SHIGELLA INFECTION

Dysentery is a common infectious disease of man, caused by bacterium of genus Shigella.

- **Dysentery is characterized by principal damage of the mucous membrane of the distal section of the large intestine.**

- The disease is accompanied by symptoms of the general intoxication, abdominal spastic pains, frequent watery stool with admixture of mucus and blood, and tenesmus.

INTRODUCTION

- Shigella organisms cause bacillary dysentery, a disease that has been recognized since the time of Hippocrates.

- Shigellosis occurs world-wide. The incidence in developing countries is 20 times greater than that in industrialized countries.

- >95% of shigella infections are asymptomatic hence the actual incidence may be 20 times higher than is reported.

THE SHIGELLA BACILLUS

- Shigella species are aerobic, non-motile, glucose-fermenting, gram-negative rods.
- It is highly contagious, causing diarrhea after ingestion of as a few as 180 organisms.
- Shigella spreads by fecal-oral contact, via contaminated water or food.
- Epidemics may occur during disasters, in day-care centers & nursing homes.

THE SHIGELLA BACILLUS

- 4 species of shigella are identified, namely:
  - Shigella dysenteriae
  - Shigella Flexneri
  - Shigella Sonnei
  - Shigella Boydii
  - Every group is divided into serologic types and subtypes

- Shigella dysenteriae is the most virulent, but sonnei is the most common.

VIRULENCE

- Virulence in shigella species is determined by chromosomal & plasmid-coded genes.
- Chromosomal genes control cell wall antigens that are resistant to host defense mechanisms.
- Plasmid genes control production of cytotoxin and siderophores. The cytotoxins are both enetrotoxic and neurotoxic.
- Shigella invades colonic mucosa & causes cell necrosis using both virulent agents.

Epidemiology

- **The sources of the infection are the patients with acute or chronic forms of dysentery, persons in the period of convalescence and carries.**

- **The persons with mild, chronic forms and carries of the disease are most dangerous**

- The mechanism and factors of the transmission of the infection is fecal-oral.

- The transmission of the infection is realized through contaminated food-stuffs and water. Infection of food-stuffs, water, different objects happens due to direct contamination by infected excrements, through dirty hands and also with participation of flies.

- Dysentery is characterized by seasonal spread like other intestinal infections. It is registered more frequently in summer and autumn.

PATHOHENESIS

- *Shigella* adheres to intestinal epithelial cells and M cells. After adhering to the host cells, the bacteria use a type III secretors system to inject bacterial proteins into the host cells.
- These bacterial proteins cause the host cells to ruffle and ingest the bacterial cells.
- Once in the cells, the bacteria use a surface hemolysin to lyse the phagosome membrane and escape into the cytoplasm.

PATHOHENESIS

- The bacteria then use the host cells' actin to move around inside the cell (actin rocket tails). When bacteria reach the periphery of the cell, the cell pushes outward to form membrane projections, which are then ingested by adjacent cells.
- Some strains of the *Shigella* genus produce the shiga toxin or verotoxin, which is similar to the verotoxin of *E coli* O157:H7. The shiga toxin or verotoxin enters the cytoplasm of the host cells and stops protein synthesis by removing an adenine residue from the 28S rRNA in the 60S ribosomal unit. This toxic activity results in death of the host cells.

PATHOHENESIS

- The cell-to-cell travel and toxin activity produces superficial ulcers in the bowel mucosa and induces an extensive acute inflammatory response. The inflammatory response usually prevents entry of the bacteria into the bloodstream. Unlike certain species of *Salmonella* (e.g., *S typhi, S paratyphi* A), *Shigella* only rarely enters the bloodstream.

Pathogenesis of Shigella

- **Shigellosis**

- **Two-stage disease:**
  - **Early stage:**
    - **Watery diarrhea attributed to the enterotoxic activity of Shiga toxin following ingestion and noninvasive colonization, multiplication, and production of enterotoxin in the small intestine**
    - **Fever attributed to neurotoxic activity of toxin**
  - **Second stage:**
    - **Adherence to and tissue invasion of large intestine with typical symptoms of dysentery**
    - **Cytotoxic activity of Shiga toxin increases severity**

Pathogenesis and Virulence Factors (cont.)

- **Virulence attributable to:**
- **Invasiveness**
  - **Attachment** (adherence) and **internalization** with complex genetic control
  - Large multi-gene virulence plasmid regulated by multiple chromosomal genes
- **Exotoxin (Shiga toxin)**
- **Intracellular survival & multiplication**

Pathogenesis and Virulence Factors (cont.)

