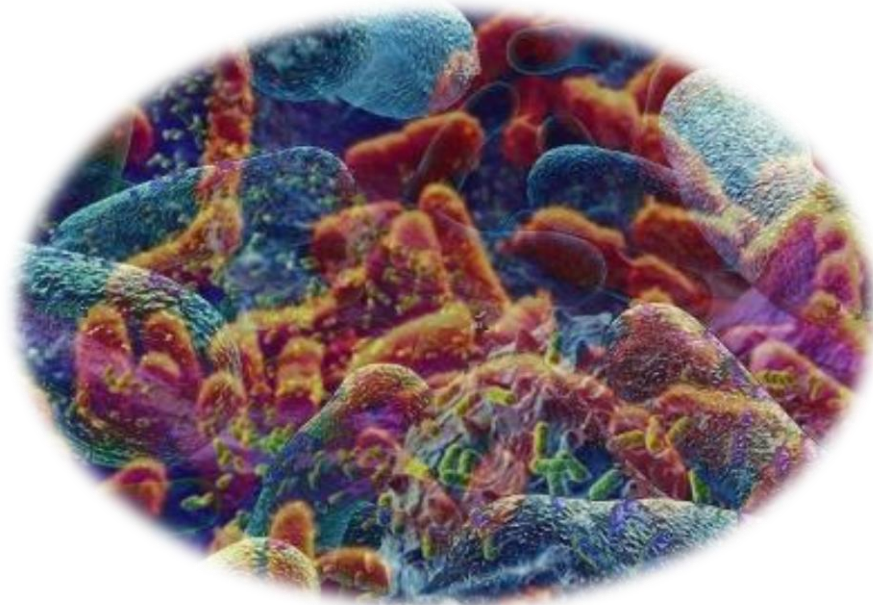


431 *Microbiology Team*

Salmonella & Shigella

GIT & HAEMATOLOGY BLOCK



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Salmonella

- **Gram negative facultative anaerobic bacilli.**
- Non lactose fermenting colonies → so it is pale on Macconkey agar.
- Invasive → invade wall of **SMALL INTESTINE** → can reach lymph nodes and bloodstream and cause sepsis.
- Motile → has flagella → H antigen
- Intracellular organism

Classification:

- Has two species ***S. enterica*** (six subspecies I, II, III, IV, V, and VI) ***S. borgori*** (rare). (not imp)
- Cold blooded animal, birds, rodents, turtles, snake and fish.

Two groups clinically; Salmonella **Typhi** (Causes Typhoid fever) and Salmonella **non-Typhi** (Causes Gastroenteritis).

Virulence Factor:

- Fimberia - adherence
- Enterotoxin

Antigenic structures:

- O. somatic antigen
- H. Flagellar antigen
- K. capsular antigen

Somatic antigen: is an antigen located in the cell wall.

Flagellar antigen: Found in the flagella of motile bacteria.

Capsular antigen: found in the capsules of certain microorganisms.

Clinical Features:

- **Acute gastroenteritis (=food poisoning = salmonellosis)**
- Non-typhoidal bacteremia → in immunocompromised, old and very young patients.
- **Typhoid fever**
- Carrier state following *Salmonella* infection

- Carrier State means the person has the bacteria but is not affected. They carry the bacteria in the gallbladder.
- Treated by: removal of the gallbladder.

Source:

Fecal-oral route:

- Water, food (e.g. Chicken) and milk contaminated with human or animal excreta.
- *Salmonella typhi* and *S. paratyphi* , From humans only.

Salmonella Causes:

