

# Disorders of water metabolism

Disorders of water metabolism are divided into:

1. **intracellular**,
2. **extracellular** :
  - **hyperhydration** (hypervolemia),
  - **dehydration** (hypovolemia).

## Intracellular changes in the amount of water

### Cloudy swelling

- Marking for the macroscopic appearance with increased water content in the cells of parenchymatous organs (liver, kidneys, myocardium, skeletal muscles).
  - The organs look like they have been boiled, they are paler, turbid (dull), swollen.
  - Microscopically, the cells are enlarged, with granular cytoplasm (enlarged mitochondria and ER).
- The cause is phosphorylation disorders in the mitochondria - a lack of ATP leads to anaerobic glycolysis and subsequent acidification causes partial denaturation of cytoplasmic proteins and failure of the Na<sup>+</sup> / K<sup>+</sup> pump - this condition occurs, for example, with a lack of oxygen, sepsis, poisoning, nutritional disorders.

### Vacuolar dystrophy

- Small vacuoles filled with water (from mitochondria and ER) are found in the cell - microcystic, honeycomb-like appearance of cells (cytoplasm forms thin septa between vacuoles, nucleus on the periphery of the cell), examples are:
  - **osmotic** vacuolar dystrophy in cells of the proximal renal tubule after infusion of hypertonic glucose solution (osmotic nephrosis);
  - **hydropic** vacuolar dystrophy in hepatocytes seen in "water intoxication";
  - **disintegration** vacuolar dystrophy in the kidneys and liver due to poisoning with CCl<sub>4</sub>, dioxane, ethylene glycol, etc.

### Balloon dystrophy

- Accumulation of water in the cell, which enlarges, becomes rounded or even bursts - e.g. balloon degeneration of epidermis cells during viral infections (blisters in variola, varicella and herpes), septa from cell membranes remain - so-called reticular degeneration.

## Extracellular changes in the amount of water

- These are changes in volemia, which is one of the components of homeostasis and is subject to nervous-humoral regulation, mainly the activity of the GIT and kidneys is applied :
  - increase in volume by reducing diuresis - ADH - ADH (vasopressin) + renin-angiotensin-aldosterone;
  - decrease in volemia by increasing diuresis - ANP.
- **Dehydration** (almost always associated with hyponatremia).
  - It manifests itself with reduced skin turgor, dryness and stickiness of the mucous membranes and serosa, the cheeks are sunken and the nose protrudes sharply - **facies Hippokratika** .
    1. **Hypotonic** - greater loss of solutes than water (loss of hypertonic fluid).
    2. **Isotonic** - loss of isotonic fluid (bleeding, diarrhea, vomiting...).
    3. **Hypertonic** - greater loss of water than solutes (hypotonic fluid loss) or decreased water intake.
  - **Hyperhydration** - occurs either by the movement of water from the intravascular space into the interstitium (edema) or by the retention of Na<sup>+</sup> and water by the kidneys.
    1. **Hypotonic** - greater intake (or retention) of water than solutes - eg water poisoning.
    2. **Isotonic** - retention of isotonic fluid - formation of edema.
    3. **Hypertonic** - greater retention of solutes than water.

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## Links

### Related Articles

- Disorders of water and electrolyte balance (signpost)
- Edema
- Dehydration

### Source

- PASTOR, Jan. *Langenbeck's medical web page [online]* [online] . 1. edition. Grada Publishing, a.s., 2004. vol. 1. Available from <<https://langenbeck.webs.com/>>. ISBN 0.