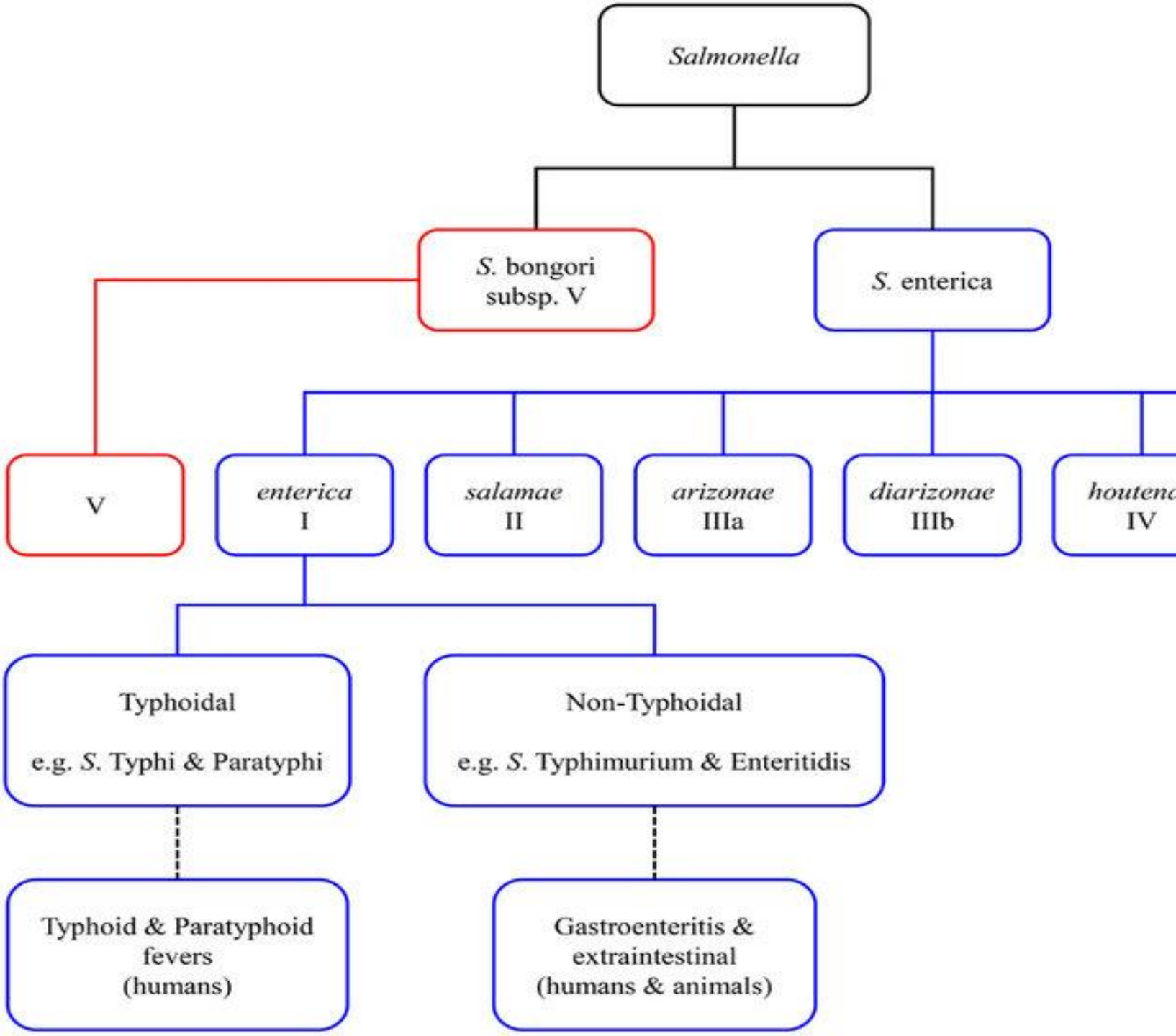
SALMONELLA

INTRODUCTION

- Salmon and smith in 1885 isolated for first time , named after its discoverer salmon.
- Wide spread pathogens of animal including man belonging to Enterobacteriaceae.
- Found in the intestine of pigs, cows, goats, sheep, rodents, hens, ducks and poultry.
- S.typhi and S.paratyphi found only in humans.
- Enteric fever (typhoid fever)

CLASSIFICATION

- DOMAIN Bacteria
- KINGDOM Bacteria
- PHYLUM Proteobacteria
- CLASS Gamma proteobacteria
- ORDER Enterobacteriales
- FAMILY Enterobacteriaceae
- GENUS Salmonella


Salmonella
S. bongori subsp. V
S. enterica
V
enterica I
salamae II
arizonae IIIa
diarizonae IIIb
houtena IV
Typhoidal
e.g. S. Typhi & Paratyphi
Non-Typhoidal
e.g. S. Typhimurium & Enteritidis
Typhoid & Paratyphoid fevers (humans)
Gastroenteritis & extraintestinal (humans & animals)

MORPHOLOGY

- Gram negative rods with approximately size 2-4 X 0.6 micrometer.
- Non sporing ,non capsulated, usually motile having peritrichous flagella exception S.gallinarium , S.pullorum.
- May posses fimbriae (mannose sensitive , hemagglutinating).
- Non acid fast.

