



Body fluid compartments:

- ♣ Water constitute 50-70% of lean body weight.
- ♣ Total body water content is higher in men.
- ♣ Concentrated in skeletal muscles.
- ♣ Declines steadily with age.
- ♣ Intracellular fluids, 40% of body weight.
- ♣ Extracellular fluids, 20% of body weight :
 - ▶ Plasma or intravascular compartment 5%.
 - ▶ Interstitial compartment 15% .
- ♣ Na^+ is the principal extracellular *cation* .
- ♣ Cl^- and HCO_3^- are the principal extracellular anions .
- ♣ K^+ and Mg^{+2} are the principal intracellular anions.
- ♣ *Phosphates* and negatively charged proteins are the principal intracellular anions .

Fluid balance :

- ♣ Daily requirement.
- ♣ Replacement of ongoing loss.
- ♣ Correction of abnormalities.
- ♣ Basal Requirement :
 - ▶ 35cc / kg / day.
 - ▶ 100 cc / 50 cc / 20 cc
- ♣ Fluids turnover :
 - ▶ GI tract 6000-9000cc / day
 - ▶ Renal 1000-15000cc / day
 - ▶ Insensible loss 600-800cc / day.

Volume disorders :

- ❖ **Hypovolemia :**
 - ▶ Mild: 4% loss of TBW, 15% of blood .
 - ▶ Moderate: 6% TBW, 15-30% of blood .
 - ▶ Severe: 8% TBW, 30-40% of blood .
 - ▶ Shock: > 8% TBW, >40% of blood .

- ❖ **Hypervolemia :**
 - ▶ Parenteral overhydration .
 - ▶ cardiac failure .
 - ▶ renal failure .



❖ Hyponatremia :

♣ Hypotonic:

▶ Hypovolemic: Loss of isotonic fluids or replacement with inadequate volume of excessively hypotonic fluids.

▶ Hypervolemic: Fluid retaining .

▶ Isovolemic: SIADH .

♣ Isotonic: Pseudohyponatremia.

♣ Hypertonic:

▶ Non-sodium osmotic substances.

▶ 100 mg/dl glucose Na^+ 3 meq/l .

λ Hyponatremia treatment :

♣ Underlying disorder .

♣ Water restriction .

♣ Loop diuretics .

♣ Rate of infusion .

❖ Hypernatremia :

♣ Water loss greater than salt loss .

♣ Hypovolemic: 3 meq rise in Na^+ = 1 L loss of water .

♣ Isovolemic: Diabetes insipidus .

♣ Hypervolemic: iatrogenic, endocrine.

λ Hypernatremia treatment :

♣ Underlying disorder.

♣ Water deficit=(0.6 x kg weight) (serum Na^+ /140-1).

♣ Slow replacement.

❖ Hypokalemia :

♣ Redistributive losses from intracellular uptake of *potassium*

♣ Depletion: GI loss, renal loss.

♣ ECG changes, weakness, fatigue, ileus.

λ Hypokalemia treatment :

♣ Adequate renal function .

♣ Enteral replacement .

♣ Parenteral replacement .

♣ Treat alkalosis.



❖ Hyperkalemia :

- ♣ Leukocytosis, hemolysis, thrombocytosis.
- ♣ Redistributonal: acidosis, tissue necrosis.
- ♣ Renal failure, excessive intake, *spironolactone*.
- ♣ Nausea, vomiting, diarrhea , colic.
- ♣ ECG changes .
- ♣ Cardiac arrest.

λ Hyperkalemia treatment :

- ♣ Remove exogenous source.
- ♣ If > 7.5 its an emergency:
 - ▶ *Calcium gluconate*
 - ▶ *Insulin and D50W*
 - ▶ *Kayexalate*.

Acid-Base balance :

- ♣ Enzymatic balance.
- ♣ Three primary systems:
 - ▶ Buffer system: RBCs, proteins, *phosphate*.
 - ▶ Respiratory system .
 - ▶ Renal system .

Metabolic acidosis :

- ♣ Overproduction or underexcretion of acid.
- ♣ *Anion gap* = $\text{Na}^+ - (\text{Cl}^- + \text{HCO}_3^-)$.
- ♣ Normal *anion gap* (RTA, diarrhea).
- ♣ Wide *anion gap* (DKA, RF, toxins).