# DOSAGE CALCULATIONS

## A RATIO-PROPORTION APPROACH

THIRD EDITION

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Chapter 14

# Pediatric and Adult Dosages Based on Body Weight

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# Caution

- Those who administer drugs to patients are legally responsible for recognizing incorrect and unsafe dosages

# Administering Medications to Children

- Birth to 1 year of age have greater percentage of body water
- Age 1 to 12 years metabolize drugs more readily than adults

# Administering Medications to Children

- Children at risk for overdose, toxic reactions, and death
  - Due to immature physiological processes
    - E.g., absorption, distribution, metabolism, excretion

# Administering Medications to Children

- Safe pediatric dosages calculated by:
  - Body weight
    - Measured in mg per kg, mcg per kg, etc.
  - Body surface area (BSA)
    - Measured in $m^2$

# Remember

- 1 kg = 2.2 lb
  - When converting pounds to kilograms, round kilogram weight to one decimal place
    - Tenths
- 1 lb = 16 oz

# Example One

- Convert 45 lb to kilograms

1. Approximate equivalent
   - Equivalent is: 1 kg = 2.2 lb
2. Set up ratio

$$\frac{1\text{ kg}}{2.2\text{ lb}} = \frac{X\text{ kg}}{45\text{ lb}}$$

# Example One

3. Calculate

Cross-multiply $\frac{1\text{ kg}}{2.2\text{ lb}} = \frac{X\text{ kg}}{45\text{ lb}}$

$$2.2\,X = 45$$

Simplify $\frac{2.2\,X}{2.2} = \frac{45}{2.2}$

$$X = 20.45 \text{ or } 20.5 \text{ kg}$$

# Example Two

- Convert 10 lb 12 oz to kilograms

1. Approximate equivalent
   - 1 kg = 2.2 lb
2. Set up ratio to convert ounces to pounds
   - Answer: 10 lb 12 oz = $10\frac{3}{4}$ lb

$$\frac{1 \text{ lb}}{16 \text{ oz}} = \frac{X \text{ lb}}{12 \text{ oz}}$$

$$16X = 12$$

$$\frac{16X}{16} = \frac{12}{16}$$

$$X = \frac{3}{4} \text{ lb}$$

# Example Two

- Convert $10\frac{3}{4}$ lb to kilograms
- Think:
  - $\frac{1}{2}$ of $10\frac{3}{4}$ = approximately 5
- Change to decimal
  - $10\frac{3}{4} = 10.75$
- Set up ratio and calculate

# Example Two

3. Calculate

$$\frac{1\text{ kg}}{2.2\text{ lb}} \times \frac{X\text{ kg}}{10.75\text{ lb}}$$

$$2.2\,X = 10.75$$

$$\frac{2.2\,X}{2.2} = \frac{10.75}{2.2}$$

$$X = 4.88 \text{ or } 4.9 \text{ kg}$$

# Calculating Safe Pediatric Dosage: Body Weight Method

1. Convert child's weight in pounds to kilograms rounded to nearest tenth
2. Calculate safe dose as noted in drug reference in mg per kg or mcg per kg rounded to nearest tenth

# Calculating Safe Pediatric Dosage: Body Weight Method

3. Compare ordered dose with recommended dose
   - Determine safety
4. If safe, calculate ordered dose and administer
   - If unsafe, consult prescriber

# Calculating and Verifying Safe Dosages

- Single dose example:
  - Physician orders morphine sulfate 1.8 mg IM stat
  - Child weighs 79 lb
  - Is the dose safe?

# Calculating and Verifying Safe Dosages

1. Convert 79 lb to kilograms
   - Approximate equivalent
     - 1 kg = 2.2 lb
   - Set up ratio and calculate
     - Round to nearest tenth

$$\frac{1\text{ kg}}{2.2\text{ lb}} = \frac{X\text{ kg}}{79\text{ lb}}$$

$$2.2X = 79$$

$$\frac{2.2X}{2.2} = \frac{79}{2.2}$$

$$X = 39.9\text{ kg}$$

# Calculating and Verifying Safe Dosages

2. Calculate safe dose in mg per kg as noted in reputable drug resource
   - Resource notes usual IM dose as 0.05 mg per kg per dose
   - Set up ratio and calculate

$$\frac{0.05 \text{ mg}}{1 \text{ kg}} = \frac{X \text{ mg}}{35.9 \text{ kg}}$$

$$X = 0.05 \times 35.9$$

$$X = 1.79 \text{ or } 1.8 \text{ mg per dose}$$

# Calculating and Verifying Safe Dosages

3. Compare ordered with recommended dose
   - Ordered dose:
     - 1.8 mg
   - Recommended dose:
     - 1.8 mg
   - Conclude ordered dose is safe

# Calculating and Verifying Safe Dosages

4. Calculate one dose
   - Ordered: Morphine sulfate 1.8 mg IM
   - Available: Morphine sulfate 5 mg per mL

# Calculating and Verifying Safe Dosages

- Calculate one dose
  1. Convert
     - No conversion necessary
  2. Think
     - If 5 mg per mL and need 1.8 mg, will give less than 1 mL

# Calculating and Verifying Safe Dosages

- Calculate one dose
  3. Calculate

$$\frac{5 \text{ mg}}{1 \text{ mL}} = \frac{1.8 \text{ mg}}{X \text{ mL}}$$

$$5X = 1.8$$

$$\frac{5X}{5} = \frac{1.8}{5}$$

$$X = 0.36 \text{ mL}$$

# Calculating and Verifying Safe Dosages

- Draw up 0.36 mL of morphine sulfate 5 mg per mL in 1 mL syringe

# Calculating and Verifying Safe Dosages

- Single dose range example:
  - Physician orders Vistaril 20 mg IM q. 4 h p.r.n. nausea
  - Child weighs 44 lb
  - Is the dose safe?

