Ministry of Health of the Republic of Belarus
Educational Institution
“Gomel State Medical University”

Department of Pathological Anatomy

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METHODICAL GUIDELINES

for conducting a practical class
in the academic discipline “Pathological Anatomy”
for students
of the 3rd year, Faculty of International Students (instruction in English),
enrolled in the specialty
7-07-0911-01 “General Medicine”

Topic: “Infectious pathology: intestinal infections”

Duration: 3 hours

Approved at the meeting of the Department of Pathological Anatomy
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EDUCATIONAL AND INSTRUCTIONAL GOALS, OBJECTIVES, AND MOTIVATION FOR MASTERING THE TOPIC

Educational Goal:

- To study the definition, classification, etiology, pathogenesis, morphology, clinical presentation, complications, and outcomes of intestinal infections. To analyze bacterial intestinal infections: salmonellosis (enterocolitis, typhoidal form, bacteremia), shigellosis (bacillary dysentery – shiga toxin, ulcerative colitis-like changes, pseudomembranes), campylobacteriosis (Campylobacter jejuni – most common bacterial cause of gastroenteritis worldwide), cholera (Vibrio cholerae – cholera toxin, profuse watery diarrhea, "rice water" stools, volume depletion), Escherichia coli infections (enterotoxigenic – ETEC, enteropathogenic – EPEC, enterohemorrhagic – EHEC (O157:H7) – hemorrhagic colitis, hemolytic uremic syndrome (HUS), enteroinvasive – EIEC), yersiniosis (Yersinia enterocolitica – terminal ileitis mimicking Crohn disease), clostridial infections (Clostridioides difficile – pseudomembranous colitis). To analyze viral intestinal infections: rotavirus (most common cause of severe diarrhea in children – destruction of enterocytes), norovirus (epidemic gastroenteritis), adenovirus, astrovirus. To examine parasitic intestinal infections: giardiasis (Giardia lamblia), amoebiasis (Entamoeba histolytica – flask-shaped ulcers, liver abscess), cryptosporidiosis (immunocompromised patients). To describe the morphological changes: acute enteritis (inflammatory infiltrate, villous blunting, cryptitis), acute colitis (inflammatory infiltrate, crypt abscesses, ulcers, pseudomembranes), pseudomembranous colitis (raised yellow-white plaques adherent to mucosa composed of fibrin, mucus, inflammatory cells). To discuss complications: dehydration, electrolyte imbalances, sepsis, hemolytic uremic syndrome (HUS – in EHEC), toxic megacolon, perforation, reactive arthritis, Guillain-Barré syndrome (after Campylobacter).

Instructional Goal:

- Within the framework of the educational process for this academic discipline, the student must acquire not only theoretical knowledge, practical skills and abilities in the specialty but also develop their personal potential. They should cultivate qualities of responsibility and patriotism, be prepared to actively participate in the economic, socio-cultural, and public life of the country, recognize the social significance of their future professional activity, understand the norms of medical ethics and deontology, and learn to observe academic and labor discipline. In the course of studying the educational material, students should realize the importance of maintaining a healthy lifestyle and, as an example in the future, when performing professional duties, set an example for those around them and their patients.

Objectives: Upon completion of the practical session, the student must:

***Know*:**

- The classification and etiology of major intestinal infections;
- The pathogenesis and morphology of shigellosis (bacillary dysentery);

- The pathogenesis and morphology of cholera (rice water stools);
- The pathogenesis and complications of EHEC infection (hemorrhagic colitis, HUS);
- The morphology of pseudomembranous colitis (C. difficile);
- The morphological changes in viral and parasitic intestinal infections.

Be able to:

- Recognize pseudomembranous colitis on macroscopic and microscopic examination;
- Identify flask-shaped ulcers in amoebiasis;
- Diagnose pathological processes and diseases based on the description of macroscopic and microscopic changes in organs and tissues of the body.

Master:

- Basic techniques for working with a microscope;
- Skills in clinical-anatomical analysis;
- The fundamentals of synthetic generalization of morphological diagnostic signs of diseases and their correct interpretation in cause-and-effect relationships.

Motivation for Mastering the Topic:

Intestinal infections are among the most common infectious diseases worldwide, causing significant morbidity and mortality, particularly in children under five years of age in developing countries. They are a leading cause of diarrhea, dehydration, malnutrition, and death. In developed countries, outbreaks of foodborne and waterborne intestinal infections remain important public health concerns. Understanding the pathophysiology and morphology of these infections is essential for infectious disease specialists, gastroenterologists, pediatricians, emergency physicians, pathologists, and public health professionals for diagnosis, treatment, outbreak investigation, and prevention.

QUESTIONS

1. Typhoid fever. Definition. Etiology. Morphology of different stages of the disease. Complications and outcomes.
2. Cholera. Definition. Etiology. Morphology. Complications and outcomes. Causes of death.
3. Intestinal coli infection. Definition. Etiology. Morphology. Complications and outcomes.
4. Salmonellosis. Definition. Etiology. Classification. Morphology. Complications and outcomes.
5. Dysentery. Definition. Etiology. Classification. Morphology. Complications and outcomes. Causes of death. Morphological features of dysentery in children.

