# Contents at a Glance

**Introduction**  
1

**Part I: Orientation and Basic Concepts**  
**CHAPTER 1:** What You Need to Know to Prepare for the Medication Aide Certification Examination (MACE)  
13

**Part II: Authorized Duties**  
**CHAPTER 2:** The Roles and Responsibilities of the Medication Aide  
31

**Part III: Medication Administration, Observation, and Reporting**  
**CHAPTER 3:** Pharmacology Review  
51  
**CHAPTER 4:** Drug Orders, Forms, Measurements, and Handling  
61

**Part IV: Administering Medications**  
**CHAPTER 5:** Administering Medication Safely  
77  
**CHAPTER 6:** Medication Administration Procedures and Techniques  
93

**Part V: Medication Effects on Body Systems: Implications for Care**  
**CHAPTER 7:** Medications Affecting the Cardiovascular System  
117  
**CHAPTER 8:** Medications Affecting the Respiratory System  
143  
**CHAPTER 9:** Medications Affecting the Digestive System  
157  
**CHAPTER 10:** Antibiotics and Other Anti-Infective Agents  
175  
**CHAPTER 11:** Medications Affecting the Urinary System  
193  
**CHAPTER 12:** Medications Affecting the Musculoskeletal System  
209  
**CHAPTER 13:** Medications Affecting the Central Nervous System  
223  
**CHAPTER 14:** Medications Affecting the Endocrine System  
251  
**CHAPTER 15:** Medications for the Eye and Ear  
263  
**CHAPTER 16:** Medications Used in the Treatment of Cancer  
275  
**CHAPTER 17:** Medications Used to Treat Mental Health Disorders  
287
Part VI: Practice Exams

Practice Exam I 301
Practice Exam I Rationales 311
Practice Exam II 317
Practice Exam II Rationales 327

Part VII: Appendixes

APPENDIX A: Medication Administration Skills Performance Checklist 333
APPENDIX B: Arithmetic Review: Weights and Measures 337
APPENDIX C: Herbals, Vitamins, and Minerals 341
APPENDIX D: To Err is Human: Building a Safer Health System 343
Glossary 351
Index 375
# Table of Contents

## Introduction

Notes ........................................... 1  
NCSBN: Test Plan / Content Outline ..................... 1  
Sample Questions .................................. 3  
Correct Answers .................................... 4  
Sample Notes from VA: Pretest Items .................... 4  
Sample Examination ................................ 5  
  Examination Content Outline and Reference Material .... 5  
  Content Outline ................................... 5  
Applying for Registration and Examination .............. 9  
Exam Cost .......................................... 10  
How to Use This Book ................................ 10  
  Contact the Authors ................................. 11

## Part I: Orientation and Basic Concepts

### Chapter 1:
What You Need to Know to Prepare for the Medication Aide Certification

Examination (MACE) .................................. 13
  Testing Strategies ................................... 14  
  Answering the Questions ............................. 14  
  Self-Assessment ..................................... 16  
Exam-Prep Questions .................................. 17  
Rationales ............................................ 27

## Part II: Authorized Duties

### Chapter 2:
The Roles and Responsibilities of the Medication Aide ..................... 31  
Your Roles and Responsibilities ........................ 32  
  Roles and Responsibilities of Other Nursing Team Members ........ 33  
  The Role of UAPs ..................................... 33  
  Exclusions to the MA-C Role (Legal Limitations) ............. 35

From the Library of Scott Kruse
Part III: Medication Administration, Observation, and Reporting

Chapter 3: Pharmacology Review ............................................................... 51
   Drug Classifications and Drug Names ........................................ 52
   Drug Actions and Implications ................................................ 53
      Drug Metabolism ................................................................. 54
      Factors Influencing Drug Effectiveness ................................ 54
   Drug Interactions ........................................................................ 55
   Drug Side Effects ........................................................................ 55
   Selected Drug Information Sources ............................................ 57
   Exam-Prep Questions ................................................................ 58
   Rationales .................................................................................. 60

Chapter 4: Drug Orders, Forms, Measurements, and Handling .................. 61
   Drug Orders ................................................................................ 62
   Common Medical Terminology, Dosages, and Abbreviations .......... 63
   Drug Labels ............................................................................... 65
   Drug Packaging ......................................................................... 66
   Drug Storage and Disposal ....................................................... 66
   Drug Measurements .................................................................... 67
   Drug Forms ............................................................................... 68
      Solids and Semisolids ............................................................ 68
      Liquids and Semiliquids ........................................................ 69
Part IV: Administering Medications

Chapter 5: Administering Medication Safely ................................................... 77

Introduction ........................................................................................................... 78
  Set Up for Medication Administration .............................................................. 78
  Safety Checks When Administering Medications .............................................. 82
  The Six Rights of Medication Administration ................................................. 83
  Causes and Reporting of Medication Errors ...................................................... 87
Exam-Prep Questions .............................................................................................. 89
Rationales ............................................................................................................... 91

Chapter 6: Medication Administration Procedures and Techniques .......... 93

Pre-Administration Procedures ............................................................................. 94
  Identifying Client ................................................................................................. 94
  Hand Washing ....................................................................................................... 94
  Gloving .................................................................................................................. 95
  Explaining the Medication Procedure .................................................................. 95
  Positioning the Client ............................................................................................. 95
Giving Medications Through Various Routes ..................................................... 96
  Oral ..................................................................................................................... 96
  Nasal Instillation ................................................................................................. 101
  Inhalation ............................................................................................................. 102
  Ophthalmic/Ocular (Eye) .................................................................................... 102
  Otic (Ear) ............................................................................................................. 104
  Topical .................................................................................................................. 104
  Vaginal ................................................................................................................ 106
  Rectal ................................................................................................................... 107
Special Medication Administration Techniques ................................................. 108
  Aged Clients ....................................................................................................... 108
  Clients with Physical Limitations ..................................................................... 109
  Clients Refusing to Take Medications ............................................................... 110
  Noncommunicative Clients .............................................................................. 111
Post-Administration Procedures ............................................ 112
Client Comfort .......................................................... 112
Client Environment ..................................................... 112
Right Documentation .................................................. 113
Exam-Prep Questions .................................................... 114
Rationales ............................................................. 116

Part V: Medication Effects on Body Systems: Implications for Care

Chapter 7:
Medications Affecting the Cardiovascular System ........................................ 117
Cardiovascular Structure and Function ........................................ 119
Introduction to Cardiovascular Disorders ................................ 122
Drugs Used to Treat Hyperlipidemia ...................................... 123
Drugs Used to Treat Hypertension ....................................... 124
Drugs Used for Angina .................................................. 128
Drugs Used for Arrhythmias ............................................. 131
Drugs Used for Congestive Heart Failure ............................. 133
Other Cardiovascular Medications ........................................ 134
Exam-Prep Questions .................................................... 139
Rationales ............................................................. 141

Chapter 8:
Medications Affecting the Respiratory System ......................................... 143
Structure and Function of the Respiratory System ..................... 144
The Upper Respiratory Tract ............................................ 150
Lower Respiratory Tract .................................................. 152
Exam-Prep Questions .................................................... 155
Rationales ............................................................. 156

Chapter 9:
Medications Affecting the Digestive System ......................................... 157
Structure and Function of the Digestive System ......................... 158
Disorders of the Gastrointestinal Tract ..................................... 158
Antacids ........................................................................... 160
Histamine-2 Antagonists .................................................. 161
Prostaglandins ............................................................ 163
Proton Pump Inhibitors ................................................... 163
Contents

Antispasmodics .............................................................. 165
Antiemetics ..................................................................... 166
Antidiarrheals .................................................................. 167
Laxatives .......................................................................... 168
Exam-Prep Questions .................................................... 171
Rationales ......................................................................... 173

Chapter 10:
Antibiotics and Other Anti-Infective Agents ................................. 175
  The Infection Process ...................................................... 176
  Common Infections .......................................................... 180
  Antibiotics and Other Anti-Infective Agents ......................... 183
Exam-Prep Questions ...................................................... 190
Rationales ......................................................................... 192

Chapter 11:
Medications Affecting the Urinary System ................................. 193
  Urinary Structure and Function ......................................... 194
  Disorders of the Urinary System ......................................... 195
    Urinary Tract Infections .................................................. 195
    Dysuria ......................................................................... 201
    Overactive Bladder (OAB) ............................................... 202
    Urinary Retention .......................................................... 203
Exam-Prep Questions ...................................................... 205
Rationales ......................................................................... 207

Chapter 12:
Medications Affecting the Musculoskeletal System ..................... 209
  Structure and Function of the Musculoskeletal System .......... 210
  Disorders of the Musculoskeletal System ......................... 213
    Muscle Spasms ............................................................. 213
    Muscle Spasticity .......................................................... 213
    Osteoporosis ................................................................. 215
    Gout ........................................................................... 215
Exam-Prep Questions ...................................................... 220
Rationales ......................................................................... 222
Chapter 16:
Medications Used in the Treatment of Cancer ........................................ 275

  Introduction to Cancer ................................................................. 276
  Drug Therapy for Cancer ............................................................. 278
  Antineoplastic Antibiotics ............................................................ 282
  Exam-Prep Questions .................................................................... 284
  Rationale ..................................................................................... 286

Chapter 17:
Medications Used to Treat Mental Health Disorders .............................. 287

  The Nervous System and Emotions .................................................. 288
    Common Mental Health Disorders .................................................. 288
    Exam-Prep Questions .................................................................... 297
    Rationales .................................................................................. 299

Part VI: Practice Exams

Practice Exam I .................................................................................. 301

Practice Exam I Rationales ................................................................. 311

  Answers at a Glance ....................................................................... 311
  Answer Rationales ......................................................................... 312

Practice Exam II .................................................................................. 317

Practice Exam II Rationales ................................................................. 327

  Answers at a Glance ....................................................................... 327
  Answer Rationales ......................................................................... 328

Part VII: Appendixes

Appendix A:
Medication Administration Skills Performance Checklist ........................ 333

  Administering Oral Medication ......................................................... 333

Appendix B:
Arithmetic Review: Weights and Measures .......................................... 337

  Decimal Fractions .......................................................................... 337
  Changing Common Fractions to Decimal Fractions .......................... 338
Conversions in the Metric System ........................................ 338
Multiplying Decimals by Decimals ....................................... 339
Calculating Doses ............................................................ 339
Dose on Hand ................................................................. 339

Appendix C:
Herbals, Vitamins, and Minerals ........................................ 341
Herbals ......................................................................... 341
Vitamins and Minerals ..................................................... 342

Appendix D:
To Err is Human: Building a Safer Health System ............... 343

Glossary ........................................................................ 351
Index ............................................................................ 375
About the Authors

Linda Whitenton is the co-author of the popular *CNA Exam Cram* (2009). Her 42-year nursing career began in 1967 as a Nursing Assistant in Paducah, Kentucky. Following her graduation from Murray State University’s BSN program in 1970, she practiced in mental health, pediatrics, and medical-surgical nursing. Teaching Nursing Assistants, emergency medical technicians, and unit secretaries in her role as a hospital in-service education director in the early 1970s in a Mississippi hospital cemented her love for teaching. She accepted her first teaching position at Northeast Mississippi Community College in 1975. While at NEMCC, she taught fundamentals, medical-surgical nursing, management, and psychiatric nursing and served as assistant director and director of the program for seven years. In 1977, Linda earned her Master’s of Science degree in nursing at the Mississippi University for Women, which also afforded her the Family Nurse Clinician credential. In 1987, she relocated to Florida and accepted a position as associate director of nursing for the associate degree nursing program at St. Petersburg College in St. Petersburg. While at SPC, she designed curriculum for more than 1,000 employees of the Pinellas County EMS, taught LPN transitional students at night, and practiced part-time at the Bayfront Medical Center Trauma Center. During her 28 years of teaching, Linda continued to practice in emergency nursing, urological nursing, and as a nurse clinician. Linda also earned 30 hours of post-Master’s work in anthropology and educational psychology. In 2004, she returned to clinical practice as the director of nursing/vice president for a Mississippi community hospital. While there, she received a national award for outstanding nursing leadership. She returned to Florida in 2000 to design and direct a new AD nursing program for Northwest Florida State College, formerly Okaloosa-Walton College, the first of five health programs now in place at the college. Linda served as associate dean of health technology, adding administrative oversight for the health programs she launched during her nine-year tenure at NWFSC. In 2008, Linda retired from full-time tenure at the college, receiving the honor of emeritus associate dean and director of nursing. Linda currently serves as adjunct instructor at NWFSC, teaching medical terminology to health career majors. She is a Certified Nurse Educator, CNE, and a member of Sigma Theta Tau International Nursing Society.

Marty Walker has practiced nursing for the past 30 years at the vocational nursing level as a registered nurse, and at the Master’s level. Marty began her nursing career as a licensed practical nurse, receiving her vocational education certificate from Atlantic Vocational School in Pompano Beach, Florida, in 1979. In 1982, she earned an Associate degree in nursing from Broward Community College in Davie, Florida. She worked for more than 10 years as a staff nurse in telemetry, critical care, and emergency nursing before completing a Bachelor of Science degree in nursing from Florida International University in Miami, Florida. In 1995, she began teaching medical-surgical nursing at Ivy Tech State College in Sellersburg, Indiana.
After relocating to Miami, Marty accepted a position as Nurse Clinical Educator for three cardiac units at Jackson Memorial Hospital. She attained a Master’s in Nursing Science in Nursing Education from Barry University in Miami Shores, Florida, in 2003. Marty’s love of teaching led her to Mercy Hospital’s School of Practical Nursing and to adjunct teaching positions at Florida International University and Barry University. While in Miami, Marty added pediatrics to her teaching expertise. She taught medical-surgical nursing for a short time at Pensacola Junior College in Pensacola, Florida, before accepting a full-time associate professor position at Northwest Florida State College, where she currently teaches in the RN-BSN program and in the Associate Degree Nursing Program. Marty’s expertise also includes test construction. She has led the faculty at NWF State College in improving the success rates of students enrolled in the program as well as their success on the NCLEX-RN. Marty’s versatility extends to her clinical practice, as she has recently completed the Family Nurse Practitioner certificate program at the University of South Alabama in Mobile, Alabama. Marty volunteers as a clinic nurse and as the director of nursing services for the Crossroads Medical Center Clinic in Valparaiso, Florida.

### About the Technical Editors

**Steven M. Picray** is a medical-surgical Registered Nurse in a major metropolitan hospital. He has also been a Baptist pastor and a computer programmer. He has a Bachelor and a Master’s degrees in theology and a Bachelor’s degree in nursing. He is currently working on his Master’s degree in nursing in preparation for a career as a nurse practitioner.

**Pat Reinhart** has been a nurse for 45 years, and her experience has been diverse. It includes clinical nursing, obstetrics, director of nursing in a skilled facility, emergency department, public health, and home care.

For the past 25 years, she has been a nursing faculty member at Minneapolis Community and Technical College (MCTC). She has taught in the PN program in a variety of areas, including psychosocial nursing, microbiology, and medical-surgical nursing. Currently, she is the coordinator of the Nursing Assistant Home Health Aide program, teaches the Health Care Core Curriculum, and teaches the Acute Care Nursing Assistant course for hospital-based Nursing Assistants, which she helped to develop. She develops healthcare courses with the Continuing Education and Customized Training Division of MCTC and is their instructor for the Trained Medication Assistant Program for Unlicensed Personnel and Train the Trainer with the Minnesota Department of Health for Registered Nurses who desire to either teach the MDH-approved Nursing Assistant Program or to begin the approved program in Minnesota.
Dedication

Linda: This review is dedicated to my Aunt Lois LeVin, who inspired me to become a nurse. This review is further dedicated to the certified Nurse Aides who are committed to providing the safest and best care to clients through higher education and certification.

Marty: This review is dedicated to my mother, Betty Herbert, who has inspired me to be the best at whatever I do. Thanks, Mom, for all your love and encouragement in life.

Acknowledgments

We want to acknowledge our technical assistant, Kathy McNair, for her dedication, diligence, and commitment to this project and for her continued friendship and encouragement.

We also thank our loving families for always being there for us.
We Want to Hear from You!

As the reader of this book, you are our most important critic and commentator. We value your opinion and want to know what we’re doing right, what we could do better, what areas you’d like to see us publish in, and any other words of wisdom you’re willing to pass our way.

We welcome your comments. You can email or write to let us know what you did or didn’t like about this book—as well as what we can do to make our books better.

Please note that we cannot help you with technical problems related to the topic of this book.

When you write, please be sure to include this book’s title and author as well as your name and email address. We will carefully review your comments and share them with the author and editors who worked on the book.

Email: feedback@pearsonitcertification.com

Mail: Pearson IT Certification
ATTN: Reader Feedback
800 East 96th Street
Indianapolis, IN 46240 USA

Reader Services

Visit our website and register this book at pearsonitcertification/register for convenient access to any updates, downloads, or errata that might be available for this book.
Introduction

Welcome to Medication Aide Certification (MACE) Exam Cram!

This book helps you prepare to take and pass the Medication Aide Certification Examination (MACE), hereafter referred to as the exam. This introduction describes the exam in general, how to apply for it, and the exam test-taking process. Let’s get started!

Exam Cram is a standalone study guide, but you can use it with other instructional textbooks and materials, including CDs/DVDs and computerized learning programs. The purpose of this book is not to reteach classroom content but to highlight important content you are likely to find included on the exam.

We help you recall critical information needed to pass the certification examination. Using a concise and simplified approach, we focus on key principles and procedures for a safe and ethical practice as a Medication Assistant (hereafter called Medication Aide) and your role as a health team member. We review communication skills, values and ethics, health and safety, body systems and common diseases/conditions affected by drug therapy, and the basic components of medication administration (including dosage, preparation, administering drugs, documentation of drug therapy, and prevention of medication errors). Throughout this text, we focus on the basic competencies of the Medication Aide—that is, the knowledge, skills, and attitudes necessary for safe Medication Aide practice, which is the basic premise of Medication Aide certification.

Notes

NCSBN: Test Plan / Content Outline

I. Authorized Duties (10% of test content)

A. Roles, responsibilities, legal aspects, and limitations of Medication Aides

1. Authorized duties for a medication aide, including

   a. Permitted routes of medication administration: Oral, eye, ear, nasal, inhalant, transdermal, topical, vaginal, and rectal

   b. Prohibited routes: Subcutaneous, intradermal, intramuscular, and intravascular injections and medications via tubes and ostomies

2. Medication Aide’s responsibility for reporting to a nurse

3. How to address conflict with role and authorized duty issues
4. Medication Aide’s role under state regulations
   a. Completed an NC Board of Nursing-approved course
   b. Completed a state-approved competency examination
   c. Listed on NC Medication Aide Registry

II. Medication Administration (80% of test content)

A. Administering and charting medications
   1. Medication packaging
   2. Preparation and administration of medications by approved routes
   3. Special circumstances for administering medications
      a. Liquid medication
      b. Scoring medications
      c. Crushing medications
      d. Swallowing challenges
      e. Administering medications to children
      f. Allergies
   4. Correct medication administration procedure (6 rights)
      a. Right client
      b. Right medication
      c. Right dose
      d. Right route
      e. Right time
      f. Right documentation
   5. Client medication rights, including the right to confidentiality and the right to know and refuse medications
   6. Client safety and error prevention
   7. Appropriate communication with supervising licensed nurse
   8. Infection control procedures, including standard precautions
   9. Use of Medication Administration Record (MAR) to
      a. Administer medications
      b. Document medication administration

From the Library of Scott Kruse
10. Medication errors and reporting techniques

11. Auditing and inventory systems
   a. Controlled substance counts
   b. Disposition of unused or contaminated medications

III. Medication Concepts (10% of test content)
   A. Concepts in administration of medications
      1. Commonly used abbreviations
      2. Terminology and definitions

Sample Questions
The following questions are the kinds of questions that you will find on the exam. Check your answers to these questions in the following section.

1. Information that should be located on the MAR includes what?
   - A. Medication dose
   - B. Client's next of kin
   - C. Medication side effects
   - D. Agency medication administration policies

2. When should a Medication Aide report a medication error to the supervisor?
   - A. Before the next medication is due
   - B. During the end-of-shift report
   - C. As soon as the error occurs
   - D. After calling the physician

3. One teaspoon of an elixir is equal to what?
   - A. 10 milliliters
   - B. 5 milliliters
   - C. 1 ounce
   - D. 1 pint

From the Library of Scott Kruse
4. A symptom of anaphylaxis, a life-threatening allergic reaction, is which of the following?
   - A. High blood pressure
   - B. Quiet breathing
   - C. Slow heart rate
   - D. Wheezing

5. The site selected for applying a transdermal patch should be what?
   - A. Cold
   - B. Warm
   - C. Hairless
   - D. Odor free

**Correct Answers**

1. Correct answer is A. The medication dose along with the medications name and route is listed on the MAR along with the patient’s identification.

2. Correct answer is C. As soon as the error occurs, it should be reported to the nurse so that the patient can be assessed and the physician notified.

3. Correct answer is B. One measured teaspoon equals 5 milliliters.

4. Correct answer is D. When a patient begins wheezing after receiving a medication, they could be demonstrating an anaphylactic reaction.

5. Correct answer is C. When applying a topical medication, it is best that the skin is clean, dry, and hairless for the best absorption.

**Sample Notes from VA: Pretest Items**

In addition to the number of examination items specified in the examination content outlines, a small number (5 to 10) of “pretest” questions may be administered to candidates during the examinations. These questions will not be scored, and the time taken to answer them does not count against examination time. The administration of such unscored experimental questions is an essential step in developing future licensing examinations.
Sample Examination

Examination Content Outline and Reference Material

The examination content outline has been approved by the Virginia Department of Health Professions. This outline reflects the minimum knowledge required by Medication Aide professionals to perform their duties to the public in a competent and responsible manner.

Use the outline as the basis of your study. The outline lists the topics that are on the exam and the number of items for each topic. Do not schedule your exam until you are familiar with all topics in the outline.

Number of questions: 80
Minimum passing score: 70%
Time allowed: 2 hours

Content Outline

I. Legal and Ethical Issues (8 items)
   A. Identify legal and ethical issues in medication management
   B. Identify client rights regarding medication, treatment decisions, and confidentiality
   C. Identify laws and regulations relating to administration of medications in Virginia assisted-living facilities
   D. Identify permitted practices and practices prohibited by Medication Aides in Virginia
   E. Identify requirement to report client abuse, neglect, or exploitation

II. Preparing for Safe Administration of Medication (12 items)
   A. Explain principles of maintaining aseptic conditions
   B. Recognize emergencies and other health-threatening conditions
   C. Explain principles of communicating with the cognitively impaired client
   D. Measure vital signs
   E. Explain the use of international time
   F. Identify the five rights of medication administration
III. Introduction to Pharmacology (8 items)
   A. Define key pharmacology terms, medical terminology, and abbreviations
   B. Explain how drugs are classified
   C. Identify factors that affect drug action
   D. Explain how to facilitate client awareness of the purpose and effects of medication
   E. Demonstrate the use of selected drug information sources
   F. Identify Virginia drug-labeling requirements

IV. Administration of Prepared Instillations and Treatments (16 items)
   A. Identify basic principles of medication administration
   B. Administer or assist with self-administration of oral medication
   C. Administer or assist with self-administration of eye drops
   D. Administer or assist with self-administration of ear drops
   E. Administer or assist with self-administration of nasal drops and sprays
   F. Administer or assist with self-administration of topical preparations
   G. Administer or assist with administration of medicinal solutions by way of compresses and dressings
   H. Administer or assist with self-administration of vaginal products
   I. Administer or assist with self-administration of rectal products
   J. Administer or assist with self-administration of medicinal solutions by way of soaks and sitz baths
   K. Assist with the use of oral hygiene products
   L. Administer or assist with self-administration inhalation medications
   M. Administer or assist with self-administration of medications by way of a nebulizer
   N. Administer or assist with self-administration of transdermal patches
   O. Administer or assist with self-administration of EpiPen injections

V. Documentation (12 items)
   A. Identify three commonly used forms for documentation
   B. Demonstrate procedures for receiving and transcribing healthcare provider orders
   C. Document medication administration using appropriate forms
   D. Document medication errors using appropriate forms
VI. Storage and Disposal of Medication (8 items)
A. Identify procedures for storing and securing medication
B. Identify procedures to maintain an inventory of medication, including controlled substances
C. Identify proper procedures for disposal of medications

VII. Special Issues in Medication Administration (8 items)
A. Identify common concerns of drug use in the elderly
B. Recognize special considerations for psychotropic drug use
C. Identify procedures for monitoring therapeutic drug levels
D. Recognize when a drug is a chemical restraint
E. Define the Beers Criteria of medications for the elderly population
F. List ways of dealing with medication noncompliance
G. Identify issues related to over-the-counter medications and herbal preparations

VIII. Insulin Administration (8 items)
A. Explain basic facts about diabetes mellitus
B. Identify activities involved in the management of diabetes
C. List signs and symptoms of hypoglycemia and hyperglycemia
D. Perform fingerstick for blood-glucose monitoring
E. Administer insulin injections

Each state or jurisdiction contracts with a testing vendor to administer the written exam, which consists of 50 to 100 multiple-choice questions that test your knowledge of accurate and safe drug therapy. A select number of questions, often referred to as experimental questions, are often used for statistical purposes but not scored or counted against the total testing time allotted for the exam. The National Council of State Boards of Nursing (NCSBN) owns the exclusive rights to the exam, known by the NCSBN as the MACE. The following outline identifies the subject matter and percentage of questions related to such on the exam:

I. Authorized Duties (16% = 8 questions)
A. Building relationships
B. Delegation
C. Role of MA-C
   1. Permitted duties
   2. Restrictions/limitations
D. Specific legal and ethical issues
E. Location and use of resources and references (for example, nurse, pharmacist, physician, package/drug insert, drug reference manuals)

II. Medication Administration, Observation, and Reporting (60% = 30 questions)
A. Administering and charting medications
   1. Medication orders
   2. Documentation of medication administration
   3. Storage
   4. Disposal
B. Safety and rights of medication administration
C. Routes of administration
D. Factors affecting how the body uses medication
E. Classifications/categories of medications related to body systems (cardiovascular, dermatological, endocrine, and so on) and actions (for example, antimicrobials)
F. Rights of individuals
G. Causes of medication errors
H. Reporting of medication errors
I. Reporting of symptoms and side effects
J. Reporting any change from client’s normal condition

III. Medication Concepts and Measurements (24% = 12 questions)
A. Medication concepts
   1. Terminology and abbreviations
   2. Dosage range
   3. Actions and implications
   4. Therapeutic effects and side effects (for example, idiosyncratic, paradoxical, antagonist)
5. Precautions
6. Interactions

B. Forms of medication
   1. Liquid
   2. Solid and semisolids

C. Measurements

Source: NCSBN, 2011

This text reviews each category listed here, but not necessarily in the same order or using the exact terms as in the test plan. Although all categories are important content, for exam-preparation purposes, allot the most time in your study for section II of this test plan because the majority of the MACE, 60%, addresses that category.

Applying for Registration and Examination

Each state or jurisdiction for which you seek registration has the responsibility for the exam; the test questions reflect each state’s approved curriculum and therefore may vary in content. Referred to by each state as its Medication Aide competency evaluation, the exam also meets state laws and regulations.

Expect to take the exam online via an electronic testing program. Follow each vendor’s specifications, which most likely will include a specified time in which you must complete the exam. It is important, therefore, that you practice answering questions in this book with testing time limits in mind. (More about time management later.)

The registration and examination process begins with your application to the state agency charged with overseeing health occupations licensing and credentialing. Usually, a second application to each state-contracted vendor is required to arrange for testing. For specific information, contact each agency as soon as you decide on a practice locale and follow their requirements carefully and timely so as not to delay testing and registration. Special testing accommodations may be made according to each state’s requirements. Candidate handbooks or other information are helpful guides to your preparation and are often available online. Because this information may change without notice, contact your state agency directly via telephone, fax, or email to verify their current mailing address and any registration updates.
Exam Cost

Contact the relevant state agency in the state in which you want to be registered and follow their specific directions for remitting all registration and testing fees. Again, timeliness and accuracy with fee payments is crucial to avoid testing delays.

How to Use This Book

Organized review is an effective test-preparation strategy. To help you with organization, we have structured *Exam Cram* to include important segments in a logical format:

- **Opening hot lists**: Each chapter opens with key terms you must remember to review the content. Hot lists appear before the chapter introduction that previews the review material.