Characteristics of Shiga Toxin

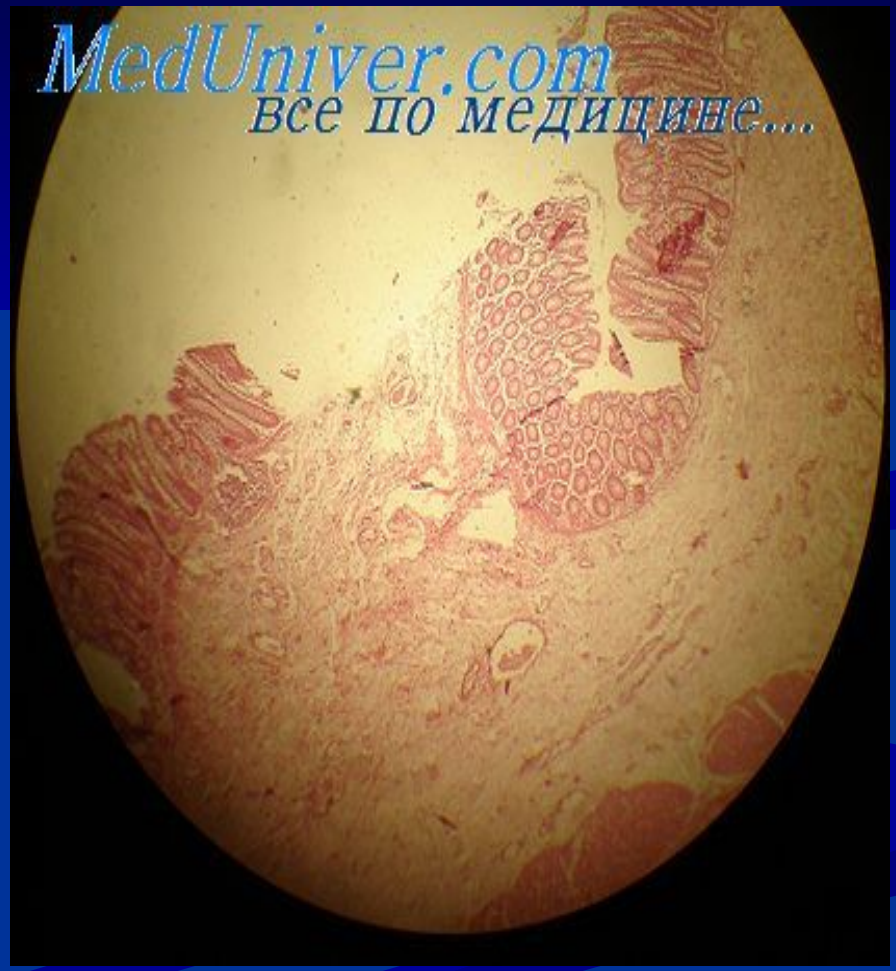
- **Enterotoxic**, **neurotoxic** and **cytotoxic**
- Encoded by **chromosomal genes**
- Two domain (**A-5B**) structure
- **Similar to the Shiga-like toxin of enterohemorrhagic *E. coli*** (EHEC)
  - **NOTE:** except that Shiga-like toxin is encoded by lysogenic bacteriophage

PATHOLOGY

- Gross pathology consists of mucosal edema, erythema, friability, superficial ulcers & focal mucosal hemorrhage involving the rectosigmoid junction primarily.

PATHOLOGY

- **Microscopic pathology consists of epithelial cell necrosis, goblet cell depletion, polymorph & mononuclear cell infiltrates in lamina propria and crypt abscess formation.**



AT RISK GROUPS

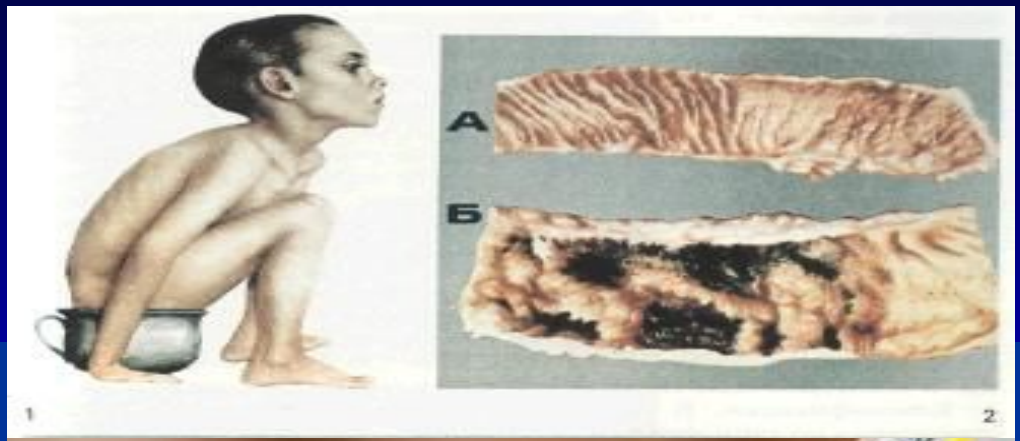
- Children in day care centers
- International travelers
- Homosexual men
- Patients with HIV infection
- People with inadequate water supply
- Persons in prisons & military camps

