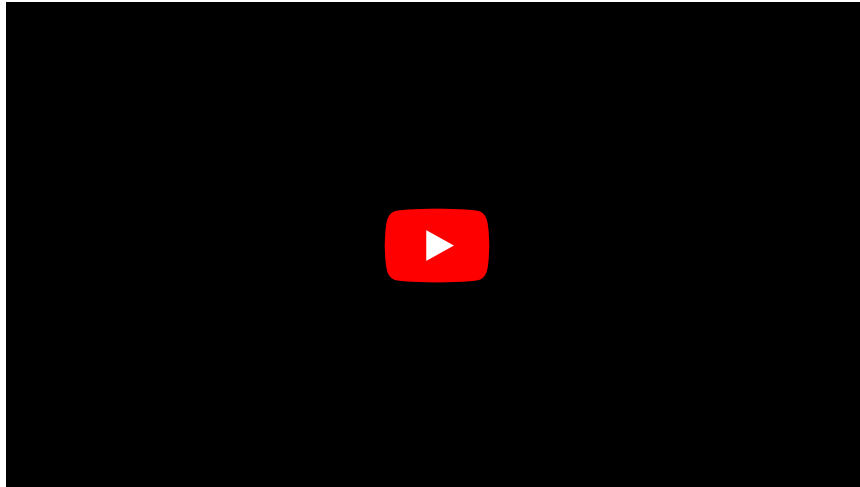


# Disturbances in water management in the body

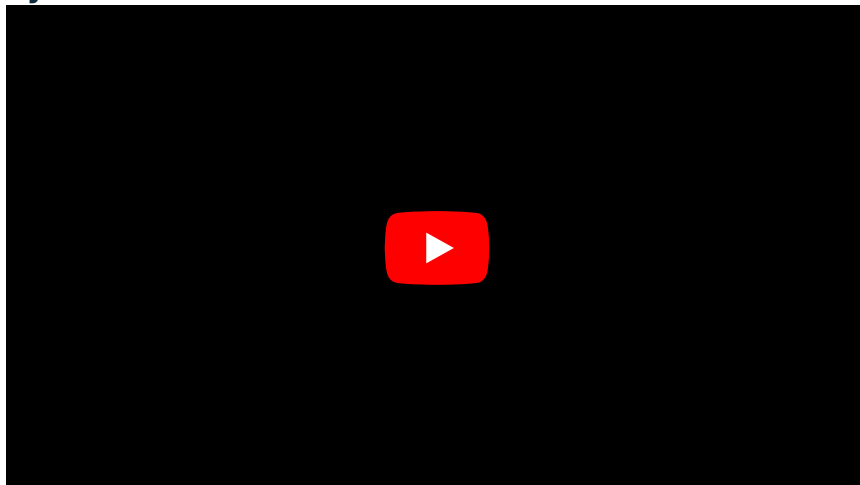
## Disorders of water metabolism

The loss or excess of water in the body causes pathologies that are called **dehydration** or **hyperhydration**.

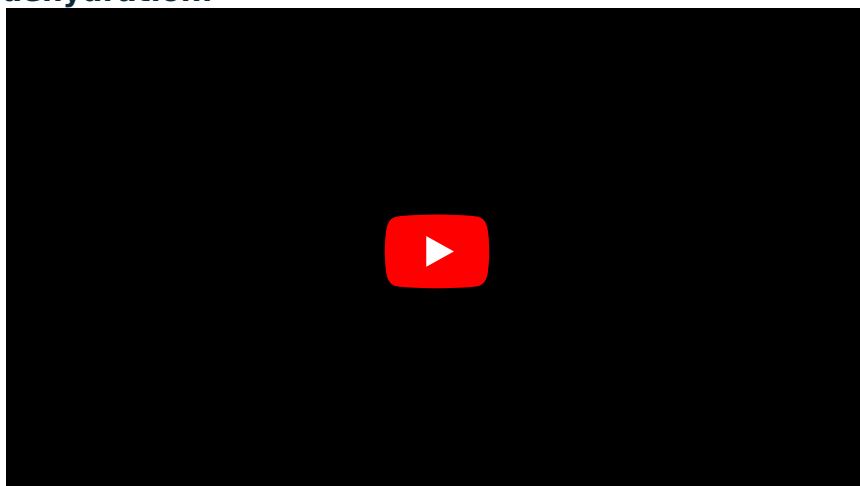
### Water metabolism cases:



### Isotonic hyper/dehydration:



### Hypotonic hyper/dehydration:



### Hypertonic hyper/dehydration:



## Dehydration

- **From reduced supply:**
  1. lack of water,
  2. restriction of reception,
  3. impossibility of receiving fluids (coma, swallowing disorders, lack of care for the affected).
- **From increased losses:**
  1. Skin: sweating, fever,
  2. Lungs: hyperventilation,
  3. Kidney: diabetes insipidus renalis, osmotic diuresis, insufficient concentration ability, hypokalemia, hypercalcemia,
  4. Gastrointestinal tract: diarrhea, vomiting,
  5. Lack of ADH.