- **Topical coverage**: The chapter title guides you to the material within it. Each chapter reviews the subject in a concise, need-to-know format to help you prepare for the exam.

---

**EXAM ALERT**

Exam Alert: To bring your attention to a key term, activity, or subject that is likely to appear on the exam, we’ve furnished you with an Exam Alert icon that looks like this.

---

**NOTE**

Note  The Notes icon directs you to material/concepts not directly related to the exam itself but important to enhance your knowledge or skill.

---

**TIP**

Tip  Helpful hints, these, as they help you save time and effort in accomplishing nursing care. Pay particular to these practice aids.

---

- **Exam-prep questions**: Remember to practice, practice, practice! You can check your test readiness along the way as we present important review material in each chapter. You can also use the practice questions to validate your recall of the chapter’s topic while improving your test-taking and reasoning skills. Rationales for the answers help you learn the *what* and *why* of each correct and incorrect option. Questions placed at the end of each chapter will also help you build confidence as you proceed, validating your knowledge and providing you with additional areas for review before you take the practice examinations.
Introduction

- **Practice exams**: In this book, you'll find two practice exams written in the expected testing format. These exams allow you to take a practice test for an extended period of time to increase your confidence and help condition you more realistically for testing conditions at the actual testing site. Although it is important that you not rush through the questions, keep in mind that you should be able to allot a minute to a minute and a half for each question.

  Answers and rationales appear for these practice sessions. To score the practice exams (that is, the percent you answered correctly), subtract the number of questions you missed from the total number of questions, and then divide the total number of correct responses by the total number of questions. Scoring your practice test will give you a good idea about your readiness. You need to score at least 70% to feel confident about your potential success on the “real” exam.

- **Glossary**: At the back of this book, you will find terms that are essential to learning the content in this text. Recall of these key terms is a good review exercise as you prepare for the exam.

- **Cram Sheet**: For last-minute just-in-time study and review, we’ve attached a tearout card called the Cram Sheet. This handy pocket tool provides concise bulleted information, facts, and tips for the exam.

**Contact the Authors**

We are most interested in your success and want you to pass the exam on your first attempt. If, after reviewing this text, you want to contact us, please use the following addresses: Linda Whitenton (whitsend746@yahoo.com) or Marty Walker (Marty916@hotmail.com).
CHAPTER ONE

What You Need to Know to Prepare for the Medication Aide Certification Examination (MACE)

For this chapter, the hot list of medical terms is omitted as the review content is general in nature and no specific terms in this chapter should be included on the MACE.

Along with testing preparation tips listed in the introduction, we suggest that you find a quiet location each day where you can concentrate and review your notes, textbooks, CDs/DVDs, this book, and any other helpful materials. At least six weeks prior to taking the MACE, a minimum of two hours of review each day until testing time is a good plan. If you have access to classmates, you might also find studying in a group helpful.

We strongly believe that answering practice questions is one of the best strategies to prepare for success. For those questions that prove difficult for you, go back to the textbook and study that content. Through review of missed practice test items, you may see a pattern of difficulty (for example, medical asepsis). If so, study that chapter in your textbook or other resource. Repeat those questions after further study to see how you progress. Keep repeating the process until you become more confident in your knowledge. Remember, you cannot answer, nor are you expected to answer, every question correctly. To pass the examination, you must know sufficient knowledge about a variety of subjects. Use the test outline in the introduction to help you prioritize the time you spend in reviewing the content. For example, if 60% of the exam covers medication administration, spend more time reviewing that category than, say, duties of the Medication Aide (MA), which accounts for only 16% of the test plan.

Pay particular attention to Exam Alerts and the Cram Sheet for just-in-time preparation. The better prepared you are, the less stressed you will feel about the exam. Overpreparation is a good thing.
Testing Strategies

Test taking is a skill we cannot assume you will learn in your program. We know from experience in teaching that those of you who use test-taking techniques are more likely to succeed on your examinations. We also know that the strategies we suggest to you are in no way a substitute for thorough knowledge of the subject matter. We do believe, however, that if you study the review materials thoroughly and practice using the suggested strategies wisely while applying your knowledge, you can successfully pass the exam. Remember, practice, practice, practice.

Answering the Questions

The following terms relate to test questions, commonly referred to as test items:

- **Test item**: The question and the answer options
- **Options**: All possible answers to a particular question
- **Stem**: The part of the test item that asks a question or states a problem
- **Multiple-choice test item**: A question offering four options

Remember these key tips for choosing the correct option:

- **Take your time**: A common problem we observe in test takers is failing to read each question carefully. You may already be thinking of the right answer (option) before you finish reading the question in its entirety, rushing to answer the question and hurrying on to the next item. Slow down and force yourself to finish reading the question before you select the option. You might be surprised that the end of the stem contains the most important information needed to select the correct option (which you would have otherwise missed by hurrying to record your answer).

- **In your own words**: Rethinking the question and possible answers in your own mind will help you translate the intent of the question (that is, what the question is asking and how you would answer it in your own words). After doing so, look for the option that is closest to the one you thought about. Ask yourself whether that option is the best one available of the four you’ve been given. If so, go for it.

- **Stay under the umbrella**: Two or more options may be similar and, in your opinion, part of the answer, but you can choose only one option. If this occurs, look for an option that contains a broader choice, an *umbrella term*, that includes those similar options and best answers the question. For example, if a question asks you to measure a resident’s physical status, you would not select option A (temperature) or option B (pulse), nor option C (blood pressure). Instead, you would choose option D (vital signs), which includes the other options.
Testing Strategies

- **Focus on key words**: We know from experience that very few absolutes occur in resident care, especially when selecting the best test option. These answers are seldom, if ever, correct. For that reason, look for key words in the options, such as *always, never, all, only, most, none, and every*. If you see one of these adverbs as part of the option, choose another option.

- **Opposites attract**: Look for opposite options; one of them is usually correct.

- **Feelings**: When answering a communication-type question or one requiring a response, choose the option that acknowledges or deals with the resident’s feelings.

- **Safety first**: If a test item asks you for an immediate response or to decide what to do *first*, choose the option that protects the resident’s safety or well-being. Other key words include *least, next, most important*, and so on. Look for these words to ensure that you select the correct response by choosing the correct priority of action taken by the MA in the question scenario.

- **Remember the face value**: Avoid reading too much into the test item. You may be tempted to remember a particular work-related or resident experience or situation that was very different from the test option you encounter. Remember to read the item at face value, selecting the best option from the information presented. This is the time to go *by the book*.

- **Process of elimination**: Eliminate incorrect options as soon as possible to improve your chances of success. Often, your first response to the question is the correct one. You can also eliminate an option you know is incorrect. If you can narrow the remaining options to two, your chances of answering the question are now 50-50, much like a true-false question.

- **When all else fails, choose option C**: You will encounter questions for which you have no idea of the answer. If so, and if all the above strategies fail, give it your most educated guess. No evidence exists that choosing option C is the best strategy. The point is, you will not be penalized for guessing, only for answering the question incorrectly.

- **Prepare your body as well as your mind**: Be sure to get enough sleep the night before the exam. Research shows that successful test takers are those who are physically and mentally refreshed. On the morning of the exam, eat a complex carbohydrate breakfast to give you a high-energy boost. Include protein in your diet to help you maintain your energy level throughout the testing experience. This is not the time to crash diet! Avoid too much caffeine; otherwise, you might become jittery, especially if you are already anxious. Studies show that being a little anxious improves your concentration, but becoming panic stricken can have a devastating effect on your testing experience. Stay relaxed. If you begin to get nervous, slowly take a few deep breaths to relax yourself, and then get back to work. Remember, the more rested, relaxed, and prepared you are, the less anxious you will be. A positive attitude is a key element to success. Yes, you can pass the exam!
Avoid last-minute crises: Be sure to set your clock to arrive at the testing site at least 15 to 30 minutes before the testing appointment or as directed by the testing vendor. If you are not familiar with the testing site location, find it the day before the exam so that you are not frantically trying to get there through unfamiliar territory or heavy traffic. Bring all required materials, personal identification, and other required documentation with you, following the testing center’s instructions carefully. If you have questions about testing directions, contact the center in plenty of time to avoid a last-minute panic.

Self-Assessment

Before we present the review content, we recommend that you complete the self-assessment exam-prep questions that follow to give you a baseline for focus in the upcoming chapters. See how well you recall information as you answer each question. The answer key and rationales are provided for immediate feedback. If you score 75% or better, congratulate yourself and begin reading the chapters with added confidence. If you score less than 75%, congratulate yourself for completing the first step in your review journey with an honest appraisal of your knowledge, the “before” in your test readiness. Now, you can use the self-assessment examination as a beginning; subsequent practice examinations and a mock written examination will serve as the “after” story of your progress in preparing for the exam. Good luck!
Exam-Prep Questions

1. Why is it important for you as a Medication Aide to introduce yourself to the residents?
   ○ A. For the residents to know who is in charge
   ○ B. To build relationships with the residents
   ○ C. For the residents to be able to call you if needed
   ○ D. To adhere to proper etiquette

2. You are asked by the Certified Nursing Assistant (CNA) to give a resident his pain medication. You know your responsibility as the Medication Aide is to see that this request is followed up by asking for further clarification from whom?
   ○ A. The resident
   ○ B. Another CNA
   ○ C. The manager
   ○ D. The resident's roommate

3. The MA may appropriately complete which of the following actions?
   ○ A. Administering medications
   ○ B. Ordering medications
   ○ C. Assessment of the resident's condition
   ○ D. Evaluating the effectiveness of medications

4. The Medication Aide is responsible for administering what?
   ○ A. Only the medications learned in school
   ○ B. Medications under the direct supervision of a nurse
   ○ C. Medications by all routes
   ○ D. Expired medications

5. Before giving a medication, the label is checked for all of the following except what?
   ○ A. Dosage
   ○ B. Expiration date
   ○ C. Name
   ○ D. Cost
6. There are six “rights” of medication administration. They include all the following except for what?
   - A. Right dose
   - B. Right medication
   - C. Right patient
   - D. Right place
   - E. Right time

7. A fellow Medication Aide going on break hands you a crushed pill and asks you to administer it to a resident. Which of the following responses is required from you as an MA?
   - A. To give the medication right away
   - B. To ask your fellow Medication Aide what the medication is and to administer it if it is the correct medication
   - C. To politely refuse to do the other Medication Aide's work and to let him or her give the medication when he or she returns from break
   - D. To refuse to give the medication because it cannot be properly identified

8. All medication orders must be complete and written in a specific format. This format includes all the following except for what?
   - A. Patient’s name
   - B. Name of the drug
   - C. Pharmacist’s signature
   - D. Dose
   - E. Route of administration
   - F. Time frequency for the medication to be given
   - G. Signature of the healthcare provider who wrote the medication prescription

9. “Give ibuprofen for pain every 6 hours as needed.” What component of this physician order is missing?
   - A. The route
   - B. The dose
   - C. The frequency
   - D. The condition
10. Place the preparation steps for medication administration in the correct order.
   ○ A. Wash hands.
   ○ B. Read order on Medication Administration Record.
   ○ C. Check label on prepackaged medication as it is removed from drawer.
   ○ D. Gather Medication Administration Record.
   ○ E. Check label again and compare to Medication Administration Record.
   ○ F. Gather equipment.
   ○ G. Detach correct prepackaged dose from cart or bottle and place in medicine cup.
   ○ H. Check label a third time after remaining prepackaged medication is returned to the drawer.

11. The Medication Aide is preparing to administer morning medications to residents. What is one important safety rule?
   ○ A. Never leave an unattended cart unlocked.
   ○ B. Always make sure that all medications are out of sight of other residents.
   ○ C. Provide liquids to swallow medications.
   ○ D. Check to make sure that the medication carts have charts available to make corrections as needed.

12. Storing medications is an important responsibility for the medication aide. Which of the following actions demonstrates the correct storing of a medication?
   ○ A. Medications with similar names are stored close together.
   ○ B. Mr. and Mrs. Jones's medications are in the same medication storage bin.
   ○ C. All medications are stored in their own prepackaged containers.
   ○ D. Once medications are opened, they are all kept in the cart, regardless of the directions on the packaging.

13. The MA is about to administer a medication, but the resident requests that the MA leave the medication on the counter for him or her to take later. What is the correct course of action for the MA?
   ○ A. Leave the medication as requested by the resident.
   ○ B. Advise the nurse or supervisor that the resident refused to take the medication.
   ○ C. Inform the resident that it is against institutional policy to leave the medication, and instruct the resident to call when he or she is ready to take the medication.
   ○ D. Call the doctor and inform him or her that the resident is refusing to take the prescribed medication.
Chapter 1: What You Need to Know to Prepare for the Medication Aide Certification Examination (MACE)

14. All of the following are types of oral medications except for what?
   - A. Powders
   - B. Lotions
   - C. Syrups
   - D. Coated tablets

15. All of the following are topical medications except which one?
   - A. Ointments
   - B. Foams
   - C. Gels
   - D. Syrups

16. When a medication is ordered to be given sublingually, it is given how?
   - A. By mouth
   - B. Placed in the cheek
   - C. Placed under the tongue
   - D. Instilled in the nasal cavity

17. When a medication is ordered to be given in the buccal cavity, it is given how?
   - A. By mouth
   - B. Placed in the cheek “pocket”
   - C. Placed under the tongue
   - D. Instilled in the nasal cavity

18. When a medication is ordered to be given PO, it is given how?
   - A. By mouth
   - B. Placed in the cheek
   - C. Placed under the tongue
   - D. Instilled in the nasal cavity

19. When patients are taking metronidazole (Flagyl), they should avoid which of the following?
   - A. Fatty foods
   - B. Sweetened beverages
20. A common medication for thyroid problems is levothyroxine (Synthroid). Which one of the following adverse effects can this medication cause?
   - A. Fast heart rate
   - B. Slow heart rate
   - C. Low blood pressure
   - D. High blood pressure

21. The most common side effect of the diabetic drug metformin is what?
   - A. Low blood sugar
   - B. Diarrhea
   - C. Sleepiness
   - D. Change in pH

22. What medication is often prescribed for a patient who has depressive disorder symptoms?
   - A. Amitriptyline
   - B. Promethazine
   - C. Propranolol
   - D. Rifampin

23. Which of the following are used to classify medications?
   - A. Actions or indications
   - B. Side effects
   - C. Contraindications
   - D. Interactions

24. Antibiotics need to be given on time for all of the following reasons except for what?
   - A. To maintain the blood level
   - B. To keep the infection from coming back
   - C. To prevent the overgrowth of another infection
   - D. To cause the infection to go away quickly
25. Which of the following is the action of an antiviral?
   - A. Prevents the virus from making more virus
   - B. Kills the virus
   - C. Subdues the virus so that the body's own defenses can take care of it
   - D. Increases killer T cells to destroy the virus

26. Diuretics are ordered first for high blood pressure for all of the following reasons except which one?
   - A. They have the fewest side effects.
   - B. They work the best.
   - C. They work the most quickly.
   - D. They decrease urination.

27. Diuretics are medications that are primarily prescribed for a patient who has which of the following conditions?
   - A. Swelling of the feet and ankles
   - B. Low sodium levels in the blood
   - C. Low blood pressure
   - D. Feelings of light-headedness upon standing

28. True or false: Residents have the right to refuse to take medications.

29. Which of the following may cause a medication error?
   - A. Giving a resident their pain medication as requested
   - B. Following the "rights" of medication administration
   - C. Being familiar with the medication
   - D. Talking with colleagues while administering medications

30. An MA reviews the Medication Administration Record and notices that an error has occurred. A resident was given the wrong medication. The MA's first action should be to what?
   - A. Inform the resident
   - B. Call a lawyer
   - C. Inform the nurse or supervisor
   - D. Call the physician
31. Many medications have side effects. Which of the following is a side effect that the Medication Aide should watch for when giving an antidysrhythmic medication?
   - A. Increased energy
   - B. Fatigue
   - C. Low heart rate
   - D. High blood pressure

32. One important way to note if a resident's behavior is different from the norm is by doing what?
   - A. Asking the resident whether this behavior is usual for him or her
   - B. Being familiar with the resident's normal behavior
   - C. Asking the supervisor about each resident's normal behavior
   - D. Checking with the CNA who cared for the resident last week

33. Match the following terms with the correct definitions:
   - A. Drug diversion 1. A topical medication that is semisolid and has an oily base
   - B. Homeostasis 2. The body in a steady state
   - C. Ointment 3. Taking a resident's drug for an MA's own use
   - D. Seizure 4. Another name for a convulsion

34. Match the following abbreviations with their corresponding terms:
   - A. MAR 1. Metered dose inhaler
   - B. PO 2. By mouth
   - C. MDI 3. Congestive heart failure
   - D. CHF 4. Medication Administration Record

35. Dosages are calculated by weight for which group of patients?
   - A. Small adults
   - B. Very large adults
   - C. Children
   - D. The elderly
Chapter 1: What You Need to Know to Prepare for the Medication Aide Certification Examination (MACE)

36. A medication is given for anxiety but causes the resident to become more anxious; this is called a(n) ___________ effect.
   ○ A. Idiosyncratic
   ○ B. Paradoxical
   ○ C. Antagonist
   ○ D. Agonist

37. A couple of antipsychotic medications are known to have caused cases of muscle pain and muscle breakdown. This type of drug reaction is known as what?
   ○ A. Idiosyncratic
   ○ B. Paradoxical
   ○ C. Antagonist
   ○ D. Agonist

38. When the drug naloxone is administered to block the effects of an opioid narcotic, the drug action is known as which type?
   ○ A. Idiosyncratic
   ○ B. Antagonist
   ○ C. Agonist
   ○ D. Paradoxical

39. Requip is a medication used to decrease restless leg syndrome and as a treatment for Parkinsonism by mimicking dopamine in the brain. What type of drug is Requip?
   ○ A. Idiosyncratic
   ○ B. Antagonist
   ○ C. Agonist
   ○ D. Paradoxical

40. Levothyroxine (Synthroid) should be administered early in the morning, on an empty stomach, and the resident:
   ○ A. Will need to wait 3 to 4 hours before eating or drinking anything
   ○ B. Should not eat for at least 1 hour but may drink soda or milk
   ○ C. Should wait 15 minutes before eating
   ○ D. Should wait at least 30 minutes before eating or drinking
41. **Metoclopramide (Reglan) is given when?**
   - A. 1 hour before meals
   - B. 30 minutes before meals
   - C. 1 hour before meals and at bedtime
   - D. 30 minutes before meals and at bedtime

42. **A resident is prescribed a new antihypertensive medication known as a beta-blocker. After three days on the medication, the resident's heart rate is 54 and he complains of wheezing. Which of the following is the best action for the MA to take regarding medication administration of the beta-blocker?**
   - A. Wait until bedtime to give the next dose.
   - B. Hold the next dose and report to the nurse.
   - C. Give the medication and report to the nurse.
   - D. Call the physician and report the resident's response.

43. **Which of following is not a side effect of phenytoin (Dilantin)?**
   - A. Confusion
   - B. Hyperactivity
   - C. Sleepiness
   - D. Rash

44. **The reaction to antihyperglycemic medication that causes a person to shake and feel nervous is known as what?**
   - A. Hyperglycemia
   - B. Hypothyroidism
   - C. Hypoglycemia
   - D. Hyperthyroidism

45. **Which of the following actions could lead to a battery charge?**
   - A. A resident asks you to stop a procedure. You inform him or her that you have been instructed by his or her physician to complete the procedure. You complete the procedure over the objections of the resident.
   - B. You explain a procedure to a resident and do the procedure after asking permission.
   - C. You stop a procedure when asked to do so by the resident.
   - D. At his or her request, you give medication to calm the resident so the procedure can be performed.
Chapter 1: What You Need to Know to Prepare for the Medication Aide Certification Examination (MACE)

46. An MA can be charged with negligence when he or she administers the correct:
   ○ A. Medication
   ○ B. Medication to the right person
   ○ C. Medication to the right person in the wrong way
   ○ D. Medication to the right person in the right way

47. A nursing assistive personnel such as a MA-C or CNA:
   ○ A. Is a licensed nurse
   ○ B. May practice in the same way as a nurse
   ○ C. Cannot be charged with negligence
   ○ D. Can work within their job description

48. What is the average daily dose of the oral hypoglycemic agent glyburide (Glucotrol)?
   ○ A. 5mg to 10mg TID
   ○ B. 2.5mg to 20mg BID
   ○ C. 2.5mg to 20mg QID
   ○ D. 2.5mg to 20mg QD

49. Diazepam is a medication used for anti-anxiety and seizure control. Diazepam is a controlled substance. To which class/schedule does diazepam belong?
   ○ A. Class I
   ○ B. Class II
   ○ C. Class III
   ○ D. Class IV

50. Clarinex is a medication that is available as an over-the-counter drug. The drug’s action is to reduce what?
   ○ A. Allergy symptoms
   ○ B. Stomach upset
   ○ C. Pain from arthritis
   ○ D. Gas
Rationales

1. Answer B is correct. Patients have a right to know who you are and what your role in their care will be.

2. Answer A is correct. The MA is responsible for reviewing with the patient his or her reason for requesting the medication and for asking the patient to describe his or her pain level to chart the effectiveness of the medication.

3. Answer A is correct. The MA is responsible for administering medications. Any problems or questions are to be directed to the nurse in charge.

4. Answer B is correct. The MA administers medication only under the direct supervision of a nurse or supervisor.

5. Answer D is correct. All medication labels are to be checked for name, dosage, date of expiration, and route.

6. Answer D is correct. The five rights of administration include the right patient, medication, dose, time, and route.

7. Answer D is correct. Never give a medication that cannot be properly identified; otherwise, the patient could be harmed.

8. Answer C is correct. Medication orders are to consist of the patient’s name, the name of the medication, the dose, the route of administration, the time frequency of the medication, and the provider’s signature.

9. Answer B is correct. The dose is missing. All medication orders are to have the name of drug, the dosage, the route of administration, and the time frequency.

10. Answer order A, F, D, B, C, E, H, G is correct. Medication labels are to be checked three times before bringing the medication into the resident’s room.

11. Answer A is correct. For the safety of residents and visitors, never leave unattended charts unlocked.

12. Answer C is correct. All medications are to be stored in their own containers, in the patient medication storage areas for the patient for whom it is ordered. Medications are to be stored according to the manufacturer’s recommendations.

13. Answer C is correct. The patient has a right to request a medication be given at a later time, but this request and the reason for it should be documented on the MAR. For the safety of the residents and any visitors, do not leave medication unattended in a resident’s room.

14. Answer B is correct. Lotions are not used orally and could harm a resident if swallowed.

15. Answer D is correct. Syrups have a surgery base and are generally used for oral medications.

16. Answer C is correct. The definition of sublingual is “beneath the tongue.”

17. Answer B is correct. The buccal cavity is in the mouth, in the cheek area.
Chapter 1: What You Need to Know to Prepare for the Medication Aide Certification Examination (MACE)

18. Answer A is correct. PO is a Latin term that means per os, or “by mouth.”
19. Answer C is correct. Drinking alcoholic beverages while taking Flagyl may cause nausea and vomiting.
20. Answer A is correct. One side effect of levothyroxine is tachycardia (a fast heart rate).
21. Answer B is correct. The most common side effect of metformin is diarrhea.
22. Answer A is correct. Amitriptyline is a tricyclic antidepressant and is used for some cases of depression.
23. Answer A is correct. The target and actions of a medication give it its classification.
24. Answer C is correct. One side effect of an antibiotic is that it may kill some of the healthy bacteria we have in our bodies, and then other opportunistic fungus or bacteria may multiply.
25. Answer A is correct. Antiviral medications work to prevent the replication of viruses.
26. Answer D is correct. A diuretic that is working properly will increase urination.
27. Answer A is correct. Diuretics are used to decrease the overload of fluid in the body, decreasing the swelling (edema).
28. Answer: True. All patients have the right to not take their medications. Forcing a patient to take medication could be considered battery, and legal charges might be considered.
29. Answer D is correct. When administering medication, the MA should focus on the medication and the resident to decrease the error potential.
30. Answer C is correct. MAs are under the supervision of the nurse and should report any problems to the nurse immediately.
31. Answer C is correct. An antidysrhythmic works to correct an abnormal rhythm and can slow heart rate.
32. Answer is B. Become familiar with the behaviors of the residents to know when a change occurs. Whenever a resident’s behavior appears different, the MA should review the resident’s medications with the nurse to determine whether the change could be due to a side effect of one of the medications.
34. Answers: A = 4, B = 2, C = 1, and D = 4.
35. Answer C is correct. Children’s dosages are calculated by BMI or the weight of the child.
36. Answer B is correct. A paradoxical effect is one that is the opposite of what is expected.
37. Answer A is correct. Idiosyncratic reactions are drug reactions that rarely occur and therefore cannot be predicted.
38. Answer B is correct. A drug that works as antagonist binds with a special receptor within the body and blocks another drug from attaching to the receptor.
39. Answer C is correct. Requip is a dopamine agonist. Agonist medications act by binding to a chemical receptor to elicit the desired response.

40. Answer D is correct. The manufacturer has proven that this medication works best when a patient goes without food or water for at least 30 minutes after taking it. The patient also needs to wait 3 to 4 hours after the levothyroxine has been administered before taking calcium or iron.

41. Answer D is correct. Reglan decreases the amount of time food and fluid spend in the stomach to promote healing of stomach ulcers or diabetic stomach paresis.

42. Answer B is correct. Hold the resident’s medication and report to the nurse so that an assessment can be made and the physician can be notified by the nurse, who can take phone orders from the physician.

43. Answer C is correct. Confusion, rash, and sleepiness are all side effects of Dilantin. Residents need to be closely observed for any signs of confusion while taking the medication.

44. Answer C is correct. When the blood sugar drops below 70, the condition is known as hypoglycemia. The symptoms of hypoglycemia include hunger, shakiness, nervousness, sweating, light-headedness, and confusion.

45. Answer A is correct. A resident has the right to control what is done to his or her body. Whenever a resident requests that a procedure be stopped, it should be stopped. Otherwise, you could be charged with battery.

46. Answer C is correct. The five rights of medication administration are the right medication, the right person, the right route, the right time, and the right dose.

47. Answer D is correct. Assistive personnel are unlicensed persons who assist patients with basic nursing functions under the supervision of a nurse.

48. Answer D is correct. Glucotrol is a medication that is given once a day.

49. Answer D is correct. Medications that pose a risk for addiction and abuse are monitored by the government.

50. Answer A is correct. Clarinex blocks peripheral effects of histamine released during allergic reactions.
This page intentionally left blank
CHAPTER TWO
The Roles and Responsibilities of the Medication Aide

Medical Term Hot List

✓ Abuse ✓ Libel ✓ Position description
✓ Accountability ✓ Licensed Practice Nurse ✓ Practice Act
✓ Assault ✓ Medical Term Hot List ✓ Professional boundaries
✓ Battery ✓ Medically liable ✓ Registered Nurse
✓ Beneficence ✓ Medication ✓ Resident's Bill of Rights
✓ Code of ethics ✓ Administration Record ✓ Role
✓ Competence ✓ Medication Assistant-Certified ✓ Scope of practice
✓ Conscientiousness ✓ Administration Record ✓ Sexual harassment
✓ Delegated duties ✓ National Council of ✓ Slander
✓ Ethics ✓ Medically liable ✓ Professional boundaries
✓ Euthanasia ✓ Nonmaleficence ✓ Registered Nurse
✓ False imprisonment ✓ Negligence ✓ Resident's Bill of Rights
✓ Incident report ✓ Nurse Practice Act ✓ Role
✓ Libel ✓ Position description ✓ Professional boundaries
✓ Medical Term Hot List ✓ Practice Act ✓ Registered Nurse
✓ Medically liable ✓ Medication ✓ Resident's Bill of Rights
✓ Administration Record ✓ Administration Record ✓ Role
✓ Medication Assistant-Certified ✓ Professional boundaries ✓ Registered Nurse
✓ National Council of State Boards of Nursing ✓ Resident's Bill of Rights
✓ Negligence ✓ Negligence ✓ Practice Act
✓ Nonmaleficence ✓ Nonmaleficence ✓ Professional boundaries
✓ Nurse Practice Act ✓ Nurse Practice Act ✓ Registered Nurse
✓ Nursing process ✓ Nursing process ✓ Resident's Bill of Rights

This chapter reviews key issues related to your roles and responsibilities as a member of the healthcare team and the importance of establishing a caring and ethical relationship with clients. A brief review of principles of effective communication as well as residents’ rights follows.
Your Roles and Responsibilities

The National Council of State Boards of Nursing (NCSBN) accepts responsibility for developing standards of nursing care and education that protect the health and welfare of the public, thus serving as a guide for state laws addressing nursing practice. The Nurse Practice Act of each state determines what licensed nurses—Registered Nurses (RNs), Advanced Practice Registered Nurses (ARNPs), and Licensed Practical/Vocation Nurses (LPN/LVN)—can do, also known as their scope of practice (or a description of what licensed nurses can do according to their level of educational training and experience). The Model Nurse Practice Act also outlines the role and responsibilities of nursing assistive staff, known by the NCSBN as unlicensed assistive personnel (UAP).

