RSPT 2317
Calculating Drug Doses

The Metric System

The Metric System

- primary units of measure are
  - length = meter
  - volume = liter
  - mass = gram
- to change the primary units
  - add Latin prefixes for smaller sizes
  - add Greek prefixes for larger sizes

The Metric System

- increasing prefixes - Latin
  - micro = 1/1,000,000
  - milli = 1/1,000
  - centi = 1/100
  - deci = 1/10
- decreasing prefixes - Greek
  - deca = 10
  - hecto = 100
  - kilo = 1,000

Calculating Drug Doses, Percentages and Ratios

Calculating Drug Doses & Percentages

- To calculate drug dosages, remember one basic statement:

  One gram or ml of drug in 99 ml of diluent will yield a 1% solution. Therefore, 1 ml of a 1% solution contains .01 gm (10 mg) of the drug.

- The formula that proves this statement is:

$$\%\ (\text{in decimals}) = \frac{\text{amount of solute (gm)}}{\text{total amount of solution (ml)}}$$

Calculating Drug Doses & Percentages

- Examples
  - how many milligrams of active drug are in 100 ml of a 1% solution?

$$.01 = \frac{x \text{ gm}}{100\text{ml}}$$
$$x = 1 \text{ gm (1000 mg)}$$

  - how many milliliters of a 5% solution would be needed to deliver500 mg of active drug?

$$.05 = \frac{0.5 \text{ gm}}{x \text{ ml}}$$
$$.05x = 0.5 \text{ gm}$$
$$x = 10 \text{ ml}$$

Calculating Drug Doses & Percentages

- Example
  - what is the percentage strength of a solution that contains 10 mg/ml of active ingredient?

$$\% = \frac{.01 \text{ gm}}{1 \text{ ml}} \times 100$$
$$\% = .01 \times 100$$
$$\% = 1$$

Calculating Drug Doses & Percentages

- Example
  - what is the percentage strength of a solution that contains 50 mg/10 ml of active ingredient?

$$\% = \frac{.05 \text{ gm}}{10 \text{ ml}} \times 100$$
$$\% = .005 \times 100$$
$$\% = 0.5$$

Calculating Drug Dosage Ratios

- To express a ratio (e.g. 1:200) as a percentage, the following formula is used (R = ratio):

$$R \times 100 = \%$$

- In this formula, a ration such as 1:200 is expressed as a fraction

$$1{:}200 = \frac{1}{200}$$

Calculating Drug Dosage Ratios

- Example
  - express 1:100 as a percent

$$\% = \frac{1}{100} \times 100$$

$$\% = .01 \times 100$$

$$\% = 1$$

Calculating Drug Dosage Ratios

- Example
  - express 1:200 as a percent

$$\% = \frac{1}{200} \times 100$$

$$\% = .005 \times 100$$

$$\% = 0.5$$

Calculating Drug Dosage Ratios

- Example
  - express 1:1000 as a percent

$$\% = \frac{1}{1000} \times 100$$

$$\% = .001 \times 100$$

$$\% = 0.1$$

Calculating Drug Dosage Ratios

- Example
  - express 1:50 as a percent

$$\% = \frac{1}{50} \times 100$$

$$\% = .02 \times 100$$

$$\% = 2$$

Mixing Solutions

Mixing Solutions

- When mixing two solutions to obtain a desired drug percentage, the following formula is used:

$$\frac{\text{amount of solute needed}}{\text{amount of solution desired}} = \frac{\text{concentration of desired solution}}{\text{concentration of on-hand solution}}$$

Mixing Solutions

- Example
  - prepare 5 ml of a 5% solution of acetylcysteine, using 20% acetylcysteine and normal saline

$$\frac{x}{5} = \frac{5}{20}$$

$$x = \frac{25}{20}$$

$$x = 1.25$$

To prepare 5 ml of 5% acetylcysteine, mix 1.25 ml of the 20% acetylcysteine with 3.75 ml normal saline.

Mixing Solutions

- Example
  - prepare 300 ml of a 0.9% NaCl solution using H_2O and NaCl crystals

$$\frac{x}{300} = \frac{0.9}{100}$$

$$x = \frac{270}{100}$$

$$x = 2.7$$

To prepare 300 ml of 0.9% NaCl, mix 2.7 gm of the on-hand NaCl crystals with q.s. H2O to equal 300 ml total solution.

