CLINICAL DRUG THERAPY

RATIONALES FOR NURSING PRACTICE

SECOND EDITION

ANNE COLLINS ABRAMS

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Rationales for Nursing Practice

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The author and publisher have exerted every effort to ensure that drug selection and dosage set forth in this text are in accord with current recommendations and practice at the time of publication. However, in view of ongoing research, changes in government regulations, and the constant flow of information relating to drug therapy and drug reactions, the reader is urged to check the package insert for each drug for any change in indications and dosage and for added warnings and precautions. This is particularly important when the recommended agent is a new or infrequently employed drug.

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SECOND EDITION

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This second edition is dedicated to all health care providers who strive to learn and to use their knowledge to improve patient care

PREFACE

Few areas related to nursing practice expand as rapidly as the area of drug therapy. Many new drugs are marketed yearly. Some of these are different from current drugs; most are new members of expanding families of drugs. In fact, some drugs are commonly referred to as second or third generations of drug groups. In addition to new drugs, there are changes in clinical uses of both newer and older drugs as a result of research and experience. A concerted effort has been made to reflect these additions and changes in this second edition.

The organizational framework of the first edition has been retained, for the most part. The book is divided into ten sections. The first section covers the basic knowledge and skills required for safe and effective drug therapy. Specific topics include drug effects on the body, factors that influence drug effects, guidelines for studying pharmacology, methods of drug administration, and nursing responsibilities in relation to drug therapy. In subsequent sections, drugs are categorized and discussed mainly according to their therapeutic effects on particular body systems; also, separate sections take up nutritional products, drugs used in treatment and prevention of infections, and drugs used in specific situations: neoplastic disease, ophthalmic and dermatologic disorders, and uterine motility. Most sections begin with a brief chapter that reviews the physiology of a body system; others begin with introductory material related to the condition for which drug therapy is given.

Within chapters there are four major organizational categories: *a description and a list of uses of the therapeutic class of drugs, a list of individual drugs within the class, principles of therapy, and nursing actions with rationale.* Groups of drugs are first discussed in terms of their general characteristics, including their effects on the body; clinical indications for use, including descriptions of the conditions in which the drugs are used (*e.g.*, pain, congestive heart failure); and contraindications. Then individual drugs are discussed.

"Principles of Therapy" provides information on nursing assessment of the client's condition in relation to the drug group, measures to prevent or minimize the need for drugs, guidelines for the choice of drug, dosage, and route of administration, and guidelines for using drugs in specific populations (*e.g.*, geriatric clients), when appropriate.

In each chapter the nursing actions related to drug therapy are categorized in five general functions: "Administer Drugs Accurately," "Observe for Therapeutic Effects," "Observe for Adverse Effects," "Observe for Drug Interactions," and "Teach Clients."

In this edition, every chapter has been thoroughly reviewed; some chapters have been extensively revised. New tables have been added to present content

in a more meaningful way, and considerations related to pediatric, pregnant, or geriatric clients have been expanded. The nursing process is delineated and emphasized to a greater extent, especially in the chapter sections entitled "Principles of Therapy."

A unique feature of *Clinical Drug Therapy* remains the inclusion of rationales for nursing actions. The rationale for many nursing actions can be deduced with enough knowledge about the drug being administered and the condition of the person receiving it. However, this is a time-consuming process, and time is usually limited for both student and professional nurses. In addition, some nursing actions do not bear a clearly defined relationship to drug actions or the recipient's condition. Such situations promote reliance on memory rather than understanding and knowledge. If reasons for nursing actions are not understood, the nurse cannot readily alter actions when circumstances change. An explicit statement of the rationale, on the other hand, enhances understanding and promotes knowledgeable monitoring of drug therapy.

The overall purpose of this book is to promote rational, safe, and effective drug therapy. The author strongly believes that the study of drugs is important to nurses primarily in relation to drug effects on people. Thus, safe and effective drug therapy requires knowledge about both the drug and the person receiving the drug. Other beliefs and assumptions include the following:

- Knowledge and understanding of drug effects on people allow the nurse to predict both therapeutic and adverse effects of drug therapy.
- Therapeutic effects can be enhanced by nursing interventions.
- Adverse effects may be prevented or minimized by nursing interventions.
- If effective, non-drug-related interventions are generally safer than drug therapy.
- All drugs may cause adverse effects.
- Nursing responsibility includes observation of client responses to drug therapy and teaching clients about drug therapy as well as accurate administration of drugs.