As part of the UAP category in most states, your title is that of Medication Aide-Certified (MA-C). In other states, you may be referred to as a Certified Medication Aide, Certified Medication Technician, Medication Aide, Trained Medication Aide (TMA), or other similar distinction. You must hold the Certified Nurse Assistant/Aide (CNA) credential, complete a state-approved Medication Assistant program, and meet all other state requirements to become registered, which include a written competency examination and may, in some instances, include a clinical competency evaluation. An alternative route to MA-C certification may be through equivalent education in an approved program leading to LPN or RN licensure.

Your role (or function) as a Medication Aide is to assist the licensed nurse (RN or LPN/LVN) in providing safe and ethical care for clients—that is, administering prescribed drugs (also called medications or medicines) and completing other delegated nursing tasks allowed by state law. Medication Aide employment settings vary (for example, skilled nursing homes, residential settings, or assisted-living facilities; hospitals, long-term care facilities; correctional centers; home health agencies, schools, group homes, and daycare centers). For purposes of this publication, the care setting for the Medication Aide is the skilled nursing center or assisted-living facility, and your clients are referred to as residents. You must adhere to all laws and regulations of the state licensing/accrediting agency.

EXAM ALERT

State regulatory agencies protect their citizens by

- Overseeing healthcare provider licensure and registration.
- Authorizing duties of licensed nurses and other healthcare team members such as Nurse Assistants/Aides, Medication Aides, and others.
- Publishing practice limitations/exclusions and continuing education requirements to maintain licensure.
- Carrying out disciplinary action should the practitioner provide care outside state practice standards.

From the Library of Scott Kruse
Roles and Responsibilities of Other Nursing Team Members

The following is a synopsis of the role of licensed nurses in healthcare facilities:

- **Registered Nurse (RN):** RNs are responsible for carrying out both the medical plan of care prescribed by the physician and the nursing care plan developed by the nursing staff. They assess each resident and modify their nursing care as needed to help meet residents’ needs. RNs also work with other therapists and staff to ensure the well-being of each resident. They may assign you, the unlicensed assistive staff member, to assist in administering medications and directly supervise your work. RNs work under the supervision of the director of nursing and are accountable for their practice according to the state’s Nurse Practice Act, which outlines RN practice competencies and limitations of their scope of practice. They may supervise other RNs, LPNs, or other UAPs.

- **Licensed Practical Nurse (LPN):** LPNs carry out the medical and nursing plans of care for assigned residents, but work under the supervision of RNs. LPNs give treatments, administer medications, and document care given according to a prescribed scope of practice set by the board of nursing or other licensing agency. LPNs may also supervise UAPs. Their duties may be expanded with additional training and credentialing. Where allowed, LPNs may assign you to assist with medications while supervising your work.

The Role of UAPs

Certified Nursing Assistants/Nurse Aides or Patient Care Assistants/Technicians (CNAs, PCAs, and PCTs) carry out duties under the supervision of RNs or LPNs. As unlicensed assistive personnel, they provide personal, hands-on care and other tasks required to meet residents’ needs. CNAs are also responsible and accountable for their duties as defined in their position description and as proscribed by the standards of care by the state accrediting body. CNAs cannot delegate duties to other UAPs; this includes delegating medication administration tasks to you.

You, the **Medication Aide**, must perform your duties according to national standards as follows:

**The Standard Job Description of the Medication Aide-Certified (NCSBN):**

- Functions as a healthcare team member
- Carries out delegated nursing assistant tasks
- Assists the nurse in providing care to clients, which includes observation and reporting of client needs
Recognizes and performs tasks according to level of education and training
Accepts responsibility and accountability for own performance according to state laws and regulations regarding MA-Cs
Performs tasks in an ethical-legal and caring manner
Communicates changes in client status according to level of training and experience
Documents care according to agency policy and procedure
Performs tasks safely and effectively to assure client comfort and welfare
Respects client rights
Protects confidential client information unless otherwise required to promote client safety and welfare
Follows federal, state, and agency regulations to protect own health and that of others
Seeks guidance from the nurse as needed to perform tasks safely and efficiently

Similar standards apply in the state in which you become certified; it is also your responsibility to adhere to them.

Your **position description** or **job description** outlines your duties, responsibilities, and other expectations of your employer. It also documents the chain of command, or supervising personnel, to whom you report. It will note education, experience, and licensure requirements as well as desirable physical and mental abilities. Physical abilities include walking several miles during a work shift, standing for extended periods of time, lifting and moving abilities, and so forth. Mental stamina is needed when working under stressful conditions while modifying resident behaviors.

**EXAM ALERT**

*Your job duties may include the following:*  
- Giving scheduled drugs under direct supervision of a licensed nurse unless otherwise allowed by state law  
- Giving ordered PRN (as needed) medications after checking with the resident’s nurse  
- Performing tasks associated with medication administration, including vital signs, height and weight, glucose monitoring, and client observation  
- Recording medication administration according to agency procedure  
- Reporting changes in client status regarding drug therapy to ensure client comfort and safety  
- Reporting life-threatening events to the nurse to protect self, the client, and others  
- Reporting drug errors and filling out proper forms
Exclusions to the MA-C Role (Legal Limitations)

According to the NCSBN, the nurse shall not delegate to the MA-C any of the following acts:

- Giving medications that require dosage conversions or calculations
- Assessing the client’s need for, or response to, medications, including PRN medications
- Giving medications via parenteral, nasogastric, gastrostomy, or jejunostomy routes
- Regulating IV fluids, program IV pumps, insulin pumps, or giving drugs to unstable clients or patients

**EXAM ALERT**

Other role limitations may include the following:

- Giving the first dose of a newly ordered medication to the client
- Converting medication dosage from one method of measurement to another
- Giving medications when the nurse is not available to monitor the medications’ effects on clients
- Making decisions that might include withholding medications
- Calling the physician regarding client status or need for medication
- Accepting verbal or telephone orders from the physician or other healthcare professional allowed by state law to prescribe medications

This list shows just a sampling of role limitations; state law and administrative rules as well as the employing agency may further limit your practice. Remember, also, that the employing agency may not expand your practice beyond state law and regulations. This includes, for example, assigning you any duties not included in your position description. If you have any questions or conflicts related to your functions or job limitations, consult with the supervising nurse; or, if the situation involves the nurse involved in the assignment, contact your employer’s human resources officer before you act. In any case, do not perform any duty not included in your position description.

Accepting Delegated Duties

Registered nurses are responsible for the overall nursing care of clients. RNs use the nursing process, a decision-making approach, to assess, plan, implement, and evaluate client care that they or other team members provide to clients. As delegators, RNs and, where allowed, LPNs give you, the MA-C, the authority to carry out certain nursing functions (also called procedures, tasks, or activities) that do not require professional level of knowledge or skills. Your assignment must be in keeping with your credentials and position description.
Remember, other UAPs may not delegate tasks to you; for example, a CNA asks you to give a PRN medication to a resident. You must first check with the resident to validate the request, and then consult with the nurse before giving the medication.

Just as you are legally accountable, or answerable, for your delegated functions, so, too, are the nurses accountable for their delegation. In this way, you and the delegating nurse share legal accountability for safe client care.

You are responsible for accepting your assigned tasks; refusing them because you want to avoid your work is unacceptable and grounds for discipline according to agency policy. Further, you cannot delegate any part of your assignment to other unlicensed assistive personnel. However, asking for help in carrying out your tasks is permissible; for example, you may ask the CNA to help you position the resident to safely receive medications.

**EXAM ALERT**

Should you accept a task that falls outside your position description, both you and the delegating nurse are medically liable (legally responsible) for any of your actions (or lack of action) that may result in harm to the client. To help prevent such an occurrence, you must ask the nurse to clarify any assignment that is unclear or that seems illegal or unethical or above your skill level or ability. If, after clarification, you still feel uncomfortable or unprepared, politely refuse the assignment. Other considerations for refusing assignments include the following:

- The delegated task is unclear.
- You are unfamiliar with the task.
- The client’s condition is unstable.
- Performing the delegated task could harm the client.
- The task is illegal or unethical.
- You will not be supervised by the nurse.
- The nurse will not be available to monitor the client’s response to the task.

**Medication Administration Policies**

Following agency policies and procedures, your chief task/duty is to assist the nurse in giving certain prescribed drugs. In most cases, unless allowed by state law, the nurse must convert drug dosages where needed and directly supervise the administration of the drugs you give.

Agency guidelines guide you in how to receive drug orders, storage and distribution of medications, and documentation and other record keeping related to medication administration. This includes procedures for handling and disposing of controlled substances/drugs identified by state and federal agencies as scheduled drugs, which means they must be carefully monitored and inventoried.
According to agency policy, you must report to the nurse immediately any emergency you observe while administering medications, help resolve the emergency per procedure, and participate in any quality-improvement activities that may result from the incident.

**Medical Error Prevention**

Preventing medical errors is a primary responsibility of all healthcare personnel. As a member of the healthcare team, you must ensure that your performance adheres to all administrative policies and procedures that serve to keep the client safe. Other measures essential for promoting client safety by preventing drug errors include the following:

- Following the prescriber’s orders
- Following the drug manufacturer’s directions
- Following accepted drug administration standards, including performing safety checks, and observing the six rights (or principles) of administering medications
- Listening to the client or family
- Notifying the nurse if questions or situations arise that could threaten client safety

Maintaining your competence (knowledge, skills, and attitude) will also go a long way to help prevent errors when giving medications. Should you make an error, you are responsible for following agency policy in reporting it immediately to your supervisor and for participating in any remediation necessary to prevent a recurrence; this includes submitting a medication error report (incident report) per agency policy. Failure to report a performance error could result in termination from the agency and/or discipline by the accrediting agency of the state in which you work.

**EXAM ALERT**

Key sources are available to you in the workplace to help prevent medication errors, including the nurse or the agency pharmacist. Keeping abreast of drug literature and related educational materials is also necessary, as is attending continuing education seminars and other activities necessary to maintain your knowledge and skills.

**Effective Communication Regarding Medication Administration**

The following issues regarding effective communication are reviewed here:

- Verbal communication
- Barriers to verbal communications
- Written communication
- Personal characteristics contributing to effective communication
Verbal Communication

Being able to express yourself effectively (both verbally and in writing) is a communication skill you learned in your Nursing Assistant program. It is appropriate to review key skills here as you prepare for certification; you will use them throughout your healthcare career. Likewise, forming positive working relationships with your coworkers and building effective interpersonal relationships with residents are essential elements in effective Medication Aide practice.

Communication skills involve listening, looking, responding, and documenting what residents tell you about themselves and their unique needs. Active listening (that is, listening to residents without being distracted by your own thoughts) is key to acknowledging them as worthy human beings who deserve your attention.

NOTE

This skill is called listening with a “third” ear. Your skill in observing what residents do not tell you is just as important as what they share with you; in this way, you are tuned in to their unexpressed needs.

Good verbal communication skills also include speaking clearly at a level residents can understand (that is, avoiding medical jargon), asking open-ended questions that discourage a yes/no response, using phrases to encourage further exploration of thoughts and feelings (“Oh?,” “Tell me more,” and so on), and confirming the message you receive (“Let me see if I understand what you mean,” “Is this what I hear you saying?,” and so on).

Barriers to Effective Verbal Communication

Communication barriers can occur in practice. Try to avoid the following pitfalls when communicating with the resident: asking close-ended questions that prompt a yes/no answer, speaking “over the resident’s head,” using medical terms or other language that he or she cannot understand, or responding to him or her with advice/criticism/sarcasm. Responses to the resident that begin with “You should/shouldn’t…” or “why?” are not only demeaning but also encourage defensiveness and limit further communication. This reluctance to communicate can be hazardous for the resident and a detriment to an effective relationship with you.

It is important for you to recognize communication barriers that interfere with effective interpersonal relationships with residents and seek guidance and help from your supervisor to solve any communication problem you might encounter. Use an interpreter or family member to assist you in talking with the resident whose primary language is not English, and be patient with the resident who struggles to understand your language. Cultural barriers can also interfere with effective communication, especially if the resident’s culture is very different from your own. Nonverbal gestures like avoiding eye contact might be viewed by the resident as offensive or disrespectful. Other cues to barriers include personal space (for example, standing too close to the resident), smiling or other facial expressions that do not match the verbal
message, your conversational tone, or body posture. For example, you might be smiling when talking to a resident, and that might imply your agreement. At the same time, however, you are standing with arms crossed over your chest and leaning away from the resident, a message that you, indeed, do not agree with him or her. At best, this message is confusing, if not disrespectful. Equally important to effective interpersonal relationships with residents is the need to maintain resident safety through clear communication. This is especially important when giving medications. Barriers to communication also include those linked with the senses (that is, vision, hearing, and other sensory deficits). Speaking clearly, slowly, and directly to the resident who is hard of hearing is important to ensure understanding of your verbal communication. Offering large-print reading material or other assistance to the resident who is visually impaired is equally important. Some residents have a decreased sensation to pain and temperature changes. Specific details about giving medications to impaired residents are included in later chapters.

**Written Communication**

Reporting conversations between you and residents during medication administration is also important to maintain their safety and well-being. This includes changes in their condition, specific requests, concerns or evaluations regarding their care, safety considerations, and any other pertinent observations.

Recording/charting all drugs you give is an important and appropriate function. Charting requires knowledge of medical terminology and abbreviations as well as proper spelling on all designated agency forms. The *Medication Administration Record (MAR)* is the most common communication tool and chart form in the resident's medical record. Remember to follow all agency guidelines for recording on the MAR. Consult your supervisor for help with documentation to ensure completeness, objectivity, and accuracy.

Observation is the first step to ensuring resident safety, and you must report promptly to your supervisor any resident responses to the medications you give, other concerns that the resident might share, or any change in the resident's condition. Remember, where client safety is concerned, you can *never* overcommunicate.

Other personal characteristics required for effective MA-C practice include the following:

- **Honesty**, or truthfulness, is one of the most important qualities you can bring to your job. Second only to knowing your job well and being accountable for what you do is being truthful in your interactions with others. Accepting your own limitations is another example of being truthful. These attributes are essential to an effective and lawful practice.

- **Caring** means having a sincere regard for the safety and well-being of all the residents in your care and being willing to care for them and about them. You can be the most skillful Medication Aide in the facility, but if you do not care about what happens to
the residents, you are in the wrong job. In education, for example, we evaluate caring characteristics in our students in part by observing the time they spend with residents other than the time required to give care. Spending time with residents is only one way to evaluate caring behaviors, but it is an effective job-performance measure. These caring characteristics are the hallmark of the exemplary employee.

- **Being empathetic** (that is, seeing yourself in others’ situations without pitying them) is also an important attribute you must possess. Consideration for other peoples’ feelings is also an important personal quality for effective practice. This means being aware of the effect of what you say and how you say it. Cooperating with coworkers to help support them and the facility when short-staffed is another example of being considerate.

- **Having respect for other people** is important, especially when their values, culture, language, or beliefs differ from your own. Honesty, empathy, sincerity, and caring behaviors are all part of legal and ethical practice—basic but crucial expectations of your employer.

- **Dependability** is a basic expectation of your employer. Coming to work when scheduled and on time demonstrates your commitment to your job and to the residents. Doing what you commit to do and doing so consistently also demonstrate your dependability.

- **Flexibility** and dependability go hand in hand. Despite the best assignment plan, “stuff happens,” meaning you might be reassigned to another unit or group of residents or staff you do not know. You must be able to accept this normal disruption in your work schedule and make the best of the situation.

- **Accountability** is a key quality you bring to your work. You must care for all residents in a variety of conditions and situations for which you have been prepared to handle and are expected to perform your duties in the way you have been trained to perform them. Should you have any questions or concerns about your assignment, discuss them privately with your supervisor.

- **Self-responsibility** means that you are responsible for your own health and safety. Wearing personal protective equipment (PPE), using safe body mechanics when positioning residents to take medications, maintaining a safe workspace, organizing your work to conserve energy, and maintaining a healthful lifestyle are examples of those actions you must take to protect yourself and promote your own well-being.

- **Conscientiousness** (that is, having a careful attitude about your work and concentrating on your duties without distraction) is most important for safe and effective practice. This is a critical attitude where giving medications is concerned. A sloppy, careless attitude can harm clients and place your job in jeopardy. The nurse and client alike must be able to trust that you are serious about your responsibilities and that you have the clients’ best interests in mind in all that you do.
Being a team player implies working well with others; this is a hallmark of effective and efficient performance and will serve you well as a team member. Respecting each team member’s talents and contributions goes a long way toward making the residents’ lives meaningful, promoting a harmonious workplace environment, and making your work more fulfilling.

**NOTE**

Being a team player also means being able to accept constructive criticism, especially from your supervisor. Listening to supervisor feedback without getting defensive will help you to improve your performance and contribute to your job satisfaction. Always follow the facility’s chain of command when resolving work-related issues, especially for work conflicts or other disagreements (which are bound to occur). It is important for you to consult with your supervisor about any situations that concern you in this regard.

---

**Specific Ethical and Legal Issues**

As mentioned previously, if you perform duties outside your job description or perform appropriate duties incorrectly that result in harm to a resident, you can be held liable. Liable acts may include the following:

- **Abuse**: A threat of physical or mental harm to a resident (including physical, mental, or sexual abuse).
- **Aiding and abetting**: Participating in an unlawful act or observing it and not reporting it. For example, observing sexual harassment of a resident and not reporting it.
- **Assault**: Threat of touching a resident without permission.
- **Battery**: Unlawful personal violence toward a resident (for example, forcing residents to take medications despite their refusal).
- **False imprisonment**: Preventing a resident from moving freely about, with or without force, against the resident’s wishes (for example, restraining a resident’s hands while giving medications).
- **Invasion of privacy**: Failing to keep a resident’s affairs confidential or exposing the resident’s body when performing care.
- **Involuntary seclusion**: Keeping a resident isolated from others as a form of punishment.
- **Negligence**: Neglecting to act in the manner in which you were taught, either omitting care or performing care incorrectly, with resultant harm to a resident.
- **Theft**: Taking something that does not belong to you. This can include taking medications intended for use by the resident, known in legal terms as **diversion**.
Diversion most often applies to diverting a drug categorized in the Controlled Substance Act (1970) as a Schedule II drug; all scheduled (levied according to category) drugs must be carefully regulated according to agency policy and state and federal laws. Diversion of a Schedule II drug is a federal crime, punishable by immediate termination of employment, prosecution by the court system, as well as discipline from the state accrediting agency.

**Residents’ Rights**

In 1973, the American Hospital Association (AHA) issued a policy for all patients called “A Patient’s Bill of Rights.” A similar document, the “Resident’s Bill of Rights,” contains additional considerations for residents in long-term-care settings. By law, all nursing homes must have written policies describing residents’ rights and must make them available to all residents. The following list outlines the issues addressed in these bills of rights; namely, that every resident has the right to

- **Be informed about the facility’s services and charges:** The services of the nursing home and all charges involved with the services should be made available and fully explained to every resident. Likewise, charges that are not covered by Medicare or Medicaid should also be included in the notice of services; this includes those services not covered by the basic charges for facility rates.

- **Be informed about one’s medical condition:** Unless the physician notes in the medical record that to be informed of his or her medical condition is not in the resident’s best interest, every resident deserves to be apprised of his or her medical condition. Be truthful with you answer residents’ questions about their condition, being careful to inform them of what you observe only (for instance, answering a resident’s questions about vital signs or output).

**EXAM ALERT**

The RN or doctor should address the resident’s medical condition because you cannot answer medical questions for which you have not been prepared to answer. You can, however, answer questions about medications as you give them to the residents (for example, name, dosage, and safety measures such as taking medications on empty stomach and so on). Explaining side effects and other more detailed drug information is the duty of the nurse. It is your responsibility to report to the nurse as soon as possible the resident’s request for detailed drug information.

- **Participate in the plan of care:** Every resident must have the opportunity to participate in his or her plan of care or to refuse care/treatment. Despite your belief that a procedure or care activity will help residents, be careful that you do not force them to participate against their wishes. This includes assisting other staff to do the same. Failure to observe this resident right is an example of assault, battery, and/or invasion of privacy. Giving medications to residents despite their refusal is an example of assault and battery.
Choose one’s own physician: Every resident has the right to determine his/her own physician and pharmacy.

**EXAM ALERT**

Remember, your personal opinion is unimportant in this situation. Refer the resident to the RN or social worker for assistance.

Manage one’s own personal finances: Residents can manage their own finances or appoint someone else (power of attorney) to manage them. If authorized by the resident to manage funds, the manager must report the resident’s financial status as directed and provide all receipts for business transactions. Avoid handling any money or valuables of the resident (for example, inventory of personal items upon resident admission to the facility) without a witness.

Privacy, confidentiality, dignity, and respect: Privacy includes visitation for married couples (for example, closing the door to ensure couples are alone and are not interrupted and knocking before entering the room).

**EXAM ALERT**

Confidentiality means that all information about the resident’s care and condition must be kept private; this includes all conversations with the resident and all medical records and reports. A positive regard for each resident, regardless of race, sex, age, ethnicity, or other personal attributes, is also paramount to every resident’s health and well-being.

Use one’s own clothing and possessions: Unless hazardous, or potentially infringing on other residents’ rights, each resident has the right to wear his or her own clothing and use his or her own possessions.

Grievance without retaliation: Residents should be able to express concerns, make recommendations about facility services or care, and consult with outside sources to resolve conflicts involved in their care without fear of criticism, discrimination, or other acts of vengeance by the facility or its staff.

Be discharged or transferred only for specific reasons: Residents may be transferred or discharged from a facility only for medical reasons, for their welfare or the welfare of other residents, or for nonpayment (excluding becoming Medicaid eligible). If transfer or discharge is planned, the resident or representative must be notified in writing within 30 days of the change.
Access to:

- Receive or refuse any visitor (includes family members)
- Visiting hours, posted in public places
- Confidential communication with visitors, including help with personal, social, or legal services
- Claim own rights and benefits through consultation with others for the purpose of legal action, organizational activity, or other forms of representation

Be free from abuse and restraints: Residents must be protected from mental and physical abuse, which can include unauthorized use of restraints. Except as authorized in writing by a physician for a specified and limited time or when necessary to protect the individual from hurting himself or others, residents must be free from chemical or physical restraints that cause them to be unable to move about freely.

Failure of any healthcare team member to honor residents’ rights can be grounds for termination from employment, discipline by the state accrediting agency, or, where a crime has occurred, prosecution by the court.

EXAM ALERT
Abuse, or intentionally mistreating or harming another person, is one of the most serious offenses that can occur in the healthcare setting. Abuse is considered a crime and, as such, is punishable by prosecution by the court system.

Abuse may occur in several forms:

- Mental abuse refers to any threat to the psychological well-being of the resident that results in psychological or emotional distress. This can include financial exploitation or verbal assault; depriving residents of any of their rights is also considered mental abuse.
- Slander, or sharing information with others about the resident that could damage the resident’s reputation, is a form of abuse and potential grounds for a civil lawsuit, called a tort. Accomplishing the same result by writing or recording this kind of negative reference to a client is called libel.

EXAM ALERT
To help you distinguish between the two legal terms, remember that libel means “literature or writing.”

- Physical abuse includes hitting or rough handling of a resident. Withholding food or fluids and failure to change a wet bed are forms of physical abuse.
Specific Ethical and Legal Issues

- **Sexual abuse** is a form of physical abuse and involves threats or physical contact for sexual favor or control. Fondling (or inappropriately touching a resident), rape, sexual assault, or sexual molestation are examples of sexual abuse.

- **Sexual harassment** (or making unwelcomed sexually explicit or implied statements to residents) is abusive and could become grounds for resident grievance.

Be watchful for any signs or other clues of resident abuse, including the following:

- Skin tears or bruises, especially in the genital area
- Increased elimination difficulties
- Frequent crying or periods of sadness or withdrawal
- Personality changes
- Refusal to carry out activities of daily living (ADLs)
- Fear of touch
- Anxiety or nervousness
- Refusal of certain visitors, including spouse or family members

**EXAM ALERT**

You have a moral, ethical, and legal duty to report any suspicion of abuse. Be as factual as possible, avoiding assumptions and personal opinions about what you observe. Do not worry if your suspicions are unfounded. Your sincere attempt to protect the resident outweighs any fears you might have. In all cases, follow the facility policy for reporting abuse concerns. Abuse hotlines might also be available for reporting suspicions of abuse. An ombudsman committee might also be available as a source for investigating abuse complaints. An ombudsman committee is a group of concerned citizens, usually appointed by the state governor, to investigate all complaints of abuse. The committee members are not affiliated with a healthcare facility. The originator of the abuse complaint, whether a fellow citizen or a healthcare provider, is kept confidential.

**Ethics**

Ethics is often linked with legalities when determining right and lawful behavior in health care. **Ethics** is a branch of philosophy dealing with the good, bad, right, and wrong thing to do in human interactions and the principles that help guide professionals in terms of what ought to be done in certain situations. Ethical principles, or standards, help guide you in your work. Examples cited include **beneficence** (doing good for others), **nonmaleficence** ("do no harm," which underscores the need to not cause undo harm to a resident and instead provide safe and effective care), and **veracity** (or truthfulness, which means speaking the truth consistently and dependably).
Nurses adhere to a published code of ethics, or code of conduct, which admonishes them to practice in an ethical manner at all times. Such guiding principles help form a practice framework on which nurses can build. A description of ethical behavior is to “do the right thing when nobody else is looking.” This could be evidenced by refusing to accept money, gifts, or favors from residents or their families, avoiding shortcuts in job performance, maintaining a positive attitude about the facility, and treating residents’ belongings with care.

**Values** are your personal beliefs about what is most important; they serve as guiding ethical principles for you throughout your life. Ethical problems occur when your “inner ethical voice” conflicts with a situation that causes you to struggle with the right course of action to maintain your values. Ethical dilemmas abound in today’s world, especially in health care. Specific examples of ethical dilemmas regarding residents in long-term care mirror those of clients in other healthcare settings, such as quality-of-life issues, death and dying, access to health care, and euthanasia (commonly referred to as mercy killing).

An important ethical consideration for all health team members is that of maintaining professional boundaries. Although it is essential to form a caring, empathic relationship with residents, certain limits or boundaries must be set to ensure that your actions are helpful to residents and are not centered on meeting your own needs. Meeting the residents’ needs must be your primary goal. Situations involving residents may place you in an ethical dilemma. One example is the resident who wants to give you gifts, money, or personal items. Another example is a resident requesting something (a favor) that is not permitted by the agency (for example, a ride in your personal vehicle or you buying the resident cigarettes or other items not permitted by their physician). Giving gifts or money to residents or providing personal advice or financial assistance in any form or conducting business with residents is also unethical and outside professional boundaries of conduct. It is ethical to befriend residents; however, it is unethical to form personal friendships that could result in poor judgment on your part or interfere with safe and efficient care of the resident. This includes becoming overly involved with the resident’s family or friends. Sharing personal information about yourself and spending time with the resident outside your work schedule are other examples of unethical behavior that cross professional boundaries.

Another rule of ethical behavior is to respect residents by not using profanity or other offensive language and by not referring to them as “honey,” “sweetheart,” or other euphemisms or using suggestive or romantic language when talking to them. The golden rule applies here as in all aspects of care. If you find yourself in any potential unethical situation instigated or suggested by a resident, report the incident to your supervisor immediately. In extreme circumstances, you may request a reassignment to resolve the issue.