Classification of the clinical forms

- Dysentery is divided into acute and chronic dysentery. Acute dysentery continues from some days to 3 months (prolonged course of acute dysentery). Dysentery is considered to be chronic, if it persist over 3 months.
- There are the following clinical variants of acute dysentery:
- colitic variant;
- gastroenterocolitic variant;
- gastroenteric variant.
- In dependence on severity of the course of the disease there are mild, moderately severe and severe course of dysentery, and also carriers.

MAIN CLINICAL SYNDROMS

- Intoxication
- Colitic



CLINICAL PICTURE

- Incubation period is from 2 to 5 days, rarely – 7 days.
- Symptoms begin with sudden onset of high-grade fever, abdominal cramps & watery diarrhea
- Subsequently the diarrhea became mucoid, of small volume & mixed with blood. This is accompanied by abdominal pain, tenesmus & urgency. Fecal incontinence may occur.
- Physical signs are those of dehydration beside fever, lower abdominal tenderness & normal or increased bowel sounds.

Mild course

- The onset of the disease is acute.
- The moderate pains develop in the in the left iliac area.
- These pains precede the act of defecation.
- Tenesmus are observed in the some patients.
- Stool is from 3-5 to 10 times a day. It contains mucus, sometimes – blood.
- The temperature is normal or subfebrile.
- On rectorhomanoscopy catarrhal inflammation of the mucous membrane is observed, sometimes erosions and hemorrhages.

Moderate course

- The onset of the disease in acute or with short prodromal period. It is characterized by weakness, malaise, discomfort in the stomach.

Colitic syndrome:

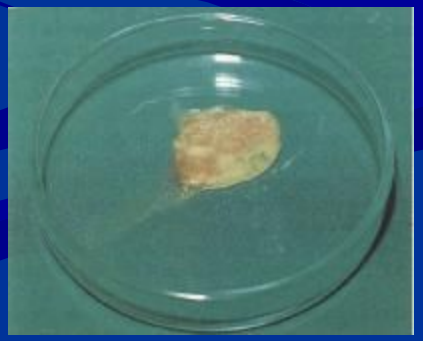
- Develop spastic pains in the lower part of the abdomen, tenesmus.
- Tenderness and spastic of the sigmoid are revealed.
- Stool has fecal character. Then, mucus and blood appear in stool.
- Stool loses fecal character and has appearance of “rectal spit” (excretion of scanty stool – “fractional stool”), with mucus and blood. Stool is accompanied by fecal urgency and tenesmus. Stool is from 10-15 times a day.

Intoxication syndrom

- The temperature increases to 38-39°C with duration 2-3 days.
- The patients complain of weakness, headache.
- May be collapse, dizziness. The skin is pale.
- Hypotension, relative tachycardia are observed.

- **Leukocytosis and moderate neutrophillosis are observed in the peripheral blood.**

- On coprocystoscopy erythrocytes (over 30-40 in the field of the vision) are revealed.
- In rectorhomanoscopy diffuse catarrhal inflammation, local changes (hemorrhages, erosions, ulcers) are revealed.
- Functional and morphological convalescent may be prolonged – to 2-3 months in the patients with moderately severe course of acute dysentery.



Severe course.

- **The onset of the disease is acute.**
- **The temperature increases to 39°C and more.**
- **The patients complain of headache, sharp weakness, nausea, vomiting.**
- **Severe abdominal spasmodic pains, frequent stool scanty, with mucus and blood are marked.**
- **There are hypotension, acute tachycardia, breathlessness, cyanosis of the skin.**

Severe course

- Acute pain in the left iliac area, especially in the area of the sigmoid is marked on palpation of the abdomen.
- Paresis of the intestine is possible.
- There are marked leukocytosis, neutrophillosis with shift to the left to young form.
- ESR is accelerated.

