Chapter 26: Fluid, Electrolyte & pH Balance

I. Body Fluids

Born with ~73% water, eventually decreases to ~45%.
Water content lower with higher fat content.

Approximately 2/3 water is intracellular.
Extracellular water divided mostly between plasma and interstitial fluid.

Solute consist of electrolytes and non-electrolytes.

Intracellular fluid has higher levels of protein and K+, less Na+.
Continuous exchange between compartments, based on gradients of hydrostatic and osmotic pressure.

II. Water Balance

Provided by diet and metabolism;
Lost in urine, feces, sweat, evaporation.

Hypothalamus determines thirst, stimulated by osmoreceptors.
Regulation with ADH.

Disorders:
dehydration;
hypotonic hydration – leads to hyponatremia;
Edema: an increase of interstitial fluid.

III. Electrolyte Balance

The most influential is Na+. Regulated with aldosterone & angiotensin II.
Levels lower with Addison’s Disease (aldosterone deficiency). Opposed by ANP.
Hyper- vs. hyponatremia.
Potassium balance also maintained by kidneys. Secretion of excess via aldosterone. Hyper- vs. hypokalemia.

Calcium and phosphate regulated together. PTH & Calcitonin.

IV. Acid – Base Balance

Most body fluids slightly alkaline. More common problem is H+ accumulation. Alkalosis vs. acidosis.

(A) Buffer Systems replace strong acids/ bases with weak ones.

1- bicarbonate: \( \text{H}_2\text{CO}_3 \rightarrow \text{H}^+ \text{ and } \text{HCO}_3^- \) in blood and ECF.

2- phosphate: in urine and ICF.

3- proteins: in cells. \( \text{COOH} \rightarrow \text{COO}^- \text{ and } \text{NH}_2 \rightarrow \text{NH}_3^+ \)

(B) Respiratory Regulation

Based on CO2 concentration. \( \text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{HCO}_3^- \rightarrow \text{H}^+ \text{ and } \text{HCO}_3^- \)

(C) Renal Mechanisms

Based on HCO3- secretion vs. reabsorption, H+ secretion.

(D) pH Abnormalities

Respiratory alkalosis vs. acidosis: due to CO2 levels.

Metabolic alkalosis vs. acidosis:

Diarrhea increases HCO3- loss; vomiting increases H+ loss.