



**MEDICAL UNIVERSITY - PLEVEN
FACULTY OF MEDICINE**

DISTANCE LEARNING CENTRE

**DEPARTMENT OF INFECTIOUS DISEASES, EPIDEMIOLOGY,
PARASITOLOGY AND TROPICAL MEDICINE**

PRACTICAL EXERCISE № 2 –

**BOWEL INFECTIOUS DISEASES – TYPHOID FEVER,
SALMONELLOSIS, SHIGELLOSIS, COLIENTERITIS, CHOLERA
– ETIOLOGY, CLINICAL FEATURES, DIAGNOSIS,
DIFFERENTIAL DIAGNOSIS.**

THESIS

**FOR E- LEARNING IN INFECTIOUS DISEASES
ENGLISH MEDIUM COURSE OF TRAINING**

SPECIALTY OF MEDICINE

**ACADEMIC DEGREE: MASTER
PROFESSIONAL QUALIFICATION: DOCTOR OF MEDICINE**

**PREPARED BY
ASSOC. PROF. GALYA GANCHEVA**

PRACTICAL EXERCISES – THESES

PLEVEN, 2020

I. Aim of the practical exercise – after completed exercise, the students must be able to take informative history and physical examination of patients with gastrointestinal infectious diseases, to group symptoms in syndromes, to prepare plan for diagnosis (and differential diagnosis), to be familiar with major principles of etiological and supportive treatment of gastrointestinal infectious diseases.

II. Tasks for achievement of mentioned above aim:

1. Repetition of microbiological characteristics of family Enterobacteriaceae with emphasizing on specific features of *Salmonella typhi*, other *Salmonella* species, *Shigella*, *E. coli*, and *Vibrio cholerae*.
2. Discussion on specific features of history in gastrointestinal infectious diseases.
3. Importance of epidemiological part of history.
4. Information about past history and comorbidity.
5. Taking of physical examination of a patient with gastrointestinal infectious disease.
6. Discussion about syndromes in gastrointestinal infectious diseases and their diagnostic value.

III. Theoretical part of the exercise:

INTRODUCTION

A. Definitions

1. Diarrhea is the excretion of more than 200 g of stool/day. The stool usually has a loose consistency, and the frequency of excretion increases. Diarrhea can be caused by bacteria, viruses, or parasites. There are two basic types of diarrhea:

a. Profuse secretory diarrhea, characterized by the frequent passage of watery stools, is usually caused by the secretion of **exotoxins** or by **viral infection** of the intestinal mucosa.

b. Dysentery is characterized by the frequent passage of stools with low volume that contain mucus and pus, and by abdominal cramps and pain during defecation (tenesmus). Dysentery and bloody diarrhea are usually caused by the release of **cytotoxins** or by the **invasion** of the mucosa by bacteria or protozoa.

2. Gastroenteritis is an infection (acute or chronic) of the gastrointestinal tract that includes diarrhea and symptoms of gastric irritation (e.g., nausea, vomiting, epigastric pain). Bacteria and viruses are the most common etiologic agents.

3. Enterocolitis is an infection of the lower gastrointestinal tract that does not produce symptoms of gastric irritation.

4. Food poisoning is a type of acute gastroenteritis in which the ingestion of a single meal can be identified as the vehicle for infection. Bacteria and bacterial toxins are most commonly implicated in classic cases of food poisoning.

B. Prevalence

1. Acute gastroenteritis is one of the most common forms of infectious disease.

2. The prevalence of particular causative agents depends on the **age of the patient**, the **season of the year**, and **socioeconomic factors**.

C. Clinical presentation. **Diarrhea, vomiting, abdominal pain, and fever**, in different combinations, are the most common clinical symptoms of acute gastroenteritis.

1. Fever in a patient with gastroenteritis usually means that the causative agent is invasive. The invasion can be limited to the intestinal mucosa, extend to the submucosa, or spread systemically through the circulation (bacteremia).