Anne Collins Abrams, R.N., B.S.N., M.S.N.

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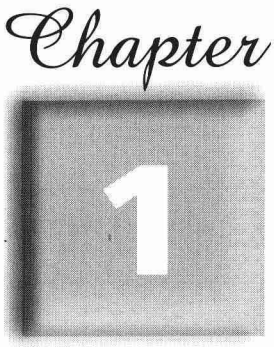

Medical Assisting as a Profession

PERFORMANCE OBJECTIVES

The medical assistant is a member of a highly skilled team of health care providers, working on a daily basis with physicians, nurses, allied health care professionals, and patients. It is important to display the professionalism that medical assisting requires. Students entering a program of medical assisting education can use this workbook chapter to consider the scope of the medical assistant's duties and strive to cultivate the qualities of a professional medical assistant.

EXERCISES AND ACTIVITIES

Vocabulary Builder

Replace the **highlighted** *words in the following paragraph with the proper key vocabulary terms from the list below.*

accredits	compliance	integrate
ambulatory care settings	credential	licensed
attributes	disposition	licensure
baccalaureate	empathy	litigious
certify	facilitates	practicums
competency	improvising	versatile

The medical assistant is a **multiskilled** _____ health care professional who performs many clinical and administrative duties in physicians' offices and **outpatient facilities** _____. In today's **lawsuit-prone** _____ society, health care consumers are demanding educated, skilled health care professionals. The American Association of Medical Assistants is a national organization that **recognizes qualifying standards for** _____ medical assisting education programs and **practical applications of theory** _____; provides national **proficiency** _____ exams that **guarantee** _____ the skills of medical assistants at entry-level job, earning them the **official credit** _____ of CMA; and encourages continuing education. Medical assistants are educated at community,

1

INTRODUCTION TO PHARMACOLOGY

Pharmacology is the study of drugs. Drugs are chemicals that alter functions of living organisms. Drugs are generally given to prevent, diagnose, or cure disease processes or to provide palliation (relief of signs and symptoms without cure of the underlying disease). They may be given for local or systemic effects. Drugs that have local effects, such as creams, ointments, and local anesthetics, act mainly at the site of application. Those that have systemic effects are absorbed into the bloodstream and circulated to various parts of the body. Most drugs are given for their systemic effects.

Sources of drugs

Drugs are obtained from plant, animal, and mineral sources and are also made synthetically. Plants yield pharmacologically active substances such as alkaloids. An alkaloid is an alkaline substance that reacts with an acid to form a salt. For example, morphine is an alkaloid, and morphine sulfate is a salt. The salt forms are more often used as drugs because they are more soluble. Drugs obtained from animal sources include hormones extracted from animal endocrine glands. Insulin, for example, is extracted from pork and beef pancreas. Mineral sources provide iron and potassium preparations, among others. Synthetic drugs are artificially prepared from chemical substances in laboratories. Semisynthetic drugs are naturally occurring substances that have been chemically altered.

Drug nomenclature

Drugs are classified or grouped according to their effects on particular body systems, their therapeutic uses, and their chemical characteristics. For example, morphine can be classified as a central nervous system (CNS) depressant, a narcotic analgesic, and an opium derivative. Individual drugs that represent classifications or groups of drugs are called *prototypes.* Morphine is the prototype of narcotic analgesics and is the standard with which other narcotic analgesics are compared. Drug classifications and prototypes are extremely stable, and most new drugs can be assigned to a group and compared with an established prototype.

Individual drugs may have several different names. The two most commonly used are the generic name and the trade name. The generic name is related to the chemical or official name and is independent of the manufacturer. The trade or brand name is designated and patented by the manufacturer. For example, ampicillin is the generic name of an antibiotic. Ampicillin is manufactured by several pharmaceutical companies, each of which assigns a specific trade name such as Amcill, Penbriten, and Omnipen. (Trade names

are capitalized; generic names are lower case.) Drugs may be prescribed and sold by generic or trade name.