COURSE OF THE SESSION

Typhoid fever

- Pathogen - **Salmonella typhi**
- Infection occurs from a sick person, as well as a bacillicarrier
- Transmission is by the **fecal-oral route**
- The incubation period lasts for 3 to 25 days (usually 10-14)

During this period, bacteria multiply in the lower small intestine. Some of them die, while releasing endotoxin, which has a toxic effect on the body, especially on the cardiovascular and nervous systems. Intracellularly, through the microvilli of the intestinal mucosa, Salmonella migrate through the lymphatic vessels to the solitary follicles and group lymphatic follicles (Peyer's patches), to the regional lymph nodes, and then to the blood.

- The disease begins with a general malaise, a feeling of weakness throughout the body, deterioration of sleep and appetite, and a decrease in working capacity.
- The temperature **rises gradually** and reaches 39-40°C by **the 4th-6th day of illness**. Patients have an indifferent look, a sharp pallor of the skin and mucous membranes. The skin is dry, hot to the touch. The abdomen is swollen, constipation is noted, sometimes there are liquid stools.
- On **the 8th-9th day** of the disease, a mild rash of pale pink color (roseola) appears on the skin, the size of a pinhead, disappearing with pressure. During this period, the patient is especially contagious, since the pathogen is excreted with sweat, milk, urine, feces, and bile.

Typhoid fever pathology

Local changes. The main changes in typhoid fever are detected in the **lymphoid follicles** (Peyer's patches) of the ileum, less often with involvement of the large intestine.

These changes go through 5 stages:

- swelling of lymphoid follicles;
- necrosis of lymphoid follicles;
- the formation of "dirty" ulcers;
- clean ulcers;
- healing (regeneration).

Each stage takes about a week of illness.

General changes. The liver is somewhat enlarged in size: microscopically we can find typhoid nodules, protein and fatty degeneration in hepatocytes. In mesenteric lymph nodes, especially the ileocecal angle, there are changes that develop in the same sequence as in the lymphatic apparatus of the intestine. The spleen in typhoid fever can be enlarged 3-4 times, the capsule is tense, the tissue is dark red, gives abundant scraping of the pulp.

Salmonellosis

- Pathogen - **Salmonella typhimurim, Salmonella enteritidis, Salmonella cholerae souis, Salmonella parattyphi A** and **Salmonella Schottmulleri**
- With these salmonellosis, inflammatory changes can be identical to typhoid fever (**typhoid form**). Along with this, **intestinal** (toxic) and **septic forms** are distinguished.

After invasion into the epitheliocytes of the intestinal mucosa and macrophages, **endotoxin**, released during the decay of Salmonella, has a **pyrogenic, cytotoxic and vasoparalytic effect**. In some cases, acute gastroenteritis, severe vascular disorders, and collapse develop; in other cases, salmonellosis is similar to typhoid fever.

- In the **intestinal form**, there are clinical manifestations of *acute gastroenteritis*, with a sharp dehydration of the body. The mucous membrane is edematous, full-blooded, with small hemorrhages and small superficial ulcerations. *Macroscopically*, the intestinal lumen is paralytically dilated. The lymphatic apparatus of the intestine is hyperplastic to a lesser extent than in typhoid fever.
- In the **septic form**, patients develop metastatic abscesses, including in the brain and lungs.
- The **typhoid form** is characterized by fever and chills (1 week); rash, abdominal pain (2 weeks); typhoid changes (3 weeks).

Dysentery

- Pathogen - **Shigella dysenteriae, Shigella flexneri, Shigella boydii** and **Shigella sonnei**
- Transmission is by the **fecal-oral route** (by interaction, food and water)
- Incubation period 2 to 7 days (average 3 days)

The characteristic localization of Shigella is the **transverse and descending colon**.

The disease develops rapidly. There are weakness, malaise, chilling, headache,
↑ temperature, nausea, sometimes vomiting, cramping pains in the abdomen. The stool becomes more frequent up to 10-25 or more times a day, the stools become liquid, scanty, mucus and blood appear in them. Characterized by **tenesmus**.

The clinical picture depends on the **quantity of Shigella** that have entered the human body.

Bacteria **do not penetrate** beyond the lamina propria.

The place of life and reproduction of Shigella is the **epithelium of the colon mucosa**, where they are **inaccessible to leukocytes, antibodies, antibiotics**. Shigella multiply in the cytoplasm of the epithelial cell until they are absorbed by the phagolysosomes of the epithelial cell. With the death of Shigella, **Shiga toxin** is formed, which has a **cytopathic effect** on epitheliocytes and is selective in relation to the **endotheliocytes** of the colon, as well as the vascular glomerulus of nephrons.

Pathology of dysentery

The most pronounced changes are detected in the **rectum and sigmoid colon**.