**Exposure to Medical Malpractice/Negligence Claims/Lawsuits**

It is your legal and ethical responsibility to respect residents’ rights, perform your duties according to your position description, maintain professional boundaries, and communicate effectively and efficiently to avoid exposure to a lawsuit. Despite your careful performance and personal conduct, lawsuits can occur. However, following agency policies and procedures, seeking guidance from the nurse where needed, and maintaining a positive attitude can all serve you well as you work with clients.
Exam-Prep Questions

1. The Medication Aide is responsible to know the medical information of whom?
   - A. All residents at their place of employment
   - B. Residents he/she is assigned to
   - C. All residents on the unit or floor
   - D. Residents assigned to their supervising nurse

2. Which of the following is the responsibility of the Medication Aide?
   - A. Giving the first dose of a newly ordered medication to the client
   - B. Converting medication dosage from milligrams to micrograms
   - C. Withholding a patient medication without reviewing it with the nurse first
   - D. Giving PRN medications ordered after checking with the resident's nurse

3. Which of the following is not a role limitation of an Medication Aide?
   - A. Observe the client's need for, or response to, medications, including PRN medications
   - B. Make decisions that might include withholding medications
   - C. Report changes in client status regarding drug therapy to ensure client comfort and safety
   - D. Call the physician about client status or need for medication

4. The nurse you are to work with for the upcoming shift informs you, the Medication Aide, that she will be late today and asks you begin to administer medications. With regard to this scenario, which of the following statements is correct?
   - A. Medications that are usual for the residents can be administered without the nurse present.
   - B. All medications can be administered without the nurse present.
   - C. No medications can be administered without supervision.
   - D. No PRN medications can be given without appropriate supervision.

5. Maintaining competence refers to the
   - A. Knowledge, skills, and attitude necessary to fulfill the role as an MA-C.
   - B. MA-C gaining greater knowledge to perform newer skills.
   - C. MA-C who does not have the necessary skills to do something successful.
   - D. Person who cannot perform the role of a Medication Aide due to mental deficiency.
6. Verbal communication skills include speaking clearly and at a level residents can understand, avoiding medical jargon, and
   ☐ A. Asking open-ended questions that discourages a yes/no response.
   ☐ B. Using phrases to stop residents from sharing feelings.
   ☐ C. Interrupting patients when they are taking too long to answer questions.
   ☐ D. Using authoritative language to get the resident to follow directions.

7. Unlawful personal violence toward a resident (for example, forcing residents to take medications despite their wishes) is the definition of what?
   ☐ A. Abuse
   ☐ B. Neglect
   ☐ C. Assault
   ☐ D. Battery

8. Which of the following is a reason for a Medication Aide to suspect a resident may be a victim of physical abuse?
   ☐ A. Skin tears on the forearm
   ☐ B. Bruises in various stages of healing
   ☐ C. Frequent crying or periods of sadness or withdrawal
   ☐ D. Refusal of patient to see any visitors

9. Sharing information with others about the resident that could damage the resident’s reputation is the definition of what?
   ☐ A. Libel
   ☐ B. Abuse
   ☐ C. Neglect
   ☐ D. Slander

10. Which of the following is an example of an ethical dilemma?
    ☐ A. Euthanasia
    ☐ B. Slander
    ☐ C. Abuse
    ☐ D. Stealing
Rationales

1. Answer B is correct. The Health Insurance Portability and Accountability Act (HIPAA) states that all healthcare personnel should access health information only if it is necessary for them to perform their job.

2. Answer D is correct. Part of the MA-C duty is to give PRN medications as prescribed by the physician. A, B, and C are limitations of duties for the MA-C.

3. Answer C is correct. The Medication Aide’s role does not include assessing or making decisions to decide whether a resident needs a medication or to obtain orders from a physician. The MA-C is responsible to report changes.

4. Answer C is correct. If you accept a task that falls outside your position description, both you and the delegating nurse are medically liable (legally responsible) for any of your actions, or lack of action, that may result in harm to the client, and that includes not being supervised by a nurse.

5. Answer A is correct. Competence is maintaining the knowledge, skills, and attitude necessary to perform the roles needed. B and C are incomplete definitions, and D is the definition of legal incompetence.

6. Answer A is correct. It is important to ask open-ended questions when you need more than a yes or no answer. Residents should be encouraged to speak freely and share feelings and not be interrupted or spoken down to.

7. Answer D is correct. Battery is unlawful personal violence toward a resident. Abuse is a threat of physical or mental harm, assault is a threat to touch a resident without permission, and neglect is to not act in the manner in which you were taught (either omitting care or performing care incorrectly) and that results in harm to a resident.

8. Answer D is correct. A, B, and C are all possible signs of abuse. D is the correct answer because patients will usually become withdrawn when a person who may be abusing them comes to visit.

9. Answer D is correct. Slander, or sharing information with others about the resident that could damage the resident’s reputation, is a form of abuse and potential grounds for a civil lawsuit, called a tort.

10. Answer A is correct. The only option here that centers on an ethical dilemma involving residents in long-term care is euthanasia. Other examples of ethical dilemmas include quality-of-life issues, death and dying, and access to health care.
This page intentionally left blank
# Chapter Three

## Pharmacology Review

### Medical Term Hot List

- Allergic drug reaction/effect (ADR/ADE)
- Analgesics
- Anaphylaxis
- Antagonist
- Antibiotics
- Antidiabetic agents
- Antidiarrheals
- Antiemetics
- Antihistamines
- Anti-infective agents
- Antilipidemics
- Antipsychotics
- Antipyretics
- Antitussives
- Beta blockers
- Bronchodilators
- Cardiac arrest
- Corticosteroids
- Decongestants
- Diuretics
- Drug
- Drug absorption
- Drug dose
- Drug interaction
- Drug overdose
- Drug reaction
- Drug toxicity
- Drug trade name
- Drug trademark
- Generic drug name
- Herbals
- Laxatives
- Medication
- Medication Administration Record (MAR)
- Nonsteroidal anti-inflammatory agents (NSAIDS)
- Pharmacology
- Pharmacotherapeutics
- Physician’s Drug Reference (PDR)
- Placebo
- Paradoxical
- Respiratory arrest
- Sedative/hypnotics
- Side effect
- Therapeutic effect
- Tinnitus
- Urticaria
Drug Classifications and Drug Names

A drug is a chemical substance that once introduced into the body becomes a medicine, intended to promote a change in the body.

Pharmacology means the study of the effects of drugs on the body. As clinicians dedicated to helping clients, physicians, nurses, pharmacists, and other therapists are responsible for knowing and applying knowledge of pharmacotherapeutics (or how drugs serve to prevent, treat, or diagnose health conditions or disease). The therapeutic effect is the intended effect of a drug on the body; therefore, it is crucial that nurses, in particular, be able to apply knowledge of drug therapy to safely administer medications to their clients.

Drugs are made from animal, plant, or environmental sources; they have thousands of names, which make learning them very difficult (not to mention the fact that many new drugs become available for use each year). Drug names have similar spellings, which can be a potential safety hazard, because drugs with similar spellings can be mixed up and mistakenly given to clients.

Drug names are listed as follows:

- **Chemical name**: Name that explains the exact description of the drug's chemical makeup
- **Generic name**: Drug not protected by a trademark (for example, furosemide)
- **Trade name**: Brand name by which the manufacturer markets the generic drug (for example, Lasix, the trade name for furosemide)

Classifying, or grouping, drugs helps identify them according to their effects on various body systems and relief of symptoms associated with system-specific diagnoses or conditions. Drug classifications make it easier to identify them and describe them more precisely according to their intended action or purpose. Classifications of drugs that you are most likely to administer include the following:

- **Analgesics**: Drugs that relieve pain
- **Antibiotics**: Drugs that destroy microorganisms or inhibit their growth
- **Antidiabetic agents**: Drugs that prevent or treat diabetes
- **Antidiarrheals**: Drugs used to prevent or treat diarrhea
- **Antiemetics**: Drugs that help prevent or relieve nausea and vomiting
- **Antihistamines**: A histamine-blocking agent
- **Anti-infective agents**: Any agent (antibiotic, antiviral, or antifungal) used to fight infection
Drug Actions and Implications

- **Antilipidemics**: Drugs used to lower fats in the blood
- **Antipsychotics**: Medications that treat mental illness
- **Antipyretics**: Drugs that reduce fever
- **Antitussives**: Drugs used to prevent or relieve coughing
- **Beta blockers**: Drugs used to block beta-adrenergic actions
- **Bronchodilators**: Drugs used to expand the bronchi
- **Corticosteroids**: Drugs used to treat inflammatory diseases
- **Decongestants**: Drugs that reduce congestion or swelling
- **Diuretics**: Drugs that help increase urinary output
- **Herbals**: Plant sources used for prevention or treating of illness
- **Laxatives**: Chemicals or other substances used to prevent or treat constipation
- **Nonsteroidal anti-inflammatory agents (NSAIDS)**: Nonsteroidal preparations that decrease inflammation and relieve pain
- **Sedative/hypnotics**: Combination drugs that provide a calming and sedating effect
- **Vitamins**: Substances that promote metabolism and nutrition

When presented with a new or different drug order, you can associate prior drug knowledge of drug classifications with the new drug once you know its associated group, which helps ensure safe administration and monitoring. For example, your client has a new antibiotic whose name you do not recognize. By researching the drug’s classification, you already know much about the new drug without having to learn new information.

### Drug Actions and Implications

The physician orders a drug in various strengths (dosages, amounts, or concentrations) to help diagnose, prevent, or treat illness or disease or for maintenance purposes. These are referred to in drug literature as **indications**, or reasons for using the drug; the physician’s **drug order** is to establish the legal basis as well as the medical need for the drug.

Drugs act on the human body by forming a chemical bond at certain receptor sites inside the cell. When a drug’s action changes the client’s response to illness in a positive way, it provides a **therapeutic effect**, which means it helps the client.
Drug Metabolism

A drug's effectiveness depends, largely, on how well it is transported, absorbed, and metabolized (used). The blood actively transports the drug to receptor sites. Once absorbed, the liver, the primary metabolic “engine,” breaks down the drug (or detoxifies it). The drug then travels via the bloodstream to the kidneys or bowel where it is excreted (or leaves the body), most often via the urine or feces. Other avenues for excreting the drug are the skin, the lungs, or, in lactating mothers, the breast milk.

Factors Influencing Drug Effectiveness

Several factors can affect how drugs act on the body, including the following:

- Client's weight (increased tissues and drug receptors in heavier adult client versus those of a smaller adult or child)
- Age, gender (muscle mass in men versus that in women)
- Physiological factors (electrolyte balance, hydration)
- Pathological factors (disease, liver or kidney disease, low blood pressure, poor circulation, and so on)
- Genetic factors, psychological factors (health beliefs, compliance)
- Environmental factors (noise, light, and temperature)
- Accumulation of the drug over time

The client’s positive attitude about what to expect from a drug has also proven to influence its effects. This attitude is called the placebo effect.

Drugs given over time may no longer affect the client as some drugs meet resistance by the body and must be given in increasing doses, or amounts, in order to provide the same therapeutic effect. This is known as drug tolerance, a term most often associated with narcotics or other mind-altering drugs. To combat this, narcotics may be combined with other drugs that enhance, or potentiate, the effect and, at the same time, decrease the amount of narcotic needed by the client. Another term used in this regard is that the drug has an additive effect. Conversely, when a drug is given to counteract the effects of another drug, it is said to have an antagonist effect. At times, drugs, for unknown reasons, have an opposite effect than that intended for their purpose; their effect is said to be paradoxical. An example of a paradoxical effect is increased agitation experienced by a resident who received a sedative to calm him or her. When a drug affects the client in ways not anticipated or for unknown reasons, it is said to have an idiosyncratic effect.
Drug Interactions

Drug-to-drug interactions can occur when drugs enter the body at the same time. This can be purposeful, as in the narcotic example given earlier. However, unintended effects can occur with other drugs that can have negative effects on the client. You should question the nurse if you learn of a warning related to giving certain drugs together.

Drug absorption and distribution can be further influenced by food intake. Certain drugs must be given on an empty stomach to improve absorption and distribution, whereas others need to be given with food to avoid irritation to the stomach. This is particularly true with corrosive drugs, or those that can damage the stomach lining, or mucosa.

Some drugs use the same receptor sites; this is why they should be given several hours apart so as to prevent a heightened reaction to them. This could lead to a toxic level of the drug. Likewise, certain foods bind to certain drugs, making them less effective; this can occur, for example, when ciprofloxacin (Cipro) is given with milk products.

Drug Side Effects

When an undesired effect occurs, the client may respond to a drug in a variety of ways, from a mild reaction (side effect) to a life-threatening occurrence (anaphylaxis). Knowing the therapeutic, or desired action, of the drug is important so that when a side effect or, in some cases, an adverse drug reaction (ADR) occurs, you can recognize the event immediately and report it to the nurse so that she can take action to relieve any distress the client may experience.

Side effects are undesirable effects of a given drug. Common side effects include nausea and vomiting (N & V), ringing in the ears (tinnitus), and dry mouth.

A susceptible client may suffer a more adverse, or allergic, reaction to the drug. This occurs when the body interprets the drug as a foreign invader that threatens normal functions. A specific hypersensitive reaction occurs as the body attempts to protect itself; this is evidenced by the release of histamine, a natural body chemical that fights the allergen. Signs of an allergic reaction may include severe itching and hives, or urticaria (raised patches on the skin), low blood platelets (thrombocytopenia), or hyperglycemia (high blood sugar).

Drug toxicity, or poisoning of the client’s body, can occur suddenly or over time as a response to a drug with varying degrees of severity. Excessive levels of a drug in the blood can signal potential toxicity. Certain drugs have a very narrow range of safety, which means that their effects on the body can become toxic very quickly with only small doses of the drug.

Toxicity is a special concern in drug therapy for the older client because the liver or kidneys may not filter drugs efficiently, which can lead to toxic drug levels. Hepatotoxicity (poisoning of the liver), nephrotoxicity (drugs poisonous to the kidneys), and ototoxicity (drugs causing hearing loss) are terms commonly associated with drug toxicity. Clients who suffer can die or be forced to live with permanent organ damage as a result of drug toxicity. This can also occur in a drug overdose, or excessively high dose of a drug, either accidentally or intentionally, as in a suicide attempt.
Chronic illness often requires multiple drug therapies that can also accumulate and/or interact with each other. Poor nutrition is another concern when giving drugs to elders, because they may not absorb drugs as efficiently as a younger client. If older clients self-medicate, they can also overdose on medications by forgetting drug schedules or other drug-related safety precautions.

A medical emergency can also arise due to a sudden life-threatening drug reaction, known as an **anaphylaxis** (literally meaning without protection). Signs of anaphylaxis include the following:

- Difficulty breathing (dyspnea)
- Low blood pressure (hypotension)
- Irregular pulse (dysrrhythmia)
- Sweating
- Swelling of the larynx (laryngeal swelling) / bronchi (bronchospasm)

Unless treated immediately and aggressively, the client will stop breathing (respiratory arrest) or her heart will stop beating (cardiac arrest). A review regarding medication safety measures will follow in Chapter 6, “Medication Administration Procedures and Techniques.”

**Drug precautions** are those special considerations given to certain drugs that may affect certain clients. Listed most commonly are children, pregnant/lactating clients, elders, and clients whose immune system is compromised or those with preexisting conditions or chronic illnesses affecting the stomach, blood, liver, or kidneys (because these organs are an integral part of drug transport, metabolism, and excretion). Other precautions include additive effects of drugs given together as well as timing of certain medications. For example, certain drugs must be given with food to avoid damage to the gastrointestinal system; others may need to be given last in a sequence to improve their effect, such as a drug to coat the stomach lining being given after other oral drugs because it needs to adhere to the mucous membranes in the stomach and not diluted with water. Further, clients receiving any drugs that have any effect on the central nervous system must be monitored for any potential accidents resulting from sedation or other common side effect of a mind-altering drug.

**Contraindications** are those warnings that warn clients from taking certain drugs for any reasons. These include pregnant clients and clients who have a history of allergies to the medications or foods that could indicate a potential for a severe reaction (for example, shellfish allergy in a client scheduled for a kidney x-ray involving iodine). It is important for you to note all precautions and contraindications of drugs the client may be scheduled to receive.

**EXAM ALERT**

You should also report any and all changes in the normal behavior of a resident because these changes may indicate a serious drug-related problem that the nurse must address immediately.
Selected Drug Information Sources

Keeping up-to-date with information about drug classes, actions, dosage, side effects, precautions, and so on is crucial for safe practice. You must consult all available drug information resources, including drug handbooks and other drug guides that focus on nursing care and considerations, the *Physician’s Drug Reference* (PDR), drug inserts, and reputable online websites such as the National Medicines Comprehensive Database.

The pharmacist is the drug expert for your facility and stands ready to assist you in answering any questions about drugs and their effects. You cannot know all there is to know about drugs, but you are accountable for learning about the key issues related to each drug you give and for applying your knowledge to give drugs safely.
Exam-Prep Questions

1. Which of the following is an example of a trade name?
   - A. Accupril
   - B. ACE Inhibitor
   - C. lisinopril
   - D. quinapril

2. When a drug’s action changes a resident’s response in a positive way, the drug is said to provide a what?
   - A. Therapeutic effect
   - B. Threshold effect
   - C. Dose-dependent effect
   - D. Drug action effect

3. Which of the following definitions explains the metabolism of a medication?
   - A. Decreases effect over time
   - B. An effect not anticipated
   - C. How the medication is used by the body
   - D. Disposal of the drug from the body

4. The nurse tells you that the blood level of a drug is too high. What do you know from that?
   - A. The resident may be taking illegal drugs.
   - B. The resident is at risk for toxicity.
   - C. The rate of absorption of the drug is low.
   - D. The rate of excretion for the drug is too high.

5. An example of a contraindication to giving a patient a particular medication is that the patient:
   - A. Has taken the medication before
   - B. Has an allergy to the medication
   - C. Had an upset stomach the last time the medication was taken
   - D. Has diarrhea when taking the medication
6. Which of the following situations is life threatening?
   - A. Allergic reaction
   - B. Adverse drug reaction
   - C. Idiosyncratic drug reaction
   - D. Anaphylactic reaction

7. One of the residents assigned to the MA-C complains of severe itching. You observe raised, irregular patches on the person’s skin. This may be what?
   - A. Measles
   - B. Hives
   - C. Cancer
   - D. Fungus

8. When a person requires higher dosages of a medication to produce the same effects that once were achieved through lower dosages, this condition is called what?
   - A. Tolerance
   - B. Dependence
   - C. A cumulative effect
   - D. A drug interaction

9. Which of the following choices below is the best source for keeping up-to-date drug information?
   - A. Pharmacists
   - B. Pharmacology books
   - C. Drug pamphlets
   - D. Electronic resources

10. Most drugs are excreted through what?
    - A. Skin and sweat
    - B. Lungs and saliva
    - C. Liver and pancreas
    - D. Urine and feces
Rationales

1. The correct answer is A. Accupril is the trade name, also known as a brand name. Choice B, ACE Inhibitor, is the classification of the medication. Choices C and D, lisinopril and quinapril, are the generic names of the medication.

2. The correct answer is A. Choice B, threshold, is the amount of medication needed to elicit an effect. Choice C, dose-dependent, is the dosage needed to have the desired effect. Choice D, drug action, refers to the way in which a drug works.

3. The correct answer is C. Choice A is the explanation of drug tolerance. Choice B is the definition of idiosyncratic. Choice D is the explanation for execration.

4. The correct answer is B. As for choice A, only a special test for drug levels can show illegal drugs in the system. Choices C and D can be predicted only by knowing the drug's half-life and the resident's kidney function.

5. The correct answer is B. Choices C and D are examples of side effects, not contraindications. Choice A is not a contraindication unless the patient has taken the medication before and has had an allergic reaction.

6. The correct answer is D. An anaphylactic reaction causes difficulty breathing in most cases. Choices A, B, and C can sometimes, but not always, cause life-threatening reactions.

7. The correct answer is B. Choice A is a rash that starts a couple of days after a fever. Choice C is an area that does not heal or is different from the rest of the skin. Choice D is a red, patchy area, possibly circular, in skin folds.

8. The correct answer is A. The body is said to have built up a tolerance to a drug's effects when higher and higher dosages are needed to elicit the same response. Choice B occurs when a person is physically or psychologically addicted to a medication. Choice C occurs when a drug has built up in the body and gives a greater response than expected. Choice D is considered when an untold response occurs when another substance is given at the same time as the medication.

9. The correct answer is A. The pharmacist is the most reliable resource for drug information in pharmacology. Choice B, C, and D have information, but the information may not be evidence based.

10. The correct answer is D. The majority of medication is excreted through urine and feces. As for choices A, B, and C, only small amounts of medication are excreted through the skin, mucous membranes, and sweat.
CHAPTER FOUR

Drug Orders, Forms, Measurements, and Handling

Medical Term Hot List

✓ Buccal
✓ Drug capsule
✓ Drug order
✓ Drug route
✓ Drug solution
✓ Drug suspension
✓ Emulsion
✓ Enteric-coated
✓ Extended-release capsule
✓ FDA
✓ Granule
✓ Inhalation
✓ Injection
✓ Instillation
✓ Intra-arterial
✓ Intra-articular
✓ Intracardiac
✓ Intradermal
✓ Intramuscular
✓ Intraocular
✓ Intraosseous
✓ Intrathecal
✓ Intravenous
✓ Intravenous
✓ Irrigation
✓ Liniment
✓ Lotion
✓ Lozenge/troche
✓ Mucous membrane
✓ Ointment
✓ Otic
✓ Parenteral
✓ Patch
✓ Paste
✓ Powder
✓ Prescription
✓ PRN order
✓ Scored tablet
✓ Self-administer
✓ Single order
✓ Solution
✓ Standing order
✓ STAT
✓ Subcutaneous
✓ Sublingual
✓ Suspension
✓ Suppository
✓ Syrup
✓ Tablet
✓ Telephone order
✓ Topical
✓ Transdermal
✓ Verbal order
Drug Orders

In the clinical setting as well as the home, a healthcare provider (physician/doctor, physician assistant, or the Advanced Registered Nurse practitioner) orders/prescribes drugs for the patient or resident. The order is most often written on the agency’s designated chart form or on a physician drug order; it may also be written on a prescription form. In some settings, the doctor may enter the drug order electronically per the agency’s computerized medical record system.

If ordered to be given over a specific length of time, the drug order is called a routine order. If the drug is to be given only once at a specified time, it is considered a one-time order. One-time drug orders are often those given to prepare the resident for a diagnostic procedure or, in the case of a condition, such as a Fleet’s enema for constipation. A standing order may be written before needed, which is often the case in the long-term care setting when the resident’s condition changes rapidly and drug therapy is required. The physician writes and signs the order, which is then readily available should the resident need it. An example is an order for acetaminophen (Tylenol) for temperature above 101.0°F. In an urgent or emergency situation, the doctor may issue a STAT drug order, which means the drug must be given immediately.

When the physician is not physically present, he or she may order a drug via telephone (telephone order or T.O.) or, when necessary, give the nurse a face-to-face verbal order (V.O.), after which time the physician will cosigns the order once transcribed or transferred to the order form by the nurse. In most cases, the physician is required to sign the V.O. or T.O. within 24 hours; an unsigned drug order is an illegal order. It is preferable for the physician to give a drug order in writing to prevent an error.

**EXAM ALERT**

Remember that the Medication Aide-Certified (Medication Aide) cannot accept verbal or telephone orders. Do not be pressured into accepting either order; instead, refer the physician to the nurse immediately so the order can be carried out immediately.

A PRN order is one that designates what drug a resident may receive when requested; prior to giving the PRN medication, the nurse must thoroughly assess the resident and verify the need for the medication. Where ordered by the doctor, the resident may self-administer (that is, take certain drugs without the nurse’s assessment or assistance).

A drug order contains the following:

- Date and time order is written (helps establishes when drug needs to be discontinued)
- Patient full name / identification (residents with same last names may also have ID numbers to distinguish them from each other)
Drug orders can be confusing, often due to poor penmanship, inappropriate or unfamiliar use of abbreviations or symbols, and other factors that contribute to misinterpretation. Confusion can lead to a medical transcription error, which means that the patient/resident could receive the wrong drug, the wrong dose or route of administration, or receive the drug at the wrong time. Likewise, many drugs have similar spellings, making them more likely to be transcribed incorrectly. Drugs spelled correctly but written too closely to the dosage may also be transcribed incorrectly. For example, any drug name ending in the letter L (for example, Inderal 80mg) might be misinterpreted as Inderal 180mg; this could mean that the resident would receive 100mg more drug than intended. Spacing can also cause dosage errors if the drug name is correct but the dose is written too closely to the drug measurement. For example, in the case of a drug dose written as 10mg, if the M is written too closely to the number 10, the dosage could be read as 100mg or 1000mg, meaning the patient could receive a tenfold or hundredfold increase in the drug. Remember, poorly written and transcribed drug orders can be deadly!

**EXAM ALERT**

Although the nurse is responsible for checking drug orders and transcription on the Medication Administration Record (MAR), it is your responsibility as Medication Aide to get clarification of any questionable drug order you review before you give the drug. If in doubt, check it out!

**Common Medical Terminology, Dosages, and Abbreviations**

Medical terms and abbreviations are shortcuts to communication in the medical field. Table 4.1 shows a list of key terms and abbreviations you are likely to encounter regarding drug orders.
It is important to use only agency-approved medical terms and abbreviations when transcribing or documenting drug orders. To help prevent medical errors, the Joint Commission and the Institute for Safe Medication Practices (ISMP) has recently cited several terms, abbreviations, and symbols as potentially dangerous to clients, some of which are listed in Table 4.2.