- Typhoid fever
- Gastroenteritis

	<u>TYPHOID FEVER</u>	<u>GASTROENTERITIS</u>
Organism	<i>Salmonella typhi</i>	<i>S. enterica</i> <i>S.typhimurium</i>
Source	By contact or Ingestion of contaminated food by infected or carrier individual (From Human only)	Food poisoning through contaminated food poultry, milk, egg and handling Pets (From animals or humans)
Infective dose	10 ⁶ Bacteria	10 ⁶ Bacteria
Symptoms	<ul style="list-style-type: none">○ Prolonged fever○ Bacteremia○ Rose spots* → characteristic feature○ Fever○ Malaise○ Anorexia○ Constipation IP: 9-14 days (2 weeks) → prolong	<ul style="list-style-type: none">○ Fever○ Chills○ watery diarrhea○ abdominal pain (self-limiting) IP: 8 – 36 hrs (1-3 days) ¹
Treatment	<ul style="list-style-type: none">○ We start with Ceftriaxone <u>OR</u> Ciprofloxacin. (empiric)○ If sensitive to ampicillin we switch to it. (cheaper & Safer)	<i>Salmonella</i> gastroenteritis uncomplicated cases require fluid and electrolyte replacement only. - In nontyphoidal bacteremia: <ul style="list-style-type: none">○ We start with Ceftriaxone <u>OR</u> Ciprofloxacin. (empiric)○ If sensitive to ampicillin we switch to it. (cheaper & Safer)

¹ IP: incubation period

Features	<ul style="list-style-type: none"> ○ Common in tropical , subtropical countries and areas with sewage and poor sanitation. ○ Involvement of the reticuloendothelial system (liver, spleen, intestines and mesentery) ○ Dissemination* to multiple organs 	In sickle cell, ulcerative colitis, in immunocompromised, elderly or very young patient it may be severe →Cause non typhoidal bacteremia.
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Rose Spots: rose-colored spots on the abdomen and thighs

*Dissemination: spreading

- Sickle cell disease patients are prone to Salmonella infections (salmonella sepsis and osteomyelitis)

Progress of Typhoid fever:

<u>First week</u>	<ul style="list-style-type: none"> ○ POU Fever* ○ General non specific symptoms → malaise, anorexia, myalgia and a continuous dull frontal headache. ○ Patient develops <u>constipation</u> It invades Mesenteric lymph node → go to blood stream to liver, spleen and bone marrow → Engulfment of <i>Salmonella</i> by mononuclear phagocytes (multiply intercellular) → Released into the blood stream again that can lead to high fever (blood culture positive)
<u>2nd and 3rd Week</u>	<ul style="list-style-type: none"> ○ Sustained fever, prolonged bacteremia ○ Rose spots ○ Invade gallbladder and payer's patches ○ Billiary tract → GIT ○ Organism isolated from stool in large number

*POU Fever (pyrexia of unknown origin): refers to a condition in which the patient has an elevated temperature but no explanation has been found.

Complications:

- Necrotizing cholecystitis.
- Bowel hemorrhage and perforation (salmonella can perforate intestinal wall and go to peritoneum causing peritonitis).
- Pneumonia and thrombophlebitis.
- Meningitis, osteomyelitis, endocarditis and abscesses.

Shigella

- **Gram negative bacilli**
- Cause bacillary dysentery (blood, mucus and pus in the stool)
- Non lactose fermenter → so it is pale on Macconkey agar
- Not very Invasive → invade wall of **LARGE INTESTINE** → can not reach blood stream
- Non Motile → no Flagella → no H antigen

Clinical Infection:

- S.sonnei most predominant in USA (fever, watery diarrhea)
- S.flexneri 2nd most common
- S. dysenteriae and S. boydii are most common isolates in developing countries
- S.dysenteriae type 1 most severe.
- Human is the only reservoir.
- Penetrate epithelial cells leads to local inflammation, shedding of intestinal lining and ulcer formation
- Low infective dose < 200 bacilli

Grown in a special culture containing Bile salts?
To prevent the growth of any other bacteria that can
not live in the gut.

Antigen Structure:

- It has 4 species and 4 major O antigen groups.
- All have O antigens some serotype has K antigen.
- *Shigella* are non-motile, lack H antigen.

Source of infection:

- Person to person
- Flies, fingers, in psychiatric wards → because it has a low infective dose
- Food and water
- Young children in daycare, people in crowded area and anal oral sex in developed countries

Symptoms:

- High fever, chill, abdominal cramp and pain accompanied by **tenesmous***, **bloody stool with mucus & WBC.**
- Can lead to rectal prolapsed in children
- Bacteremia in 4 % of severely ill patient → very very very rare (as the doctor said we have never heard of shigella bacteremia or shigella sepsis)

*tenesmous: is the feeling of constantly needing to pass stools even if the bowels (or bladder) are already empty.

Treatment:

We start with **Ceftriaxone** OR **Ciprofloxacin**. (Empirically) → after doing sensitivity test if organism turns out to be sensitive to **ampicillin** we switch to it.