Sources of drug information

There are many sources of drug data. Among the most useful are pharmacology textbooks, drug reference books, and journal articles. For the beginning student of pharmacology, a textbook is usually the best source of information because it describes groups of drugs in relation to therapeutic uses. Thus, an overview of the major drug classifications and their effects on the human body can be obtained.

Drug reference books are usually most helpful in relation to individual drugs. Two authoritative sources are the *American Hospital Formulary Service* and the *AMA Drug Evaluations.* The former is published by the American Society of Hospital Pharmacists and kept current by the periodic addition of revisions and updated monographs. The latter is prepared by the American Medical Association Department of Drugs. New editions are published every 3 to 5 years. A widely available but less authoritative source is the *Physicians' Desk Reference* (PDR). The PDR is simply a compilation of manufacturers' package inserts for selected drugs.

Many pharmacologic, medical, and nursing journals contain information on drugs. Journal articles often describe drug usage in specific disease processes. Some helpful journals include the *Journal of the American Medical Association, The New England Journal of Medicine, Drug Therapy,* and the *American Journal of Nursing.*

Drug laws and standards

Two major drug laws are important in nursing practice. One is the *Federal Food, Drug and Cosmetics Act of 1938* and its amendments. This law regulates the manufacture, distribution, advertising, and labeling of drugs in an attempt to ensure safety and effectiveness. It confers official status on drugs listed in *The Pharmacopeia of the United States* and *The National Formulary.* The names of these drugs may be followed by the letters *USP* or *NF.* Official drugs must meet standards of purity and strength as determined by chemical analysis or animal response to specified doses (bioassay). The law also requires extensive testing of new drugs before they are marketed for general use. The Food and Drug Administration (FDA) is charged with enforcing the law. In addition, the Public Health Service regulates vaccines and other biologic products, and the Federal Trade Commission (FTC) can suppress misleading advertisements of nonprescription drugs.

The second law important in nursing practice is the *Comprehensive Drug Abuse Prevention and Control Act of 1970.* Title II of this law, called the *Controlled Substances Act,* regulates distribution of narcotics and other drugs of abuse. It categorizes these drugs according to therapeutic usefulness and potential for abuse. These categories are listed as follows:

Schedule I. Drugs that are not approved for medical use and that have high abuse potentials are included in this category (heroin, LSD, peyote, mescaline, tetrahydrocannibols, marihuana).

Schedule II. These drugs are used medically and have high abuse potentials; abuse may lead to severe psychologic or physical dependence. Included in this group are morphine, opium, codeine, hydromorphone (Dilaudid), methadone, meperidine (Demerol), oxycodone (Percodan), oxymorphone (Numorphan), cocaine, dextroamphetamine (Dexedrine), methamphetamine (Desoxyn), phenmetrazine (Preludin), methylphenidate (Ritalin), amobarbital (Tuinal), secobarbital (Seconal), and pentobarbital (Nembutal).

Schedule III. These drugs have less potential for abuse than those listed in Schedules I and II. Abuse may lead to high psychologic or low to moderate physical dependence. Included are mixtures containing small amounts of controlled substances such as codeine, glutethimide (Doriden), methyprylon (Noludar), barbiturates not listed in other schedules, benzphetamine (Didrex), phendimetrazine (Plegine), and paregoric.

Schedule IV. Drugs included in this category are those with some potential for abuse, such as phenobarbital, chloral hydrate, ethchlorvynol (Placidyl), ethinamate (Valmid), meprobamate (Equanil), paraldehyde, fenfluramine (Pondimin), diethylpropion (Tenuate), phentermine (Fastin), mazindol (Mazanor, Sanorex), chlordiazepoxide (Librium), diazepam (Valium), clorazepate (Tranxene), flurazepam (Dalmane), oxazepam (Serax), clonazepam (Klonopin), prazepam (Centrax), lorazepam (Ativan), and propoxyphene (Darvon).

Schedule V. These products contain moderate amounts of controlled substances. They may be dispensed by the pharmacist without a physician's prescription but with some restrictions regarding amount, record keeping, and other safeguards. Included are antidiarrheal drugs such as diphenoxylate and atropine (Lomotil).