Calculating Pediatric Doses

Calculating Pediatric Doses

- Fried's rule (infants under 1 year)

$$\text{Infant dose} = \frac{\text{infant age (months)}}{150 \text{ months}} \times \text{adult dose}$$

Calculating Pediatric Doses

- Fried's rule (infants under 1 year)
  - example
    determine the dose for a 3 month old infant of a drug with an adult dose of 15 mg

$$\text{dose} = \frac{3}{150} \times 15$$

$$\text{dose} = .02 \times 15$$

$$\text{dose} = 0.3 \text{ mg}$$

Calculating Pediatric Doses

- Young's rule (1 to 12 years)

$$\text{child dose} = \frac{\text{child age (years)}}{\text{child age} + 12 \text{ years}} \times \text{adult dose}$$

Calculating Pediatric Doses

- Young's rule (1 to 12 years)
  - example

    determine the dose for a 5 year old child of a drug with an adult dose of 30 mg

$$\text{dose} = \frac{5}{5 + 12} \times 30$$

$$\text{dose} = \frac{5}{17} \times 30$$

$$\text{dose} = .294 \times 30$$

$$\text{dose} = 8.82 \text{ mg}$$

Calculating Pediatric Doses

- Clark's rule

$$\text{child dose} = \frac{\text{child weight (lbs)}}{150 \text{ lb}} \times \text{adult dose}$$

Calculating Pediatric Doses

- Clark's rule
  - example
    determine the dose for a child weighing 60 lbs for a drug with an adult dose of 40 mg

$$\text{dose} = \frac{60}{150} \times 40$$

$$\text{dose} = 0.4 \times 40$$

$$\text{dose} = 16 \text{ mg}$$

Calculating Pediatric Doses

- Using body surface area
  - considered to be most accurate

$$\text{child dose} = \frac{\text{child BSA } (m^2)}{1.73\ m^2} \times \text{adult dose}$$

Calculating Pediatric Doses

- Using body surface area
  - example
    determine the dose for a 8 year old child with a BSA of .98 m^2 for a drug with an adult dose of 50 mg

$$\text{dose} = \frac{.98}{1.73} \times 50$$

$$\text{dose} = .566 \times 50$$

$$\text{dose} = 28.3 \text{ mg}$$

In-class Problems

In-class Problems (set 1)

1. A .3 ml dose of 5% Metaprel contains how many mg metaproterenol?

$$\%\ (\text{in decimals}) = \frac{\text{amount of solute (gm)}}{\text{total amount of solution (ml)}}$$

In-class Problems (set 1)

2. A .5 ml dose of 1:200 Isuprel contains how many mg isproterenol?

   First, convert 1:200 to a percentage (in decimal form)

$$\%\ (\text{in decimals}) = \frac{\text{amount of solute (gm)}}{\text{total amount of solution (ml)}}$$

In-class Problems (set 1)

3. How many ml of 1:200 Proventil would be needed to deliver 5 mg albuterol?

$$\%\ (\text{in decimals}) = \frac{\text{amount of solute (gm)}}{\text{total amount of solution (ml)}}$$

In-class Problems (set 1)

4. What is the percentage strength of a solution of Ventolin that contains 5 mg albuterol per ml?

$$\%\ (\text{in decimals}) = \frac{\text{amount of solute (gm)}}{\text{total amount of solution (ml)}}$$

In-class Problems (set 1)

5. What is the ratio strength of an epinephrine solution that contains 1 mg epinephrine per ml?

$$\%\ (\text{in decimals}) = \frac{\text{amount of solute (gm)}}{\text{total amount of solution (ml)}}$$

In-class Problems (set 2)

1. Prepare 250 ml of 1% NaCl using H_2O and 10% NaCl solution.

$$\frac{\text{amount of solute needed}}{\text{amount of solution desired}} = \frac{\text{concentration of desired solution}}{\text{concentration of on-hand solution}}$$

In-class Problems (set 2)

2. Prepare 50 ml of 5% acetylcysteine solution using NS and 20% acetylcysteine.

$$\frac{\text{amount of solute needed}}{\text{amount of solution desired}} = \frac{\text{concentration of desired solution}}{\text{concentration of on-hand solution}}$$

In-class Problems (set 2)

3. Prepare 2 L of 20% $NaHCO_3^-$ solution using H_2O and $NaHCO_3^-$ crystals.

$$\frac{\text{amount of solute needed}}{\text{amount of solution desired}} = \frac{\text{concentration of desired solution}}{\text{concentration of on-hand solution}}$$

In-class Problems (set 2)

4. Prepare 1 L of NS using H2O and NaCl crystals.

$$\frac{\text{amount of solute needed}}{\text{amount of solution desired}} = \frac{\text{concentration of desired solution}}{\text{concentration of on-hand solution}}$$

In-class Problems (set 2)

5. Prepare 1 L of 2% acetic acid using water and vinegar (5%).

$$\frac{\text{amount of solute needed}}{\text{amount of solution desired}} = \frac{\text{concentration of desired solution}}{\text{concentration of on-hand solution}}$$