Why? Because it is cheaper & safer.

Summery (important points)

Difference between Salmonella and shigella:

- Both are gram negative and intracellular organisms → so you need good cellular immunity to get rid of the organisms.
- Both are Non lactose fermenter → so both are pale on Macconkey agar.
- **Slamonella** is **motile**, while **Shigella** is **non-motile**.
- **Salmonella** causes **watery diarrhea**, while **Shigella** causes **bloody diarrhea**.
- **Salmonella** mainly attacks the **small intestine**, while **Shigella** usually invades the **large intestine**.
- **Salmonella** is way **more invasive** that it can reach lymph nodes and blood stream and cause sepsis, **unlike shigella** which is **less invasive and localized**.
- Treatment: Shigellosis and typhoid fever must be treated. HOW?
 - We start with **Ceftriaxone** OR **Ciprofloxacin** Empirically → after doing sensitivity test and organism turns out to be sensitive to **ampicillin** we switch to it. Why? Because it is cheaper & safer.
 - Salmonellosis is self-limited and only requires fluid and electrolyte replacement **UNLESS** we are dealing with an immunocompromised patient (because in this case we are afraid of dissemination leading to non-typhoidal bacteremia and other complications) Ex: sickle cell disease or child below 2 years or elderly or cancer patients → in this case we treat with antibiotics.

	<u>TYPHOID FEVER: HUMAN DISEASE</u>	<u>SALMONELLOSIS: ZOOBOTIC AND HUMAN DISEASE</u>	<u>SHIGELLOSIS: HUMAN DISEASE</u>
Organism	Salmonella typhi → contain Vi antigen (Salmonella paratyphi causes paratyphoid fever, which is a milder disease)	Salmonella enterica, Salmonella typhimarium	S. dysenteriae S. boydii S. sonnei S. flexneri
History	Contact with infected person or drink water or eat food contaminated by feces of infected person (it is a Waterborne disease)	Main source → poultry and chicken ex: get infected after eating shawarma. Sickle cell disease is a risk factor	Contact with infected person or drink water or eat food contaminated by feces of infected person
Clinical presentation	<u>First week</u> : general symptoms (fever, malaise, headache) + constipation <u>Second week</u> : sustained fever + rose spots (Bacteremia must be present!)	Fever, watery diarrhea, and abdominal cramps (Bacteremia only if immunocompromised)	Fever, bloody diarrhea, abdominal cramps, and tenesmous. Bacillary dysentery → blood, mucus and pus in the stool
Complication	Perforation, peritonitis, death.	Bacteremia or sepsis	Intestinal obstruction, bacteremia is very very rare (almost never)
Treatment	Ceftriaxone OR Ciprofloxacin OR ampicillin.	Fluid and electrolyte replacement if not immunocompromised.	Ceftriaxone or Ciprofloxacin or ampicillin

Questions:

Q1: patient presented with fever, nausea and vomiting, and watery diarrhea. Stool culture shows gram-negative motile bacilli, most likely organism:

- A) Shigella
- B) Salmonella
- C) Cholera
- D) Campylobacter

Q2: in which of the following cases we do not treat with antibiotics:

- A) Cancer patient with salmonellosis
- B) 20 yrs old patient with salmonellosis
- C) 20 yrs old patient with shigellosis
- D) 20 yrs old patient with typhoid fever

Q3: patient presented with high fever, abdominal cramps, bloody diarrhea and tenesmous. Stool studies show presence of RBCs, pus cells and mucous.

What is the most likely organism?

- A) Shigella
- B) cholera
- C) salmonellatyphi
- D) salmonellaenterica

Q4: in previous case, what is the drug of choice?

- A) Ceftriaxone
- B) Doxycycline
- C) Metronidazole
- D) Gentamycin

Q5: A patient came to hospital because of with fever skin rash. While taking history “ patient said (last week I had with Flu like illness, Headache, fever, and constipation). Doctor immediately admitted the patient and gave the patient IV ceftriaxone. Doctor also took tissue biopsy from the area of skin rash.

What do you expect to see under microscope?

- A) Gram positive diplococci
- B) Gram negative non-motile bacilli
- C) Gram negative motile bacilli
- D) Acid Fast Bacilli

Answers: Q1: B Q2: B Q3: A Q4: A Q5: C