



MEDICAL UNIVERSITY – PLEVEN
FACULTY OF MEDICINE
**DEPARTMENT OF INFECTIOUS DISEASES, EPIDEMIOLOGY,
PARASITOLOGY AND TROPICAL MEDICINE**

Lecture № 3

GASTROINTESTINAL INFECTIONS

MANAGEMENT AND TREATMENT OF DEHYDRATION

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DEHYDRATION

- **Definition** – state of reduction of water content in extracellular and intracellular space.
- **Three types of dehydration** exist – hypertonic, hypotonic and isotonic.
- Hypertonic dehydration is observed when there is a reduction of intracellular fluid due to:
 - ❖ increased electrolytes,
 - ❖ intensification of intracellular dehydration.
- **Reasons** for hypertonic dehydration:
 - ❖ diseases with diarrhea syndrome,
 - ❖ fever,
 - ❖ abundant perspiration,
 - ❖ diabetes mellitus, insipid diabetes.

Hypertonic dehydration

Clinical manifestations

- Thirst; weakness, apathy; somnolence or excitation, disorientation, hallucinations, convulsions, comma.
- Dry skin, increased temperature, dry and red tongue.
- Oliguria and anuria with high density of the urine.
- Breathing – hurried with pauses.
- Lethal outcome because of brain edema.

Hypotonic dehydration

- **It is observed at:**
 - ❖ 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 salt,
 - ❖ polyuria in individuals with diabetes mellitus,
 - ❖ infusion of glucose solutions.

Hypotonic dehydration

Clinical manifestations

- Falling down of the blood pressure (BP) and central venous pressure (CVP),
- tachycardia,
- cold cyanotic skin,
- reduced skin turgor and elasticity,
- hollowed-eyed cheeks, decreased muscle tone,
- disturbance of the consciousness up to comma and convulsions.

REMEMBER!!!

- 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

- Reduction of the extracellular fluid in normal osmotic pressure,
- intracellular fluid content is not disturbed.
- **Isotonic dehydration is observed at:**
- fluid's losses accompanied by vomiting and diarrhea (intestinal infections),
- abdominal, duodenal and enteric fistulas,
- blood loss, polyuria, burns, peritonitis.

Isotonic dehydration

Clinical manifestations

- Insignificant thirst.
- Tachycardia – reduction of the blood pressure up to shock.
- Weakness, delayed reactions, disturbance of the consciousness, comma.
- Dry mucosa, dry skin with reduced elasticity.
- Lethal outcome because of failure in the blood circulation.

Degrees of dehydration

- **First degree of dehydration – loss of body weight to 5 %.**
- **Clinical signs:**
 - ❖ Central neural system (CNS) – the patient is in most cases relaxed, sometimes irritable.
 - ❖ Rather dry mucosa and tongue, skin turgor is slightly reduced.
 - ❖ The fontanel in infants is slightly hollowed.
 - ❖ Blood pressure is normal or a little decreased up to 80 mm Hg.
 - ❖ Cardiovascular system – pulse is normal or a little rapid.
 - ❖ There is not apparently expressed thirst.

Degrees of dehydration

- Second degree of dehydration – loss of body weight up to 10 % (subtoxicosis)
- **Clinical signs:**
 - ❖ Central neural system: in adults – the patient is anxious and nervous; in children – the weight loss leads to somnolence and later to stupor.
 - ❖ Skin and mucosa – dry, turgor – very reduced
 - ❖ The fontanel in infants is hollowed.
 - ❖ Cardiovascular system – tachycardia, soft pulse, blood pressure under 80 mm Hg, without shock.
 - ❖ Oliguria.

Degrees of dehydration

- **Third degree of dehydration – loss of body weight more than 10% is equivalent to hypovolemic shock.**
- **Clinical signs:**
 - ❖ Central neural system – comma.
 - ❖ In all patients – the mucosa is dry and red, the cornea is seared, the skin is dry, wrinkled, without turgor.
 - ❖ In infants – the fontanel is greatly hollowed.
 - ❖ Cardiovascular system – a sharp fall down of the blood pressure.
 - ❖ Tachypnea, cyanosis, anuria.

Cholera – dehydration 3-rd degree



Figure 2: A child, lying on a cholera cot, showing typical signs of severe dehydration from cholera

The patient has sunken eyes, lethargic appearance, and poor skin turgor, but within 2 h was sitting up, alert, and eating normally.

Aims of the management

- **Supportive treatment:**
 - ❖ Recovery of volume of the fluids.
 - ❖ Recovery of electrolytes' balance.
 - ❖ Correction of metabolic acidosis.
- **Etiological treatment.**

- **In cases with second and third degree of dehydration a metabolite acidosis is observed,**
- Intracellular water loss and electrolyte deficiency
- Disturbed function of the kidney, liver, cardiovascular system and adrenal glands.
- In adults: Endotoxic shock is observed in Gram-negative bacteria.
- In children: it is expressed by toxicosis.

Restoration of normovolemia (rehydration)

- **Restoration of previously fluids' losses:**
- **Lost fluids recover themselves within first six hours as follows:**
 - 50 % within first two hours and
 - 50 % during the next four hours.

Restoration of normovolemia (rehydration)

- Daily needs:
- Little children:
 - ❖ first trimester x 150 ml/kg body weight/ 24 h;
 - ❖ second trimester x 120 ml/kg body weight/ 24 h;
 - ❖ third trimester x 100 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.

