Shigella

- Dysentery : characterized by loose motion mixed with blood & mucus
- Bacillary dysentery, mainly caused by genus Shigella, so named after Shiga , who isolated the 1st member of this genus in1896 in Japan.
- Enteroinvasive E Coli, Campylobacter & V parahaemolyticus can also cause the same clinical condition of dysentery.

Morphology

- Short, Gram negative bacilli
- Nonmotile
- Noncapsulated, Nonsporing
- 0.5 µ x 1- 3 µ in size
- Fimbriae may be present

Culture characteristics

- Aerobes and facultative anaerobes, optimum temperature of 37ºc,PH 7.4.
- Can grow on ordinary media
- On NA colonies are about 2mm in diameter,circular,convex,smooth & translucent.
- On MacConkey or DCA – colorless colony except Sh. Sonnei-late lactose fermenter

Resistance

- killed at 56ºc in one hour & by 1 % phenol in 30 minutes.
- Destroyed by boiling or chlorination of water,& pasteurization of milk.
- In faeces they die within a few hours due to acidity produced by the growth of coliforms.
- Sh sonnei in general more resistant than other species.

Biochemical reaction

- MR positive & reduce nitrates to nitrite.
- Can not utilize citrate, do not form H2S
- Catalase +ve except Sh dysenteriae type 1
- Glucose with acid only except Newcastle & Manchester biotypes of Sh flexneri type 6.
- Mannitol fermentation except Sh dysentriae

Classification

- classified into 4 species or subgroups based on biochemical & serological characteristics.
- Sh.dysentriae (subgroup A)
- Sh.flexneri (subgroup B)
- Sh.boydii (subgroup C)
- Sh. sonnei (subgroup D)

Biochemical reaction of shigella species

Subgroup	A	B	C	D
Species	Sh.dysentriae	Sh. flexneri	Sh. boydii	Sh. sonnei
Mannitol	-	A	A	A
Lactose	-	-	-	A late
Sucrose	_	_	_	A late
Dulcitol	_	_	d	_
Indole	d	D	d	_
Serotypes	10	6+2variants	18	**2phase 17colicin type**

Sh. dysentriae

- Mannitol nonfermenting bacilli consist of 10 serotypes.
- Type 1 originally described by Shiga (Sh.shigae). indole negative & catalase –ve
- Unique among shigellae forming exotoxins
- Three types of toxic activity: neurotoxin,enterotoxin,cytotoxin
- Type 1 causes the most severe type of bacillary dysentery associated with complication.

Virulence factors

- Shiga toxin – is produced by *S. dysenteriae* and in smaller amounts by *S. flexneri* and *S. sonnei.*
  - Acts to inhibit protein synthesis by inactivating the 60S ribosomal subunit by cleaving a glycosidic bond in one of the rRNA constituents.
  - This plays a role in the ulceration of the intestinal mucosa

- Outer membrane and secreted proteins
  - These proteins are expressed at body temperature and upon contact with M cells in the intestinal mucosa they induce phagocytosis of the bacteria into vacuoles.
  - *Shigella* destroy the vacuoles to escape into the cytoplasm.
  - From there they spread laterally (Polymerization of actin filaments propels them through the cytoplasm.) to epithelial cells where they multiply but do not usually disseminate beyond the epithelium.

- Type 2 (Sh.schmitzi) forms Indole & ferments sorbitol & rhamnose.
- Serotypes 3 -7 : Large – Sachs group
- Three other serotypes

Sh.flexneri (subgroup B)

- Flexner described mannitol fermenting shigellae from Philippines.
- Antigenically most complex
- Based on type specific & group specific antigens, classified into 6 serotypes.(1-6)
- Serotypes 6 is always Indole negative & occurs in 3 biotypes some of which form gas from sugars. Boyd 88,Manchester,Newcastle

Sh.boydii(subgroup C)

