SALMONELLA & SHIGELLA

GIT BLOCK

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Objectives

1-Develop an algorithm using biochemical tests to identify and classify *Salmonella* and *Shigella*

2- Describe the antigenic structures and virulence factors of *Salmonella* and *Shigella*

3- Compare the pathogenesis of various species of *Salmonella* and *Shigella*

4-Describe the clinical features and risk factors for the infection with the two organisms

5- Describe the general concepts for the management of gastroenteritis caused by both organisms.

Salmonella

Introduction

- **Salmonella** is a Gram negative facultative anaerobic bacilli
- Non lactose fermenting
- Motile

Classification

- **Two species of salmonella : *S.enterica*** (six *subspecies I, II, III, IV, V, VI)& S.borgori* **(rare)**

- **Found in cold blooded animal, birds, rodents, turtles, snakes and fish**

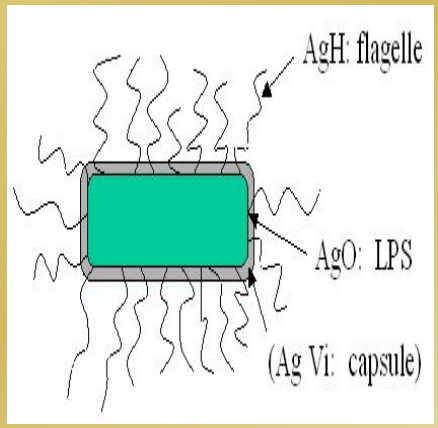
Virulence factors

- Fimbriae (Pili) : for adherence
- Enterotoxin

Antigenic structures

- **O. Somatic antigen**
- **H. Flagellar antigen**
- **K. Capsular antigen**

- **V_i surface polysaccharide antigen in *Salmonella serotype typhi* prevents phagocytosis & allow intracellular survival.**
- **O Antigen (Heat – stable) is lipopolysaccharide in the outer membrane**
- **H antigen (Heat labile)**



Clinical diseases

- Acute gastroenteritis
- Typhoid fever
- Nontyphoidal bacteremia
- Carrier state following *Salmonella* infection

Source

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

Salmonella gastroenteritis

- Food poisoning through contaminated food
- *S. enterica* subsp. *enterica the common cause*
- Source :poultry, milk, egg & egg products and handling pets
- Infective dose: 10^6 bacteria
- Incubation period : 8 – 36 hrs.
- fever, chills, watery diarrhea and abdominal pain. Self limiting.
- In sickle cell ,hemolytic disorders , ulcerative colitis, elderly or very young patients; the infection may be very severe.
- Patients at high risk for dissemination and antimicrobial therapy is indicated.

Enteric fever
(Typhoid fever)

- Prolonged fever
- Bacteremia
- Involvement of the reticulo endothelial system (liver, spleen, intestines and mesentery)
- Dissemination to multiple organs
- Ingestion of contaminated food by infected or carrier individual
- Caused by *Salmonella* serotype *typhi* or *S. paratyphi* A, B and C (less severe)
- Common in tropical , subtropical countries, and travelers to these countries due to inappropriate sewage disposal and poor sanitation.
- Incubation period : 9 – 14 days.

First week: fever, malaise, anorexia, myalgia and a continuous dull frontal headache then,

- Patient develops constipation
- Mesenteric lymph node → blood stream liver, spleen and bone marrow
- **Engulfment of *Salmonella* by mononuclear phagocytes .**
- Bacteria released into the blood stream again and can lead to high fever . Blood culture is positive.

2nd and 3rd week

- Sustained fever & prolonged bacteremia.
- Invade gallbladder and Payer's patches
- Rose spots 2nd week of fever
- Billiary tract → GIT
- Organism isolated from stool .

Management & Treatment

Enteric fever:

- **Ceftriaxone**
- **Ciprofloxacin**
- **Trimelhoprim – Sulfamethoxazole**
- **Ampicillin**
- **Azithromycin or Ceftriaxone for patients from India and SE Asia due to strains resistant to Ciprofloxacin. Ciprofloxacin can be used for patients from other areas.**

Salmonella gastroenteritis:

- **Uncomplicated cases require fluid and electrolyte replacement only.**

COMPLICATIONS

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

Shigella

- **Shigella** is non lactose fermenting Gram negative bacteria
- Cause bacillary dysentery (blood, mucus and pus in the stool)