2. Profuse, watery diarrhea usually indicates the effects of a toxin.

INFECTIOUS DIARRHEA AND GASTROENTERITIS

A. Epidemiology. There are two main models for transmitting infectious agents that cause diarrhea and gastroenteritis.

1. Fecal-oral transmission may involve:

- a. Direct person-to-person transmission (usually involving crowding and poor personal hygiene; seen in jails, mental institutions, and day care centers)
- b. Contamination of meat, poultry product, or seafood during processing
- c. Contamination of food during or after cooking.

2. Food-borne transmission may involve distribution in consumers of meat, poultry products, seafood or vegetables that have been contaminated before processing (e.g. by a zoonotic organism).

B. Pathogenesis of bacterial diarrhea

1. Colonization and proliferation

- a. Infectious diarrhea may result from:
 - 1) Multiplication of an organism in the gastrointestinal tract
 - 2) The mobilization of host defense mechanisms in an attempt to eliminate the invading infectious agent
- b. All diarrhea-producing bacteria adhere to intestinal mucosal cells. Adherence is usually mediated by surface proteins such as fimbriae (colonization factors) and non-fimbrial adhesins.
- c. Once bacteria start proliferating in the intestine, they can:
 - 1) Induce structural abnormalities of the mucosal cells via poorly defined mechanisms, which result in increased secretion of fluids and electrolytes
 - 2) Release toxin
 - 3) Invade the intestinal mucosa

2. Noninvasive bacteria

- a. The most important toxin-producing enteropathogenic bacteria are:
 - 1) *Vibrio cholera*
 - 2) Enterotoxigenic *Escherichia coli* (ETEC)
 - 3) Verotoxin-producing (VTEC, EHEC, *E. coli* O157:H7)
 - 4) *Shigella dysenteriae* type 1
 - 5) *Clostridium perfringens*
 - 6) *Clostridium difficile*
 - 7) *Vibrio parahaemolyticus*
 - 8) Some strains of *Staphylococcus aureus*
- b. Toxin-producing bacteria may release **enterotoxins** or **cytotoxins**.
 - 1) **Enterotoxins** (e.g., cholera toxin) produce fluid secretion by several mechanisms, including stimulation of adenylate cyclase activity. Enterotoxins produce an essentially pure biochemical lesion and have virtually no histopathologic effects on the intestinal mucosa.
 - 2) **Cytotoxins** (e.g., Shiga toxin, Verotoxin, and *C. difficile* toxins) have enterotoxic as well as general cytotoxic activity.

a) Bloody diarrhea. At the intestinal level, cytotoxin producing bacteria cause tissue damage, leading to inflammation and blood loss.

b) Hemolytic-uremic syndrome. Shiga toxin and verotoxin produced by *E. coli* O157:H7 cause massive endothelial cell damage, which results in disseminated thrombosis with massive consumption of platelets and clotting factors. This, in turn, leads to thrombocytopenia and coagulopathy. These toxins also cause vasoconstriction and microangiopathic hemolytic anemia. In the kidney, the combined effects of endothelial toxicity on glomerular capillaries and hemoglobin toxicity on tubules lead to acute renal failure with uremia, hypertension, and encephalopathy. Death occurs in the most severe cases.

3. Invasive organisms (e.g., *Salmonella enteritidis*, *Shigella*) penetrate the bowel epithelium. These organisms stimulate an intensive acute inflammatory reaction with accumulation of large numbers of polymorphonuclear (PMN) leucocytes. This direct damage to the intestinal mucosa and the accompanying inflammatory reaction results in the presence of blood, mucus, and inflammatory cells in the stool.

C. Diagnosis. Identifying the precise cause of acute gastroenteritis is a low priority issue when the patient is only mildly ill with profuse diarrhea or vomiting and no constitutional symptoms. When an outbreak of a contagious form of diarrhea is suspected, or when the disease is severe or associated with constitutional symptoms, identification of the responsible microorganism becomes important.