### TABLE 4.1 Drug Order Key Terms and Abbreviations

<table>
<thead>
<tr>
<th>Medical Term</th>
<th>Meaning</th>
<th>Medical Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>(Ante) before</td>
<td>mg</td>
<td>Milligram</td>
</tr>
<tr>
<td>a.c.</td>
<td>Before meals</td>
<td>mL</td>
<td>Milliliter</td>
</tr>
<tr>
<td>ad</td>
<td>Toward</td>
<td>NPO</td>
<td>Nothing per os (by mouth, orally)</td>
</tr>
<tr>
<td>BP</td>
<td>Blood pressure</td>
<td>p</td>
<td>(Post) after</td>
</tr>
<tr>
<td>c</td>
<td>With</td>
<td>Per</td>
<td>Per</td>
</tr>
<tr>
<td>CC</td>
<td>Chief complaint</td>
<td>Opth.</td>
<td>Ophthalmic</td>
</tr>
<tr>
<td>c/o</td>
<td>Complains of</td>
<td>Otic</td>
<td>Ear</td>
</tr>
<tr>
<td>D/C</td>
<td>Discontinue</td>
<td>PO</td>
<td>Per os (per mouth, orally)</td>
</tr>
<tr>
<td>Elix.</td>
<td>Elixir</td>
<td>PRN</td>
<td>As needed; as necessary</td>
</tr>
<tr>
<td>ER</td>
<td>Extended release</td>
<td>q</td>
<td>Every</td>
</tr>
<tr>
<td>Gm/Gms</td>
<td>Gram/grams</td>
<td>Rx</td>
<td>Take</td>
</tr>
<tr>
<td>gr</td>
<td>Grain</td>
<td>s</td>
<td>Without</td>
</tr>
<tr>
<td>Gtt/gtts</td>
<td>Drop/drops</td>
<td>Sig.</td>
<td>Dispense</td>
</tr>
<tr>
<td>h/hr</td>
<td>Hour</td>
<td>SL</td>
<td>Sublingually</td>
</tr>
<tr>
<td>ID</td>
<td>Intradermally</td>
<td>STAT</td>
<td>Immediately, now</td>
</tr>
<tr>
<td>IM</td>
<td>Intramuscularly</td>
<td>Supp</td>
<td>Suppository</td>
</tr>
<tr>
<td>IV</td>
<td>Intravenously</td>
<td>Susp</td>
<td>Suspension</td>
</tr>
<tr>
<td>IU</td>
<td>International unit</td>
<td>Syr</td>
<td>Syrup</td>
</tr>
<tr>
<td>L</td>
<td>Liter</td>
<td>Tab</td>
<td>Tablet</td>
</tr>
<tr>
<td>MDI</td>
<td>Metered-dose inhaler</td>
<td>Tr</td>
<td>Tincture</td>
</tr>
<tr>
<td>mEq</td>
<td>Milliequivalent</td>
<td>ung</td>
<td>Ointment</td>
</tr>
</tbody>
</table>

### TABLE 4.2 ISMP Terms and Abbreviations Considered Dangerous

<table>
<thead>
<tr>
<th>Do Not Use Term/Abbreviation</th>
<th>Potential Danger</th>
<th>Substitute Term/Phrasing</th>
</tr>
</thead>
<tbody>
<tr>
<td>@</td>
<td>Intended meaning: at; mistaken for the number 2</td>
<td>Use at</td>
</tr>
<tr>
<td>cc</td>
<td>Intended meaning: cubic centimeter; mistaken as u</td>
<td>Substitute mL (milliliter)</td>
</tr>
<tr>
<td>MS</td>
<td>Intended meaning: morphine; mistaken for magnesium sulfate</td>
<td>Use morphine sulfate</td>
</tr>
<tr>
<td>&gt;</td>
<td>Intended meaning: greater than; mistaken for number 7</td>
<td>Use greater than</td>
</tr>
</tbody>
</table>
Drug Labels

All drugs should be clearly labeled with the same information as in a drug order; in addition, the following should also appear on the label:

- The pharmacy’s name, address, and phone number
- The prescription number
- Original date of prescription
- Manufacturer’s name
- Warnings
- Total number dispensed (often preceded by the abbreviation Sig, meaning take)
- Number of refills

**TABLE 4.2**  
Continued

<table>
<thead>
<tr>
<th>Do Not Use Term/Abbreviation</th>
<th>Potential Danger</th>
<th>Substitute Term/Phrasing</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; Intended meaning: less than; mistaken for one another</td>
<td>Use lesser than</td>
<td></td>
</tr>
<tr>
<td>[gm]g Intended meaning: microgram; mistaken for milligram</td>
<td>Use microgram</td>
<td></td>
</tr>
<tr>
<td>q.d. Intended meaning: every day; mistaken for q.i.d./four times a day</td>
<td>Use daily</td>
<td></td>
</tr>
<tr>
<td>qhs Intended meaning: every hour of sleep/nightly, mistaken for every hour</td>
<td>Use nightly</td>
<td></td>
</tr>
<tr>
<td>q.o.d Intended meaning: every other day; mistaken for every day or four times a day</td>
<td>Write every other day</td>
<td></td>
</tr>
<tr>
<td>Sc or SQ Intended meaning: subcutaneous/subcutaneously, mistaken for sublingual</td>
<td>Write subcutaneously or subcut.</td>
<td></td>
</tr>
<tr>
<td>ss Intended meaning: sliding scale; mistaken for number 55</td>
<td>Write sliding scale</td>
<td></td>
</tr>
<tr>
<td>U or u Intended meaning: unit; mistaken for numbers 10 or 4</td>
<td>Write unit</td>
<td></td>
</tr>
<tr>
<td>&amp; Intended meaning: and; mistaken for number 2</td>
<td>Use and</td>
<td></td>
</tr>
<tr>
<td>+ Intended meaning: plus or and; mistaken for number 4</td>
<td>Write plus or and</td>
<td></td>
</tr>
<tr>
<td>3 Intended meaning: dram; mistaken for number 3</td>
<td>Use metric system</td>
<td></td>
</tr>
<tr>
<td>Periods (.) following amount abbreviations Intended to close the term; mistaken for the number 1 (for example, mg, being mistaken for mg1)</td>
<td>Avoid using a period (.) where it might be interpreted as a measurement or amount of drug</td>
<td></td>
</tr>
</tbody>
</table>

From the Library of Scott Kruse
Physician’s Drug Enforcement Agency (DEA) number if the drug is a controlled substance

Expiration date

EXAM ALERT
If you question any of these label details, consult with the nurse before giving the drug. Likewise, do not give any drug without an order.

Drug Packaging

In the long-term care setting, most drugs are filled by an off-premises pharmacy and delivered to the facility within 24 hours of the order. Because most drugs are given for an indefinite time, they are filled for a 60-day or 90-day period. Many drugs may be packaged in a single-dose or unit-dose packet. Each packet will contain the drug name, strength, and expiration date; in rare cases, such as a single one-time order, the resident’s name may be included. Blister packs or foil-wrapped packets are often part of the unit-dose system, providing a safe and efficient method of administering the drug. Little preparation is needed to give the unit dose, and there is less likely a chance for contamination by handling the drug. Unless labeled with the resident’s name, unused unit doses may be returned to the pharmacy for credit.

Drugs packaged in multidose vials, bottles containing pills or capsules, or other containers for liquids require measuring prior to administration of the desired single dose. The required computation and handling of multidose packages are potential causes for drug errors or contamination. Unused multidose containers cannot be returned for credit.

Drug Storage and Disposal

Each long-term facility has its own medication storage system, which may include the resident’s room, the medicine room, or the drug cart. In many facilities, drugs are stored in a computerized cart, which adds to drug security and inventory; the nurse must use a code to access the cart.

EXAM ALERT
In any location, all drugs must be securely locked. To prolong their effectiveness; some drugs, like certain antibiotics and vaccines, may be refrigerated. Because of the potential for contamination or mishandling, drug refrigerators must not contain other items.

Controlled substances such as narcotics, stimulants, and depressants must be stored separately in a locked cabinet in the drug room or the medicine cart; they must be monitored and inventoried by the nurse per agency protocol. This usually occurs at the beginning of each shift in
which the off-going nurse and the on-coming staff count each controlled drug and sign the designated proof-of-use form, or narcotic sheet, attesting to the correctness of the inventory. Any discrepancies in the count must be resolved before the off-going staff can leave the facility.

Emergency drugs are often found in a separate, wheeled cart, referred as the crash cart; the cart can be transported quickly to the scene of a medical emergency.

In most cases, unused drugs are not returned to the pharmacy but disposed of according to agency policy. Unused controlled substances such as narcotics must be carefully discarded and recorded by the nurse as well as another nurse who verifies the wastage.

Drugs may also be disposed if dropped on the floor, contaminated in any other way, discontinued, or when the resident is discharged from the facility. In certain cases, the resident may also refuse the drug, in which case it is disposed of and recorded according to agency procedure.

**Drug Measurements**

Drug amounts, or the volume of drug needed to deliver the correct amount of drug (dose), are measured by weight or volume and may be ordered using Roman numerals, as shown in Table 4.3.

<table>
<thead>
<tr>
<th>Metric System</th>
<th>Household Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1mL</td>
<td>1/4 teaspoon (tsp)</td>
</tr>
<tr>
<td>5mL</td>
<td>1 teaspoon (tsp) or 1/4 ounce</td>
</tr>
<tr>
<td>15mL</td>
<td>1 tablespoon (tbsp) or 1/2 ounce</td>
</tr>
<tr>
<td>30mL</td>
<td>2 tablespoons (tbsp) or 1 ounce</td>
</tr>
<tr>
<td>500mL</td>
<td>1 pint (pt)</td>
</tr>
<tr>
<td>1000mL</td>
<td>1 quart (qt)</td>
</tr>
<tr>
<td>1 kilogram (kg)</td>
<td>2.2 pounds (lbs)</td>
</tr>
</tbody>
</table>

**Weight**

1 milligram (mg) = 0.001 or 1/1000 gram (g)

1 gram = 1000 milligrams

1 kilogram = 1000g

**Roman Numerals**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>5</td>
</tr>
<tr>
<td>X</td>
<td>10</td>
</tr>
<tr>
<td>L</td>
<td>50</td>
</tr>
<tr>
<td>C</td>
<td>100</td>
</tr>
<tr>
<td>M</td>
<td>1000</td>
</tr>
</tbody>
</table>
Drug Forms

Drug products contain the active form of the drug mixed with inactive materials, partly to disguise their taste and partly to aid in their absorption by the body. Because various forms of drugs are prepared for specific parts of the body, you must be careful to administer the drug in its correct form. Doing otherwise (for example, instilling ear drops in the eye) could injure the resident. The following subsections describe various drug forms.

Solids and Semisolids

Drugs in solid forms are popular because they require no mixing, measuring, or other preparation for administration. Subcategories of solids include the following:

- **Tablets**: Drugs in powder form are compressed into a hardened shape so that they can be swallowed with a liquid. They may be stamped with the manufacturer’s identification number or scored, meaning they have a stamped line dividing them into two halves. Scored tablets are easy to break into parts as ordered to ensure that the resident receives a safe dose as ordered. In many states or jurisdictions, breaking a scored tablet might not be allowed for the Medication Aide because this is considered changing the dosage.

  Tablets may also be coated to delay their absorption by the gastrointestinal (GI) tract, to prevent their effect to be changed by interacting with gastric acids or to lessen irritation of the GI tract’s mucosal lining. The term associated with the coated tablet is called enteric-coated (EC).

  A close “cousin” to the tablet is the caplet, similar to the consistency of a tablet, while mimicking a capsule in its ingredients.

- **Capsules**: The active ingredients of a drug may be mixed with an oil, a powder, or liquid and covered with a gelatinous shell. When taken orally, the gelatin melts, releasing a single dose of the drug into the stomach. Capsules may also contain several doses of the same drug to be released gradually into the stomach. This capsule is called a time-released or sustained-release capsule (SR).

  **EXAM ALERT**

  Capsules, especially time-released capsules, are never to be crushed because the resident may be injured by the medication due to irritation of the GI tract or, in the case of a time-released capsule, a drug overdose.

- **Powders and granules**: Powders and granules, or dry drug particles, may be used internally or externally. They are mixed with liquids to ensure that they dissolve and
Lozenges/troches: Intended to soothe the throat or mouth, lozenges or troches are quick-dissolving tablets mixed with a sweet-flavored base.

Suppositories: For insertion into the urethra, vagina, or rectum, suppositories are made by mixing a drug with a firm material that melts quickly when in contact with warm mucous membranes. When released, the drug may have local or systemwide effects. Suppositories may be refrigerated to maintain their desired shape and consistency.

Lotions: Lotions are most often water based; they are applied to the skin and rubbed in to achieve the desired effect.

Ointments: Lanolin or petrolatum is the medium mixed with a drug to form an ointment; ointments are semisolids, applied most often to the skin. They may also be instilled in the eye and, as such, must be kept sterile.

Pastes: Because pastes are much thicker and absorb more slowly than ointments, they form a protective layer on the skin. Silvadene is an example of a paste.

Liquids and Semiliquids

Liquids are common forms of medications intended for ease of administration and acceptance by patients, especially children and elder residents who have difficulty swallowing tablets or capsules. Drugs in liquid form are absorbed quickly when swallowed, rubbed into the skin, or instilled in the eye or ear.

Liquid drug forms may be considered solutions (that is, liquids in which the drug is completely dissolved). Tinctures and elixirs are examples of solutions; both are made with various amounts of alcohol or alcohol and water. Tinctures are especially potent, for example, iodine or belladonna. Elixirs are less potent, have a sweet taste, and are more palatable, especially by children. Benadryl is an example of an elixir form of antihistamine. Elixirs and tinctures should be used with caution for the alcoholic client.
Chapter 4: Drug Orders, Forms, Measurements, and Handling

**Suspensions** are liquid drug forms that contain particles of the drug that cannot be dissolved in a liquid (alcohol or water) but are suspended in it. If allowed to sit, the drug particles settle to the bottom of the container, leaving the liquid at the top. Milk of Magnesia is an example of a suspension. Liniments, gels, and lotions are also forms of suspensions that are rubbed in or patted on to protect, heal, soften, or soothe the skin.

**EXAM ALERT**

Because the drug is not completely dissolved in the liquid preparation, a suspension must be shaken before it is administered.

**Syrups** contain very little amount of a drug in a large amount of heavy syrup and water, which helps disguise the drug’s unpleasant taste. Tussionex is an example of a syrup; it is used to suppress the cough reflex.

**Routes of Drug Administration**

The following are common ways that drugs are given:

- **Oral**: Drugs taken orally in liquid, tablet or capsule form are swallowed with liquid or taken alone; they are absorbed in the stomach and small intestine, but at a slower rate than other methods, especially in the presence of foods or some digestive enzymes. Some oral medications may be irritating to the stomach or cause nausea and stomach discomfort. They remain, however, a popular route for medication administration. Despite its convenience and ease of administration, the oral route is a less-reliable indicator of drug dose delivery because of the many factors that can interfere with its absorption.

- **Sublingual** *(sub, under; lingua, tongue)*: A tablet or liquid given sublingually is placed under the tongue to be dissolved quickly by the resident’s saliva. Quick absorption of a highly concentrated drug is the goal of creating a systemic effect of the drug, especially in an emergent situation like that experienced by the resident with angina or heart pain. Nitroglycerine is an example of a drug given sublingually; nitroglycerine relieves angina by dilating heart vessels, which allows the heart muscle to receive needed oxygen.

- **Buccal** *(cheek or pertaining to the cheek)*: Tablets placed inside the resident’s cheek are designed to act similarly to those given sublingually as they, too, are absorbed into the mucous membrane.

**EXAM ALERT**

Residents receiving medications by the sublingual or buccal route should not eat or drink anything until the tablet has completely. If taking multiple doses, as in the case of oxytocin given to the laboring patient, alternate sites should be used to prevent irritation of the mucous membranes.
▲ **Topical** (pertaining to a definite surface area, local): The topical route may be intended for a localized effect, like Calamine lotion applied to relieve itching.

▲ **Cremes, lotions, ointments, liniments**, and other semisolids provide localized healing and relief of pain or other discomfort. Liquid medications may also be sprayed, dabbed, or painted on the skin for the same reasons. Antiseptics such as Betadine are an example of liquid topicals.

▲ **Transdermal** (across the skin): This subcategory of drugs have a systemic effect; these include drugs such as nitroglycerine or scopolamine, whose dose is released over time through a small patch or disc applied to the skin.

▲ **Eye, ear, and nose drops** are also considered topical because they rely on absorption by the mucous membranes. Likewise are suppositories and some irrigation solutions instilled into the urethra, vagina, or rectum.

**EXAM ALERT**

Topical medications must not be taken internally, i.e., to be ingested in the GI tract; a caution label should be affixed to the topical container.

▲ **Inhalation** (*inhalatio*, the act of drawing breath): Drugs can be inhaled through a mist or spray under steam or gas into the nose, throat, or lungs. The drug is absorbed by the mucous membranes of the targeted area, providing emergency relief quickly as the surface of the lungs in particular is very large. Spray devices include the inhaler, nebulizer, and atomizer. To achieve the maximum effect of the drug, residents who use such devices must be well versed in how to use them. The devices must also be kept clean and ready for use because many may be used to relieve an airway obstruction, such as asthma. The resident using an inhaler should rinse his or her mouth after each use as well.

▲ **Parenteral** (*para*, beside; *enteron*, intestine): Parenteral medications are those delivered into the body (subcutaneous tissue, muscle, blood, or bone) by a syringe and needle. The drug dosage is more controllable and more rapidly absorbed as it bypasses the GI tract. To be injected, drugs are prepared in liquid form, in either water or saline solution. Injecting drugs is more expensive, requires sterile technique, and can have fatal consequences to the resident if delivered intravenously.

Subcategories of the parenteral route include the following:

▲ **Intradermal** (*intra*, within; *derma*, the skin): The outer layer of the skin is the intended site for the intradermal (ID) injection. A small amount of drug (usually less than 0.3mL) forms a small bleb, or bubble under the skin; the drug slowly absorbs from the injection site. The tuberculin skin test is an example of an intradermal injection.
Chapter 4: Drug Orders, Forms, Measurements, and Handling

- **Subcutaneous** (sub, under; cutis, skin): Drugs given subcutaneously (subcut.) enter the body just beneath the outer layer of the skin in the fatty layer. The total volume given in subcutaneous are in the 0.5mL to 2mL. Local anesthetics, insulin, and other drugs are given in this manner.

- **Intramuscular** (intra, within; musculus, muscle): The intramuscular (IM) route delivers drugs deep into the blood-rich muscle of the body, allowing for faster absorption than the intradermal or subcutaneous route. The muscle can absorb a higher volume of liquid than routes listed earlier; the usual amount of drug preparation is 1mL to 3mL. If a larger volume of medication is necessary, such as penicillin, the dose should be divided between two large muscle sites.

- **Intravascular** (intra, within; vasculo, vessel): Intravenous (IV) access means that drugs are delivered injected directly into the vein. Drugs given IV may be delivered directly or added to a sterile fluid infused into the vein via catheter and allowed to be absorbed over a specified period. IV fluids may be given to maintain fluid volume or correct electrolyte imbalances. The flow of IV fluids is usually controlled by a pump delivery system to avoid fluid overload or a drug overdose. To prevent irritation to the vein, most drugs must be diluted prior to IV delivery. IV drugs are most often used in emergencies when rapid absorption is necessary. The dosage is much more controllable, but the effect may be difficult to reverse if a drug error is made.

- Other drug routes reserved for the physician only include the **intrathecal** route (injection into the dura spinal space), **intracardiac** (drugs injected into the heart muscle), **intra-arterial** (into an artery), and the **intraosseous** route (into a bone).
Exam-Prep Questions

1. A physician leaving a resident's room turns to the Medication Aide and says, “Please change Mrs. Smith's Tylenol to a rectal suppository instead of P.O.” The Medication Aide then does what?
   - A. Quickly writes down the order on the MAR to be sure it is written correctly
   - B. Tells the nurse the verbal order the physician just gave so that the nurse can write it in the chart
   - C. Tells the physician that he or she cannot take verbal orders but that he or she will get the nurse
   - D. Writes the order in the chart for the nurse to sign

2. As the Medication Aide is preparing to administer medications to a resident, it is noticed that pain medication is double the dose it was last time it was given. The best action for the Medication Aide is to do what?
   - A. Go ahead and give the medication because the resident has been having more pain lately
   - B. Withhold the medication and let the next shift give it if it is requested by the resident
   - C. Ask the resident whether the dose is correct
   - D. Bring the MAR to the nurse to check it against the physician's order

3. Thirty milliliters (mL) is equal to what?
   - A. 1 teaspoon
   - B. 2 tablespoons
   - C. 1 tablespoon
   - D. 2 teaspoons

4. One of your residents complains of a headache, but he has no analgesic ordered. What then is the best course of action for the Medication Aide?
   - A. Give two Tylenols tablets and tell the nurse that they have been administered
   - B. Call the physician and get an order for an analgesic
   - C. Tell the nurse about the resident's request for pain medication and that there is no updated order
   - D. Give two Tylenol tablets and record as usual
5. Staff members store their lunches in the closest refrigerator, which also holds the medications that need to be kept at a certain temperature. As the Medication Aide, you know what?
   ☐ A. Medications can be kept in any refrigerator.
   ☐ B. Anything can be kept in the medication refrigerator as long as the temperature is constant.
   ☐ C. Only specimens cannot be kept in the medication refrigerator.
   ☐ D. Only medications can be kept in the medication refrigerator, and it must stay locked.

6. For maximum absorption of a sublingual medication
   ☐ A. It should be given with a full glass of water.
   ☐ B. The medication must be placed on the tip of tongue.
   ☐ C. The medication should be placed at the back of the tongue.
   ☐ D. No food or fluids until the medication is fully dissolved.

7. To properly administer a liquid medication that is a suspension, it must be
   ☐ A. Shaken to thoroughly mix it.
   ☐ B. Rolled gently between the palms of the hands to mix it.
   ☐ C. Administered as is; no need to mix it.
   ☐ D. Mixed with water from the faucet.

8. Topical medications are given how?
   ☐ A. Intravenously
   ☐ B. Orally
   ☐ C. Via a mucous membrane
   ☐ D. By inhalation

9. Medications ordered via inhalation are administered how?
   ☐ A. By mouth
   ☐ B. By breathing in
   ☐ C. By placing on the skin
   ☐ D. By injection
10. When the provider orders medications intravenously, it is given

- A. By the nurse.
- B. By the nurse or the Medication Aide.
- C. Only by the Medication Aide.
- D. By a family member.

Rationales

1. The correct answer is C. Choices A, B, and D are incorrect because the Medication Aide cannot accept verbal or telephone orders.

2. The correct answer is D. Choices A, B, and C are incorrect because the nurse is responsible for checking drug orders and transcribing them on the MAR, it is the responsibility of the Medication Aide to get clarification of any questionable drug order you review before giving the drug.

3. The correct answer is B. Choice A is incorrect because 1 teaspoon equals 5mL. Choice C is incorrect because 1 tablespoon equals 15mL. Choice D is incorrect because 2 teaspoons equals 10mL.

4. The correct answer is B. Choices A and D are incorrect because the Medication Aide should not give any drug without an order, not even a medication that can be purchased at the local store. Choice B is incorrect because the Medication Aide cannot take orders from providers.

5. The correct answer is D. In any location, all drugs must be securely locked, and drug refrigerators must not contain other items due to the potential for contamination or mishandling, making Choices B and C incorrect. Choice A is incorrect because it is only half right; the door must be locked, or the drug refrigerator must be in a locked room.

6. The correct answer is D. Choice A is incorrect because medications given by the sublingual or buccal route should not eat or drink anything until the tablet has completely dissolved. Choices B and C are incorrect because sublingual medications are to be under the tongue.

7. The correct answer is A. A suspension must be shaken before it is administered because the drug is not completely dissolved in the liquid preparation. Choice B is incorrect because gently rolling the medication would not mix it thoroughly. Choice C is incorrect because a suspension easily separates and must be mixed before administering. Choice D is incorrect because you would not mix a medication using water from the faucet.

8. The correct answer is C. Topical medications must not be taken internally, (that is, to be ingested in the GI tract); a caution label should be affixed to the topical container. Choice A is incorrect because medications ordered intravenously are administered through a vein and are not given by the Medication Aide. Choice B is incorrect because a medication ordered by mouth is written as the oral route. Choice D is incorrect because inhalation means to breathe it in.
9. The correct answer is B. Drugs can be inhaled through a mist or spray under steam or gas into the nose, throat, or lungs. Choice A is incorrect because a medication ordered by mouth is written as the oral route. C is incorrect because medications order for the medication to be placed on the skin would be written as transdermal. Choice D is incorrect because a medication given by injection could mean intramuscular, intradermal, intravascular, and even intrathecal.

10. The correct answer is A. Intravenous medications are administered through a vein and are administered only by the registered nurse.
CHAPTER FIVE

Administering Medication Safely

Medical Term Hot List

- Aspiration
- Blood-borne pathogen
- CDC
- Hand hygiene
- Hallucinations
- HBV
- OSHA
- Medical asepsis
- Medicine cup
- Medicine dropper
- Pathogen
- PPE
- Soufflé cup
- Standard precautions
- Syringe
Introduction

Key considerations for safe administration of medications in this chapter include a review of medical asepsis, safety standards, safety checks involved in administering medications, and the six rights of medication administration.

Set Up for Medication Administration

The following are guidelines for safe preparation of medicines:

Assuring Accuracy of Medications

- Check the ordered drug on the Medication Administration Record (MAR) or Kardex with the drug label, being sure that both match; if you have any question about the accuracy of the drug order, consult with the nurse.
- Check to be sure that the drug has not already been given, especially if giving a PRN (as needed) medication.
- If allowed, and you see that you must calculate the drug dose, double-check your calculation and ask the nurse to verify your work. (See Appendix B, “Arithmetic Review: Weights and Measures,” for a basic mathematics review.)

NOTE

Nurses often ask other nurses to validate their drug calculations; this is an example of best practice and helps avoid a drug error.

- Question any unusually large or small dose of the prescribed drug.
- Question any new drug order if a similar drug is already in use by the resident.
- Do not attempt to interpret a drug order that is illegible; consult with the nurse.
- Do not assume that all drugs in the resident’s drawer or medication bin are to be given to the resident; likewise, missing drugs should alert you to ask whether the drug has already been given, or if the pharmacist dispensed a short supply of the drug. If any question about the presence or absence of the drug, consult with the nurse.
- Note which of residents are NPO (nothing by mouth); consult with the nurse to discuss which medications, if any, may be given at the prescribed time.
- Review the resident’s drug allergies.
- Review all medications that require checking of pulse or blood pressure before administering them.
The Medication Workstation/Preparation Area

- Keep your workstation clean, neat, and organized.
- If working in a drug supply room/medication room, make sure that you have good lighting and keep the door locked when not in use.
- When leaving the workstation, restock and clean the area.

Mental and Physical Preparation

- Remember to give only drugs allowed by your state or employer.
- Pay full attention to your task.
- Do not talk to others while preparing medications; distractions encourage errors.
- Unlock the medicine drawer or log on to the computer-based dispensing system.
- Place unit-dose medications directly into the soufflé cup; open them only at the bedside.
- If preparing a controlled drug, check the narcotic record for the last recording/count and compare current count with available drug; if you discover a discrepancy in the count, report it to the nurse immediately.
- If you need to divide a tablet to give the correct dose, use only a pill cutter and cut along the scored line on the tablet.
- If taking multiple tablets from a bottle, pour the tablets into the upturned bottle cap and then into the soufflé cup.
- If the drug is to be crushed and mixed with food or liquid, check all references to be sure that the drug is allowed to be mixed; if not, consult with the nurse to discuss another acceptable method of administering the drug.

**NOTE**

Remember, if you mix a drug, you must give the entire amount of the mix.

- When deciding which fluid to give with medications, consider the resident’s allergies, diet, fluid restrictions, preferences, and ability to swallow.
- Avoid offering liquids that might alter the drug’s effect (either enhancing or slowing its absorption).
- Consult with nurse regarding vital signs, urinary output, and other resident drug-related information when preparing to give antihypertensives, antidysrhythmics, antipyretics, or any other drug that could cause an adverse resident reaction to the drug.

From the Library of Scott Kruse
Consult with the nurse if you have any concerns about the patient’s status before giving any drugs.

Give only drugs that you have prepared; do not give a drug that someone else has prepared and asked you to give for them.

Do not give a drug that is not clearly labeled.

Do not give a drug that has expired.

If you question the drug’s appearance, dose, or any other aspect of the drug, consult with the nurse before administering it.

If you drop a drug on the floor, do not give it; instead, dispose of it per agency policy.

Lock the drug cabinet/storage unit after preparing medications; carry the keys with you at all times.

Before preparing medications, follow medical asepsis (clean technique) as part of standard precautions (steps to avoid contact with blood or body fluids):

Medical Asepsis: A Review

1. Practice good hand hygiene:

   Wash your hands with soap and water (review concepts from your Certified Nursing Assistant [CNA] training); hand washing is the easiest and most effective way to prevent the spread of infection.

   Following manufacturer’s directions, use an alcohol-based hand sanitizer when not able to wash your hands. A sanitizer will help prevent contamination (spreading of disease-causing organisms, or pathogens).

   Keep hands moist with lotion PRN because cracked skin allows pathogens to enter the skin.

   Try not to directly touch any medication; if you must touch a drug, wear gloves; transfer medications from the drug’s container directly into the soufflé cup (small paper cup designed to give dry medicines).

   When pouring a liquid medicine into a medicine cup (a small plastic cup marked with measurement guides), do not touch the lip of the medicine bottle to the medicine cup.

2. Cover your mouth or nose when coughing or sneezing.

3. When giving medications to a resident in isolation, wear personal protective equipment (PPE): gloves, gown, cap, and so on.

4. Turn bottle cap upside down if placing on a surface (for infection control).
5. Follow all policies and procedures to prevent spread of blood-borne pathogens (that is, pathogens spread through the bloodstream). The Hepatitis B virus (HBV) is a dreaded blood-borne organism and a major concern of all healthcare givers and residents. Preventing exposure to HBV is an important goal of the Center for Disease Control (CDC) as well as OSHA, the Occupational and Safety Health Administration. Both have published standards and regulations to protect both healthcare workers and the public.

**Special Circumstances for Administering Medications**

**Residents with Swallowing Difficulties**

- Before giving any medications to the resident, verify with the nurse that the resident can swallow.
- Give medications in a form that is easiest for the resident to swallow.
- Position residents in high Fowler's position/sitting position (approximately 90°) with chin tucked to help prevent choking/aspiration (drawing food, fluid, or medications meant for the gastrointestinal tract into the respiratory tract).
- Moisten the resident's mouth by offering water or other liquid to help propel the medication through the mouth and esophagus; unless restricted, offer at least 5 to 6 ounces of liquids with the medications.
- Do not rush the resident, allowing him or her time to rest briefly after each medication is given.
- Give each drug separately to help prevent choking; offer liquids after each drug and check to be sure each drug has been swallowed before giving other medications.
- Thicken liquids if the resident cannot tolerate thin fluids.
- If the resident has one-sided weakness, place the medication on the strongest side of the mouth.
- Avoid using straws, because with them the resident has less control of the amount of liquid taken.
- If using a dropper to give a liquid medication, insert the dropper in the side of the resident's mouth and deliver very small amounts of drug to prevent choking.
- If the resident has trouble swallowing the first drug, do not continue. Instead, consult with the nurse before proceeding with subsequent medications.
Place the call light within easy reach of the resident to ease anxiety after receiving medications.

