



**MEDICAL UNIVERSITY - PLEVEN
FACULTY OF MEDICINE**

DISTANCE LEARNING CENTRE

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

PRACTICAL EXERCISE № 3 –

BOWEL INFECTIOUS DISEASES

**DEHYDRATION – DEGREES, CLINICAL FEATURES,
HYPOVOLEMIC SHOCK. MANAGEMENT AND TREATMENT.**

THESIS

FOR E- LEARNING IN INFECTIOUS DISEASES

ENGLISH MEDIUM COURSE OF TRAINING

SPECIALTY OF MEDICINE

ACADEMIC DEGREE: MASTER

PROFESSIONAL QUALIFICATION: DOCTOR OF MEDICINE

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PRACTICAL EXERCISES – THESES

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I. Aim of the practical exercise – after completed exercise, the students must be able to assess a degree of dehydration according to the clinical signs of dehydration, to be familiar with major principles of etiological and supportive treatment of gastrointestinal infectious diseases.

II. Tasks for achievement of mentioned above aim:

1. Discussion of the clinical signs of different degrees of dehydration.
2. Discussion on significance of laboratory parameters and their reference values.
3. Work with records of patients admitted in the Clinic of Infectious Diseases and interpretation of laboratory results.
4. Discussion on major principles and rules for rehydration, correction of electrolytic dysbalance and metabolic acidosis.
5. Discussion on indications for etiologic treatment of bowel infectious diseases, appropriate antibacterial drugs and their doses, treatment courses and eventual combinations.

III. Theoretical part of the exercise:

1. BASIC STATEMENTS.

The most important part of the treatment of gastrointestinal infections is supportive treatment. It includes recovery of hypovolemia and ionic balance, and correction of metabolic acidosis. If physicians want to lead correct treatment, it is necessary to know the following basic concepts:

Dehydration is a state of reduction of water content in extracellular and intracellular space.

Hypertensive dehydration is observed when there is a reduction of extracellular fluid; increased electrolytes; intensification of intracellular loss of water.

Reasons: diseases with diarrhea syndrome, fever, abundant perspiration, diabetes mellitus, diabetes insipidus.

Clinical manifestations:

- polydipsia, weakness, apathy, somnolence, excitation, disorientation, hallucinations, convulsions, comma
- dry skin, increased temperature, dry and red-strawberry tongue
- oliguria and anuria – high urine density
- breathing – hurried with apneic pauses
- lethal outcome because of brain edema

Hypotensive dehydration – reduction of the extracellular fluid, decreased osmotic pressure in the extracellular fluid

This leads to: passage of the water in the intracellular space, hyperhydration / overhydration of the cells.

It is observed at: loss of saline, polyuria in individuals with diabetes mellitus, infusion of pure glucose solutions.

Clinical manifestations:

- falling down of the blood pressure and central venous pressure
 - tachycardia or bradycardia
 - cold cyanotic skin
 - reduced turgor and elasticity
 - mild bulbs, decreased muscle tone
 - disturbance of the consciousness up to comma and eccentric convulsions
- Increasing of the extracellular space volume more than twice is still compatible with the life, whereas the sharp decreasing of the body fluids with 20% is fatal and leads to lethal outcome.

➤ **Isotonic dehydration** is the most frequently observed and it is expressed by:

- reduction of the extracellular fluid in normal osmotic pressure
- intracellular fluid content is not disturbed

Isotonic dehydration is observed in:

- fluid's loss accompanied by vomiting and diarrhea (intestinal infections)
- abdominal, duodenal, and enteric fistulas
- blood loss, polyuria, burns, peritonitis

Clinical manifestations:

- insignificant thirst
- tachycardia – reduction of the blood pressure up to shock
- ease tiredness, delayed reactions, disturbance of the consciousness, comma
- dry mucosa, dry skin with reduced elasticity
- lethal outcome because of failure of the blood circulation

2. DEGREES OF DEHYDRATION:**I degree of dehydration – loss of body weight to 5%****Clinical signs:**

- Central nervous system – the patient is more frequently calm, then irritable
- Rather dry mucosa and tongue, turgor is slightly reduced
- The fontanel in infants is slightly hollowed
- Blood pressure is normal or a little lowered up to 80 mm Hg (systolic)
- Cardiovascular system – pulse is normal or a little rapid
- There is not apparently expressed thirst.

II degree of dehydration – loss of body weight up to 10%**Clinical signs:**

- Central nervous system: in adults – the patient is anxious and nervous; in children – the body weight loss leads to somnolent-stupor state
- Skin and mucosa – dry, turgor and elasticity – very reduced / decreased
- The fontanel in infants is hollowed
- Cardiovascular system – tachycardia, soft pulse, blood pressure under 80 mm Hg (systolic), without shock
- Oliguria

III degree of dehydration – a loss of body weight more than 10 – 15% is equivalent to hypovolemic shock.**Clinical signs:**

- Central nervous system – comma
- In all patients: the mucosa is dry and red, the cornea is seared, the skin is dry, wrinkled, without turgor; in children – the fontanel in infants is greatly hollowed
- cardiovascular system – a sharp fall down of the blood pressure
- tachypnea, cyanosis, anuria

In cases with II and III degree of dehydration a metabolic acidosis is observed

- Water-cellular electrolyte deficiency
- Disturbed function of the kidney, liver, cardiovascular system and suprarenal glands.
- In adults – endotoxic shock is observed in Gram-negative bacteria. In children – it is expressed by toxicity.