1. Patient history. Clues to the causative organism may be gleaned from the **type of diarrhea, incubation time, and associated symptoms** (Tables 1, 2, and 3).

Table 1. Noninvasive Versus Invasive Diarrhea

	Noninvasive	Invasive (Bacterial/Parasitic)
Stool	Profuse secretory (Severe, watery)	Dysentery (blood, mucus, PMN leucocytes)
Fever	No	Yes
Systemic toxicity	No	Yes
Abdominal pain	Mild	Severe (cramping, tenesmus)
Site of infection	Small intestine	Colon

Table 2. Features of Specific Types of Noninvasive Bacterial Diarrhea

	<i>Vibrio cholerae</i>	<i>Escherichia coli</i>	<i>Clostridium perfringens</i>	<i>Bacillus cereus</i>	<i>Staphylococcus aureus</i>
Incubation (hours)	12-72	24-72	6-12	3-8	1-6
Duration (hours)	48-120	24-48	12-24	12-24	6-12
Abdominal cramps	0	+	++++	++	++
Vomiting	+	±	+	++	++++

Table 3. Features of Specific Types of Invasive Bacterial Diarrhea

	<i>Shigella</i>	<i>Escherichia coli</i>	<i>Salmonella</i>	<i>Yersinia enterocolitica</i>
Incubation (hours)	24-72	24-72	8-48	1-6
Duration (hours)	48-120	24-48	12-24	6-12
Abdominal cramps	++++	++++	+	++
Vomiting	++	+	+	++
Fever	++	++	++++	++

2. Laboratory diagnosis

a. Fecal specimens are preferred for the diagnosis of gastroenteritis with watery diarrhea.

b. Blood cultures are indicated when constitutional symptoms are present.

c. Enzyme immunoassay (EIA) may aid in the identification of viral agents or exotoxins.

FOOD POISONING

A. INTRODUCTION

1. A classic case of food poisoning has the following features:
 - a. **Similar symptoms in several members of a group** sharing a meal
 - b. **Acute onset** a few hours after food ingestion
2. Food poisoning may be caused by:
 - a. **Intoxication**, the ingestion of food containing preformed bacterial toxins
 - b. **Infectious food poisoning**, the ingestion of viable infectious agents

B. Diagnosis. The type of food ingested, incubation period, and type of severity of symptoms may help establish the cause of the outbreak (**Table 4**).

1. As a rule, incubation periods of less than 12 hours indicate ingestion of **preformed toxins**.
2. Longer incubation periods indicate ingestion of **live bacteria** that must proliferate before reaching the critical mass necessary for the emergence of clinical symptoms.
3. Identification of the causative agent requires isolation of an infectious agent (e.g., in stool samples) or detection of the toxin in contaminated food.

Table 4. Clinical and Epidemiological Features of Bacterial Food Poisoning

Cause	Percentage of Reported Outbreaks	Incubation Period (hours)	Clinical Presentation	Characteristic Foods
Intoxication				
<i>Bacillus cereus</i>	1-2	1-6	Vomiting	Re-warmed fried rice
<i>Clostridium botulinum</i>	5-15	12-72	Neuromuscular paralysis	Canned foods of all types
<i>Staphylococcus aureus</i>	15-25	2-4	Vomiting, diarrhea	Meats, custards, salads
<i>Vibrio parahaemolyticus</i>	1-2	10-24	Watery diarrhea	Shellfish
Infection				
<i>Bacillus cereus</i>	1-2	6-24	Watery diarrhea	Meat, poultry, vegetables
<i>Clostridium perfringens</i>	5-15	9-15	Watery diarrhea	Meat, poultry
<i>Salmonella</i>	10-30	6-48	Dysentery	Poultry, eggs, meat, vegetables
<i>Shigella</i>	2-5	12-48	Dysentery	Variable

March, 2020

Prepared by
Assoc. Prof. G. Gancheva, MD, PhD