BIOCHEMICAL CHARACTERS

- Glucose , manitol, maltose, produce A/G.
- Salmonella typhi do not produce gas.
- Lactose/ salicin/ sucrose not fermented.
- Indole –
- Methyl red +
- VP –
- Citrate +
- Urea –
- H_2S produced by salmonella typhi
- Paratyphi A do not produce H_2S.

RESISTANCE OF SALMONELLA

- 55 degree Celsius – 1 hour
- 60 degree Celsius – 15 MT
- Boiling, chlorination, pasteurization destroy the bacilli.

ENRICHMENT MEDIUM

- Liquid medium
- Tetrathionate broth
- Above medium are used for isolation of salmonella from contaminated specimens.
- Particularly stool specimens.

CULTURAL CHARACTERS

- Aerobic / facultatively anaerobic.
- Grows on simple media – nutrient agar.
- Temp 15-41 degree Celsius / 37 degree Celsius.
- Colonies appear as large 2-3 mm , circular , low convex.
- On MacConkey medium appear colorless (NLF)
- Selective medium- Wilson Blair Bismuth Sulphide medium . Produce Jet black colonies H_2S produced by salmonella typhi.

ANTEGENIC STRUCTURE

- H- flagellar antigens
- O - somatic antigen
- Vi - surface antigen in some species only .
- H antigens also called flagellar antigens, heat labile protein
- Boiling destroys antigenicity.
- When mixed with antiserum produces agglutination and fluffy clumps are produced
- H antigens are strongly immunogenic induces antibodies rapidly.

O antigens

- It forms integral part of cell wall like endotoxin.
- O antigens unaffected by boiling
- O antigen are less immunogenic than H .

