

Lecture – 6

Salmonella and Shigella



Microbiology Team 430

Done By:

Mohanned Al-Essa

Khawla Al-Othman

Ghadeer Alwuhayed

Hanan Alrabiah

Hanan Alsalman

Salmonella

- Gram negative facultative anaerobic bacilli
- Non lactose fermenting colonies
- It has flagellum → **Motile organism**

❖ *Classification*

- Has two species S.enterica (**common one**) (six subspecies I, II, III, IV, V, VI) **and** S.borgori (rare)
- It affected Cold blooded animal, birds, rodents, turtles, snake and fish

❖ *Virulence Factors*

- Fimbria → help to **Adherence**
- **Enterotoxin** (is a protein toxin released by a microorganism in the intestine)

Fimbria : is a proteinaceous appendage in many Gram-negative , that is thinner and shorter than a flagellum . Fimbriae are used by bacteria to adhere to one another and to adhere to animal cells .

❖ *Antigenic Structures*

- **O.** somatic antigen → (**Heat – stable**) is lipopolysaccharide in the out membrane. (doesn't break down in the heat)
- **H.** Flagellar antigen (in the flagellum) → (**Heat labile**) (break down in the heat)
- **K.** capsular antigen, but in salmonella it's a virulence capsule so that they name it V_I , For salmonella serotype Typhi vs phagocytosis

❖ *Clinical Features*

- Acute gastroenteritis
- Typhoid fever
- Nontyphoidal bacteremia
- Carrier state following salmonella infection

❖ *Source*

- Salmonella non typhi → Water, food and milk contaminated with human or **animal excreta**
- **Salmonella typhi and S. paratyphi** → the source is human

Salmonella can cause two diseases :

- Gastroenteritis
- Typhoid fever

	Gastroenteritis	Typhoid fever
Organism	S. enteric (salmonella non typhi)	Salmonella serotype Typhi or S. Paratyphi A,B,C
Source	Poultry (like chicken) , milk, egg & egg products and handling pets (from animals)	Ingestion of contaminated food by infected or carrier individual (from human)
Infective dose	10 ⁶ bacteria (high infective dose)	10 ⁶ bacteria
Incubation Period	8 – 36 hrs.	9 – 14 days (1-2 weeks)
Symptoms	<ul style="list-style-type: none"> • Food poisoning through contaminated food • fever, chills, watery diarrhea and abdominal pain 	<ul style="list-style-type: none"> • Prolonged fever • Bacteremia (systemic disease) → skin rash (rose spot) • The patients usually <u>didn't</u> come with diarrhea • Patients may be come with <u>bradycardia</u>
Treatment	<p>self- limiting but require fluid and electrolyte replacement only .</p> <p>expect in a specific situation like :</p> <ul style="list-style-type: none"> • In sickle cell patients (hemolytic disorder) • ulcerative colitis • elderly people • very young patient (children less than 2 years) • immunocopromised patients <p>→ we can use some antibiotic such as</p> <ul style="list-style-type: none"> • Chloramphenicol • Ampicillin • Trimelhoprim – sulfamethoxazole • Fluid replacement 	<ul style="list-style-type: none"> • We have to treat them from 10-14 days → we can use some antibiotic such as • Chloramphenicol • Ampicillin • Trimelhoprim – sulfamethoxazole • Fluid replacement
Some features	<ul style="list-style-type: none"> • The infection may be very severe. • At high risk for dissemination (spread to other organs) and Antimicrobial indicated 	<ul style="list-style-type: none"> • Involvement of the reticulo endothelial system (liver, spleen, intestines and mesentery) • Dissemination to multiple organs • We should ask patients about travelled history because the Tropical subtropical and Traveler (swage, poor sanitation) → at risk to develop the disease

Development of typhoid fever(Enteric Fever) disease :

First Week	2nd and 3rd week
<ul style="list-style-type: none">• Fever, malaise, anorexia, myalgia and a continuous dull frontal headache (flu like illness)• then Patient develops constipation• Mesenteric lymph node → blood stream liver, spleen and bone marrow• Engulfment of salmonella by mononuclear phagocytes (multiply intercellularly)• Released into the blood stream again that can lead to high fever (bacteremia)	<ul style="list-style-type: none">• Sustain fever prolonged bacteremia• Invade gallbladder and payer's patches (in ilium)• Rose spots (skin rash) of the 2nd week of fever• Billiary tract →GIT• Organism isolated from stool in large number <p>After invasion of the gall bladder, it get necrotized and the patient is presented asymptotically but the organism is still there so they try treating it by antibiotics, and if the antibiotics didn't work they do surgery.</p>
Best diagnostic way : blood culture (blood culture positive)	Stool analysis (the organism isolated from stool in large number .) → Stool (+)

