

Lilley: Pharmacology for Canadian Health Care Practice, 2nd Canadian Edition

Chapter 2: Pharmacological Principles

Instructor's Manual

OVERVIEW

Nurses need a sound understanding of basic pharmacological principles to appreciate the effects, both positive and negative, that drugs can have on a patient's health. In order to understand pharmacology, the basic principles of pharmacotherapeutics (the use of drugs and the clinical indications for drugs to prevent and treat diseases) as well as the roles of pharmacokinetics (the study of what the body does to the drug), pharmacodynamics (the study of what the drug does to the body), and pharmacognosy (natural drug sources) must be included.

KEY TERMS

Additive effects, p. 37
Adverse drug event (ADE), p. 38
Adverse drug reaction (ADR), p. 38
Adverse effects, p. 38
Agonist, p. 22
Allergic reaction, p. 34
Antagonist, p. 34
Antagonistic effects, p. 37
Bioavailability, p. 23
Biotransformation, p. 30
Chemical name, p. 30
Contraindication, p. 35
Cytochrome P450, p. 30
Dissolution, p. 22
Drug, p. 21
Drug actions, p. 22
Drug effects, p. 33
Drug-induced teratogenesis, p. 39
Drug interaction, p. 37
Duration of action, p. 33
Enzymes, p. 34
Evidence-informed practice (EIP), p. 41
First-pass effect, p. 24
Generic name, p. 21
Half-life, p. 32
Idiosyncratic reaction, p. 38
Incompatibility, p. 37
Medication error (ME), p. 38
Medication use process, p. 38

Metabolite, p. 22
 Onset of action, p. 33
 Parent drug, p. 22
 Peak effect, p. 33
 Peak level, p. 33
 Pharmaceutics, p. 22
 Pharmacodynamics, p. 22
 Pharmacogenetics, p. 38
 Pharmacognosy, p. 22
 Pharmacokinetics, p. 22
 Pharmacology, p. 21
 Pharmacotherapeutics, p. 22
 Prodrug, p. 22
 Receptor, p. 22
 Steady state, p. 33
 Substrate, p. 30
 Synergistic effects, p. 37
 Therapeutic drug monitoring, p. 34
 Therapeutic effect, p. 34
 Therapeutic index, p. 22
 Toxic, p. 22
 Toxicity, p. 33
 Toxicology, p. 22
 Trade name, p. 21
 Trough level, p. 33

LEARNING OBJECTIVES

1. Define common terms used in pharmacology (see the listing of terms in the Glossary).
2. Describe the role of pharmaceutics, pharmacokinetics, and pharmacodynamics in drug administration.
3. Discuss the application of the four principles of pharmacotherapeutics to nursing practice as they relate to a variety of patients in different health care settings.
4. Discuss the use of natural drug sources in the development of new drugs.
5. Describe evidence-informed nursing practice.
6. Discuss the role of evidence-informed practice as it relates to pharmacology and medication administration.
7. Develop a collaborative plan of care that considers the phases of pharmacokinetics in carrying out drug therapy.

CHAPTER OUTLINE AND TEACHING STRATEGIES

Chapter Outline	Teaching Strategies
Overview, p. 21	Make a list of generic names of commonly used over-the-counter (OTC) drugs, and give a “quiz” to students to see who can name the trade names of these drugs. You

Chapter Outline	Teaching Strategies
	can even toss in a few chemical names for an added challenge.
Pharmaceutics, p. 22	
Pharmacokinetics, p. 23 Absorption Enteral Sublingual and buccal Parenteral Topical Transdermal Distribution Metabolism Excretion Half-life Onset, peak, and duration	<p>Divide the class into groups and assign each group a different drug, ensuring that each assigned drug represents a different class of medication. Have each group outline the pharmacokinetic stages for each drug, using the textbook or other resources. Specify that the stages of <i>absorption</i>, <i>distribution</i>, <i>metabolism</i>, and <i>excretion</i> be covered. Have each group share their findings with the class.</p> <p>Have students illustrate the following principles on posters that can be displayed in the classroom for review:</p> <ul style="list-style-type: none"> • First-pass effect • Half-life (including a calculation for a specific drug, such as digoxin or theophylline) • Chemical, generic, and trade names • Onset, peak, duration <p>Encourage colourful illustrations of these principles.</p>
Pharmacodynamics, p. 34 Mechanism of action Receptor interactions Enzyme interactions Nonselective interactions	<p>Set up the following scenario for students: Three patients have been given the same dose of the same drug by the same route. However, one patient develops a disturbing set of reactions, including severe skin rash, vomiting, and (eventually) convulsions. After tending to her immediate needs, you check the drug information again; however, not one of these reactions is listed as an adverse effect of this drug or as an adverse reaction to it. Furthermore, the other two patients did not have this violent reaction to this drug. When you report this to the physician, she asks you, "Have you thought of the possibility of an idiosyncratic reaction?" Where do you find that on the label? What does she mean? (<i>Answer: You</i></p>

