Fluids and Electrolytes

• After reading this chapter, the student should be able to do the following: Define the key terms as listed.
• List, describe, and compare the body fluid compartments.
• Discuss active and passive transport processes and give two examples of each.
• Discuss the role of specific electrolytes in maintaining homeostasis.
• Describe the cause and effect of deficits and excesses of sodium, potassium, chloride, calcium, magnesium, phosphorus, and bicarbonate.
• Differentiate between the role of the buffers, lungs, and kidneys in maintenance of acid-base balance.
• Discuss the role of the nursing process for fluid, electrolyte, and acid-base balances.

Fluids (Water)

• Functions
  – Delivery of nutrients to the cells and carry waste products from the cells
  – Provides a medium in which chemical reactions, or metabolism, can occur within the cell
  – Acts as a lubricant for tissues
  – Assists in heat regulation via evaporation
Fluids (Water)
• Percentage of body weight that is water depends on several factors.
  – Age
    • Premature infant: 90%
    • Newborn: 70-80%
    • Twelve years to adult: 50-60%
    • Older adults: 45-55%

Fluids (Water)
• Amount of Fat
  – Fat contains relatively little water.
  – The female has proportionately more body fat than the male, which means that the female has less body fluid.

Fluid Compartments
• Extracellular Fluid
  • Between the cells or in the tissue
  • Accounts for approximately 27% of the fluid in the body
  • Examples: lymph, cerebrospinal fluid, and gastrointestinal secretions
• The normal daily loss of fluids must be met by the normal daily intake.
• Daily water intake and output is approximately 2 to 2.5 liters.
• Fluid leaves the body through the kidneys, lungs, skin, and GI tract.

Intake and Output
• Intake includes all fluids entering the body.
  – This also includes tube feedings and parenteral intake such as intravenous fluids, blood components, and total parenteral nutrition.
• Output includes all fluids leaving the body.
  – Examples are urine and vomitus.
  – Also included is drainage from surgical wounds.

Intake and Output
• The kidneys play an extremely important role in fluid balance.
  – Output of 1 to 2 L of urine per day.
• The kidneys must excrete a minimum of 30 ml/hr of urine to eliminate waste products from the body.
• Several methods are used by the body to move fluids, electrolytes and other solutes, or dissolved substances into and out of cells.
  – Passive Transport Processes
    • No cellular energy is required to move substances from a high concentration to a low concentration.
  – Active Transport Processes
    • Cellular energy is required to move substances from a low concentration to a high concentration.

Passive Transport

• Diffusion: Example is the lungs and exchange of gases in the aveoli
  – This is the movement of particles in all directions through a solution or gas.

Passive Transport

• Osmosis
  – This is the movement of water from an area of lower concentration to an area of higher concentration.
  – It equalizes the concentration of ions or molecules on both sides of the membrane.
  – The flow of water will continue until the number of ions or molecules on both sides are equal.
Passive Transport

- Filtration
  - A force behind filtration is called hydrostatic pressure, or the force pressing outward on a vessel wall.

Active Transport

- Requires energy
- Force that moves molecules into cells without regard for their positive or negative charge and against concentration factors that would prevent entry via diffusion
- Substances actively transported through the cell membrane include sodium, potassium, calcium, iron, hydrogen, amino acids, and glucose.

Active Transport

- Electrolytes
  - Electrolytes develop tiny electrical charges when they dissolve in water and break up into particles known as ions.
    - Cations have a positive charge.
    - Anions have negative charge.
  - A balance exists between the electrolytes; for each positively charged cation, there must be a negatively charged anion.
Active Transport

• Sodium
  – A cation
  – Most abundant electrolyte in the body
  – Normal level: 134 to 142 mEq/L
  – Functions of sodium: regulates water balance

Active Transport

• Potassium
  – Normal level is 3.5 to 5 mEq/L
  – Well-balanced diet usually provides adequate potassium; approximately 65 mEq is required each day.
  – The main route of potassium excretion is the kidneys.
  – The main function is regulation of water and electrolyte content within the cell.

Active Transport

• Potassium
  – Hypokalemia
    • Decrease in body’s potassium to a level below 3.5 mEq/L
    • The major cause of loss is renal excretion.
    • Potassium can be depleted due to excessive GI losses from gastric suctioning or vomiting and the use of diuretics.
    • This can affect skeletal and cardiac function.
Active Transport

- **Potassium**
  - **Hyperkalemia**
    - Increase in the body’s serum potassium level above 5 mEq/L.
    - The major cause of excess potassium is renal disease; severe tissue damage causes potassium to be released from the cell.
    - This can cause cardiac arrest.

Active Transport

- **Chloride**
  - An extracellular anion.
  - Normal level is 96 to 105 mEq/L.
  - The main route of excretion is the kidneys.

Active Transport

- **Calcium**
  - A positively charged ion.
  - Normal level is 4.5 mEq/L.
  - Of calcium in the body, 99% is concentrated in the bones and teeth.
  - Vitamin D, calcitonin, and parathyroid hormone are necessary for absorption and utilization of calcium.
  - The best food sources are milk and cheese.
Tests for hypocalcemia. A, Chvostek’s sign; B, Trousseau’s sign.

Acid-Base Balance
• Acid-base balance means homeostasis of the hydrogen ion concentration in the body fluids.

Slide show over
• Time to get something to eat!