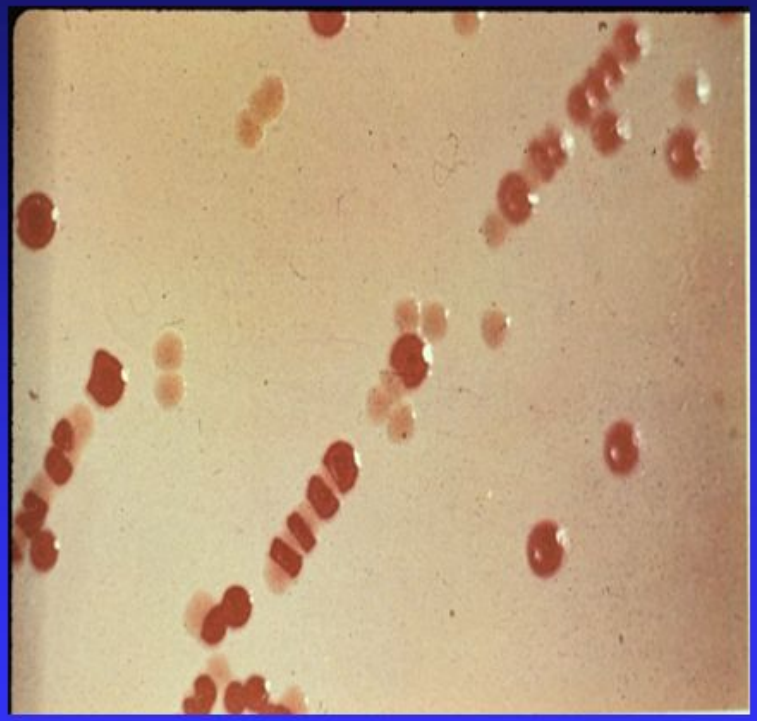
ANTIGENIC STRUCTURES

- **Shigella has four species and four major O antigen groups:**

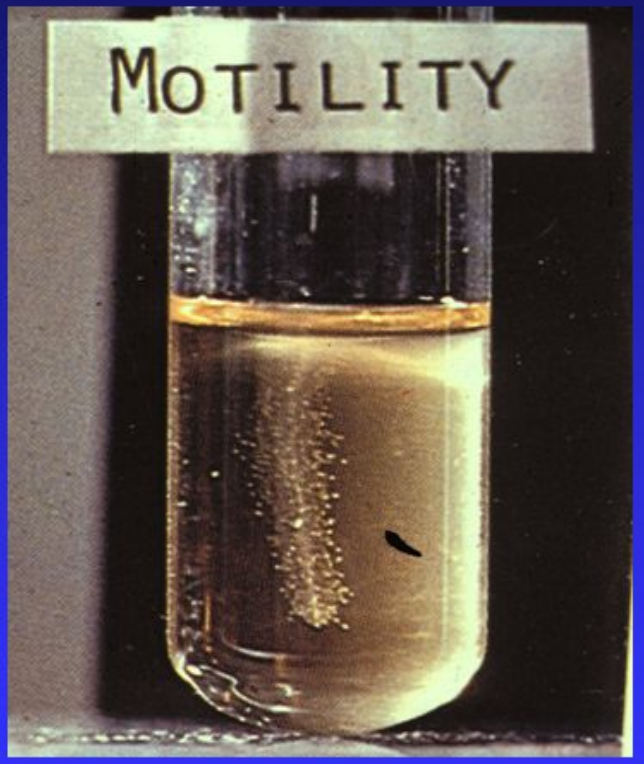
***S.dysenteriae, S.flexneri. S.boydii & S.sonnei*.**

- **All have O antigens , some serotypes has K antigen**
- ***Shigella* are non motile so lack H antigen**