Report any difficulties encountered by the resident to the nurse; alternative methods may be necessary to deliver the drugs safely.

Residents with Physical Impairments
Ask a co-worker to assist you in helping the resident with a physical impairment to hold a glass of water, and position the resident correctly for comfort and safety or for any other assistance needed to ensure safe medication administration. If the resident is blind, explain each step you will take in giving him or her medications; if deaf, use pictures or diagrams or ask an assistant who knows sign language to assist you. If one side is weak, place medications on the strongest side of the resident’s mouth.

Residents with Cognitive Limitations
Residents with dementia or other thought disorders may become suspicious and anxious if they do not understand your purpose in giving medications. Consult with the nurse as to the best approach to take with the residents. Use simple language and proceed slowly to help ensure compliance. In all situations, be honest with the residents and do not force them to take any medications (otherwise you risk potential liability for assault).

Order of Medication Administration
Certain medications must be given in proper sequence to ensure their absorption. For example, when giving tablets, liquids, syrups, and lozenges, give them in that order; lozenges should be given last because they must dissolve slowly in the mouth. Other medications that should be given last are those that coat the mucus membranes, such as Carafate.

Safety Checks When Administering Medications
The following are the four safety checks necessary to ensure safe medication administration:

- **First:** Compare the drug label to the drug order on the MAR or Kardex.
- **Second:** Check the drug when removing it from the drug cart, drawer, bin, or shelf.
- **Third:** Check the drug label before preparing the prescribed drug dose.
- **Fourth:** Check the drug label just before giving the drug.

Always remember: ✓ check, ✓ check, ✓ check, and ✓ check!
The Six Rights of Medication Administration

The six rights of medication administration are as follows:

1. Right drug
2. Right resident
3. Right route
4. Right dose
5. Right time
6. Right documentation

Right Drug
When preparing drugs, compare the drug label three times with the MAR, computer printout, or computer screen:

- Before taking the drug from the drawer/bin or shelf
- When removing the drug from its container
- When you return the container to the drawer or shelf for storage

These checks apply, as well, when taking medications from a medication-dispensing system.

Be aware of drugs with similar spellings because they might be mistaken for each other. Question any drug that is not familiar to you or that looks different from other drugs in the drawer with the same label; verify the spelling with the nurse if you have any question about the drug's name.

Generic names differ from brand names, as discussed in Chapter 4, “Drug Orders, Forms, Measurements, and Handling.” You are responsible for double-checking labels to be sure that you have the right drug.

Listen to the resident who questions the drug you are giving. The resident’s concerns should alert you that the drug might not be correct for the resident. Never give a drug that the resident questions. Instead, withhold it, and report the resident’s concerns immediately to the nurse, who should assist you in rechecking the drug order. The drug order might have changed, but sometimes an error has occurred. If the resident still refuses the drug, discard it according to agency procedure. If a unit-dose drug is in question, you may be able to save it unless it has been opened. If the drug is a narcotic, dispose of it with a nurse witness and double signatures (yours and the nurse’s) on the agency’s narcotic record.
Chapter 5: Administering Medication Safely

NOTE
Remember, when in doubt (yours or the resident’s), check it out!

Right Resident
Use at least two identifiers when giving medications to the resident. Compare the MAR, computer printout, or computer screen with acceptable identifiers. These include the resident’s identification bracelet, asking the resident to restate his or her name (least reliable when the resident is confused, hard of hearing, or distracted), or hospital ID number/bar code. If you are using a photo ID system in a long-term care facility, compare the client’s admission photograph to the resident. Follow agency policy regarding the use of all identifiers. Do not ask another resident to verify someone else’s name.

CAUTION
Remember, relying on the client’s room or bed number as an identifier is not acceptable.
If the resident’s ID bracelet is hard to read, report it to the nurse to obtain a new one.
Be extremely careful in giving medications to residents with the same or similar last names; this is a common reason for medical errors.

Identify the resident right before giving the medications at the bedside. Do not identify the resident and leave the room to retrieve the medication, because you might return to the wrong room and give the medication to the wrong resident.

Right Route
The drug route means how the drug enters the body. The oral route is the most common route, but do not assume that the drug order is oral if it is not specified on the drug order. If the drug route is omitted, do not give it until the prescriber has been contacted to clarify the order.

Check the route included in the drug order against the MAR and the pharmacy label. If they conflict, withhold the drug until you have consulted with the nurse.

CAUTION
Never change the route of the drug you are giving. Only the prescriber can make such changes.

Drug routes are often restricted. Drugs intended for injection, for example, cannot be given orally and are most often labeled “for injection only.”

Give only drugs by the route for which you are allowed per your agency and the state in which you are certified to practice. In most states, you are not allowed to give parenteral injections, which includes IV drugs.
Right Dose
Giving the incorrect dose of a drug is the most common drug error and, unfortunately, can harm or even kill a resident. If allowed to do simple mathematical calculations in your state, compare the dose ordered with the supply of the drug on hand. If you must calculate the dose, double-check your calculations and verify your work with the nurse. Likewise, if you suspect that the dose on the drug label is wrong, consult with the nurse. See Appendix B for a basic mathematics review.

Remember, when pouring a liquid drug into a medicine cup, place the cup at eye level on a firm surface for an accurate measurement. Measure the liquid at the bottom of the meniscus on the marked measurement line on the cup.

Use a medicine dropper or oral syringe for amounts less than 5 milliliters (mL). Expel air bubbles from the dropper or syringe before administering the medication. To remove an excess amount from the dropper or syringe, expel the unwanted amount into the container, not into the air or other surface.

Right Time
To effectively diagnose/treat residents, each drug order specifies the numbers of times per day the drug is to be given, but often not the specific time. Standardized time schedules may vary from one agency to another but are designed to help prevent errors while assisting the nursing staff to organize care activities. For example, if a drug is to be given four times a day, it may be scheduled for 0800 (8 a.m.), 1200 (12 noon), 1600 (4 p.m.), and 2000 (8 p.m.).

Certain drugs may be ordered to be given at a certain time to allow for laboratory data or other data to be obtained before the drug is given. In such cases, the laboratory results may determine whether the drug dose needs to be changed, or, in certain situations, be withheld. This is often the case with insulin schedules, which depend on the resident's blood glucose levels.

Other drugs must be given at regular intervals to maintain adequate levels of the drug needed to produce the desired effect. If a drug is not given on time, the blood levels fall and the drug is less effective.

Some drugs must be given on an empty stomach; they are often ordered to be given at least one hour between meals and at bedtime; they may also be ordered pc, which means they are due one-half hour after eating. If ordered ac, the drug is due 30 minutes before meals.

Drugs that alter awareness are often ordered at bedtime to avoid difficulty in carrying out activities of daily living for the resident. Special precautions must be taken at bedtime, however, to prevent the resident from falling.

A preoperative medication may be ordered to be given on call, meaning the medication is given when the nurse is notified by the operating room staff that the medication is due. Delaying the time ordered can have negative consequences for the resident.
Chapter 5: Administering Medication Safely

If a drug is ordered now or STAT, it must be given immediately as a one-time only administration. Record the medication, the time, and the resident’s responses to it on the MAR. Remember to check the MAR when preparing a PRN medication to be sure that enough time has elapsed between doses and that someone else has not already given it. For example, if a PRN medication is ordered every four hours, you must wait at least four hours before giving it. Record the PRN medication as soon as you give it on the MAR and on the progress note.

**NOTE**

Never leave medications at the resident’s bedside to be taken later.

Drug administration schedules allow 30 minutes before the scheduled time or 30 minutes after the time ordered. This allows you to give medications to multiple residents within a time period that is feasible but that does not interfere with the effectiveness of the medical regimen. For example, if medications are due at 0900, you have from 0830 to 0930 to give the medication within the acceptable time limit. If you cannot administer the medication within the one-hour time frame, you must record the time given on the MAR. Likewise, if the drug is held for any reason, you must record the actual time you give it.

**Right Documentation**

As soon as you give the medications, you must record them on the MAR or the computer printout or input the data into the bedside or handheld computer.

**NOTE**

Never document a medication before you give it!

Follow agency policy for providing initials, signature, and the resident’s vital signs if needed or other data associated with giving the medications. If not already printed on the MAR or other form, be sure to include the drug name, dose, route, the time of administration, and (when applying a transdermal patch) the site. In most states, Medication Aides do not give injections. If allowed to administer injections, follow agency policy in documenting all injections, including the site.

If the medication is withheld for any reason, follow agency policy in documenting the hold; this may be done by circling the medication or noting the hold on the MAR in another way. Explain the reason for the hold in the progress notes and sign the documentation. Likewise, if the resident refuses the medication, follow the same procedure. Do not become defensive if the resident refuses to take any medication; it is their right. Report the refusal to the nurse, who will investigate the situation further.
Introduction

The resident may be unaware that he or she is allergic to a medication until it is given, or, as discussed earlier, the resident may experience an allergic reaction to a medication that has been given over time and whose effects have accumulated to the point where the resident responds negatively. This situation is especially troubling when giving medications to the elderly resident who might not be able to detoxify the drug effectively. An example of such an occurrence is the resident receiving potassium replacement. The safe blood level range of potassium is very small, making potassium supplements a special precaution for the MA-C. An accumulated level of potassium can cause severe side effects, such as changes in heart rhythm and muscle spasms. Laboratory data review of potassium levels by the nurse should help prevent an overdose of potassium.

Other severe negative responses to medications may include a rash, restlessness, oversedation, anxiety, hallucinations (hearing or seeing things that are not there), bradycardia, or tachycardia. Severe allergic reactions include wheezing, hives, shortness of breath, and severe anxiety. Report any and all signs and symptoms you observe and the time you observed them and document your observations, noting the name of the nurse you notified.

Failure to document medications and their reactions can have be harmful and even life threatening for the resident. Following the guidelines and precautions noted in this chapter can help prevent such occurrences.

Causes and Reporting of Medication Errors

Drug errors most often occur by failing to observe the six rights of drug administration. Other causes include ordering the wrong drug or wrong dose or a mistake in labeling the drug by the pharmacy. The point here is that the total organization/team or system has a stake in drug errors, not just the nurse or the MA-C. Each member is responsible for following all procedures designed to protect the resident. If you commit a drug error, you must report it immediately to the nurse, the next staff member in the chain of command. The most important thing to do in case of a drug error is to ensure the safety of the client by reporting the incident
timely to prevent injury in any way to the resident. Withholding vital information by not revealing the error can make the resident’s condition worse. For example, if you give an overdose of an antihypertensive, the resident's blood pressure could fall dangerously low.

You must also report the error on the designated report form, not in the resident’s medical record. Your report should be factual, honest, and descriptive and must not contain your personal opinion as to why the error happened. Follow-up analysis should be done by designated risk management staff or a committee to explore how the error happened and how to improve the medication administration process to prevent further problems.

If you witness a drug error made by another staff member, you are obligated to report it to the nurse. You must keep your observations private and follow the chain of command. This is not the time to gossip or share your thoughts about the occurrence with others.
Exam-Prep Questions

1. True or false: All side effects of medications are anaphylactic drug reactions.

2. Which of the following is not a right of medication administration followed to prevent medication errors?
   - A. Right drug
   - B. Right person
   - C. Right size
   - D. Right dose

3. When is it not necessary to read a drug label?
   - A. Before giving the medication
   - B. After giving the medication
   - C. Before pouring the medication
   - D. After removing the medication from the medication drawer

4. Which of the following medications requires therapeutic blood levels of the drug to make sure the dose of the medication is not too high or too low?
   - A. ASA
   - B. Potassium
   - C. Nitroglycerin
   - D. Cardizem

5. Which of the following is a medication given to regulate the heart and requires blood levels?
   - A. ASA
   - B. Lovenox
   - C. Nitroglycerin
   - D. Lanoxin
Chapter 5: Administering Medication Safely

6. Which two identifiers are used to recognize a resident before giving a medication?
   - A. Room number and identification band
   - B. Have the resident state his/her name and check the identification band
   - C. Have the resident state his/her name and check the room number
   - D. Check the identification band and check the bed number

7. The provider orders 5mg of a medication. The medication is supplied as 10mg in 10mL. What quantity of medication will you give?
   - A. 10mL
   - B. 2.5mL
   - C. 5mL
   - D. 15mL

8. What medication administration route has the slowest onset of action?
   - A. Intravenous
   - B. Subcutaneous
   - C. Oral
   - D. Intramuscular

9. Drug administration errors occur most frequently under which of the rights of medication administration?
   - A. Right dose
   - B. Right patient
   - C. Right medication
   - D. Right time

10. The resident in room 220 had trouble swallowing breakfast this morning. The Medication Aide’s best course of action is to do what?
    - A. Change the medication route to rectal instead of by mouth
    - B. Give the medication slowly with ample water
    - C. Hold the medication and tell the nurse of the resident’s difficulty swallowing
    - D. Call the provider to report the resident’s difficulty swallowing
Rationales

1. The correct answer is **False**. Not all side effects are life threatening. Anaphylactic reactions cause life-threatening effects.

2. The correct answer is **C**. Choices A, B, and D are all a part of the six rights of medication administration (right drug, right dose, right time, right route, and the right person).

3. The correct answer is **B**. It is too late to check a medication to be sure the resident is getting the right medication after the medication has already been given. Choices C, and D are part of the drug label checks that are to be done before giving a medication.

4. The correct answer is **B**. Potassium is medication whose level must be checked to make sure that it does not get too high or low, which could cause cardiac problems.

5. The correct answer is **D**. Lanoxin is a cardiac medication that is given to slow and strengthen the heart. If the levels get too high, it can cause serious heart problems. Choices A, B, and C are all used for the heart, but drug levels are not monitored.

6. The correct answer is **B**. Two resident identifiers are used before a medication is administered. Choices A, C, and D are incorrect because it is not appropriate to use a person bed or room number as an identifier. The resident could be in someone else’s bed or the resident could have changed rooms recently.

7. The correct answer is **C**. 5mg x 10mg / 10mL = 5-mL.

8. The correct answer is **C**. The fastest route for administration of medication is intravenous, then intramuscular, subcutaneous, and lastly oral.

9. The correct answer is **A**. Giving an incorrect dose of a drug is the most common drug error. Choices B, C, and D are rights of medication administration, and errors can occur in these areas but not as often. When the safety procedures for medication administration are followed, errors are less likely to occur.

10. The correct answer is **C**. Choice A is incorrect because a Medication Aide is not allowed to change a resident’s route of administration. Choice B is incorrect because giving water to a resident who is having difficulty swallowing is not going to help. Choice D is incorrect because the MA-C is not qualified to take orders for medication changes.
CHAPTER SIX

Medication Administration Procedures and Techniques

Medical Term Hot List

✓ ADA ✓ Instill ✓ Pledget
✓ Aphasic ✓ Lithotomy position ✓ Rectal sphincter
✓ Cerumen ✓ Noncommunicative ✓ Therapeutic relationship
✓ Conjunctival surface ✓ Ophthalmic ✓ Transdermal
✓ Hyperextending ✓ Otic ✓ Vagina
✓ Lacrimal ✓ Mortar and pestle

From the Library of Scott Kruse
Pre-Administration Procedures

The following are steps to take to administer medications safely.

Identifying Client

As reviewed in Chapter 5, “Administering Medication Safely,” it is imperative that you use identifiers to accurately name the client who is to receive medication. Each time you give a drug, ask each client to state his or her name. Avoid asking, “Are you Mrs. Jones?” The client might be confused or not hear correctly and answer yes, when, in fact, her name is different. Likewise, clients might have the same last name; and so, answering to their last name only may lead to their receiving the wrong medication. To be courteous, also identify yourself and address clients by name when checking their identification bracelet, but do not rely on your greeting to take the place of their stating their full name.

**EXAM ALERT**

This might seem unnecessary when you have worked with the client over time, such as those living in a long-term care facility. Despite your relationship with the client, including this crucial step in the six rights each time you give medications can be a client lifesaver.

Compare the client’s stated name and identification bracelet to the Medication Administration Record (MAR) or medication computer sheet to ensure correct identification.

**EXAM ALERT**

If the two identifiers do not match the MAR, do not give the medication; instead, report the incident to the nurse immediately. This is especially important if the ID bracelet is illegible, smeared, or hard to read.

It is also important for you to identify clients just before giving medications, not identify them and then leave the room to retrieve medications. You might become distracted, reenter the wrong room, and give the identified client’s medications to another client. This is another reason why you must identify the client each time you give medications.

Hand Washing

Hand washing cannot be overemphasized in the healthcare setting; it is the single most important step in preventing infection. Wash your hands just before preparing medications for each client. Review Chapter 5 for details.

**EXAM ALERT**

Although donning gloves may be necessary for certain medications, like applying topicals or when you must touch the client’s mouth, do not rely on them alone to take the place of proper hand washing; gloves can have small tears that allow contamination.
Gloving

After washing your hands, don gloves, ensuring that they fit properly and have no obvious tears. Avoid touching dirty or contaminated surfaces with your gloved hands, and give the medications immediately. Use only once, removing the gloves by pulling gently on the cuff and slowly turning each glove inside out, disposing of them per agency policy immediately after use. Wash hands and, if needed, don another pair of gloves for the next client. Repeat hand washing between giving medications for each client and the same procedure as needed for gloving. Take every advantage of hand sanitizers available to you as you encounter clients.

Explaining the Medication Procedure

Every client has a right to information, especially treatments. Clients are also more likely to cooperate with treatment if they are aware of the purpose, name, and other information necessary as part of their care.

**NOTE**

Use simple terms, but do not insult the client by using demeaning language such as “it’s time for our medicines” or “look, dear, I have something special for you.” First of all, the medicine is not for you, and second, using endearing terms, no matter how innocent, is disrespectful and could be interpreted by the client as demeaning. Any time while giving medications, answer any questions the client may have that you are allowed by your job position to answer; immediately refer questions beyond your role as a Medication Aide to the nurse to allay any concerns the client might have. Remember, if the client refuses the medication, respect that decision and report the incident to the nurse.

Positioning the Client

Proper positioning is not only considerate but also increases safe administration of the medications by preventing choking and improving transport of the medication to the stomach (in the case of oral medications), and proper absorption (for topical applications, suppositories, and buccal medications).

**EXAM ALERT**

The best position for the client to help in swallowing medications is the upright position with head forward and chin down. If this position is not possible for the client, ask the client to keep his head up. If necessary, ask another Certified Nursing Assistant (CNA) or nurse to assist you in positioning the client. Encourage the client to hold the glass of water or other approved liquid. Reposition the client for comfort following medication administration and verify the client’s position of comfort before leaving the room.
Chapter 6: Medication Administration Procedures and Techniques

Giving Medications Through Various Routes

Chapter 4, “Drug Orders, Forms, Measurements, and Handling,” covered the various medication routes. The following subsections are special considerations when adminstering drugs via those routes.

NOTE

When giving medications through all the routes discussed here, always observe the six rights of medication administration.

Oral

Equipment

- MAR or computer record
- Medication cup (paper for solids, clear plastic for liquids)
- Water, juice, or preferred liquid (check restrictions, contraindications with the drug, and allergies) as determined on the client’s care plan
- Drinking straw (avoid straight design)
- Pill-crushing device
- Gloves, as needed

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Within 30 minutes of ordered time for medication administration, unlock medication bin or log on to computer medication form.</td>
<td><strong>Right Time</strong> For safety, keep the medication drawer locked until just before giving medications. Medications must be given within 30 minutes of ordered time to ensure adequacy of drug effects. Give PRN medications as soon as ordered to ensure intended effect as soon as possible. Double-check client identification on a computer form or MAR.</td>
</tr>
<tr>
<td>2. Choose the medication, checking each label with the MAR for accuracy of drug and dose.</td>
<td><strong>Right Drug</strong> <strong>Right Route</strong> To ensure potency, check the expiration of the drug before giving it.</td>
</tr>
<tr>
<td>3. Calculate dose if different from medication label. Verify accuracy with the nurse before giving the medication.</td>
<td><strong>Right Amount</strong> Double-check your calculations. If there is a problem with dose calculation and supply available, consult with the nurse to ensure that the medication has not already been given.</td>
</tr>
</tbody>
</table>
### Procedure | Consideration
--- | ---
4. For unit-dose medication, select the dose pack and place it unopened into soufflé cup. | Keeping unit-dose medication unopened until at client bedside helps prevent contamination and helps ensure proper ID of medication at bedside (✓ Safety Check).
5. Separate medications that require a vital signs check or other pre-administration monitoring. | Medications that lower blood pressure, slow the heart rate, or affect blood sugar can endanger the client if vital signs or blood sugar levels are excessively low. Keeping these medications separate from other drugs helps ensure that they are not given when contraindicated. If holding these medications, report to the nurse and record the hold per agency policy.
6. For drugs stored in stock containers, remove the container cap and place it with cap inside up on a clean, firm surface. Pour selected drug tablets or capsules into the upturned cap without directly touching the drug. Transfer the selected drug into a medicine soufflé cup. | Allows you to cleanly remove drugs without contaminating the drug container lid. ✓ ✓ Safety Check: Helps prevent giving the wrong medication.
7. Where indicated, crush pills using a pill crusher or mortar and pestle device. Mix the crushed drug with a small amount of approved soft food (usually 2 to 3 teaspoons; give 1/2 teaspoon of mixed drug at a time). Wash mortar and pestle after use. Divide large scored tablets if approved by the nurse, using the scored line on the tablet. | Check to ensure that the drug can be crushed or divided; this excludes long-acting drug forms, capsules, and enteric-coated tablets. Disguising the crushed drug helps improve the taste. Mixing the crushed drug with small amount of soft food helps to ensure that the entire dose drug is given. Washing the mortar and pestle prevents cross-contamination of another client’s medications. Give the medication in divided amounts to increase tolerance; to ensure a proper dose is given, split only scored pills.
8. Give a sip of water or other acceptable liquid prior to giving each pill, tablet, or capsule. Where permitted, instruct the client to drink a full glass of water after each solid medication. | Moistened mucous membranes in the mouth and throat help propel the medication, increase client comfort, and prevent sticking/choking. Liquids help dissolve the drug and enhance its effectiveness.
Chapter 6: Medication Administration Procedures and Techniques

### Procedure Consideration

9. Although you may place all solid forms in one soufflé cup, give each drug one at a time.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.</td>
<td>Helps increase tolerance and improve safe swallowing of medication; helps prevent choking.</td>
</tr>
</tbody>
</table>

### Liquids

1. Remove stock bottle/container from the medication cart/drug drawer.

   - Agitating the mixture ensures proper distribution of drug; this is especially important when giving a suspension or emulsion.

2. Compare the container/drug to the MAR/computer form.
   
   a. For a multidose bottle of a liquid drug, gently agitate the container. Remove the cap and invert onto a hard surface; holding the stock bottle with the label against the palm of your hand, pour the desired dose at eye level into a plastic medication cup or dosage spoon; do not touch the bottle edge with the medicine cup or spoon. Before returning the stock bottle to the drawer, compare the stock bottle with the prepared dose against the MAR/computer form. Wipe the bottle top, replace the lid carefully, and return the medication to the medication drawer.

   - First check to help ensure safety: Right drug.
   - Note the expiration date of the drug.
   - Placing the bottle cap upside down avoids contamination of the inside of the lid. Touching the cup or spoon to the container edge contaminates the cup, spoon, or the bottle.
   - Pouring the drug at eye level helps ensure that the proper drug dose is dispensed into cup.
   - Placing the label side of bottle to the palm helps prevents smudging of the label with liquid medication, which might otherwise make it harder to read.

   - A second check helps ensure the right drug and dose.
   - Helps prevent sticking of lid to the bottle.
   - Helps prevent contamination while easing access for future administration.

   b. For single-dose medication, do not transfer liquid from the package; it is already prepared by dose.

   c. For a medicine syringe (oral syringe), pull the plunger slowly toward you to fill to the required drug dose level from a medicine cup containing the liquid drug; overfill the barrel of the syringe and expel excess air to the drug dose level. Place the filled syringe on a tray.

   - Transferring a unit-dose drug into another medicine cup is an unnecessary step and promotes contamination.
### Procedure

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Compare the prepared drug to the MAR/computer form.</td>
<td><strong>A third check</strong> helps ensure the right drug and dose.</td>
</tr>
<tr>
<td>4. Lock the medication drawer.</td>
<td>Ensures safekeeping of medications.</td>
</tr>
<tr>
<td>5. Give medications as described giving only one liquid medication, undiluted, at a time. Give syrups last in the sequence of liquid medications. For syringe, place drug inside mouth and slowly depress the plunger to deliver small amounts of the drug into the mouth. Stay with the client after each drug is given to ensure that each oral drug is swallowed. Speak to the client. Never leave a drug at the client's bedside unless ordered to do so.</td>
<td>Do not mix liquid medications or dilute them. Explain the purpose of the drug sequence. One purpose of the medication is to soothe the mucous membranes of the throat. Diluting syrup decreases a drug's effectiveness. Slow delivery of the drug helps increase comfort and ensures all the drug is given. Safety concern: Ensure that the resident swallows each drug. Safety concern: Drugs can be lost, discarded, hoarded by a client, or taken accidentally by another client.</td>
</tr>
<tr>
<td>6. Discard used drug containers and restock supplies and equipment per agency policy.</td>
<td>Maintains cleanliness, promotes work efficiency, and prevents contamination.</td>
</tr>
<tr>
<td>7. Wash hands.</td>
<td></td>
</tr>
<tr>
<td>8. Record the drug administration on a MAR/computer form.</td>
<td>Verifies order given; prevents accidental repeating of drug.</td>
</tr>
</tbody>
</table>

### Powderes

1. Follow pre-administration procedures as for all drug administration routes described previously. Ensures accurate, safe administration.

2. Mix powders in acceptable liquid until dissolved and give immediately. If administration is delayed, mixed powders may thicken and become difficult to swallow.

3. Follow pre-administration procedures as for all drug administration routes described previously. Ensures accurate and safe administration.

### Lozenges/Troches

1. Follow pre-administration procedures as for all drug administration routes described previously. Ensures accurate and safe administration.
2. Open the unit-dose package carefully to avoid touching the drug directly. Ask the client to insert into mouth or, if client is unable to assist, don gloves and insert the drug into the client’s mouth.

3. Instruct the client to hold the lozenge in her mouth until completely dissolved. Instruct the client to avoid eating or drinking until the lozenge dissolves completely.

4. Follow post-administration procedures as for all drug administration routes described previously as well as for considerations described later in this chapter.

**Sublingual/Buccal**

1. Follow steps 1 through 8 for oral medications (as listed earlier), except for giving water before or with medications.

2. Instruct the client to keep the drug under the tongue (or, if buccal, inside the cheek) until it completely dissolves. The client should avoid swallowing liquids until the drug is absorbed.