On microscopically examination of stool erythrocytes are marked in all fields of the vision.

- On rectorhomanoscopy catarrhal or fibrinous inflammation, presence of the local changes (erosions, ulcers) are marked.
- The functional and morphological convalescent of the intestine is over 3-4 months in the patients with colitic variant of acute dysentery.

Gastroenteritic variant of acute dysentery

- **The principal feature of this variant of acute dysentery is predominance of the clinical symptoms of gastroenteritis and presence of appearances of dehydration of the different degree.**
- **The principal feature is - acute onset of the disease after short incubation period (6-8 hours).**

Gastroenterocolitic variant of acute dysentery

The principal feature of this variant of the acute dysentery course is acute onset of the disease after short incubation period (6-8 hours). The presence of symptoms damage of stomach, small and large intestines

- **Intoxicative syndrome and syndrome of gastroenteritis are observed in the initial period. The symptoms of enterocolitis predominate in the period of clinical manifestation.**
- **Can be development dehydration of I-II-III degree**

- ***Prolonged course of acute dysentery*** **is clinical manifestations of the disease are observed over 3-4 weeks.**
- **The period of functional and morphological convalescent of the intestine is over 3 months.**
- **Chronic dysentery is prolonged of *acute dysentery* is more than 3 months**

Diagnostics shigellosis

The mains methods of specific diagnostics are microbiological and serological methods of examination

- **Microbiological examination of feces and gastric washings**
- **It is necessary to take the material for bacteriological investigation before beginning of the specific treatment.**
- **Diagnosis may be confirmed by serological methods -Reaction of indirect agglutination with standard erythrocytes diagnostic. Diagnostic titer is 1:200 with increase of titer in 7-10 days.**

Non-specific *diagnostics*

- **Blood-test, Ht (WBC is usually leukocytosis, increasing Ht – hemoconcentration)**
- **Urine-test**
- **Electrolitis (Na, K, CL)**
- **Coprogram (Stool microscopy reveals presence of RBC & pus cells with mucous)**

MORTALITY & MORBIDITY

- Whereas mortality caused by shigellosis is rare in western countries, it is associated with significant mortality & morbidity in developing world.

- Dehydration is the common complication of shigellosis, but serious gastrointestinal & systemic complications may occur.

GASTROINTESTINAL RISKS

- Rectal prolapse
- Toxic mega colon
- Mild Hepatitis

NEUROLOGICAL COMPLICATIONS

- These include:
- Lethargy, delirium, meningismus & seizures
- Encephalopathy (rare & may be lethal)
- Febrile seizures

SYSTEMIC COMPLICATIONS

- Hemolytic uremic syndrome
- Disseminated intravascular coagulation (DIC)
- Reiter syndrome, arthritis, conjunctivitis & urethritis
- Myocarditis

DIFFERENTIAL DIAGNOSES

- Amebiasis
- Campylobacter infection
- Yersinia Entrocolitica infection
- Salmonellosis
- Escherichia Coli infection
- Clostridium difficile infection
- Crohn disease
- Ulcerative colitis

TREATMENT

- The treatment of the patient should be given complex and based on pathogenesis. The treatment depends on the clinical variant and severity of the course of dysentery.
- Diet N 4
- Enzims
- Sorbents
- Correction of water-electrolyte balance and detoxication therapy

TREATMENT

- Medical care include rehydration & use of antipyretics in febrile patients followed by antibiotics.

- Drugs of choice are Cotrimoxazole, 3rd generation cephalosporins & ciprofloxacin.

- Ampicillin is effective but resistant is common.

- Nalidixic acid is also effective but should be avoided in patients with G6PD deficiency.

PUBLIC HEALTH ASPECTS

- Isolation & barrier nursing is indicated
- Notification of the case to the infection control nurse in the hospital.
- Isolation source of infection.
- Continue breastfeeding infants & young children & light diet for other patients in the first 48 hours.

PREVENTION

- Education on hygiene practices particularly hand washing after toilet use.
- Avoidance of eating in non hygienic places.
- Proper handling & refrigeration of food even after cooking.
- Antibiotic prophylaxis is not needed for house-hold contacts.

PROGNOSIS

- Most patients with normal immunity will recover even without antibiotic therapy but illness will be prolonged & severe.
- With antibiotic treatment fever subsides in 24 hours & colic & diarrhea within 2-3 days.
- Few patients will have mild cramps & loose motions for 10-14 days after treatment.
- Mortality in tropical countries may be as high as 20%.


Thank you