Restoration of normovolemia (rehydration)

- **Current losses:**

- ❖ Current losses caused **by vomiting and diarrhea** x 30ml/kg body weight/ 24 h.
- ❖ **For perspiration** x 30ml/kg body weight/24 h.
- ❖ **For supporting of urine output** x 30ml/kg body weight/ 24 h.
- ❖ **For each temperature degree over 38° C** x 10 ml/kg body weight/ 24 h.

Ward for cholera



Formula for correction of fluids

T (body weight) x 4 x (Ht_{patient} - Ht_{norm}) =
fluids for 24 h.

Criteria for severity of hypovolemia

- C (coefficient) = $\frac{\text{pulse}}{\text{systolic BP}}$ = 0.5 **normal**
- At $C = 1.0$ – There is a danger of hypovolemic shock.
- At C more than 1.5 – There is hypovolemic shock.
- At decreasing of C under 1.0 – An active and effective resuscitation is necessary.

RESUSCITATION SOLUTIONS IN DEPENDANCE OF THE TYPE OF DEHYDRATION

- HYPOTONIC DEHYDRATION –
2/3 saline solutions - 1/3 glucose solutions.
- HYPERTONIC DEHYDRATION –
2/3 glucose solutions - 1/3 saline solutions.
- ISOTONIC DEHYDRATION – EQUAL PARTS
of saline and glucose solutions.
 - 80 % – parenterally,
 - 20 % – orally.

Recovery of electrolytes' balance

- Daily needs:

- ❖ Na^+ , K^+ , Cl^- – 1-2 meqv/kg body weight/ 24 h

- ❖ Ca – 1-2 meqv/kg body weight/24 h

- Hypernatremia over 150 mmol/l leads to brain stroke – because of subarachnoid and subdural bleeding.

Recovery of electrolytes' balance

- Current losses:

- **At 100 g body weight loss, definite quantities of electrolytes expressed in mmol/l are lost because of:**

	Na	Cl	K
• <u>vomiting</u>	10	10	2
• <u>diarrhea</u>	6	6	6
• <u>vomiting and diarrhea</u>	8	8	4

mean	8	8	4

Formula for correction of SODIUM
expressed in mmol/l

$$BW \times 0,3 \times (145_{\text{norm}} - \text{Sodium}_{\text{ionogram}})$$

- Sodium and chlorine / Na and Cl – not more than 10 meqv/kg body weight/24 h.

- **Formula for correction of POTASSIUM expressed in mmol/l**

$$BW \times 0,3 \times (5_{\text{norm}} - \text{Potassium ionogram})$$

- No more than 2 –3 mmol/l in 100 ml fluids,
- No more than 4 meqv/kg body weight/24 h.
- **Never potassium fastly intravenously!!!**
- **Never potassium at anuria!!!**
- **Administration – in slow infusion!!!**

Correction of metabolic acidosis

- Equation of Astrup:

BW (body weight in kg) x 0,3 x BE =
Sodium bicarbonate 8.4%/ml

Administration – 2/3 of estimated!!!

Other supportive measures

- Human albumin 5% and 20% – 10 ml/kg body weight/24 h
- Blood – 10-20 ml/kg body weight/24 h
- Methylprednisolone – 1-2 mg/kg body weight/24 h

Other supportive measures

- In cases of cholera is applied **Phillips' solution:**
- Sodium chloride – 5.0
- Sodium bicarbonate – 4.0
- Potassium chloride – 1.0
- Distilled water – 1000 ml.
- It contains: Sodium – 135 mmol/l, chlorides – 15 mmol/l, and bicarbonates – 40 mmol/l.

Other supportive measures

- **WHO solution for oral rehydration:**
- Sodium chloride – 3.5 g.
- Sodium bicarbonate – 2.5g.
- Potassium chloride – 1.5 g.
- Glucose – 20.0 g.
- Distilled water – 1000 ml.

Etiological treatment

- **TYPHOID FEVER**
- Ciprofloxacin 1000 – 1500 mg/ 24 h
- Ceftriaxon – 100 mg/ kg weight/ 24 h in children, 4-6 g/ 24 h for adults
- In resistant agents to quinolones – azithromycin 1g/ 24 h; other quinolones; chloramphenicol (according to antibiogram)

Etiological treatment

- **CHOLERA**
- Doxycycline – 3 x 100 mg/ 24 h – for 5 days.
- Alternative – aminoglycosides (Amikacin – 7 – 15 mg/kg body weight/24 h for children, 1000 mg/24 h for adults or Tobramycin – 3-5 mg/kg body weight/24 h for children, 160 mg/24 h for adults).
- Ciprofloxacin and other quinolones.

Etiological treatment

- **COLIENTERITIS**

- Amikacin 7,5 – 15 mg/kg body weight/24 h.
- Colimycin 100 000 E / kg body weight/24 h. i.m.
- Colistin 200 000 E/kg body weight/24 h. per os
- Carbenicilin 150-200 mg/kg body weight/24 h.
- Ciprofloxacin 1000 – 1500 mg/ 24 h
- Ampicillin – 100-200mg/ kg weight/ 24 h for children, 8-12 g/ 24 h for adults
- Trimetoprim/ sulfamethoxazole – 30-50 mg/kg weight/ 24 h for children, 2 x 480 mg/ 24 h

- **Cephalosporines – II generation**

- Cefuroxim – 60-80 mg/kg body weight/24 h.

- **Cephalosporines – III generation**

- Ceftriaxon – 100 mg/ kg weight/ 24 h in children, 4-6 g/ 24 h for adults

**THANK YOU
FOR ATTENTION !**