3. Give sublingual or buccal drugs last in the sequence of oral medications.

For all medications, monitor client responses that might indicate an allergic reaction or unexpected reaction to the drug; report any concerns related to response promptly to the nurse. For any unexpected response to any drug, consult with the nurse about withholding the next dose until the prescriber is notified and further drug orders are received.
## Nasal Instillation

### Equipment
- MAR or computer record
- Gloves, as needed
- Tissues

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Follow medication pre-administration procedures as listed for the oral route.</td>
<td>Follow Six Rights! Helps ensure safety, efficiency, and client comfort.</td>
</tr>
<tr>
<td>2. Compare the drug canister, bottle, or other container label to a MAR/computer printout.</td>
<td>Right Drug, Time, and Client</td>
</tr>
<tr>
<td>3. Review the dose and instructions on the container.</td>
<td>Right Amount, Route</td>
</tr>
<tr>
<td>4. Instruct the client to gently blow nose.</td>
<td>Clears nasal passages to promote drug absorption.</td>
</tr>
<tr>
<td>5. If blowing the nose does not clear passages, with gloved hands clean clogged nares as needed; remove gloves and wash hands.</td>
<td>Promotes drug absorption; promotes client comfort.</td>
</tr>
<tr>
<td>6. When/if the condition allows, assist the client to position himself with his head tilted back (hyperextending the neck) or supine (on back) with head extended beyond mattress edge.</td>
<td>Head tilt improves delivery of drug to the nasal passages.</td>
</tr>
<tr>
<td>7. For a spray bottle, close the unaffected naris with a nondominant finger and quickly dispense the drug with quick sequential depressions of the bottle/container into the affected naris (nasal opening) as the client inhales. If using a dropper, slowly squeeze the dropper to instill the drug into one or both nares. Avoid touching the nares as much as possible. Repeat for other nares as ordered.</td>
<td>Helps ensure that the drug reaches intended site for absorption. Express intended dose only. Excessive swallowing of the nasal medication can be irritating to the gastrointestinal (GI) tract. Ensures that the drug reaches the affected naris efficiently. Contact with nares contaminates the application tip or medicine dropper.</td>
</tr>
<tr>
<td>7. Reposition the client and offer tissue wipes.</td>
<td>Increases comfort.</td>
</tr>
<tr>
<td>8. Follow post-administration procedures and client monitoring as for the oral route.</td>
<td>Right Documentation Promotes comfort, safety, and efficiency.</td>
</tr>
</tbody>
</table>
Inhalation

Most clients receiving inhalations prefer to self-administer them because they can more easily inhale properly to absorb the drug. Assist them to help ensure compliance and their comfort. Record self-administration of this medication per agency policy. Remind the client to do the following:

- Follow inhaler manufacturer directions for use and cleaning of inhaler and spacer.
- Check the order to ensure that the right number of puffs is delivered per manufacturer directions.
- Rinse mouth after inhaling corticosteroid (helps prevent fungal infection).
- Per manufacturer instructions, check often to ensure a ready supply of drug, especially if used for emergency management as in asthma attacks.

**NOTE**

For nasal instillations and inhalations, check with the nurse before allowing the client to blow his or her nose because blowing can increase pressure inside the head and/or cause a nosebleed. If contraindicated for any reason, instruct the client to avoid blowing the nose prior to or following nasal medication administration.

**Ophthalmic/Ocular (Eye)**

**Equipment**

- MAR
- Gloves
- Tissues
- Washcloth
- Gauze pad
- Saline (salt solution)

Remember to

- Avoid wasting of **ophthalmic** (eye) medications; they are expensive.
- Check the expiration date on the drug label.
- Give eye medications at room temperature to increase client comfort.
Clean eyes of debris with saline-soaked gauze before giving eye medications, using the inside edge of the lids to the outside edge (inner canthus to outer canthus), one swipe at a time with separate gauze.

Instruct the client to avoid squeezing eyes after instilling eye drops to avoid expelling the drug and preventing absorption.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Follow pre-administrations steps as for oral medications.</td>
<td>Follow Six Rights! Helps ensure safety, efficiency, and client comfort.</td>
</tr>
<tr>
<td>2. Don gloves.</td>
<td>Right Drug, Time, and Client</td>
</tr>
<tr>
<td>3. Expose the conjunctival surface of eye (inside of lower lid) by gently pulling down on the eyelid with the nondominant gloved hand and gauze pad or tissue. Carefully look at the affected eye to see whether cleansing is needed; ask resident to look up.</td>
<td>Right Amount, Route For safety, position your hand on the cheek or forehead of the resident to stabilize your administering hand, which facilitates movement with the resident as needed to maintain a safe technique.</td>
</tr>
<tr>
<td>4. For ointment</td>
<td></td>
</tr>
<tr>
<td>a. With your dominant gloved hand (starting at inner edge of the eye), squeeze a small ribbon-like line of ointment along the conjunctiva to the outer canthus (edge) of eye without touching the tip of the drug tube to the eye.</td>
<td></td>
</tr>
<tr>
<td>b. Release the lower lid.</td>
<td></td>
</tr>
<tr>
<td>c. Ask the client to gently close eyelids and move eye around inside closed lids to evenly distribute the medication.</td>
<td></td>
</tr>
<tr>
<td>d. Recap the eye medication.</td>
<td></td>
</tr>
<tr>
<td>e. Wipe excess medication from the eyelid and position for comfort.</td>
<td></td>
</tr>
<tr>
<td>f. Follow post-administration procedures as for oral administration.</td>
<td></td>
</tr>
<tr>
<td>5. For eye drops</td>
<td></td>
</tr>
<tr>
<td>a. Expose conjunctival surface of the eye by gently pulling down on the eyelid with your nondominant gloved hand and gauze pad or tissue.</td>
<td></td>
</tr>
<tr>
<td>b. Hold eye dropper 1/2 to 3/4 inch from the lid surface and drop the medication into the exposed conjunctiva; wait one to five minutes between drops to help ensure absorption.</td>
<td></td>
</tr>
<tr>
<td>c. Using a clean and dry gauze pad, apply gentle pressure to the inner canthus of the eye for one minute to prevent drug entering lacrimal (tear) duct.</td>
<td></td>
</tr>
<tr>
<td>d. Return the dropper to the drug container and store per manufacturer instructions.</td>
<td></td>
</tr>
<tr>
<td>e. Follow post-administration procedures as for oral administration.</td>
<td></td>
</tr>
</tbody>
</table>
Otic (Ear)

Equipment

- MAR
- Tissues
- Washcloth
- Gauze pad or cotton pledget (plug)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Follow pre-administration procedures as for oral route.</td>
<td>Follow Six Rights! Helps ensure safety, efficiency, and client comfort.</td>
</tr>
<tr>
<td>2. Check expiration date on drug label.</td>
<td>Right Drug, Time, and Client</td>
</tr>
<tr>
<td>3. Give ear medication at room temperature.</td>
<td>Right Amount, Route</td>
</tr>
<tr>
<td>4. Position client on side with affected ear up for each instillation.</td>
<td>Gravity helps ensure the drug reaches the affected area.</td>
</tr>
<tr>
<td>5. With your gloved nondominant hand, gently pull the ear up and back to expose the ear canal.</td>
<td>Techniques helps ensure the drug reaches the affected area.</td>
</tr>
<tr>
<td>6. If cerumen (ear wax) is visible in the ear canal, gently remove with a clean washcloth. Do not use an instrument to remove.</td>
<td>Using an instrument to remove cerumen is beyond the scope of practice for a Medication Aide.</td>
</tr>
<tr>
<td>7. Without touching the ear, instill (give drop by drop) a drop into the ear canal as ordered; return the dropper to the container.</td>
<td>Right Amount, Route</td>
</tr>
<tr>
<td>8. Insert a cotton pledget (plug) into the canal if ordered and instruct the client to maintain position and/or leave in place per order.</td>
<td></td>
</tr>
<tr>
<td>9. If instilling drops to both ears, wait at least 5 to 10 minutes between instillations.</td>
<td>Allows time for each drug to be better absorbed.</td>
</tr>
<tr>
<td>10. Follow post-administrations per previously discussed routes.</td>
<td>Right Documentation</td>
</tr>
</tbody>
</table>

Topical

Transdermal

Equipment

- Soap or skin cleanser
- Wash cloth and towel
- Transdermal disk or patch
• Clean gloves
• MAR
• Drug ointment (if not already embedded in patch)
• Ruled measuring applicator paper specific to the drug
• Nonallergenic tape

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>For Transdermal Patch/Disk</strong></td>
<td></td>
</tr>
<tr>
<td>1. Follow pre-administration procedures as for all route of drug administration.</td>
<td>Follow Six Rights! Helps ensure safety, efficiency, and client comfort.</td>
</tr>
<tr>
<td>2. Check the ointment tube/container for the expiration date.</td>
<td>Right Drug, Time, and Client</td>
</tr>
<tr>
<td>3. Position the client and assess the new application site.</td>
<td>Right Amount, Route</td>
</tr>
<tr>
<td>4. Remove the old application patch and observe the skin for any irritation.</td>
<td>Helps prevent overdose; helps prevent skin irritation/breakdown.</td>
</tr>
<tr>
<td>5. Don clean gloves.</td>
<td>Exposed skin can allow absorption of drug into your skin.</td>
</tr>
<tr>
<td>6. Recheck the drug order against the drug label.</td>
<td>Right Drug, Time, and Client</td>
</tr>
<tr>
<td>7. Using ruled measuring applicator paper, measure the drug amount order (for example, 1/2 inch or 1 inch) onto paper, squeezing an even line of ointment to the length desired.</td>
<td>Right Amount, Route</td>
</tr>
<tr>
<td>8. Recheck drug when replacing the cap and returning the drug to the tray/receptacle.</td>
<td>Right Drug, Time, and Client</td>
</tr>
<tr>
<td>9. Apply the ointment-filled paper to the skin and smooth evenly to distribute the drug.</td>
<td>Right Amount, Route</td>
</tr>
<tr>
<td>10. Tape paper in place with nonallergenic tape, labeled with date, time, and your initials. Avoid pressing on application.</td>
<td>Helps prevent loss of drug from skin Increases absorption rate.</td>
</tr>
<tr>
<td>11. Reposition the client and check for comfort.</td>
<td>Helps ensure client’s right to comfort.</td>
</tr>
<tr>
<td>12. Follow post-procedure administration steps as for all medications described already in this chapter.</td>
<td>Ensures safe and consistent procedure.</td>
</tr>
</tbody>
</table>

| **For Transdermal Drug Delivery (TDD) System** | |
| 1. Follow steps 1–12 as listed already in this table, deleting the taping step because the drug is already embedded into the disk/patch. Before applying a patch, write your initials, date, and time on the patch. | Helps ensure documentation of application to help prevent duplication of drug treatment. |
### Lotions, Creams, and Powders

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow pre-administration procedures as for all routes of drug administration described previously.</td>
<td>Right Drug, Time, and Client</td>
</tr>
<tr>
<td>2. Don gloves.</td>
<td>Right Amount, Route</td>
</tr>
<tr>
<td>3. Clean and dry the application site/body.</td>
<td></td>
</tr>
<tr>
<td>5. If suspension, shake bottle/container to evenly distribute the drug.</td>
<td>Helps ensure proper absorption and drug effect.</td>
</tr>
<tr>
<td>6. Using firm strokes, apply a thin coating to the skin per order.</td>
<td>Excess lotion is unnecessary and wasteful, causing added expense to the client.</td>
</tr>
<tr>
<td>8. Perform post-administrative procedures as for all drug administration routes described previously.</td>
<td>Right Documentation</td>
</tr>
</tbody>
</table>

### Vaginal

**Suppository**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Perform pre-administration procedures as for all drug administration routes described previously.</td>
<td>Right Drug, Time, and Client</td>
</tr>
<tr>
<td>2. Instruct the client to void prior to the procedure.</td>
<td>Right Amount, Route</td>
</tr>
<tr>
<td>3. Provide privacy and position the client in the lithotomy position as tolerated (on back with knees bent and legs apart; hips elevated). If the lithotomy position is not feasible, position in a side-lying position.</td>
<td>Privacy is a client right. A proper position helps ensure proper insertion and absorption of drug.</td>
</tr>
<tr>
<td>4. Arrange a pad, towel, or other protective cloth under the buttocks.</td>
<td>Helps prevent soiling of linens.</td>
</tr>
<tr>
<td>5. Don gloves.</td>
<td>Prevents contamination.</td>
</tr>
<tr>
<td>6. Remove foil or other cover from cool suppository, lubricate with water-soluble lubricant, and insert (tapered end first) carefully into vagina, directing suppository to the side wall of the vagina.</td>
<td>Cooling the suppository keeps it intact and from melting at room temperature. Lubrication increases comfort; placing suppository in touch with vaginal wall helps ensure absorption.</td>
</tr>
<tr>
<td>7. Instruct the client to maintain her position for 5 to 10 minutes.</td>
<td>Helps ensure proper absorption of the drug as the drug melts.</td>
</tr>
<tr>
<td>8. Reposition the client for comfort and remove the protective pad.</td>
<td>Helps ensure client's right to comfort.</td>
</tr>
<tr>
<td>9. Perform post-administration procedures as for all drug administration routes described previously.</td>
<td>Helps ensure consistent and safe practice.</td>
</tr>
</tbody>
</table>
## Vaginal Cream or Foam

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Perform pre-administration procedures as for all drug administration</td>
<td>Helps ensure consistent and safe practice.</td>
</tr>
<tr>
<td>routes described previously.</td>
<td></td>
</tr>
<tr>
<td>2. Instruct client to void.</td>
<td>Improves client comfort.</td>
</tr>
<tr>
<td>3. Provide privacy and position the client as for vaginal suppository</td>
<td>Helps ensure proper drug absorption.</td>
</tr>
<tr>
<td>insertion. Use an alternate position as needed to help ensure proper</td>
<td></td>
</tr>
<tr>
<td>insertion of drug.</td>
<td></td>
</tr>
<tr>
<td>5. Expose and hold the vaginal labia with your nondominant hand.</td>
<td>Helps ensure proper insertion of the drug into the vagina.</td>
</tr>
<tr>
<td>6. Gently insert the applicator into the vaginal vault as far as it will</td>
<td>Increases client comfort; insertion far into the vaginal vault ensures that</td>
</tr>
<tr>
<td>reach and dispense the medication.</td>
<td>the medication reaches the target site.</td>
</tr>
<tr>
<td>7. Gently remove the applicator and replace the cap or place the</td>
<td>Increases client comfort; prevents contamination of the applicator.</td>
</tr>
<tr>
<td>applicator on a clean paper towel.</td>
<td></td>
</tr>
<tr>
<td>8. Instruct the client to maintain the lithotomy position for 5 to 10</td>
<td>Helps ensure proper absorption of drug.</td>
</tr>
<tr>
<td>minutes with hips elevated.</td>
<td></td>
</tr>
<tr>
<td>9. Perform post-administration procedures as for all drug administration</td>
<td>Right Documentation</td>
</tr>
<tr>
<td>routes described previously, including proper cleaning and storage of the</td>
<td></td>
</tr>
<tr>
<td>vaginal applicator.</td>
<td></td>
</tr>
<tr>
<td>10. Reposition the client for comfort.</td>
<td></td>
</tr>
</tbody>
</table>

## Rectal

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Perform pre-administration procedures as for all drug administration</td>
<td>Right Drug, Time, and Client</td>
</tr>
<tr>
<td>routes described previously.</td>
<td></td>
</tr>
<tr>
<td>2. Instruct the client to vacate (move) bowels if possible prior to</td>
<td>Right Amount, Route</td>
</tr>
<tr>
<td>procedure.</td>
<td></td>
</tr>
<tr>
<td>3. Provide privacy and position the client in left Sims’ position (on</td>
<td>The left Sims’ position helps ensure that the drug reaches the rectal mucous</td>
</tr>
<tr>
<td>side with knee bent and flexed upward and over opposite, straightened</td>
<td>membrane.</td>
</tr>
<tr>
<td>leg; arm bent at elbow and resting on pillow).</td>
<td></td>
</tr>
<tr>
<td>4. Don gloves and expose the anus.</td>
<td>Helps ensure proper insertion of drug.</td>
</tr>
</tbody>
</table>
5. * For a suppository, lubricate as for the vaginal route and insert per vaginal suppository, being sure to insert the suppository past the rectal sphincter and at least 2 to 4 inches into the rectum. For cream, insert the nozzle of the applicator gently into the anus and expel the desired amount of drug. Helps ensure proper contact with the rectal wall and subsequent melting and absorption of the drug. Placing the suppository past the rectal sphincter discourages the client's physical urge to expel it. Gently remove your gloved finger and carefully apply pressure to the anus with a gloved hand and tissue.

6. Instruct the client to maintain position for 5 to 10 minutes. Helps ensure proper absorption of drug.

7. Perform post-administration procedures as for all drug administration routes described previously, including care and storage of reusable applicators.  

* The average human index finger is 2 inches from the fingertip to the second knuckle; this helps when determining how deep to insert the suppository.

### Special Medication Administration Techniques

#### Aged Clients

Older adults are at high risk for complications due to drug therapy because their ability to absorb, use, and excrete drugs is often affected by age, disease process, and various disabilities. The following are considerations for giving medications to the older client:

- Adapt your method of communicating with the aged client according to his or her ability to understand verbal and written communication.

- Many elder clients are afraid of medications. Be cheerful and explain all medications, their purpose, how you will give them, and what to expect from them. Knowledge is power; the informed client is more likely to be less fearful and more confident in taking medications.

- Involve the client in the medication administration process to increase compliance and promote self-esteem and independence.

- Many clients may take antipsychotics and sedative-narcotics, followed by diuretics, antihypertensives, cardiovascular drugs, antibiotics, and analgesics. Although all the drugs may be appropriate, multidrug use can cause severe side effects and increase the client's risk for falls and other accidents. Be especially careful in observing the client receiving multiple drugs for signs of confusion, delirium, dizziness, or other sudden...
behavior changes or allergic reaction that could lead to accidents or complications in his or her condition. Report all concerns to the nurse immediately.

- When the elder client appears confused, the confusion may have a physical cause, such as an infection (urinary being the most common), not a behavioral disorder. Help the client focus on what you are saying and doing. Report all confusion incidents immediately to the nurse to rule out an infection as the cause for confusion.

- Give medications one at a time, offering small sips of liquid medications to ease swallowing and prevent choking. Even if you can do it more quickly, encourage the client to take the glass of water on his or her own and assist with medications as condition allows (for example, applying lotions and ointments). This encourages independence and self-worth.

- Take your time. Do not rush the client; instead, be patient with the drug administration process. Giving the client sufficient time to take medications will help build trust in you and cooperation from the client.

- Ask the nurse to obtain a liquid form of the medication if choking is an issue. If a liquid form is not possible, crush the medication, if allowed, in a small amount of palatable food. Be aware that all the mixed medication must be taken; use the smallest amount possible to deliver the dose.

- If the elder client becomes concerned that a medication looks different and refuses to take it, do not argue with the resident; instead, hold the medication, documenting the cause, and immediately report the incident to the nurse.

- Review with clients the need for medications that seem (to the client) to be no longer needed when their symptoms subside, such as with antibiotics. Reinforce the nurse’s teaching (that is, the need to take the medication until it is all gone to help ensure the infection is gone as well). Simple explanations and a cheerful attitude on your part will help ensure compliance and contribute to the healing process.

**Clients with Physical Limitations**

- Clients who have trouble seeing or hearing are sometimes fearful of caregivers and medications, especially if they do not understand your purpose or the procedure.

- Use various means to communicate with the hard-of-hearing client (for example, pictures, diagrams, speaking slowly and in a low tone of voice on the client's unaffected side). Stand facing the client so that he or she can read your lips.

- Speak slowly and distinctly to vision-impaired clients and help direct their hand to a glass of water, straw, or other medication assistive device whenever possible to increase participation and ease anxiety.
With a client who has hemiparalysis (paralysis on one side of the body), use a form of medication that is easier to swallow or, if unable to swallow, ask the nurse to get an order for a more acceptable route of administration.

Never speak for clients who have trouble with verbal expression unless they ask you to do so.

**Aphasic** clients (those who cannot speak) may communicate via computer communication device such as Opus Communication. (See more details at http://www.fairfaxcounty.gov/aaa/pdf/ombudsman/commcogimp.pdf.)

With a client who can swallow without difficulty but cannot sit upright, ask another caregiver to help position the client for safe ingestion of the medication. Reposition the client for comfort following medication administration.

Be very patient with physically challenged clients. Never rush them.

**Clients Refusing to Take Medications**

Discover the cause of the client’s resistance and participate in calming the client as much as possible before medications are due. Pace ADL (activities of daily living) to provide rest and prevent overstimulation and subsequent resistance as much as possible:

- Approach the combative client in a calm and reassuring manner, speaking slowly and clearly.
- Ask for assistance as needed to maintain a safe distance as you approach the client.
- Do not stand over a combative client; this is a sign of aggressiveness.
- Stand with your side to the client’s front to give you space to leave the immediate vicinity if threatened.
- Explain simply and in few words your purpose; give the client time to understand your message.
- Do not force the combative client to take medications; this is a form of assault, otherwise.
- Never argue with the combative client; try distractions, not confrontation, to relieve anxiety or anger.
- Despite your calm and reassuring approach and careful explanations, the client may refuse the medications and remain combative. If so, hold the medications, chart the hold and the reason, and report the incident to the nurse.
Noncommunicative Clients

Because of disease or infirmity, the client might not effectively communicate with you. Remember, the client might be able to hear and understand you but cannot respond in a way that you would recognize; or the client might communicate with you in terms of gestures, posturing, or facial expressions that might not be familiar to you, especially if you do not know the client well. To preserve his or her dignity, treat the client the same as you would any other client. That is, introduce yourself and your purpose, explain slowly and clearly all medications and their purpose, how you will give them, and what to expect from them. The following are other tips for communicating with the noncommunicative client:

- Use concrete, short sentences to explain your purpose, medications, their use, and expected effects.
- Use writing, gestures, or pictures to explain/communicate with the client.
- If questioning, ask only one question at a time and repeat as needed.
- Repeat instructions or explanations as needed to increase understanding and cooperation from the noncommunicative client.
- Never rush the client; instead, show patience. This increases the client’s self-esteem and dignity while helping to ensure a clear understanding of the medication administration process and the client’s compliance with it.
- Assess nonverbal responses of the client that show understanding (for example, head nodding, directed eye gaze, smiling, hand signaling [thumbs up], posturing, or other gesture meaningful to the client to indicate understanding).
- Observe for meta-communication (the overall message from the client). For example, the client might smile, seemingly agreeing with what you are asking or saying but become tearful at the same time. Carefully observe this and check understanding before assuming the client’s main meaning/feedback.
- Spend as much time as possible with the noncommunicative client as with other clients who do seem to communicate.
- Use every opportunity to improve communication with the client to establish a therapeutic relationship as soon as possible (that is, a caring relationship that helps the client maintain dignity, a sense of self-worth, well-being, and a connection with reality and others).
Post-Administration Procedures

The following are important steps to take to ensure safe administration of medications.

**Client Comfort**

- Reposition the client for comfort. Be sure the client is in good alignment.
- Replace glasses or check to see that hearing aids are in place and turned on.
- Make sure that the call light or other communication device is readily available.
- Assess the client for any untoward effects of the medication and report any concerns. For PRN medications, reassess as needed to check that the drug is acting as intended (at least within 15 to 30 minutes and 1 hour after administration). Continue to observe and document results of the PRN medication.
- Answer client requests before leaving the room.

**Client Environment**

Remove all medication supplies and trash.

✓ Complete safety check before leaving the room:

- Bed is in the lowest position with wheels locked.
- Lights are readjusted for comfort and safety.
- Assistive devices are readily available (wheelchair, walker, and so forth).
- TV, radio, or other electronics are operational and within control of client or set per client instructions.
- Unnecessary care supplies are stored safely.
- Floors are tidy and dry.
- Privacy is ensured (close door, pull curtain, and so on).
Right Documentation

- Chart medications using agency procedure/protocols.
- Chart all medications promptly on the MAR, especially PRN medications, so that another caregiver does not accidentally give them again.
- Record all holds, the reason for the hold, and sign the MAR.
- Document the client response to medications, especially PRN meds, to note the intended effect of the drug or lack thereof. If not relieved from analgesic, for example, report the response to the nurse for further actions.
- Sign all entries.
- Ask for a witness when wasting unused narcotic and request a cosignature on the narcotic count record.
- Recheck the MAR to be sure that all medications have been recorded properly.
- Replenish drug supplies and keep the drug cart tidy and orderly.
Exam-Prep Questions

1. What is the best position to place the resident in to administer a vaginal medication?
   ☐ A. Prone
   ☐ B. Lithotomy
   ☐ C. Left lateral recumbent
   ☐ D. Sims’

2. A rectal medication is inserted approximately _____ into the rectum.
   ☐ A. 2 inches
   ☐ B. 5 inches
   ☐ C. 1/2 inch
   ☐ D. 1 inch

3. Which of the following is an incorrect statement regarding the application of nitroglycerin cream?
   ☐ A. Apply the medication to an area of the skin that is not open.
   ☐ B. Rub the cream into the skin.
   ☐ C. Do not place the medication on the same area of skin with each application.
   ☐ D. Apply an accurate dose.

4. When administering medication into the ear canal of an adult, it is important to do what?
   ☐ A. Pull the pinna of the ear down and back
   ☐ B. Push the ear tragus forward
   ☐ C. Not touch the tragus of the ear
   ☐ D. Pull the pinna of the ear up and back

5. Instilling nasal medication requires the medication tech to position the patient with
   ☐ A. His/her neck hyperextended as able.
   ☐ B. Lying on his/her back.
   ☐ C. Sims’ position.
   ☐ D. Lying on his/her side.
6. Which of the following medications may be appropriate to crush for easier swallowing?
   - A. Inderal XL
   - B. Contact time-release capsule
   - C. Enteric-coated aspirin
   - D. Tylenol

7. When administering ear drops, you do all of the following except for what?
   - A. Keep the medication in the refrigerator until just before administering it
   - B. Massage the ear after administering the medication
   - C. Remove any cerumen with a clean washcloth that may be blocking the medication instillation
   - D. Administer the medication to the prescribed ear only

8. Frequently used medication that may be kept in the medication room are commonly referred to as what?
   - A. Unit dose
   - B. Computerized dispensing system
   - C. Stock med
   - D. Community shared medication

9. For which of the following individuals would you withhold oral medications?
   - A. A patient who has had a stroke and needs to have liquids thickened
   - B. A patient who is unconscious
   - C. A patient who is blind
   - D. A patient who is awake and alert and has no deficits

10. How long should a patient lie flat after you administer a rectal medication?
    - A. 5 to 10 minutes
    - B. 15 to 20 minutes
    - C. 2 to 5 minutes
    - D. 0 to 2 minutes
Rationales

1. The correct answer is B. The lithotomy helps ensure proper absorption of the drug, and the amount of absorption will be increased by the patient remaining in this position for 5 to 10 minutes after the medication has been administered.

2. The correct answer is A. Helps ensure proper contact with rectal wall and subsequent melting and absorption of drug; placing the suppository past the rectal sphincter discourages the client’s physical urge to expel it.

3. The correct answer is B. Rubbing or massaging the area will increase the rate of absorption, and the nitroglycerin dose is based on slow absorption of the transdermal route.

4. The correct answer is D. The shape of the adult ear canal is slightly upward, and pulling the pinna upward and back straightens out the ear canal and allows gravity to aid in ensuring the drug reaches affected area.

5. The correct answer is A. It is important to have clear and clean nasal passages to improve the delivery of the drug, and a head tilt is the best position for this to occur.

6. The correct answer is D. Choices A and B are time released, and crushing them may affect the absorption. Choice C is enteric coated, so the medication will begin absorption in the small intestines. If the medication is crushed, it begins absorption in the stomach. Choice D is correct because there is no biochemical or physical consideration for not crushing it.

7. The correct answer is A. It is best to give ear medications at room temperature because cold drops may cause vertigo. Choices B, C, and D are all correct steps in administering ear medication.

8. The correct answer is C. Choice A, unit dose, refers to individual medications for one-time use. Choice B is a system for dispensing one-time use medications. Choice D should not exist. Each patient is issued his or her medications and may be charged for each use.

9. The correct answer is B. A patient who is unconscious has a greater chance of choking when given medication by mouth. Choices C and D do not hinder swallowing oral medications. Choice A may require the Medication Aide to test swallowing before giving medications but does not necessarily preclude the patient from swallowing oral medications.