Shigella on MacConkey Agar



Non-lactose fermenter



Non-motile

CLINICAL INFECTION

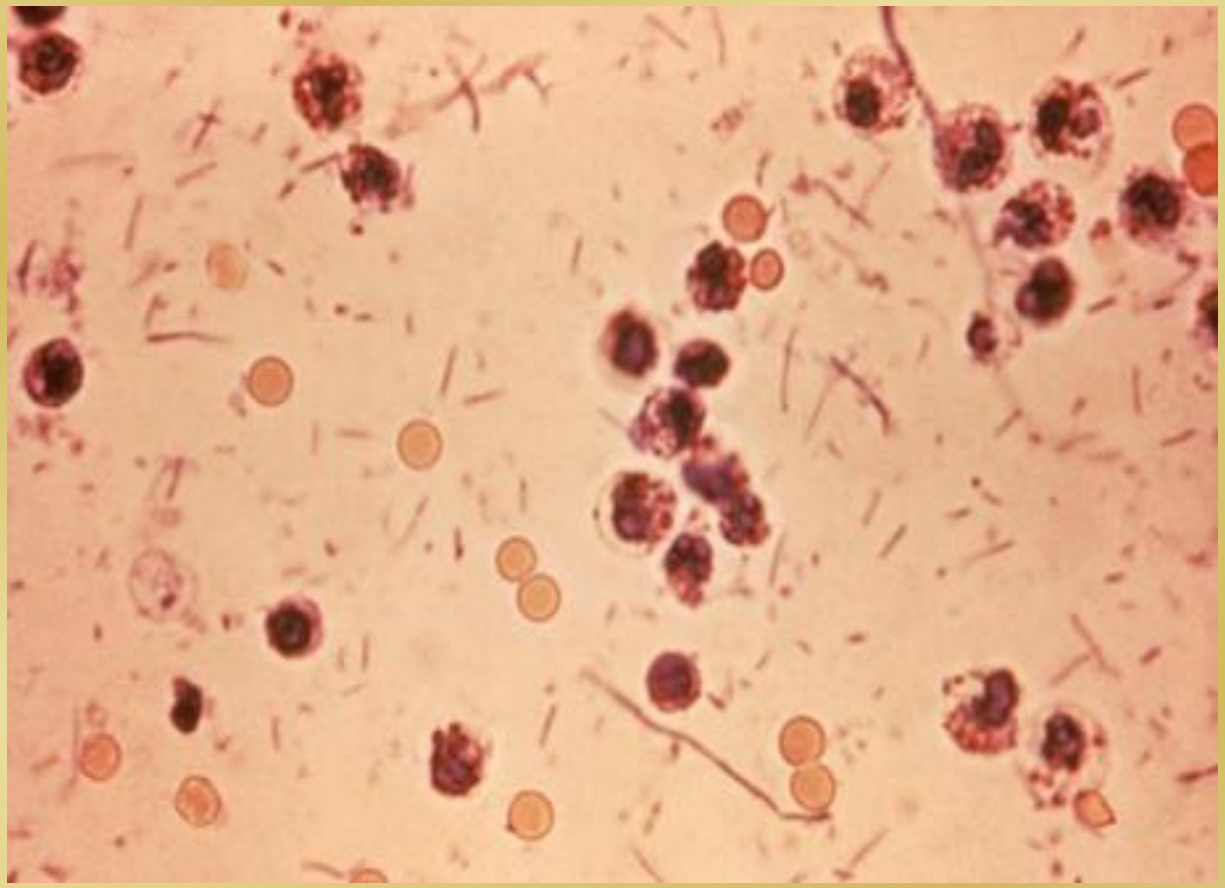
- *S. dysenteriae* type 1 associated with morbidity and mortality
- *S. dysenteriae* and *S. boydii* are most common isolates in developing countries
- *S.flexneri* :2nd common in developing countries
- *S.sonnei* : most predominant in USA. Produce fever & watery diarrhea.
- Human is the only reservoir

- Person to person through fecal –oral route .
- Flies, fingers (have a role in spread).
- Food and water.
- Young children in daycare, people in crowded area and anal oral sex in developed countries.
- Low infective dose < 200 bacilli
- Penetrate epithelial cells ,leads to local inflammation, shedding of intestinal lining and ulcer formation.

SYMPTOMS

- High fever, chill, abdominal cramp and pain accompanied by **tenesmus , bloody stool with mucus & leukocytes.**
- Incubation period : 24 - 48 hrs
- Can lead to rectal prolapsed in children
- Complications: ileus, obstruction dilatation and toxic mega colon
- Bacteremia in 4 % of severely ill patient
- Seizures, HUS (hemolytic uremic syndrome)