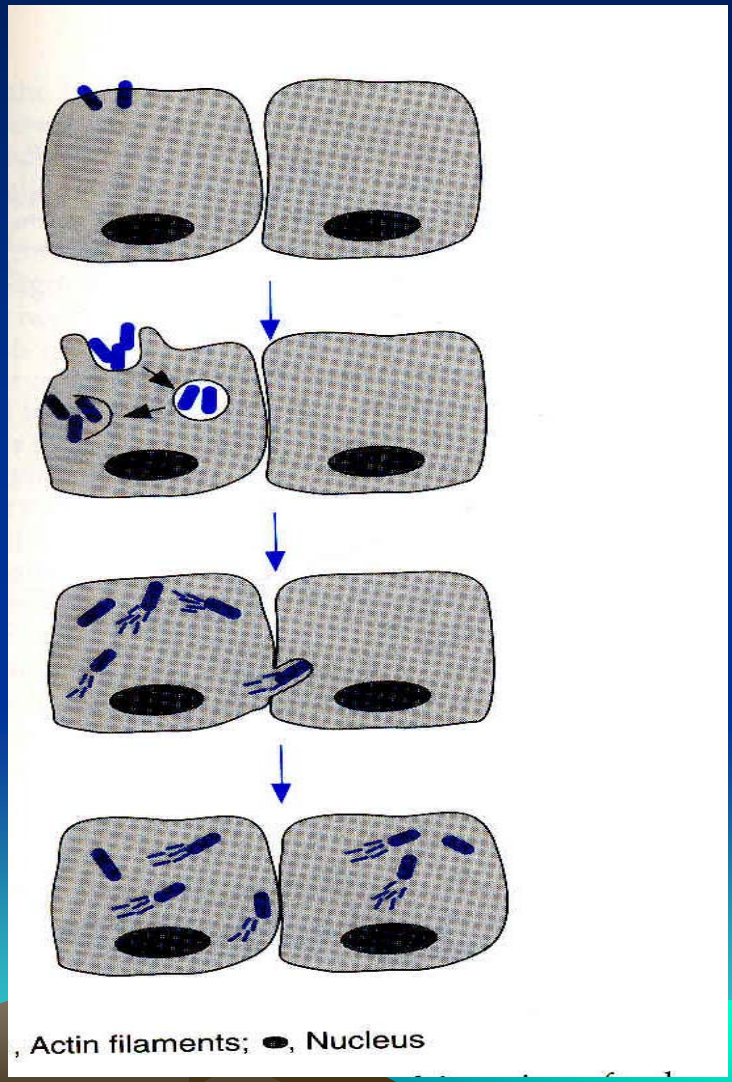
- Resemble Sh flexneri Biochemically but not antigenically
- Boyd described this strain from India
- 18 serotypes identified
- Less frequently isolated from cases of bacillary dysentery.

Sh.sonnei(subgroup D)

- Described by Sonne in Denmark
- Ferments lactose & sucrose late, Indole negative.
- Occurs in 2 forms-phase 1 & phase 2
- Causes the mildest form of bacillary dysentery in advanced countries.

Pathogenesis

- Infection occurs by ingestion
- Infecting dose is low, as few as 10-100 bacilli .
- Infect the epithelial cells of villi in the large intestine & multiply inside them, spreading laterally to involve adjacent cells & penetrating into the lamina propria.



- Inflammatory reaction develops & forms superficial ulcers.
- Bacteraemia may occur in severe infection in malnourished patient.

- Clinical significance
  - Causes shigellosis or bacillary dysentery.
  - Transmission is via the fecal-oral route.
  - The infective dose required to cause infection is very low (10-200 organisms).
  - There is an incubation of 1-7 days followed by fever, cramping, abdominal pain, and watery diarrhea (due to the toxin)for 1-3 days.

- This may be followed by frequent, scant stools with blood, mucous, and pus (due to invasion of intestinal mucosa).
- It is rare for the organism to disseminate.
- The severity of the disease depends upon the species one is infected with.
  - *S. dysenteria* is the most pathogenic followed by *S. flexneri*, *S. sonnei* and *S. boydii*.

- Complications : Arthritis, toxic neuritis,conjuctivits,parotitis,intussusceptio n in children with Sh. dysentriae.

Dysentery carriers

- Acquired after recovery from acute attack
- Excrete the bacilli in stool intermittently, but a small person become persistent carriers.
- Diagnosis is made by culture of stool.

Laboratory diagnosis

- Isolation of bacillus from feaces.Specimen may be stool, mucus flakes, rectal swab.
- Microscopic examination of stool: large number of pus cells, RBC & Macrophages.
- Culture of the specimen : Identified with colony Character & Biochemical reaction.
- Slide agglutination test :

Treatment

- Supportive measures & Antibiotics:
- Control :
- Adequate sanitation & personal hygiene
- Treatment of patients & carriers

Pseudomonas aeruginosa

Introduction

- Ps. Pyocyanea, Bacillus pyocyaneus
- Mostly saprophytic, being found in water, soil or other moist environment
- pathogenic to plants, insects or reptiles (some strains)
- Colonizes the tissues & Cause typically opportunistic infections
- Resistant to almost every antibiotics

