



**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**

$T \text{ (body weight)} \times 4 \times (\text{Ht}_{\text{patient}} - \text{Ht}_{\text{norm}}) =$   
fluids for 24 h.

# Criteria for severity of hypovolemia

- $C \text{ (coefficient)} = \frac{\text{pulse}}{\text{systolic BP}} = 0.5$  **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:

- ❖  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Cl}^+$  – 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
<hr/>			
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**

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

- 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 !**