In addition to federal laws, state laws regulate the sale and distribution of drugs.

Mechanisms of drug action and movement

How do drugs act in the human body? It is thought that most drug actions occur at the cellular level, either on the cell surface or within the cell. Drug action is relatively selective; that is, not all cells respond to a given drug. The most widely accepted explanation for selective action is that responsive cells contain receptor sites for particular drugs. Receptors are thought to be chemical groups that participate in some aspect of cell metabolism, such as enzyme activity. Drug molecules must connect or interact with receptors for drug action to occur. Additional elements of the receptor theory of drug action include the following:

1. Only drugs with an affinity for the affected tissue are able to interact with receptors and exert pharmacologic effects. Thus, molecules of other drugs may be present in tissue fluids surrounding the cell, but they do not influence cell function.
2. When a drug molecule chemically binds with a cell receptor, two types of pharmacologic effects may occur. One type, called *agonism* or *agonist effects,* involves stimulation of cell function. The other type, called *antagonism* or *antagonist effects,* prevents stimulation of cell function by natural body substances (*e.g.,* neurotransmitters, hormones) or molecules of other drugs. The antagonist drug occupies cell receptor sites and prevents their interaction with other substances.
3. The number of receptor sites available to interact with drug molecules largely determines the extent of drug action. If many receptors are available but only a few are occupied by drug molecules, few drug effects will occur. If a few receptors are available for many drug molecules, receptors may be saturated. In the first instance, increasing drug dose increases a drug's effects. In the second instance, if most or all receptor sites are occupied, increasing drug dose produces no additional pharmacologic effect.

In order to act, drugs must be able to reach tissue fluids surrounding responsive cells in adequate concentrations. Specific mechanisms of drug movement are passive diffusion, facilitated diffusion, and active transport.

Passive diffusion is the most common of these mechanisms. It involves movement of a drug from an area of higher concentration to one of lower concentration. For example, when an orally administered drug reaches the upper small intestine, its relatively high concentration promotes movement of its molecules into the bloodstream. The blood carries the molecules to other parts of the body; thus, drug concentration in the blood is low compared with that in the intestinal tract. When the drug molecules reach responsive cells, their greater concentration in the blood promotes movement of the drug into the fluids surrounding the cells or into the cells themselves. Passive diffusion continues until a state of equilibrium is reached between the amount of drug in the tissues and the amount in the blood. Facilitated diffusion is a similar process, except that drug molecules combine with a carrier substance such as an enzyme or other protein. In active transport, drug molecules are moved from an area of lower concentration to one of higher concentration. This process requires both a carrier substance and the release of cellular energy.

Drug movement and therefore drug action are affected by a drug's ability to cross cell membranes. For example, a drug given orally must pass through the cell membranes that line the intestinal tract, lymphatic vessels, and capillary walls to reach the bloodstream and circulate through the body. Cell membranes are complex structures composed of lipid and protein. Lipid-soluble drugs cross cell membranes by dissolving in the lipid layer; water-soluble drugs cross cell membranes through pores or openings. Lipid-soluble drugs are able to cross cell membranes more easily than water-soluble ones. Most drugs are lipid soluble.

Pharmacokinetics

Pharmacokinetics includes the four processes a drug undergoes after entering the body: absorption, distribution, metabolism, and excretion.

ABSORPTION

Absorption is the process occurring between the time a drug enters the body and the time it enters the bloodstream to be circulated. The rate and extent of absorption are affected by the dosage form of the drug, its route of administration, gastrointestinal function, and other variables. Dosage form is a major determinant of a drug's bioavailability (the amount of drug absorbed into the bloodstream).

Most oral drugs must be swallowed, dissolved in gastric fluid, and reach the small intestine before they are absorbed. Liquid medications are usually absorbed faster than tablets or capsules because they do not have to be dissolved in gastrointestinal fluids. Injected drugs are generally absorbed more rapidly than oral drugs. Increases in gastric emptying time and in intestinal motility usually lead to increases in drug absorption by

promoting contact with absorptive mucous membrane. (However, increased gastric emptying time may result in less absorption, because of degradation of the drug in the stomach. Also, excessive peristalsis may move a drug through the intestinal tract too rapidly for it to be absorbed.) The presence of food in the stomach tends to slow the rate of absorption and generally decreases the amount of drug absorbed. When factors related to increased absorption are present, drug actions are usually rapid and of short duration. Factors related to decreased absorption may prevent a drug from reaching adequate concentrations at cellular receptor sites.