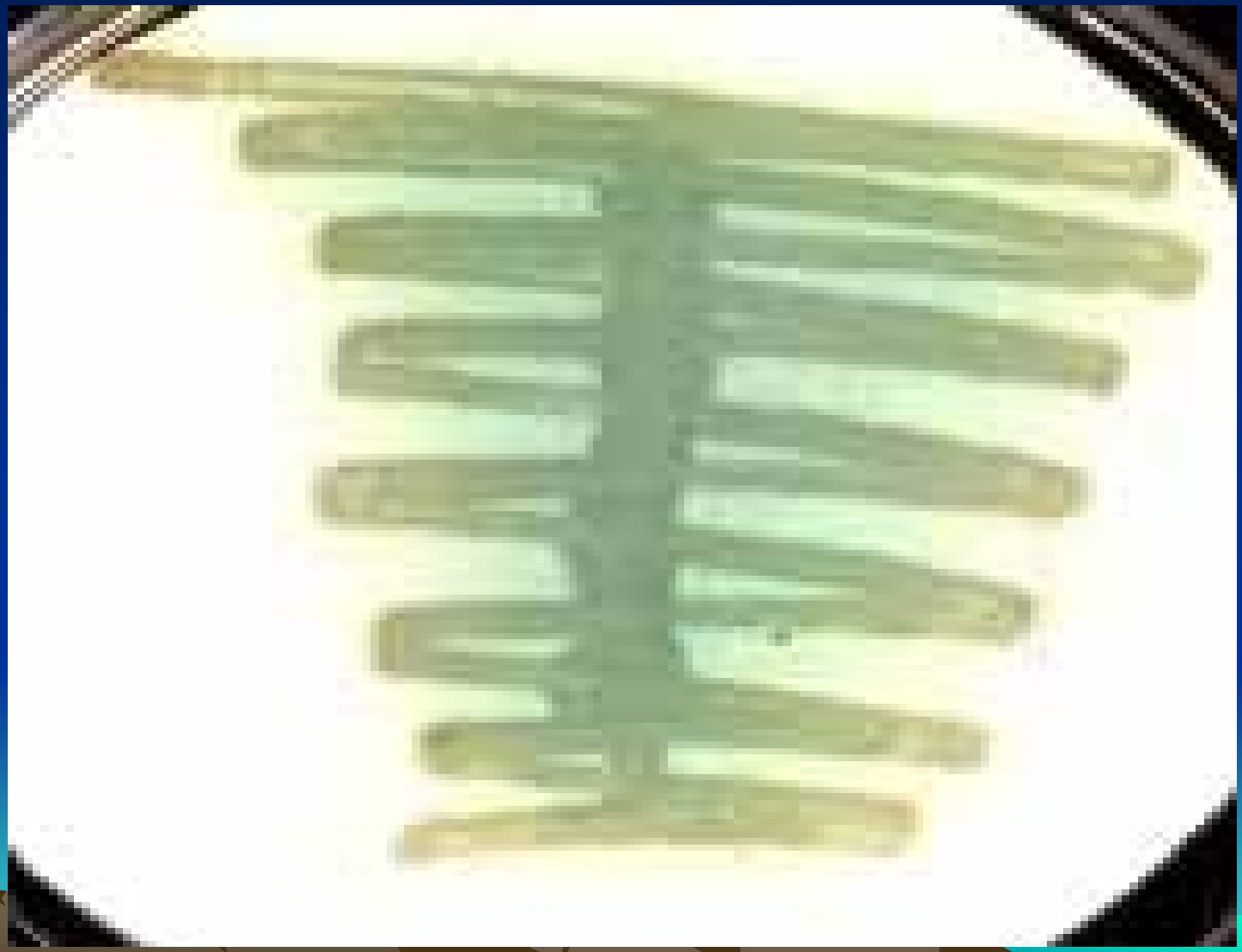
Morphology

- Gram negative slender bacilli
- Actively motile
- Non capsulated (Often form a loose capsule)
- Clinical isolates are often piliated

Culture characters

- Strict aerobes, but can grow anaerobically if nitrate is available.
- N.agar : Large, opaque, irregular with musty or earthy smell. Produce pigments i.e. pyocyanin (bluish green), pyoverdin (greenish yellow), pyorubin (red), pyomelanin (brown)
- Mac Conkey agar: NLF
- Blood agar: hemolytic
- Selective media (Cetrimide agar)

Pigment on N.agar



Pigment by Pseudomonas

Pyoverdin pigment on Flo Agar

Pyocyanin pigment on Tech agar

Biochemical reactions

- Glucose : Acid only
- IMViC : - - - +
- Catalase test : Positive
- Oxidase test: Positive
- Nitrates are reduced to Nitrite
- Arginine dihydrolase test : Positive

Virulence factors

- Exotoxin A & S : Mechanism of action is similar to diphtheria toxin & stops protein synthesis
- Protease
- Elastase
- Hemolysin
- Enterotoxin

Factors promoting infection

- Slime layer – to form biofilm –infection
- Breach in primary body defenses
- Bacterial exoproducts
- Bacterial pilli
- Lipopolysaccharide and the alginate glycocalyx

Wound inf. By Pseudomonas

Pathogenicity

- ‘Blue pus’, the term aeruginosa, means verdigris which is bluish green in colour
- Localised lesions : Infection of wounds, bedsores, eye infection
- Iatrogenic infections: Meningitis followed by lumbar puncture, post tracheostomy pulmonary infection
- PUO (Shanghai fever) resembling typhoid fever
- Infantile diarrhoea, sepsis

Laboratory Diagnosis

- Grow readily on most media.
- Pigment production helps in identification
- Prompt oxidase reaction and arginine hydrolysis
- Repeated isolation help to confirm the diagnosis


Thank u