# Calculating and Verifying Safe Dosages

1. Convert 44 lb to kilograms
   - Approximate equivalent
     - 1 kg = 2.2 lb
   - Set up ratio and calculate
     - Round to nearest tenth

$$\frac{1\text{ kg}}{2.2\text{ lb}} = \frac{X\text{ kg}}{44\text{ lb}}$$

$$2.2X = 44$$

$$\frac{2.2X}{2.2} = \frac{44}{2.2}$$

$$X = 20\text{ kg}$$

# Calculating and Verifying Safe Dosages

2. Calculate safe dose in mg per kg as noted in reputable drug resource
   - Resource notes usual IM dose as 0.05 mg to 1 mg per kg per dose
   - Need to calculate minimum and maximum dosage range

# Calculating and Verifying Safe Dosages

- Set up ratios and calculate minimum and maximum safe ranges

$$\frac{0.5\text{ mg}}{1\text{ kg}} = \frac{X\text{ mg}}{20\text{ kg}} \qquad \frac{1\text{ mg}}{1\text{ kg}} = \frac{X\text{ mg}}{20\text{ kg}}$$

$$X = 0.5 \times 20 \qquad X = 1 \times 20$$

$$X = 10\text{ mg per dose} \qquad X = 20\text{ mg per dose}$$

- Recommended range is 10 to 20 mg per dose

# Calculating and Verifying Safe Dosages

3. Compare ordered with recommended dose
   - Ordered dose:
     - 20 mg
   - Recommended dose range:
     - 10 to 20 mg
   - Conclude ordered dose is safe

# Calculating and Verifying Safe Dosages

4. Calculate one dose
   - Ordered: Vistaril 20 mg IM
   - Available: Vistaril 50 mg per mL

# Calculating and Verifying Safe Dosages

- Calculate one dose
  1. Convert
     - No conversion necessary
  2. Think
     - If 50 mg per mL and need 20 mg, will give less than 1 mL

# Calculating and Verifying Safe Dosages

- Calculate one dose
  3. Calculate

$$\frac{50 \text{ mg}}{1 \text{ mL}} = \frac{20 \text{ mg}}{X \text{ mL}}$$

$$50X = 20$$

$$\frac{\cancel{50}X}{\cancel{50}} = \frac{20}{50}$$

$$X = 0.4 \text{ mL}$$

# Calculating and Verifying Safe Dosages

- Draw up 0.4 mL of Vistaril 50 mg per mL in 1 mL syringe

# Calculating and Verifying Safe Dosages

- Total daily dose example:
  - Safe amount needs to be calculated, divided by number of doses per day, and compared with order
  - Physician orders amoxicillin 200 mg p.o. q. 8 h
  - Child weighs 22 lb
  - Is the dose safe?

# Calculating and Verifying Safe Dosages

1. Convert 22 lb to kilograms
   - Approximate equivalent
     - 1 kg = 2.2 lb
   - Set up ratio and calculate

$$\frac{1\text{ kg}}{2.2\text{ lb}} = \frac{X\text{ kg}}{22\text{ lb}}$$

$$2.2X = 22$$

$$\frac{2.2X}{2.2} = \frac{22}{2.2}$$

$$X = 10\text{ kg}$$

# Calculating and Verifying Safe Dosages

2. Calculate recommended dosage
   - Recommended dose detailed on drug label:
     - 20 to 40 mg per kg per day in divided doses
   - Label further recommends that total daily dosage be divided and administered every eight hours
     - Resulting in three doses in 24 hours
   - Note that ordered dose is for every eight hours

# Calculating and Verifying Safe Dosages

- Calculate minimum and maximum dosage for each single dose

Per dose:

200 mg ÷ 3 doses = 66.7 mg

Per dose:

400 mg ÷ 3 doses = 133.3 mg

Per day:

20 mg/~~kg~~/day × 10 ~~kg~~ = 200 mg

Per day:

40 mg/~~kg~~/day × 10 ~~kg~~ = 400 mg

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# Calculating and Verifying Safe Dosages

3. Compare ordered with recommended dose
   - Ordered dose:
     - 200 mg per dose
     - 600 mg per day
   - Recommended dose range:
     - 66.7 to 133.3 mg per dose
     - 200 to 400 mg per day

# Calculating and Verifying Safe Dosages

3. Compare ordered with recommended dose
   - Conclude ordered dose is not safe
     - Too high
4. Contact physician to discuss order

# Calculating and Verifying Safe Dosages

- Combination drugs example:
  - Combination drugs
    - Two separate drugs combined into one pill, solution, etc.
  - When calculating safe dosage for combination drugs:
    - Calculate safe dosage for each drug in combination
    - Compare with ordered dose of each

# Calculating and Verifying Safe Adult Dosage: Body Weight Method

- Many drugs prescribed for adults also dosed based on body weight
- Use same process and rules as calculations for safe pediatric dosages

# Caution

- Once adolescent attains weight of 50 kg (110 lb) or greater, standard adult dosage frequently prescribed
- Verify that order for child's dosage does not exceed maximum