DYSENTRY STOOL



Laboratory diagnosis of *Salmonella* & *Shigella* from stool

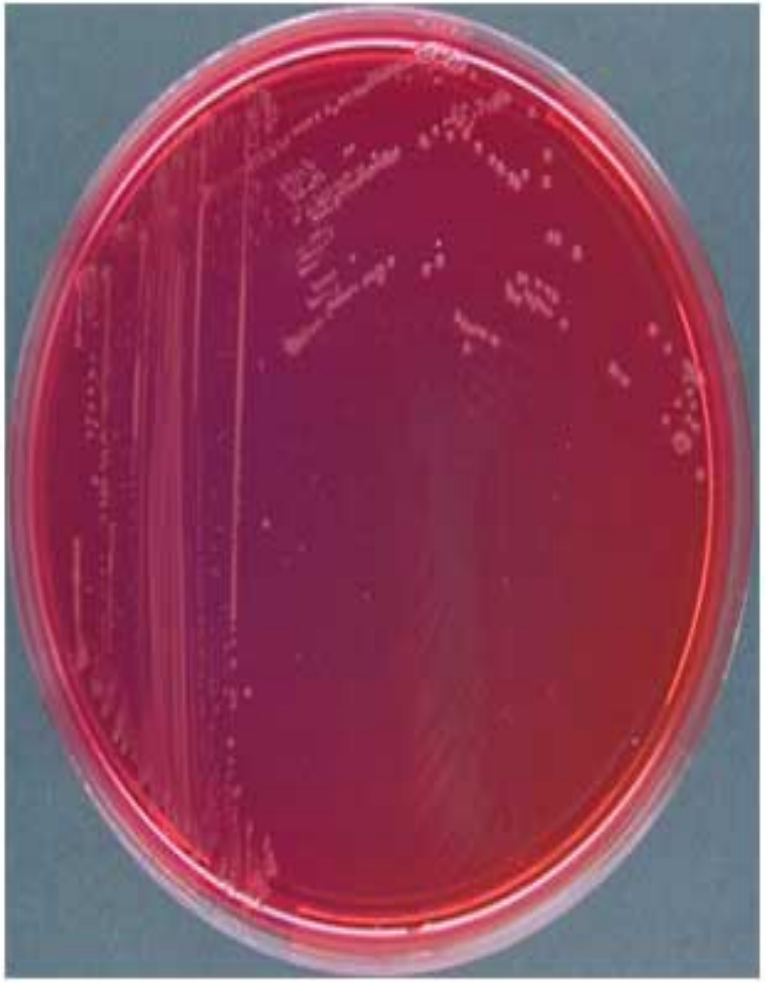
-Both are Gram negative bacilli

-Culture in selective media (*Salmonella* produce black colonies)

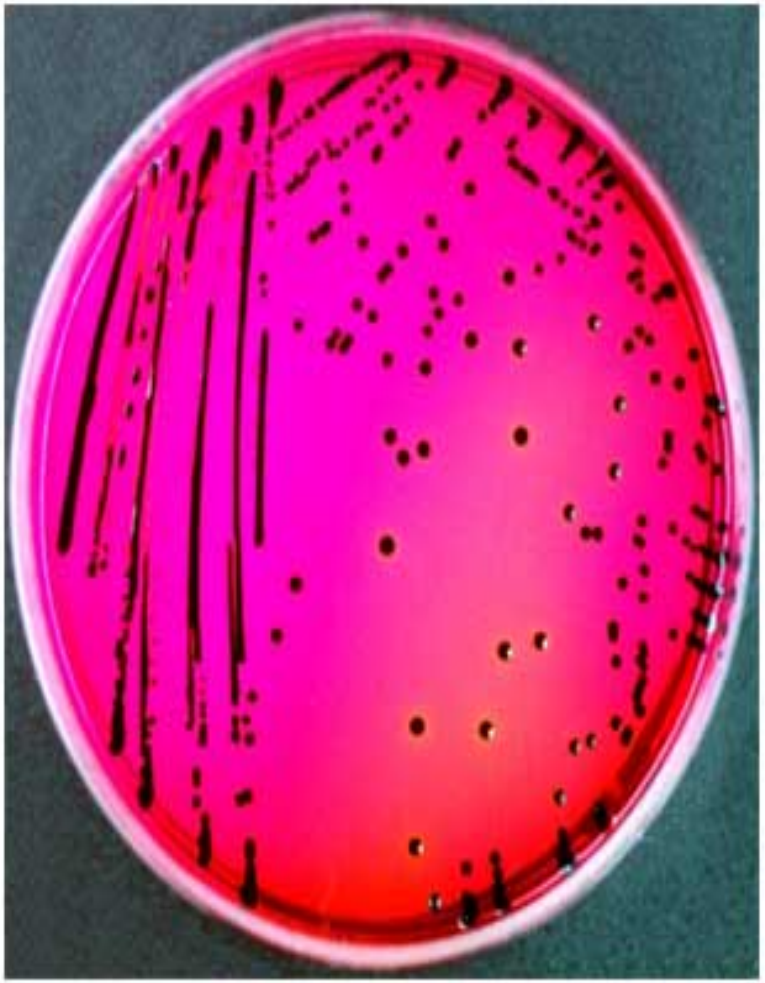
-Biochemical tests

-Motility test

-Serology for serotypes.



Shigella on XLD.



Salmonella on XLD.

Image Source: Faculty of Health and Medical Sciences - University of Copenhagen, Denmark

BIOCHEMICAL TESTS

Serology

Usually in ***Salmonella, Shigella*** and ***E.coli*** *the* final detection is by serotyping using agglutination Ag+Ab test.

Treatment of *Shigella* Dysentery

-Antibiotic indicated if symptoms severe and to reduce duration of illness.

-Antimicrobial agents depending on susceptibility testing including :

Ampicillin

Ceftriaxone

TMP-SMX

Ciprofloxacin