

CHAPTER 3

Life Span Considerations

NDEG 26 A – Pharmacology 1
Eliza Rivera-Mitu, RN, MSN

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Life Span Considerations

- Pregnancy
- Breast-feeding
- Neonatal
- Pediatric
- Geriatric

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Pregnancy

- First trimester is the period of greatest danger for drug-induced developmental defects
- Drugs diffuse across the placenta
- FDA pregnancy safety categories

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TABLE 3-1
PREGNANCY SAFETY CATEGORIES

Category	Description
Category A	Studies indicate no risk to the human fetus.
Category B	Studies indicate no risk to animal fetus; information in humans is not available.
Category C	Adverse effects reported in animal fetus; information in humans is not available.
Category D	Possible fetal risk in humans reported; however, considering potential benefit vs. risk may, in selected cases, warrant the use of these drugs in pregnant women.
Category X	Fetal abnormalities reported and positive evidence of fetal risk in humans is available from animal and/or human studies. These drugs should not be used in pregnant women.

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Table 3-1 Pregnancy safety categories

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Breast-feeding

- Breast-fed infants are at risk for exposure to drugs consumed by the mother
- Consider risk-to-benefit ratio

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TABLE 3-2
CLASSIFICATION OF YOUNG PATIENTS

Age Range	Classification
<38 wk gestation	Premature or preterm infant
<1 mo	Neonate or newborn infant
1 mo-<1 yr	Infant
1 yr-<12 yr	Child

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Table 3-2 Classification of young patients

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Pediatric Considerations: Pharmacokinetics

- Absorption
 - Gastric pH less acidic
 - Gastric emptying is slowed
 - Topical absorption faster through the skin
 - Intramuscular absorption faster and irregular

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Pediatric Considerations: Pharmacokinetics (cont'd)

- Distribution
 - TBW 70% to 80% in full-term infants, 85% in premature newborns, 64% in children 1 to 12 years of age
 - Greater TBW means fat content is lower
 - Decreased level of protein binding
 - Immature blood-brain barrier

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Pediatric Considerations: Pharmacokinetics (cont'd)

- Metabolism
 - Liver immature, does not produce enough microsomal enzymes
 - Older children may have increased metabolism, requiring higher doses
 - Other factors

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Pediatric Considerations: Pharmacokinetics (cont'd)

- Excretion
 - Kidney immaturity affects glomerular filtration rate and tubular secretion
 - Decreased perfusion rate of the kidneys

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Summary of Pediatric Considerations

- Skin is thin and permeable
- Stomach lacks acid to kill bacteria
- Lungs lack mucus barriers
- Body temperatures poorly regulated and dehydration occurs easily
- Liver and kidneys are immature, impairing drug metabolism and excretion

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Methods of Dosage Calculation for Pediatric Patients

- Body surface area method
 - West nomogram
- Body weight dosage calculations

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BSA (m²) Calculation

- To calculate BSA in m² based on *metric measurement* of height and weight:

$$\text{BSA (m}^2\text{)} = \sqrt{\frac{\text{ht (cm)} \times \text{wt (kg)}}{3600}}$$

- To calculate BSA in m² based on *household measurement* of height and weight:

$$\text{BSA (m}^2\text{)} = \sqrt{\frac{\text{ht (in)} \times \text{wt (lb)}}{3131}}$$

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BSA (m²) Calculation

- Calculate the BSA of a child whose height is 105 cm (42 in) and weight is 31.8 kg (70 lb).

– Metric:

$$\text{BSA (m}^2\text{)} = \sqrt{\frac{\text{ht (cm)} \times \text{wt (kg)}}{3600}}$$

$$\text{BSA (m}^2\text{)} = \sqrt{\frac{105 \times 31.8}{3600}} = \sqrt{\frac{3339}{3600}}$$

$$= \sqrt{0.928} = 0.963 \text{ m}^2 = 0.96 \text{ m}^2$$

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BSA (m²) Calculation

- Calculate the BSA of a child whose height is 105 cm (42 in) and weight is 31.8 kg (70 lb).