Chapter Outline	Teaching Strategies
	<i>probably will not find it mentioned on the drug label. An idiosyncratic reaction is not the result of a known property of the drug or even a patient allergy. Instead, it is usually caused by abnormal levels of drug-metabolizing enzymes [a complete absence, a deficiency, or an overabundance of the enzyme]; the reaction is peculiar to that patient.)</i>
Pharmacotherapeutics, p. 35 Acute therapy Maintenance therapy Supplemental therapy Palliative therapy Supportive therapy Prophylactic therapy and empirical therapy Monitoring Therapeutic index Drug concentration Patient's condition Tolerance and dependence Interactions Adverse drug events Other drug effects	Have students illustrate the following principles on posters that can be displayed in the classroom for review: <ul style="list-style-type: none"> • Adverse drug events • Comparison of additive and synergistic effects • Antagonistic drug interactions • Drug-induced teratogenesis • Carcinogenic effects • Peak and trough levels • Therapeutic index—what is a “low” or “narrow” therapeutic index? Encourage colourful illustrations of these principles.
Pharmacognosy, p. 40	Assign students to bring in half-page reports of examples of drugs that are obtained from natural plant or animal sources. Encourage photographs or illustrations of plant sources when possible.
Toxicology, p. 40	Assign students to find out about the local resources for poison control. Ask, “Is there an emergency poison control center in your area, and how do you contact it?”
Conclusion, p. 41	

CRITICAL THINKING ACTIVITIES

1. The laboratory calls to notify the nurse that a patient's “trough” level of an antibiotic is higher than the “peak” level. Is this the desired effect? Explain.

2. A patient has been admitted with slight pulmonary edema. She is also anxious and tells the nurse that she left her “glaucoma eye drops” at home. She has no known drug allergies, and she was recently treated for an upper gastrointestinal bleed. She also has osteoarthritis. The physician has ordered the following drugs: digoxin, furosemide,

potassium chloride, lorazepam, and oxaprozin. Using this text or a nursing drug handbook, look up the contraindications for each drug. Are there any contraindications for these drugs for this patient? (*Answer: Lorazepam is contraindicated for angle-closure glaucoma; therefore, more information may be needed before giving this drug. Oxaprozin, a nonsteroidal anti-inflammatory drug [NSAID], is contraindicated in cases of active peptic ulcer disease and gastrointestinal bleeding.*)

3. A patient has been treated for hypothyroidism for 10 years after his thyroid gland was removed due to cancer. Does this illustrate acute therapy, palliative therapy, maintenance therapy, or supplemental therapy? Explain. (*Answer: Supplemental therapy*)
4. A patient has a history of depression and has been taking bupropion for eight months, with improvement of symptoms noted. Does this case illustrate acute therapy, palliative therapy, maintenance therapy, or supplemental therapy? Explain. (*Answer: Maintenance therapy*)
5. A patient in her twenty-eighth week of pregnancy is experiencing premature labour and is given an intravenous infusion of terbutaline sulfate to stop the contractions. Does this case illustrate acute therapy, palliative therapy, maintenance therapy, or supplemental therapy? Explain. (*Answer: Acute therapy*)

LEARNING ACTIVITIES

1. Define the following terms:
 - a. Half-life
 - b. Plasma protein binding
 - c. First-pass effect
 - d. Incompatibility
2. Define *bioavailability* and *bioequivalent*.
3. What are the significant implications of protein binding as it relates to the nursing process and the administration of medications? For example, if a patient is receiving two medications that are “highly protein bound,” what are the major concerns related to these drugs?
4. Do medications given parenterally go through the first-pass effect? Explain your answer.
5. Discuss the nursing implications if a drug is known to have a low therapeutic index.

ANSWERS TO LEARNING ACTIVITIES

1.
 - a. *Half-life* is the time it takes for 50% of the drug to be eliminated from the body.
 - b. *Plasma protein binding* is a drug characteristic. The term refers to the amount of binding that a drug has to protein molecules (mostly albumin).
 - c. *First-pass effect* is a process in which drugs that are absorbed via the small intestine are metabolized or broken down prior to systemic absorption and are significantly

metabolized when exposed to the liver and its enzymes. As a result, the drug's effects may be significantly lessened.

- d. *Incompatibility* occurs when two parenteral drugs or solutions are mixed together and the result is a chemical deterioration or change in one or both of the drugs.
2. *Bioavailability* is the amount of drug that is available after absorption; it is directly related to the degree of absorption of the drug (e.g., medications administered intravenously have 100% bioavailability). Two medications that have the same bioavailability are said to be *bioequivalent*.
3. If two drugs that are "highly protein bound" are given together, there is an increased risk for drug toxicity because the two drugs will compete for protein-binding sites. As a result of this competition, either less of both drugs or less of one drug will bind to the proteins, leaving more free and unbound drug in the circulation to cause drug effects.
4. No, intravenous medications enter the circulation directly and bypass the liver; therefore, they are not exposed to the metabolizing enzymes. As a result, more of the drug is available to exert an effect.
5. The safety of a particular drug is determined by its therapeutic index. A "low therapeutic index" means that the range between a therapeutically active dose and a toxic dose is narrow. In this case, the drug has a higher likelihood than other drugs of causing an adverse reaction; therefore, the nurse should monitor the patient's response to the drug very closely.

ADDITIONAL RESOURCES

Do not forget the following supplemental teaching and learning resources found at <http://evolve.elsevier.com/Canada/Lilley/pharmacology>:

For Instructors

- Audience Response Questions
- Image Collection
- PowerPoint presentation slides
- Teaching Tips
- Test Bank

For Students (instructors have access to all student material)

- Animations
- Answer Keys for Case Studies, Critical Thinking Activities, and Examination Review
- Questions from the textbook
- Calculators
- Category Catchers
- Content Updates
- Frequently Asked Questions
- Audio Glossary
- IV Therapy and Medication Error Checklists

- Multiple-Choice Review Questions
- Nursing Care Plans
- Supplemental Resources
- WebLinks