NURS 821 Advanced Pathophysiology

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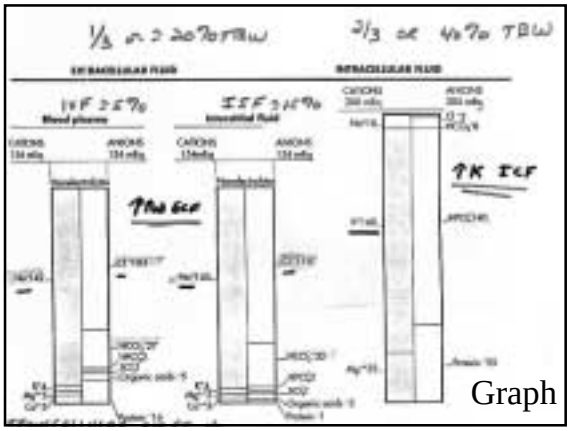
Lecture 4 Alterations in Fluid, Electrolytes, and Acid Base Balance

Fluid, Electrolyte, and Acid Base

Part 1 Body Fluid Mechanics

Total Body Water

- Newborn-75%
- Adult
  - Male (20-40 yrs)-60%
  - Female (20-40)-50%
- Elderly-45-50%



Graph

Body Water Regulation

- Controlled by osmosis and hydrostatic pressure: ***DYNAMIC!***
- Sodium=largest regulator of H2O movement within body; water follows; ***not effective osmole***!
- Total body water balance controlled by thirst and ADH
- Sodium regulated by aldosterone
- Normal H2O intake/day=2500 cc

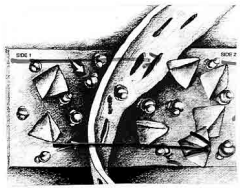
Osmotic Regulation

- Controlled by Antidiuretic Hormone (ADH)
  - Hypothalamus synthesizes after osmoreceptors sense osmolality and thirst
  - Regulates renal collecting duct permeability causing increased water reabsorption
  - Large ECF loss needed to stimulate thirst and ADH release (hemorrhage manifestation-thirst)
  - ***Increased ADH causes increased H_2O reabsorption, increased urine osmolality, and increased renal collecting duct permeability***

Process of Osmosis

Process of Osmosis

- Side 2- more solute particles
- Side 1-water molecules=
- Side 2 has greater osmotic pressure



Process of Osmosis

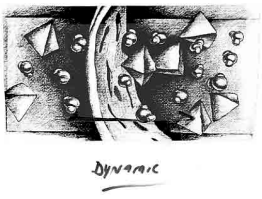
Process of Osmosis

- Water moves by osmosis to side 2 due to greater oncotic pressure
- Membrane is not permeable to solute particles; number of solute particles in compartment does not change

Process of Osmosis

Process of Osmosis

- Water movement is complete
- Solute concentration is =
- Equilibrium achieved
- No net water movement, but not static



Tonicity of Solution Effects on RBCs

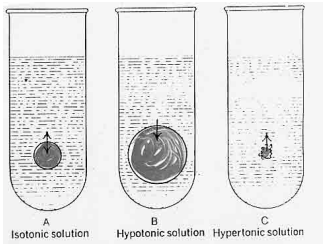


Figure 27-3 Osmosis. **(A)** red cells undergo no change in size in isotonic solutions, **(B)** they increase in size in hypotonic solutions, and **(C)** they decrease in size in hypertonic solutions. *(Chaffee EE, Greisheimer EM: Basic Physiology and Anatomy, 3rd ed. Philadelphia, JB Lippincott, 1974)*

Factors Influencing Fluid Exchange Between Blood Vessels and Tissues

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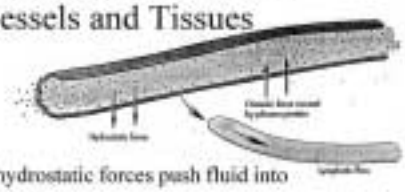

- Normally, hydrostatic forces push fluid into interstitial spaces.
- This force is counterbalanced by osmotic force of intravascular plasma proteins.
- Lymphatics drain interstitial fluids.

Filtration

Hydrostatic pressure in>out

Water moves down hydrostatic pressure gradient through semipermeable membrane to outside

Inside hydrostatic pressure=outside

No further ***net*** water movement