– Household:

$$\text{BSA (m}^2\text{)} = \sqrt{\frac{\text{ht (in)} \times \text{wt (lb)}}{3131}}$$

$$\text{BSA (m}^2\text{)} = \sqrt{\frac{42 \times 70}{3131}} = \sqrt{\frac{2940}{3131}}$$

$$= \sqrt{0.939} = 0.969 \text{ m}^2 = 0.97 \text{ m}^2$$

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Verifying Safe Dosages: BSA Method (continues)

- To verify safe pediatric dosage based on BSA:
 - Determine BSA in m^2 .
 - Calculate the safe dosage based on **BSA: $mg/m^2 \times m^2 = X \text{ mg}$**
 - Compare the ordered dosage to the recommended dosage, and decide if the dosage is safe.

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Verifying Safe Dosages: BSA Method (continued)

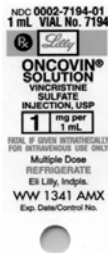
- If the dosage is safe, calculate the amount to give and administer the dose. If the dosage seems unsafe, consult with the ordering practitioner before administering the drug.

Note: Recommended dosage may specify mg/m^2 , mcg/m^2 , g/m^2 , U/m^2 , mU/m^2 , or mEq/m^2 .

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Calculation of Safe Dosage by BSA (continues)

- A child is 126 cm tall and weighs 23 kg. The drug order reads: Oncovin 1.8 mg IV at 10 AM. Is this dosage safe for this child? The recommended dosage as noted on the package insert is $2 \text{ mg}/m^2$.



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Calculation of Safe Dosage by BSA (continued)

1. Determine BSA

$$\text{BSA}(\text{m}^2) = \sqrt{\frac{126 \times 23}{3600}} = \sqrt{\frac{2898}{3600}} = \sqrt{0.805} = 0.897 \text{m}^2 = 0.9 \text{m}^2$$

2. Calculate recommended dosage

$$\text{mg}/\text{m}^2 \times \text{m}^2 = 2 \text{ mg}/\text{m}^2 \times 0.9 \text{m}^2 = 1.8 \text{ mg}$$

3. Decide if the dosage is safe

- The dosage ordered is 1.8 mg and 1.8 mg is the amount recommended by BSA.

4. Calculate one dose.

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Calculation of Safe Dosage by BSA (continued)

• Step 1. Convert

– No conversion is necessary.

• Step 2. Think

– Give more than 1 mL and less than 2 mL.

• Step 3. Calculate

$$\frac{D}{H} \times Q = \frac{1.8 \text{ mg}}{1 \text{ mg}} \times 1 \text{ mL} = 1.8 \text{ mL}$$

– Or, use ratio-proportion: $\frac{1 \text{ mg}}{1 \text{ mL}} = \frac{1.8 \text{ mg}}{X \text{ mL}}$

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Pediatric Considerations: Medication Administration

- General interventions
- Infants
- Toddlers
- Preschoolers
- School-age children
- Adolescents

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Geriatric Considerations: Pharmacokinetics

- Absorption
 - Gastric pH less acidic
 - Slowed gastric emptying
 - Movement through GI tract slower
 - Reduced blood flow to the GI tract
 - Reduced absorptive surface area due to flattened intestinal villi

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Geriatric Considerations: Pharmacokinetics (cont'd)

- Distribution
 - TBW percentages lower
 - Fat content increased
 - Decreased production of proteins by the liver, resulting in decreased protein binding of drugs

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Geriatric Considerations: Pharmacokinetics (cont'd)

- Metabolism
 - Aging liver produces less microsomal enzymes, affecting drug metabolism
 - Reduced blood flow to the liver

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Geriatric Considerations: Pharmacokinetics (cont'd)

- Excretion
 - Decreased glomerular filtration rate
 - Decreased number of intact nephrons

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Geriatric Considerations: Problematic Medications

- Analgesics
- Anticoagulants
- Anticholinergics
- Antihypertensives
- Digoxin
- Sedatives and hypnotics
- Thiazide diuretics

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