Chapter 4
Medication Math

Learning Objectives

- Identify basic units of measure for weight, length, and volume
- Accurately convert milliliters to cubic centimeters, kilograms to pounds, and milligrams to grams (and micrograms)

Learning Objectives

- Apply four basic formulas (single dose, infusion of a measured amount of fluid in a set amount of time, drip infusion not based on weight, and drip infusion based on weight) to solve drug problems and determine dosages
Introduction

Medication math can be made simple by mastering basic formulas.

Must be able to convert weight and volume and calculate volumes of drug based on concentration of the drug.

Introduction

Systems of measurement

- Apothecary system
  - Weight was measured in grains
  - Linear measures included inches, yards, and miles
  - Volume was measured in minims

Introduction

Systems of measurement

- Metric system
  - Current preferred system for drug measurement and calculation
  - Based on basic unit and its multiples or submultiples of 10
  - Weight: gram (g)
  - Length: meter (m)
  - Volume: liter (L)
Introduction

- Systems of measurement
  - Metric system
    - Several prefixes used to distinguish multiples or smaller parts of units
      - Kilo-
      - Centi-
      - Milli-
      - Micro-

Most drugs administered in the field are measured using:
- Gram (g)
- Milligram (mg)
- Microgram (mcg)

Drugs present in solutions are measured in milliliter (mL)
- May also use cubic centimeters (cc)
- mL and cc refer to the same volume

Conversions

- Failure to understand and use unit conversions may lead to overdose or less than optimal dose

- Most IV medications are supplied as solutions expressed in concentrations (mg/mL)
Conversions

- Medications are dosed as mass (mg)
- Drug doses are often determined based on patient weight (lbs or kg) or body surface area

Conversions

- Milliliter and cubic centimeters
  - Milliliter is a measurement of volume; is equal to 1/1000 of a meter
  - 1 cc = 1 mL
  - Volume = space
  - Never take medication orders in dosages of volume
    - Can result in overdosing
Conversions

- Kilograms and pounds
  - Refers to patient weight, not weight of drug
  - Many drug dosages are based on patient weight in kilograms to ensure safety from overdose
  - 1 kg = 2.2 lb
  - To convert weight in lbs to weight in kg: divide number of lbs by 2.2

- Milligrams, micrograms, and grams
  - 1000 mg = 1 g
  - To convert g to mg, multiply g by 1000
    * Can be done by moving decimal point to the right the same number of spaces as there are zeros in the number
  - To convert mg to mcg, move decimal point 3 more places to the right for a total of 6 zeros
  - To convert mg to g, divide number of g by 1000
    * Move decimal point to the left 3 places

Drug Preparations and Concentrations

- Drugs are supplied in various concentrations
- Dosages must be calculated according to particular preparation
Formulas

- Used to solve drug problems or determine dosages for patients
- Four basic formulas can be used to solve all pharmacology math problems

Formulas

- **Formula 1:**
  - Single dose:
    - Desired dose divided by dose on hand x volume or quantity divided by 1 = X

- **Formula 2:**
  - To infuse a measured amount of fluid in a set amount of time:
    - Total volume x drops/mL of IV set divided by time in minutes = drops (gtt)/min

Formulas

- **Formula 3:**
  - Drip (infusion) not based on weight:
    - Dose desired divided by dose on hand x drops/mL of IV set divided by 1 = gtt/min

- **Formula 4:**
  - Drip (infusion) based on weight
    - Dose desired divided by kg x weight in lbs divided by 2.2 lb/kg = dose desired
Formulas

- **Application of formula 1**
  - Calculates the amount of a drug given to a patient in a single dose on basis of:
    - Desired dose (DD) or amount ordered by medical direction
    - Dose on hand (DH) or amount of the weight of the drug (g, mg, mcg)
    - Volume (V) or quantity (Q) or the amount of solution in which the drug is dissolved

- **Application of formula 2**
  - Used to calculate amount of drug to give when infusing a measured amount of fluid in set amount of time
  - Fluid challenges
Formulas

- Application of formula 2
  - Choose proper formula
  - Total volume x gtt/mL of IV set/time in minutes = gtt/min
  - Fill in known values
  - Cross out like terms
  - Multiply across
  - Sometimes measured amount of fluid is ordered to be given over a period of hours
    - To make conversion, change hours to minutes by multiplying by 60 and continue as before

Formulas

- Application of formula 3
  - Used to calculate amount of drug given by drip (infusion) when dosage is not based on weight but on dose of medication per minute
  - Choose proper formula
    - DD in minutes x gtt/mL of IV set/DH = gtt/min
  - Fill in known values
  - Cross out like terms
  - Multiply across

Formulas

- Application of formula 4
  - Used to calculate amount of drug to give by drip (infusion) when dosage is based on weight
  - Choose proper formula
    - DD/kg x lb/2.2 lb/kg = DD
    - DD/DH x gtt/mL of IV set/1 = drops per minute
Formulas

- Application of formula 4
  - Determine patient's weight in kilograms by dividing weight in pounds by 2.2
  - Multiply weight in kilograms by DD/kg and cross out like terms to determine DD, with weight adjustment
  - Prepare infusion and calculate DH (drug concentration)
  - Determine drip rate with a microdrip IV infusion set that delivers 60 gtt/mL
  - Cross out like terms and multiply across

Questions?