DISTRIBUTION

The term *distribution* refers to the transport of drug molecules within the body. Once a drug is injected or absorbed into the bloodstream, it is carried by the blood and tissue fluids to its sites of pharmacologic action, metabolism, and excretion. Distribution depends largely on the adequacy of the blood circulation. Drugs are distributed rapidly to those organs receiving a large blood supply, such as the heart, liver, and kidneys. Distribution to other internal organs, muscle, fat, and skin is usually slower. Most drugs are transported in combination with plasma proteins, especially albumin, which act as carriers. Drug molecules bound to plasma proteins are pharmacologically inactive because the large size of the complex keeps them in the bloodstream and prevents their reaching sites of action, metabolism and excretion. Only the free or unbound portion of a drug acts on body cells. As the free drug acts on cells, the decrease in serum drug levels causes some of the bound drug to be released. Thus, plasma protein binding can be viewed as a method by which the body stores drugs. Some drugs are also stored in muscle, fat, or other body tissues and released gradually into the bloodstream when serum drug levels fall. Drugs that are tightly bound to plasma proteins or stored extensively in other tissues tend to have a long duration of action.

Drug distribution in the CNS is unique. Many drugs do not enter the brain and cerebrospinal fluid, at least in therapeutic concentrations, because they cannot pass the blood–brain barrier. The blood–brain barrier is a group of cells that acts as a selectively permeable membrane to protect the CNS. However, its presence can also make drug therapy of CNS disorders more difficult.

Drug distribution during pregnancy and lactation is also distinctive. During pregnancy, despite the so-called placental barrier, most drugs cross the placenta and affect the developing fetus. During lactation, many drugs enter breast milk and thus affect the nursing infant.

METABOLISM

The term *metabolism,* also called *biotransformation,* refers to the way in which drugs are inactivated by the body. Drugs are metabolized by the body in several ways. Most often, an active drug is changed into one or more inactive metabolites, which are then excreted. Some active drugs yield metabolites that are also active and that continue to exert their effects on body cells until they are metabolized further or excreted. Other drugs are initially inactive and exert no pharmacologic effects until they are metabolized.

Most drugs are lipid soluble. This characteristic aids their movement across cell membranes. However, the kidneys, which are the primary excretory organs, can excrete only water-soluble substances. Therefore, one function of metabolism is to convert fat-soluble drugs into water-soluble metabolites.

Most drugs are metabolized by enzymes in the liver; plasma, the kidneys, and the intestinal mucosa also contain drug-metabolizing enzymes. These enzymes catalyze the chemical reactions of oxidation, reduction, hydrolysis, and synthesis, by which drugs are biotransformed. With chronic administration, some drugs activate the hepatic enzymes, thereby accelerating drug metabolism. The rate of drug metabolism is reduced in infants, owing to immaturity of the hepatic enzyme system, and in people with severe hepatic or cardiovascular disease. Factors that increase the rate of drug metabolism decrease the intensity and duration of drug action. Factors that slow or prolong metabolism cause drug accumulation and increased incidence of adverse reactions.

When drugs are given orally, they are absorbed from the gastrointestinal tract and carried to the liver through the portal circulation. Some drugs are extensively metabolized in the liver, with only a portion of a drug dose reaching the systemic circulation for distribution to sites of action. This phenomenon is called the *first-pass effect.*

EXCRETION

The term *excretion* refers to elimination of a drug from the body. Effective excretion requires adequate functioning of the circulatory system and of the organs of excretion (kidneys, bowel, lungs, and skin). Most drugs are excreted by the kidneys and eliminated unchanged or as metabolites in the urine. Some drugs are excreted in bile, then eliminated in feces or reabsorbed, metabolized, and eventually excreted in urine. Some oral drugs are not absorbed and are excreted in the feces. The lungs mainly remove volatile substances such as anesthetic gases. The skin has minimal excretory function. Factors impairing excretion, especially severe