3. TREATMENT

- Recovery of normovolemia and ionic balance
- Correction of metabolic acidosis
- Etiological treatment

I. Restoration of hypovolemia:**1. Daily needs of fluids:**

Little children – I trimester x 150 ml/kg body weight/24 h

II trimester x 120 ml/kg body weight/24 h

III trimester x 110 ml/kg body weight/24 h
 Adolescents – x 60 ml/kg body weight/24 h
 Adults – x 40-50 ml/kg body weight/24 h

2. Current losses:

- Body weight loss – **Loss fluids recover within first six hours as follows – 50% within first two hours and 50% during the next four hours.**
- Current losses caused by vomiting and diarrhea x 20 ml/kg body weight/24 h
- For perspiration x 30 ml/kg body weight/24 h
- For supporting of diuresis x 30 ml/kg body weight/24 h
- For each temperature degree over than 38°C x 10 ml/kg body weight/24 h

A formula for correction of fluids:

$$T (\text{body weight}) \times 4 H (Ht_{\text{patient}}^* - Ht_{\text{norm}}^*) = \text{fluids for 24 h}$$

*Ht – hematocrit

Criteria for the hypovolemia severity:

$$C_{\text{shock index}} = \text{pulse} / \text{systolic BP (blood pressure)} = 0.5_{\text{norm}}$$

At C = 1.0 – there is a danger of hypovolemic shock

At C > 1.5 – there is hypovolemic shock

At increasing of C > 1.0 – an active and effective resuscitation is necessary.

II. Recovery of electrolytes losses:

At each 100 g body weight loss definite quantities of electrolytes expressed in mEq/kg are lost because of (Table 1):

Table 1. Current Losses of Electrolytes

	sodium	chlorine	potassium
diarrhea	6	6	6
vomiting	10	10	2
diarrhea and vomiting	8	8	4
mean	8	8	4

Patients daily needs of electrolytes:

- Na⁺, K⁺, Cl⁺ – 1-2 mEq/kg body weight/24 h
- Ca²⁺ – 1.2 mEq/kg body weight/24 h

Sodium over than 150 mEq/L leads to brain stroke – because of subarachnoidal and subdural bleeding.

A formula for correction of sodium expressed in mmol/L:

$$T (\text{body weight}) \times 0.3 \times (145_{\text{norm}} - \text{Sodium}_{\text{ionogram}})$$

A formula for correction of potassium expressed in mmol/L:

NO MORE THAN 2 – 3 mmol in 100 ml fluids!!!

III. Correction of metabolic acidosis:

$$T (\text{body weight}) \times 0.3 \times \text{BE (Basis excess)} = \text{ml Sodium hydrogen carbonate } 8.4\%$$

IV. Resuscitation solutions depending on the type of dehydration:

1. **Hypotonic dehydration** – 2/3 alkaline solutions + 1/3 glucose solutions
2. **Hypertonic dehydration** – 2/3 glucose solutions + 1/3 alkaline solutions
3. **Isotonic dehydration** – equal parts of saline and glucose solutions

The definitive fluids are instilled: 80% in parenteral administration and 20% - in oral administration.

Potassium – no more than 4 mEq/kg body weight/24 h

Sodium and chlorine – no more than 10 mEq/kg body weight/24h

Native plasma – 10-12 ml/kg body weight/24 h

Human albumin 5% and 20% – 10 ml/kg body weight/24 h

Blood – 10-20 ml/kg body weight/24 h

Methylprednisolone – 0.5-2 mg/kg body weight/24 h

In case of cholera is administrated **Phillips' solution:**

Sodium chloride – 5.0

Sodium bicarbonate – 4.0

Potassium chloride – 1.0

Aqua distillate (distilled water) – 1 000 ml

This solution contains: Sodium – 135 mmol/L, chlorides – 15 mmol/L, and bicarbonates – 40 mmol/L.

4. WHO recommends the following solution for oral administration:

Sodium chloride – 3.5 g

Sodium bicarbonate – 2.5 g

Potassium chloride – 1.5 g

Glucose – 20.0 g

V. Etiologic treatment

A. Noninvasive diarrhea. While most cases of noninvasive diarrhea are usually self-limited and do not require specific therapy, cases of invasive diarrhea are usually more severe and require more aggressive therapy.

1. Cases of acute gastroenteritis with profuse watery diarrhea and no constitutional symptoms can be treated supportively with fluid and electrolyte administration. Oral rehydration is usually adequate in previously healthy patients. Very young children and elderly individuals may require intravenous fluid administration.

2. In cases with evidence of mucosal invasion (mucosal diarrhea, inflammatory cells in fecal samples) or with constitutional symptoms, more aggressive therapy including antibiotics, is indicated. As in many other infectious diseases, if the patient is severely ill, empiric treatment should be initiated as soon as proper samples are collected, to be revised when the causative agent is identified and characterized.

3. Hospitalization and aggressive therapy are indicated whenever the symptoms suggest septicemia or the hemolytic-uremic syndrome.

B. Food-poisoning. The general approach to therapy is similar to the approach for acute gastroenteritis (see V.A.).

1. Food-poisoning by toxin-containing foods is self-limited disease that requires **supportive therapy** only (most importantly, rehydration). Infants and elderly individuals may require more aggressive supportive therapy than previously healthy adults.

2. Administration of **antibacterial drugs** is indicated only when the patient has constitutional symptoms and a live organism is suspected of causing the food poisoning. **Empiric therapy** directed against the most likely causative agents should be initiated immediately.

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