Pathophysiology of typhoid fever (Enteric Fever) disease :_(for your knowledge)

Organism enter the body and can tolerate gastric acidity → small intestine → large intestine (this will cause initially some symptoms - *Flu like illness* – Headache, fever, constipation) → Lymph Nodes → Reticuloendothelial system → Blood → Bactermia (fever, skin rash - rose spot -)

From blood → Distal organs (*Gall Bladder, Joints, Bones*)

Complication :

- Necrotizing cholecystitis
- Bowel hemorrhage and perforation
- Pneumonia and thrombophlebitis
- Meningitis, osteomyelitis, endocarditis and abscesses.

Shigella

- Gram negative bacilli Non lactose fermenter
- **Non motile organism (there is no flagellum)**
- Cause **bacillary dysentery** (blood, mucus and pus in the stool)

Dysentery: is an inflammatory disorder of the large intestine, that results in small amount of stool containing blood, pus and mucus.
And abdominal pain that will be relieved by passing stool.

❖ Antigenic Structure

- Has 4 species and 4 major O antigen groups → **S. dysenteriae** , s. boydii , S.sonnei and S.flexneri
- All have O antigens some serotype has K antigen (heat labile removed by boiling)
- **Shigella are non-motile → lack H antigen (flagellar antigen)**

❖ Clinical Infection

- **S.sonnei most predominant in USA** (fever, watery diarrhea)
- S.flexneri 2nd most common
- Young adult (man who have sex with man)
- S. dysenteriae and s. boydii are **most common** isolates in developing countries
- **S. dysenteriae type 1 associated with morbidity and mortality** → severe cases usually in underdeveloped countries
- **Human is the only reservoir**
- **Low infective dose < 200 bacilli** **Highly Infectious**
- The organism will Penetrate epithelial cells → **leads to local inflammation, shedding of intestinal lining and ulcer formation (very rare causing bacteremia)**

❖ Source

- Person to person **through fecal -oral route**
- Flies, fingers
- 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 **tenesmus of bloody stool** with mucus & WBC
- **Incubation Period: 24 - 48 hrs (1-2 days)**
- **Can lead to rectal prolapsed in children**
- Complication ileus, obstruction dilatation and toxic mega colon
- Bacteremia in 4 % of severely ill patient
- Seizures, HUS = Hemolytic uremic syndrome

Summary

	Salmonella	Shigella
Organisms	Non lactose fermenter gram negative bacilli	Non lactose fermenter gram negative bacilli
Motility of the organism	Motile	Non motile
Incubation period	Gastroenteritis → 8-36 hrs Typhoid fever → 1-2 weeks	24 - 48 hrs (1-2 days)
Infective dose	10 ⁶ bacteria Low infectious	Low infective dose < 200 bacilli Highly Infectious
Antigenic structure	O. Somatic Antigen (Heat Stable) H. Flagellar Antigen (Heat Labile) VI. Capsular Antigen	O. Somatic Antigen K. Capsular Antigen

- **Salmonella typhi and S. paratyphi → the source is human**
- Shigella cause large intestinal disease
- The best diagnostic ways in salmonella typhi → 1st week : **blood culture** , 2nd , 3rd week : stool analysis But shigella → **stool analysis**
- **Shigella are non-motile organism → lack H antigen (flagellar antigen)**
- Typhoid fever may be complicated to necrosis of the **gall bladder** or **Bowel hemorrhage and perforation**
- Shigella cause **bacillary dysentery** (blood, mucus and pus in the stool)
- The patient with shigella come with **High fever**, chill, **lower abdominal cramp and pain** accompanied by **tenesmus of bloody stool** with mucus
- **Human is the only reservoir** in case of shigella
- Shigella may be lead to **rectal prolapsed** in children
- **No treatment in case of gastroenteritis expect in special situation .**
- The treatment is a must in all cases of shigella expect s.sonnei
- **S. dysenteriae type 1 associated with morbidity and mortality.**
- Patients with typhoid fever , we must treat them with some antibiotic such as **Ampicillin from 10-14 days**
- Incubation period of typhoid fever **from 1-2 weeks**
- **S. Dysenteriae** and **s. Boydii** are most common in our country
- **S.sonnei** is the most common in USA