1. The stage of **catarrhal colitis** lasts 2-3 days.

Macroscopically, the colon mucosa is hyperemic, swollen, with hemorrhages. The intestinal lumen is narrowed due to spasm of the muscular layer. Desquamation of the epithelium is noted *microscopically*, in the cytoplasm of which Shigella are found. In the intestinal crypts, plethora, edema, hemorrhages and foci of necrosis, infiltration of the stroma by neutrophils.

2. The stage of **fibrinous colitis** lasts 5-10 days.

Macroscopically, for a considerable extent, the mucous membrane is swollen, edematous, thickened, covered with a fibrinous film of brown-green color. *Microscopically*, the mucosa is unevenly necrotic and imbibed with fibrin threads (diphtheritic colitis). Along the periphery of necrotic foci, there is pronounced edema, hemorrhages, and neutrophilic infiltration.

3. The stage of **ulcerative colitis** appears on the 11-14th day of illness.

Ulcers occur in the rectum and sigmoid colon. Due to the rejection of fibrinous films and necrotic masses, *ulcers have irregular outlines and different depths*. The possibility of bleeding and perforation of the intestinal wall is associated with the formation of ulcers.

4. The stage of **regeneration of ulcers** begins from the 3rd to the 4th week of the disease.

Mucosal defects are filled with *granulation tissue* and then with *fibrous scar tissue*. With minor defects, regeneration can be complete. With severe damage to the mucous membrane, scars are formed, leading to a narrowing of the intestinal lumen.

Cholera

Pathogen - **Vibrio cholerae** or **Vibrio cholerae biovar eltor**

Included in the group of **high consequence infectious diseases (HCID)**

The course of cholera is usually divided into three periods:

1) acute enteritis;

2) acute gastroenteritis;

3) algid (cold) period.

Getting into the body, as a rule, with **contaminated water**, the pathogen finds a favorable habitat for itself in the **small (more often jejunum) intestine**, where it parasitizes in the lumen **without penetrating into the tissues**.

The **cholerogen** exotoxin secreted by vibrio affects the intestinal wall and leads to malabsorption and active secretion of fluid into the intestinal lumen, which is accompanied by **profuse diarrhea**. The latter, in combination with the vomiting that joins in the second period, lead to a sharp **dehydration**.

Dehydration is accompanied by **hemoconcentration** and **circulatory hypoxia** due to slowing down of blood flow. The frequency of **thrombosis** increases. Exotoxin affects the cells of the autonomic nerve ganglia and causes demyelination of nerve fibers.

The **loss of electrolytes** (K +) leads to a violation of the contractile function of the heart.

INFORMATIONAL AND METHODOLOGICAL PART

MAIN LITERATURE

1. Pathomorphology : textbook / ed. by I.V. Sorokina, V.D. Markovskyi, D.I. Halata. - 2nd ed. - Kyiv : AUS Medicine Publishing, 2020. - 327 p., [10] col. inserts : tab.

2. Klatt, E. C. Robbins and Cotran Atlas of Pathology : [with Student Consult Online Access] / Edward C. Klatt. - third edition. - Philadelphia : Elsevier, 2015. - 587 p. : il.

3. Robbins Basic pathology / [ed. by] Vinay Kumar, Abul K. Abbas, Jon C. Aster. - 9th ed. - [Philadelphia] : Elsevier ; Saunders. - 910 p. : ill., scheme, tab.

ADDITIONAL LITERATURE

1. Sobotta. Atlas of human anatomy. [V. 1]. General anatomy and musculoskeletal system / ed. by F. Paulsen, J. Waschke. - 15th ed. - München : Elsevier. Urban & Fischer, 2011. - 400 p. : ill., col. ill.

2. Sobotta. Atlas of human anatomy. [V. 2]. Internal organs / ed. by F. Paulsen, J. Waschke. - 15th ed. - München : Elsevier. Urban & Fischer, 2011. - 259 p. : ill., col. ill.

3. Sobotta. Atlas of human anatomy. [V. 3]. Head, neck, and neuroanatomy / ed. by F. Paulsen, J. Waschke. - 15th ed. - München : Elsevier. Urban & Fischer, 2011. - 370 p. : ill., col. ill.

4. Weir & Abrahams' imaging atlas of human anatomy / ed.: J. D. Spratt [and oth.] ; consultant eds.: J. Weir, P. H. Abrahams. – 5th ed. - [S.l.] : Elsevier, 2017. - xvi, 263 p. : ill.

NORMATIVE LEGAL ACTS AND DOCUMENTS

1. Order of the Ministry of Health of the Republic of Belarus No. 111 of 06/01/1993 "On further improvement of the pathological service of the Republic of Belarus"

Access mode: http://patan.by/menyu/administrativnyie-proczeduryi.html - The date fccess: 20.03.2022.

ELECTRONIC DATABASES

1. Physician's consultant. Electronic Medical Library = Consultant of the doctor. Electronic medical library [Electronic resource] / Publishing group "GEOTAR-Media", LLC "IPUZ". – Access mode: http://www.rosmedlib.ru/ . – Access date: 03/15/2022.

2. Springer Link [Electronic resource] / Springer International Publishing AG. – Access mode: https:link.springer.com. – Date of access: 03/15/2022.