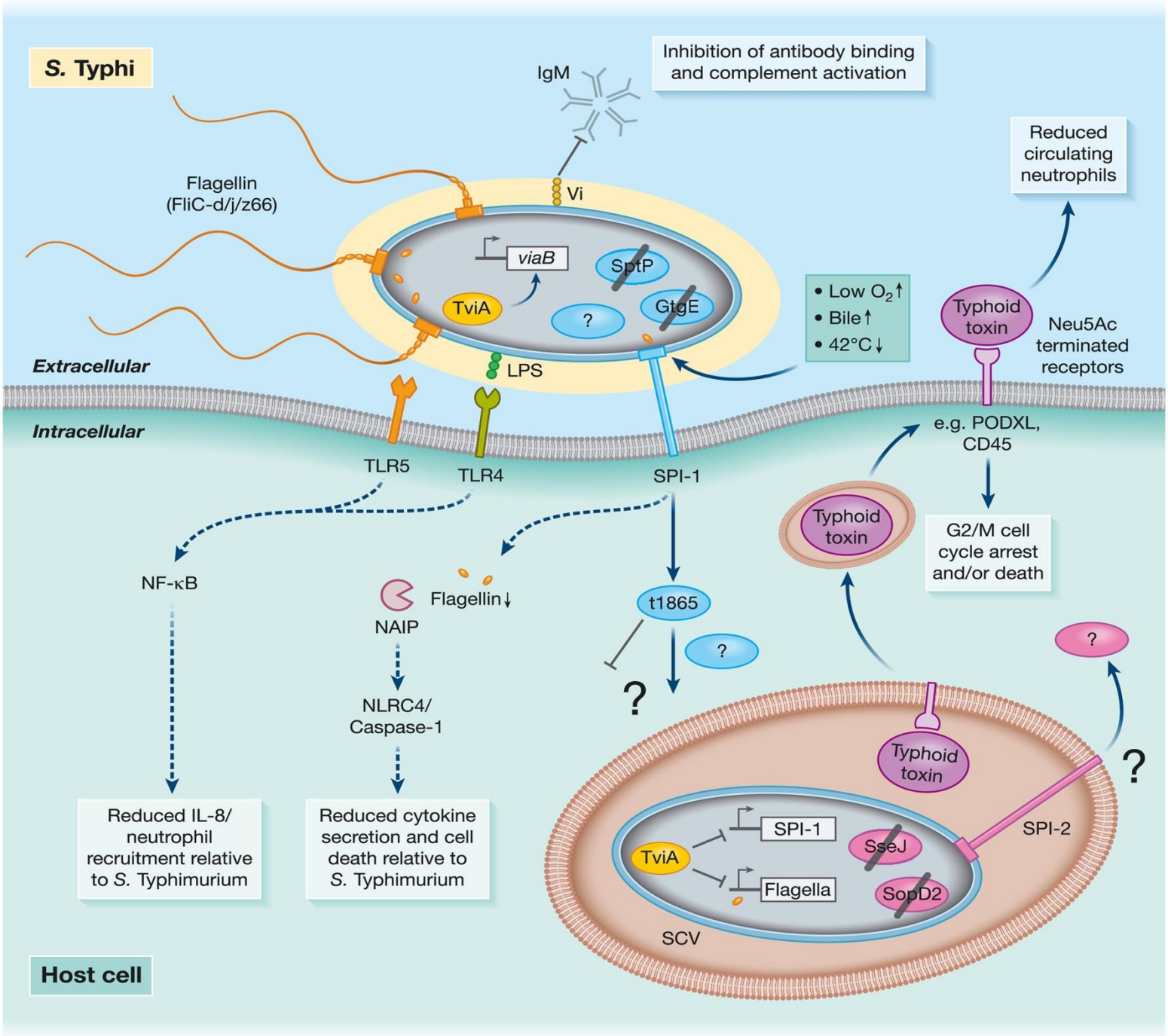
Vi antigens

- Poorly immunogenic and polysaccharide.
- Destroyed after boiling 60 degree Celsius
- Acts as virulence factor , protects the bacilli against phagocytosis and activity of complement.

PATHOGENESIS

- S.typhi , S.paratyphi A and S.paratyphi B are of great clinical and public health significance .
- Many infections due to ingestion of contaminated food and also due to zoonotic and can be transferred between humans and non humans.
- Infection occurs almost due to oral route .
- Small number of S.typhi can cause typhoid fever while for paratyphoid it needs large dose.

- All virulent strains of salmonella can survive gastric acidity and penetrate intestinal mucosa and sub mucosa .
- Hence they are facultative intracellular pathogens that enter cells via macopinosomes.
- Only S typhi is principally systemic invasive.
- These causes illness such as typhoid fever, paratyphoid fever and food borne illness.


S. Typhi
IgM
Inhibition of antibody binding and complement activation
Flagellin (FliC-d/j/z66)
Vi
viaB
SptP
TviA
?
GtgE
LPS
• Low O_2↑
• Bile↑
• 42°C↓
Reduced circulating neutrophils
Typhoid toxin
Neu5Ac terminated receptors
Extracellular
Intracellular
TLR5
TLR4
SPI-1
e.g. PODXL, CD45
Typhoid toxin
G2/M cell cycle arrest and/or death
NF-κB
Flagellin↓
NAIP
t1865
?
?
NLRC4/ Caspase-1
Typhoid toxin
?
?
SPI-1
SPI-2
TviA
SseJ
Flagella
SopD2
SCV
Reduced IL-8/ neutrophil recruitment relative to S. Typhimurium
Reduced cytokine secretion and cell death relative to S. Typhimurium
Host cell

CLINICAL DISEASES

- Enteric fever
- Septicaemia
- Gastroenteritis

- **ENTERIC FEVER**

  This includes both typhoid fever and paratyphoid fever caused by S typhi and S paratyphi.

SEPTICAEMIA

- It is commonly caused by S choleraesuis and S paratyphi C . Infection occurs through oral route and incubation period is shorter.

GASTROENTERITIS

- This is caused by ingestion of contaminated foods like milk, eggs, meat etc with Salmonella. S typhimurium is mostly isolated from food poisoning cases. Besides S enterididuis, S newport, S dublin may be involved.

EPIDEMIOLOGY

- Developed countries controlled.
- S typhi and S paratyphi are prevalent in India.
- Salmonella are primarily intestinal parasites of humans and many animals including wild birds , domestic pets and rodents, they may be isolated from their blood and internal organs.
- Found frequently in sewage , rivers and other waters and soil in which they do not multiply significantly.
- Under suitable conditions they may survive in waters and for years in soil.

- S.typhi and S.paratyphi in humans and S.para B in animals.
- typhoid spread through water, milk, food.
- HIV patients potentially susceptible for typhoid disease.
- Transmission ; close contact with acutely infected individuals or chronic carriers
- 13-17 million case per year
- 6,00000 deaths per year.

LABORATORY DIAGNOSIS

SPECIMENS

- Blood : 1st ten days and during the 3rd weeks
- Faeces : during 2nd and 3rd week
- Urine : 2nd week
- Vomit : food poisoning
- In chronic salmonellosis it may be bone marrow rather than blood.

MICROSCOPY

- Gram negative rods, faecal specimens from patient with typhoid usually contains macrophages and may contain blood in late stage infection.
- Food poisoning samples may contain few pus cells and red cells.

- Collection of sample in sterile , screw capped bottle.
- Transportation should be processed as soon as possible , in case of delay faeces should be transported in buffered glycerol -saline transport medium.
- Culture
- Serology perform Widal test.

CLINICAL COURSE

- Incubation period : 3-21 days.
- Fever :> 75% and abdominal pain : 20-40%.
- Symptoms : chills, headache, weakness, dizziness and muscle pain.
- Approx 1-5% of the patients become asymptomatic.
- Early physical finding rose spots in the trunk and chest region, hepatosplenomegaly and relative bradycardia.

TREATMENT

- Chloramphenicol
- Ampicillin or Trimethoprim Sulfamethoxazole.
- Ciprofloxcin and Norfloxacin

References

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THANK YOU