## Hyperhydration

- **A consequence of primary renal impairment**
  1. Acute renal failure,
  2. Terminal renal insufficiency,
  3. Obstruction of the urinary tract,
  4. Extracellular volume deficit,
  5. Circulatory collapse.
- **From increased ADH activity:**
  1. Cardiac insufficiency,
  2. Insufficiency of the liver,
  3. Postoperative conditions,
  4. hypothyroidism,
  5. Brain damage,
  6. Carcinoma.

## Hyperosmolality and hypoosmolality

### Hyper-osmolality

The causes of hyperosmolality include loss of body water, acute catabolism (e.g. in shock there is an accumulation of intermediate metabolites in the cell that cannot be removed from the body - this results in hyperosmolality of ICT compared to ECT, which further results in the transfer of water to ICT. A decrease in the volume of ECT then aggravates the primary condition, i.e. it intensifies the circulatory disorder). Hyperosmolality may also occur iatrogenically during infusion therapy and parental nutrition (administration of hypertonic solutions, application of glycerol compresses or transcutaneous absorption of propylene glycol in the treatment of burns). These small molecules, when absorbed, increase osmolality. This can be seen from the difference between the osmolality calculation and the value of its determination by osmometry (the so-called "osmolar gap").

**Calculation of S-osmolality =  $2 \times \text{Na}^+$  + glucose + urea (all in mmol/l)**, eg.  $2 \times 140 + 5 + 5 = 290$  mmol/l

### Hypo-osmolality

The causes of this condition include excessive water supply, swallowing water during drowning, compensation for water and salt losses only with water or solutions without electrolytes, inadequate secretion of ADH, metabolic response to trauma, chronic catabolism

With damage to the brain and spinal cord in some cases, severe osmoregulation disorders occur : diabetes insipidus may develop due to the absence of ADH secretion, which accompanies polyuria, increasing osmolality in plasma (up to 330 mmol/kg) and low osmolality in the urine. Another possibility is the development of inadequate secretion of ADH, which leads to hyponatremia and hypoosmolality. Serum osmolality is lower than urine osmolality. Patients face the threat of cerebral edema.

The adjustment of significant changes in osmolality should not occur faster than 2–4 mmol/kg/h and the change in 24 h should not exceed 20–30 mmol/kg.g.

Syndrome		Values after thirst	U-osm rise after ADH administration
Diabetes insipidus centralis	complete	Uosm < Posm	> 50 %
	partial	Uosm > Posm	≈ 10–60 %
Diabetes insipidus renalis		Uosm < Posm	< 50 %
Psychogenic polydipsia, osmotic diuresis (decompensated DM)		Uosm << Posm	< 5 %

Iron
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## Links

### Related articles

- Water management disorders
- Parameters of water management
- Dehydration

Other chapters from the book MASOPUST, J., PRŮŠA, R.: *Pathobiochemistry of Metabolic Pathways*:

- **Nutrition:** Energy metabolism and its disorders • Nutritional disorders • Examination of the state of nutrition
- **Carbohydrates:** Disorders of glucose metabolism • Glycogenosis
- **Lipids:** Lipid metabolism disorders
- **Other:** Ureagenesis disorders • Porphyria • Uric acid metabolism disorders
- Water, Trace Elements **and Minerals:** Sodium • Potassium
- **Questions and case reports:** Disorders of glucose metabolism • Nutritional disorders • Water • Acid-base balance • Bilirubin • Porphyria • Disorders of uric acid metabolism • Glycogenosis • Lipid metabolism disorders • Eicosanoids • Hereditary disorders of amino acid metabolism • Disorders of gene expression

### Source

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- MASOPUST, Jaroslav and Richard PRŮŠA. *Pathobiochemistry of metabolic pathways*. 2nd edition. Charles University, 2004. 208 pp. pp. 170–171.