10. The correct answer is A. For the best absorption of the rectal medication, it is best for the patient to continue to lie in a Sims’ position or prone for 5 to 10 minutes after the medication is administered. Choices C and D are too short of a time period, and choice B is too long.
CHAPTER SEVEN

Medications Affecting the Cardiovascular System

Medical Term Hot List

✓ Aldosterone
✓ Anemia
✓ Aneurysm
✓ Angina
✓ Angiogram
✓ Angiography
✓ Angiotensin converting enzyme inhibitor (ACE)
✓ Angiotensin II receptor blocker
✓ Anorexia
✓ Anticoagulant
✓ Antihypertensive agent
✓ Antilipemic
✓ Apical pulse (AP)
✓ Atrioventricular node (AV)
✓ Anticoagulant
✓ Antidysrhythmics
✓ Antilipidemic
✓ Antiplatelet agents
✓ Aortic valve
✓ Apex of heart
✓ Apical pulse
✓ Arrhythmia
✓ Arteries
✓ Arteriosclerosis
✓ Atherosclerosis
✓ Atria
✓ Auscultation
✓ Autonomic
✓ Beta-adrenergic blocking agent
✓ Blood pressure
✓ Brachial pulse
✓ Bradycardia
✓ Calcium channel blocker
✓ Capillaries
✓ Cardiac
✓ Carbon dioxide
✓ Cardiac arrest
✓ Cardiac catheterization
✓ Cardiac enzymes
✓ Cardiac muscle
✓ Cardiac output
✓ Cardiology
✓ Cardiomegaly
✓ Cardiomyopathy
✓ Cardiopulmonary resuscitation (CPR)
✓ Cardiotoxic
✓ Coronary
✓ Carotid pulse
✓ Cerebral vascular accident (CVA)
✓ Cholesterol
✓ Circulation
✓ Compensate
✓ Conductivity
✓ Congestive heart failure (CHF)
✓ Coronary
✓ Coronary artery disease (CAD)
✓ Cyanotic
✓ Deep vein thrombus (DVT)
✓ Defibrillation
✓ Dehydration
✓ De-oxygenated
Diarrhea
Diastole
Diastolic pressure
Digitalization
Diuretic
Dyspnea
Echocardiogram
Edema
Electrical conductive activity
Electrocardiogram (ECG)
Electrocardiograph
Embolus
Emb-emia
Enhance
Femoral pulse
Fibrillation
Flutter
Gynecomastia
Heart
Heart valve
Heart valve prolapse
High-density lipoprotein (HDL)
Homeostasis
Hyper-
Hyperlipidemia
Hypertension (HTN)
Hyponatremia
Hypokalemia
Hypotension
Implantable cardioverter defibrillator (ICD)
Inferior vena cava
Inotropic agents
Intake and output (I & O)
Intercostal space (ICS)
Intermittent claudication
Intra-
Intravenous (IV)
Ischemia
Jaundice
Left ventricular hypertrophy (LVH)
Lipid
Lethargy
Low-density lipoprotein (LDL)
Lumen
Lymphatic system
Malaise
Mitral valve
Mm Hg
Murmur
Myocardium
Myocardial infarction (MI)
Neurologic
Nitrates
Nodes
Orthostatic hypotension
Oxygen
Oxygenated
Pacemaker
Palpitations
Paroxysmal atrial tachycardia (PAT)
Pathophysiology
Percutaneous transluminal coronary angioplasty (PTCA)
Peripheral vascular disease (PVD)
Phlebitis
Platelets
Premature atrial contraction (PAC)
Premature ventricular contraction (PVC)
Pulmonary
Pulse
Phlebitis
Plaque
Platelet aggregation inhibitor
Precordial
Pre-infarct
Pulmonary circulation
Pulmonary edema
Pulse (P)
Radial pulse
Raynaud's phenomenon
Regurgitation
Renal
Risk factor
Sclerosed
Septa
Statins
Stent
This chapter is the first of several chapters reviewing basic body structure and function and the most common illnesses and conditions that affect them, as well as the most common drugs used to treat them. Remember, a review is not an exhaustive study, but is instead a recall of key information about the anatomy, physiology, pathophysiology (study of disease), and drug treatment of each body system. For further preparation for the certification exam, study your course textbook and other course materials in more depth. This is particularly important when correcting missed questions on the exam-prep section of each of the following chapters. As for previous chapters, the goal of review is to remember the safe administration of various drugs and other treatments to assist clients with common diseases and conditions affecting each body system.

Cardiovascular Structure and Function

The cardiovascular system (also called the circulatory system) is the system of the body containing the heart and the blood vessels. Both work together as the “pump” (heart) and the “pipes” (blood vessels), a complex set of muscles, nerves, and blood vessels (arteries) that serve to circulate oxygen-rich (oxygenated) blood to the body’s organ systems; veins remove de-oxygenated (no-oxygen) blood and chemical wastes from the body through various elimination mechanisms. The circulatory system has two parts: the pulmonary (lung) circulation and the systemic circulation (that is, blood circulating throughout the rest of the body). Oxygen, a gas, is the necessary fuel for sustaining life at the cellular level, then the tissue level, the organs next, and finally, the systems of the body. Carbon dioxide, also a gas, is one end product of metabolism, a waste that must be eliminated from the body to maintain a steady state/balance within the cells.

EXAM ALERT

It is through the pulmonary circulation (possible through circulating oxygen breathed into the lungs) and the heart pumping blood through the arteries (through muscular squeezing of the blood) that the oxygen circulates through the body to reach the cells. Other system nutrients are delivered in the same manner.
The veins (valve-filled blood vessels) carry de-oxygenated blood, carbon dioxide, and chemical wastes back to the heart and lungs to be exhaled and to the liver and kidneys where they are filtered and eliminated. With each breath, the process is repeated to maintain balance, a steady state, or homeostasis.

The lymphatic system is also part of the cardiovascular system, serving as the waste control/“sewage system” that removes metabolic waste products from the body.

The heart, a muscular pump, has four chambers, or sections. The cardiac/heart muscle contracts, or beats, approximately 60 to 100 times a minute, or 100,000 times each day. With each contraction, the heart pumps/ejects blood to the large arteries that deliver the blood throughout the body. Each heartbeat, or pulse (P), is felt as a thump beneath the examiner’s fingers when the artery is close to the body surface. For example, the pulse felt at the wrist is known as the radial pulse; the elbow, the brachial pulse; the carotid pulse is located on the side of the neck near the trachea; at the temple is the temporal pulse; and in the groin area, the femoral pulse can be felt. As mentioned previously, the normal pulse rate is 60 to 100 beats per minute (BPM).

**EXAM ALERT**

An abnormally slow heart rate is called bradycardia; tachycardia is defined as an abnormally fast heart rate.

The heart, a pear-shaped organ about the size of the fist, is located more to the left side of the body, with its tip, or apex, at the fifth intercostal space (5th ICS), or between the fifth and sixth rib at the sternum’s (breastbone) bottom. It is here that the apical pulse can be heard and even felt. Three thick layers of the heart (epicardium/outer layer, endocardium/inner layer, and myocardium/middle layer) work together to provide blood flow by supplying the necessary pressure, friction, and propulsion to move the blood to the systems for normal use.

The four chambers of the heart (the two upper and the two lower cavities) divide the heart into right and left sides. The septa, or walls that separate the two sides, help keep the oxygenated and de-oxygenated blood from mixing. The atria, or top chambers, receive blood from the body systems; the right atrium receives blood from the head, trunk, and extremities; the left atrium receives blood from the lungs. The ventricles, the lower chambers, are the pumping chambers that eject blood out of the heart into the lungs and the great arteries. The alternate filling and relaxing of the atria and ventricles is important to maintain sufficient pressure in the arteries to maintain efficient blood flow. When a chamber is relaxed, it fills with blood; this phase is called diastole. When the chambers contract, the phase is known as systole, the working phase, or systolic phase.

Four valves (aortic, pulmonic, tricuspid, and mitral) serve as gates to regulate how much blood enters each heart chamber as well as the lungs. They function to keep blood flowing in
only one direction, preventing it from returning to the previous chamber after contraction (called *regurgitation*). It is from the forceful shutting of the heart valves that the “lub dupp” sounds can be felt (taking the pulse) or heard directly with a *stethoscope* (instrument to *auscultate*, or listen to the heartbeat within the chest).

The *autonomic* (automatic) nervous system controls the heartbeat; it is an automatic conduction process that consists of nervous signals that cause the heart’s tissues, called *nodes*, to generate electrical impulses to all the different heart chambers to contract in a specified order. The electrical *conductive activity* can be recorded as waves on paper within an *electrocardiograph* (a machine that measures and records the conduction activity of the heart). The electrocardiogram, ECG/EKG, is a record that gives the *cardiologist* (a physician who specializes in the study of the heart) a picture of the health of the myocardium.

As an organ, the heart must be nourished with oxygen to function normally. This is done through the *coronary* (pertaining to the heart) arteries. Other large arteries, like the *aortic artery*, branch off the heart and supply blood to the rest of the body. As the aorta descends through the body, it branches into smaller and smaller arteries, then even smaller arteries, called *arterioles*, finally delivering oxygenated blood to the cells via the tiniest blood vessels, the *capillaries*.

Through the help of valves within them and the pressure of contracting muscles against them, the large veins carry de-oxygenated blood back to the heart to be replenished with oxygen through the pulmonary circulation. Like the large arteries, veins become smaller and smaller, ending in *venules*, then in capillaries at the cellular level, where de-oxygenated leaves the cells for the return trip to the heart.

The force exerted on the arteries by the circulating blood, which reflects the health of the atria and ventricles, is called the *blood pressure* (BP).

**EXAM ALERT**

The systolic pressure reflects the contracting ventricles; the diastolic pressure, the contracting atria at rest when the blood fills these upper chambers. These pressures are measured with a *sphygmomanometer*, which is an instrument that contains an occlusive cuff with rubber bladder and a pressure bulb with release valve used to inflate and deflate the cuff while measuring the amount of pressure on the arteries with resultant sounds heard with the earpieces of a stethoscope or by an electronic device. The pressures are expressed in millimeters of mercury; they are recorded in two numbers, with less than 120 for the systolic pressure and less than 80 being the normal diastolic blood pressure for the adult.

**EXAM ALERT**

Hypertension is the medical term for high blood pressure; hypotension (*hypo*: under, below, or less tension) describes low blood pressure.
Introduction to Cardiovascular Disorders

Cardiovascular illnesses are the leading cause of death in the United States. Several factors, controllable and uncontrollable, can put an individual at risk for developing cardiovascular disease.

**EXAM ALERT**

<table>
<thead>
<tr>
<th>Controllable Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ Sedentary lifestyle</td>
</tr>
<tr>
<td>▶ Stress</td>
</tr>
<tr>
<td>▶ Obesity (an epidemic in this country)</td>
</tr>
<tr>
<td>▶ Elevated serum lipid levels (hyperlipidemia)</td>
</tr>
<tr>
<td>▶ Cigarette smoking</td>
</tr>
<tr>
<td>▶ Diabetes mellitus (an alarming increase associated with obesity)</td>
</tr>
<tr>
<td>▶ Diet high in saturated fats, carbohydrates, and salt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Uncontrollable Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ Age (risk increasing with age)</td>
</tr>
<tr>
<td>▶ Race (blacks more susceptible than other races)</td>
</tr>
<tr>
<td>▶ Male gender (women equal men in risk factors after menopause)</td>
</tr>
<tr>
<td>▶ Family history (contributes to early atherosclerosis, hardening of the arteries)</td>
</tr>
</tbody>
</table>

Elders living in long-term care facilities are among the high-risk population for developing coronary artery disease. The aging process contributes to the “wear-and-tear” theory in which organ systems wear out over time, become less efficient and effective, and contribute to developing chronic conditions that impact their quality of life. Preexisting illnesses and conditions such as rheumatic fever in childhood, hypertension and high cholesterol, and diabetes mellitus make elder clients targets for coronary artery disease (CAD).

CAD is a disease in which the heart muscle suffers from lack of oxygen and nutrients because of poor cardiac blood flow to the muscle itself. In the United States, white middle-aged men (50% at age 60) and elders are most affected. Atherosclerosis, a condition involving fatty, fibrous plaque/solid lesions, causes a progressive narrowing of the coronary artery (narrowed opening, or arterial lumen); this causes a decreasing flow of oxygenated blood to the myocardium. Using a pipe analogy, a clogged pipe (like the coronary artery) cannot deliver the necessary volume, oxygen, and cellular nutrients needed to maintain normal function.
Fatty substances called lipids can contribute to decreased blood flow to the heart. Lipids are classified as high-density lipoproteins (HDL) (the good fats).

Low-density lipoproteins (LDL) are those “bad, Low-Down Lipids” that contribute to plaque buildup in the blood, a condition known as hyperlipidemia (hyper, means above/excessive; emia, blood). Cholesterol is a fat-like material found in all body cells; it serves as a necessary protective coating (Teflon-like covering) for the cell wall. Dietary fats are converted into cholesterol by the body. Another source of fat comes from animal and vegetable fats, called triglycerides. An abnormal buildup of fats in the arteries from these sources results in atherosclerosis (athera, fat; sclerosis, hardening), which is the culprit for CAD when it accumulates in the coronary arteries.

When lifestyle changes and diet restrictions are not effective, antihyperlipidemic (against excessive blood lipids) drugs may be given. The goal is to reduce the amount of cholesterol in the blood that can cause or worsen CAD.

Elder clients most often take statin drugs (drugs designed to help lower blood lipid levels and prevent the risk of heart attack and stroke).
Table 7.1 lists common antilipemic drugs, their brand and generic names, dosages, and nursing considerations.

**TABLE 7.1 Antilipemic Drugs**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Oral Dose Forms</th>
<th>Daily Adult Dose</th>
<th>Maximum Daily Dose</th>
<th>*Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Statins</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atorvastatin</td>
<td>Lipitor</td>
<td>10mg, 20mg, 40mg, 80mg</td>
<td>10mg to 40mg daily</td>
<td>≤ 80mg daily</td>
<td>Give any time of day</td>
</tr>
<tr>
<td>Lovastatin</td>
<td>Mevacor</td>
<td>10mg, 20mg, 40mg</td>
<td>20mg to 40mg daily</td>
<td>80mg daily</td>
<td>Give at bedtime</td>
</tr>
<tr>
<td>Pravastatin</td>
<td>Pravachol</td>
<td>10mg, 20mg, 40mg, 80mg</td>
<td>40mg daily</td>
<td>Up to 80mg daily</td>
<td>Same</td>
</tr>
<tr>
<td>Simvastatin</td>
<td>Zocor</td>
<td>5, 10 20mg, 40mg, 80mg</td>
<td>5mg to 20mg daily</td>
<td>Up to 80mg</td>
<td>Same</td>
</tr>
<tr>
<td>Simvastatin</td>
<td>Vytorin</td>
<td>10mg/10mg to 80mg/10mg</td>
<td></td>
<td>Simvastatin 80mg Ezetimibe 10mg</td>
<td>Same</td>
</tr>
<tr>
<td>Ezetimibe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Other Antilipemic Agents and Drugs**

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fenofibrate</td>
<td>Tricor</td>
<td>48mg and 145mg tablets</td>
<td>48mg to 145mg daily</td>
<td>≤ 145mg daily</td>
<td>Give with meals</td>
</tr>
<tr>
<td>Ezetimibe</td>
<td>Zetia</td>
<td>10mg</td>
<td>10mg once daily</td>
<td>10mg</td>
<td>Give with or without meals</td>
</tr>
</tbody>
</table>

**EXAM ALERT**

*For All Statins: Do not give with grapefruit juice; it inhibits the metabolism of some statins.

Watch for and record fatigue, anorexia (loss of appetite), malaise (feeling bad), and jaundice (yellowish skin color), and aches, soreness, or weakness.

**Drugs Used to Treat Hypertension**

Primary hypertension (HTN), or high blood pressure, can cause a stroke/CVA (cerebral vascular accident), arteriosclerosis, MI, heart failure, kidney failure, and blindness. It occurs when the systolic blood pressure exceeds 140mm. Hg and the diastolic pressure is 90mm Hg or higher. To lower the risk for CVA, diabetic clients must keep their blood pressure at or below the 130/75 range.
Introduction to Cardiovascular Disorders

The blockage prevents vasoconstriction and lowers aldosterone levels, causing less sodium and water to be retained, all resulting in lowered blood pressure.
Calcium, a chemical element, plays a key role in the nerve signals needed for muscular contractions, normal cardiac functioning, and blood clotting. Calcium travels through channels in the cells, emitting an electrical charge that stimulates nervous responses and, subsequently, contraction of smooth muscles in vascular system. Calcium antagonists (exerting an action that opposes another action) keep calcium ions (electrically charged particles) from crossing the cell wall; this antagonistic action results in vasodilation, which helps reduce the blood pressure. Also called calcium channel blockers, calcium antagonists help prevent dysrhythmias and angina, topics to follow.

**EXAM ALERT**

Alpha-1 adrenergic blocking agents also produce vasodilation, lowering blood pressure by relaxing smooth muscles. Central-acting alpha-2 agents block norepinephrine, a substance that speeds up body functions through sympathetic nervous system stimulation in the brain. Likewise, peripheral-acting adrenergic antagonists lower norepinephrine levels.

**EXAM ALERT**

While the goal of all antihypertensive drugs is to lower the blood pressure, one very serious side effect is hypotension, in which the blood pressure becomes too low. Prolonged hypotension is dangerous for the client because the body’s systems cannot function normally; tissues and organs become starved for blood, oxygen, and nutrients. If blood pressure is not restored to near normal limits, organs can become damaged beyond repair. Shock and death can follow. For these reasons, antihypertensives can produce life-threatening side effects and must be monitored carefully.

**EXAM ALERT**

Orthostatic hypotension, or low blood pressure when standing, is a common side effect that can cause the client to fall and become injured. Before administering antihypertensives, measure the client’s blood pressure lying and standing and record both measures. Notify the nurse to discuss withholding the medication if the client is hypotensive. Weight as well as intake and output (I & O) are important because antihypertensives can cause water retention. In the case of diuretics, output may be excessive, causing dehydration (decreased fluid levels in the blood and tissues). The client receiving diuretics may need to toilet often; this can cause sleeplessness if given at bedtime and may expose the client to falls when getting in and out of bed. Table 7.2 describes common anti-hypertensive drugs and drug-specific side effects.

Table 7.2 lists common antihypertensive agents.
### TABLE 7.2  Common Antihypertensive Drugs

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Oral Dose Forms</th>
<th>Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Furosemide</strong> (loop diuretic)</td>
<td>Lasix</td>
<td>0.5mg, 1mg, and 2mg tablets</td>
<td>Initially, 0.5mg to 2mg</td>
<td>Give with food or milk in the morning to prevent nocturia and stomach irritation. Watch for <strong>orthostatic hypotension</strong>, fainting; abdominal pain or signs of dehydration (muscle cramps, confusion, disorientation); signs of hearing loss; tremors; nausea; <strong>hyperglycemia</strong> in client with diabetes mellitus (DM). Weigh daily; I &amp; O daily.</td>
</tr>
<tr>
<td><strong>Chlorothiazide</strong> (thiazide diuretic)</td>
<td>Diuril</td>
<td>250mg, 500mg tablets</td>
<td>1000mg to 2000mg</td>
<td>Same as above. Report hives, rash, or itching (allergic reaction).</td>
</tr>
<tr>
<td><strong>Spironolactone</strong> (potassium-sparing diuretic)</td>
<td>Aldactone</td>
<td>25mg, 50mg, and 100mg tablets</td>
<td>Initially, 50mg to 100mg daily; maximum dose, 400mg daily</td>
<td>Same as above. Headache, <strong>diarrhea</strong> (loose, watery stool), <strong>gynecomastia</strong> (enlarged breasts) in men.</td>
</tr>
<tr>
<td><strong>Spironolactone, hydrochlorothiazide</strong> (combination drug form)</td>
<td>Aldactazide</td>
<td></td>
<td>One to eight tabs daily</td>
<td>Same as above. Low potassium (<strong>hypokalemia</strong>) or low sodium (<strong>hyponatremia</strong>).</td>
</tr>
<tr>
<td><strong>Captopril</strong> (ACE inhibitor)</td>
<td>Capoten</td>
<td>12.5mg, 5mg, 10mg, 20mg tablets</td>
<td>25mg two to three times daily</td>
<td>Check apical pulse and rhythm. Measure <strong>orthostatic BP</strong>. Observe s/s as for diuretics above.</td>
</tr>
<tr>
<td><strong>Fosinopril</strong> (ACE inhibitor)</td>
<td>Monopril</td>
<td>10mg, 20mg, 40mg tabs</td>
<td>Initial dose: 10mg daily Maintenance dose: 20mg to 80mg daily</td>
<td></td>
</tr>
<tr>
<td><strong>Diltiazam</strong> (calcium channel blocker)</td>
<td>Cardizem</td>
<td>30mg, 60mg, 90mg, 120mg tabs SR (sustained release): 120mg, 180mg, 240mg, 300mg, 360mg, 420mg</td>
<td>Initial dose: 60mg to 120mg SR twice daily Maintenance dose: 240-360mg daily to 540mg daily</td>
<td>Weigh and record I &amp; O daily to watch for edema. <strong>Watch for hypotension or fainting during the first week.</strong></td>
</tr>
</tbody>
</table>
**Nifedipine Procardia 10mg, 20mg caps**

Initial dose: 10mg

Same as diltiazam.

(calcium channel SR: 30mg, 60mg, three times daily) 10mg to 20mg three to four times daily (max dosage 180mg daily)

**Prazosin Minipress 1mg, 2mg, 5mg tabs**

Initial dose: 1mg twice to three times daily (initial) 6mg to 15mg daily in two to three divided doses

Give first dose at bedtime to reduce syncope (fainting); watch for tachycardia, headache, dizziness, drowsiness, weakness, and lethargy (tiredness).

**Clonidine Catapres 0.1, 0.2, 0.3 mg. tablets; PO twice daily (initial) small dose!**

(transdermal patch: 0.1mg/24 hrs 0.2mg/24 hrs 0.3mg/24 hrs)

Initial dose: 0.1mg. PO twice daily (initial) 0.2mg to 0.8mg. daily in divided doses

Safety check: Watch small dose! Effect usually seen in two to three days.

**Note:** Furosemide and all potassium-wasting diuretics require potassium replacement.

**Drugs Used for Angina**

One of the classic symptoms of CAD is angina. Angina is heart pain caused by oxygen starvation by atherosclerotic carotid arteries. It occurs suddenly after exertion or, in severe cases, can develop even during sleep and can awaken the client. Clients with angina describe a squeezing crushing pain and/or tightness below the sternum ( substernal ) or precordial area (area over the heart) that radiates (spreads) to the left arm, shoulder, neck, jaw, or back. They often clutch their chests over their heart when describing their symptoms. Nausea, vomiting, sweating, weakness, fainting ( syncope ), dyspnea ( difficult breathing ), and coolness in the extremities may also be associated with angina. The client may also report indigestion with angina episodes. Unfortunately, a “pre-heart” ( pre-infarct ) attack episode can be mistaken for indigestion; the client often ignores the incident, which can be a lethal mistake.

The heart muscle requires more oxygen when the work demand is higher. Normally, when the heart needs more oxygen, more blood flows to it. In CAD, this is a slower and ineffective process due to narrowed ( stenosed ) or stiff/hardened ( sclerosed ) coronary arteries. Angina
occurs most often during physical exertion, after lasting between 3 and 20 minutes. It can also
occur during emotional stress, after eating a large meal, when smoking (constricts blood ves-
sels), or when exposed to extreme temperatures. Angina is considered stable if it can be con-
trolled by rest, avoidance of the precipitating event (for example, stress), or drug therapy. If
angina worsens (that is, happens more often and lasts for longer periods despite drug therapy),
it is considered unstable. If left untreated, angina can lead to an MI, in which cardiac muscle
is irreversibly damaged, leaving the client with a weakened heart.

You can distinguish between angina and the pain from an acute heart attack by the duration of
the pain. With drugs like nitrates, angina attacks usually subside after 20 to 30 minutes. If angi-
na persists longer than 30 minutes, despite medication, a heart attack may be occurring.

Nitrates are vasodilator drugs; that is, they relax or dilate vascular (pertaining to vessels)
walls so that less force is needed to pump blood through them. Their action reduces oxygen
demand to the heart and reduces the need for oxygen to the cardiac muscle itself. They are
ideal for treating angina.

Nitroglycerin (Nitro-Bid, Nitrostat) is the most effective vasodilator and the drug of choice
for relieving angina. It acts quickly on coronary arteries, bringing relief from angina pain. Its
use also improves the client’s tolerance for exercise and reduces the frequency and severity of
angina attacks. It is most often ordered PRN for angina or can be scheduled daily.

Nitroglycerin tablets are sensitive to light; so, it is often packaged in a dark container and must
be kept tightly closed and away brightly lit areas. Check the expiration date to ensure its poten-
cy. The resident should describe the tablet as having a bitter taste, indicating its freshness. The
prescription should be refilled every few months to maintain a fresh drug supply. Unused
tablets should be discarded.

Nitroglycerin may be left at the bedside to be taken by the client PRN, as needed. The client
should be instructed to tell the staff immediately when nitroglycerin is taken.

It is important to record the number dispensed, the time and amount of drug taken and the
client’s response to the medication. At the beginning of an angina attack, sublingual (SL) nitro-
glycerin or nitroglycerin spray (one to two puffs) can take effect within two minutes. As for any
sublingual medication, the drug should be left in place until it dissolves. Observe the client for
relief of angina; if not relieved within two to five minutes, the usual order is to repeat the dose
times three.

For longer-lasting effect, time-released tablets, capsules, and topical forms of nitroglycerin are
given daily on a scheduled basis.

Table 7.3 describes nitrates, their dosage, action, and dosage ranges.
### TABLE 7.3 Nitrates

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dosage Forms</th>
<th>*Onset</th>
<th>Duration</th>
<th>Adult Dose Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amyl nitrite</td>
<td></td>
<td>0.3mL ampules, for inhalation</td>
<td>0.5 minute</td>
<td>3 to 5 minutes</td>
<td>One ampule, crushed and placed beneath client's nose.</td>
</tr>
<tr>
<td>Isosorbide dinitrate</td>
<td>Isordil</td>
<td>SL tabs: 2.5mg, 5mg, 10mg&lt;br&gt;PO: 5mg, 10mg, 20mg, 30mg, 40mg&lt;br&gt;SR tabs, caps: 40 mg</td>
<td>2–3 minutes&lt;br&gt;30–60 minutes&lt;br&gt;30–60 minutes</td>
<td>1–3 hrs&lt;br&gt;4–6 hrs&lt;br&gt;6–8 hrs</td>
<td>SL: 2.5mg to 10 mg.&lt;br&gt;2.5mg to 30mg. three or four times daily.&lt;br&gt;20mg to 40mg q6–8 hrs; 80mg q8–12 hrs. Give on an empty stomach; if GI symptoms develop, give with food.</td>
</tr>
<tr>
<td>Nitroglycerin</td>
<td>Nitrostat</td>
<td>SL tabs: 0.3mg, 0.4mg, 0.6mg</td>
<td>1 to 2 minutes&lt;br&gt;30 minutes</td>
<td>≥ 30 minutes&lt;br&gt;&lt;br&gt;SL: 0.3mg to 0.6 mg (prophylactic), during attack.&lt;br&gt;Topical: 0.5–4 inches q4–6 hrs. Rotate application sites daily to prevent skin irritation. Avoid touching ointment to prevent absorption on own skin. Discard old patch before applying a replacement. Topical: One patch applied x 12 hrs. Rotate sites. Inspect skin when removing patch; report irritation.</td>
<td></td>
</tr>
<tr>
<td>Nitro-Bid</td>
<td>Nitrostat</td>
<td>Ointment: 2%</td>
<td>30 minutes</td>
<td>3 hrs</td>
<td></td>
</tr>
<tr>
<td>Nitro-Dur</td>
<td>Transdermal: 0.1mg, 0.2mg, 0.3mg, 0.4mg, 0.6mg, 0.8mg / hr patches</td>
<td>30–60 minutes</td>
<td>≤ 24 hrs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitro-Dur</td>
<td>Translingual&lt;br&gt;on tongue: 0.4mg metered spray</td>
<td>2 minutes&lt;br&gt;30–60 minutes</td>
<td></td>
<td>Spray: One to two sprays onto/under tongue; repeat PRN in 3–5 minutes. Prophylactic: 5–10 minutes before exercising.</td>
<td></td>
</tr>
</tbody>
</table>

*Observe client for and record the following:
- Headache (most common side effect)
- Orthostatic hypotension, dizziness, nausea, fainting, flushing, tachycardia
- Tolerance

For all of the above, dosage may be adjusted for maximum drug effect with the least side effects.

Clients receiving nitrates should be instructed/reinforced as follows:
- Be aware of triggers for angina attacks (exercising, excitement, and so on).
- Take a PRN dose 5 to 10 minutes before activity or other trigger.
- Avoid alcohol.
Report all side effects of nitrate administration (dizziness, mild headache, lightheadedness).

- Report immediately severe headache, blurred vision, or dry mouth (all symptoms of possible overdose) to the nurse or physician.
- Discard unused tablets after six months.

### Drugs Used for Arrhythmias

**Arrhythmia** literally means *without rhythm*. A more common term used simultaneously with arrhythmia is the term **dysrhythmia** (difficult rhythm). A dysrhythmia is an abnormal cardiac rhythm caused by abnormal electrical impulses to the cells of the myocardium, “mixed signals” that cause an irregular heart rhythm/rate. Disruptions in the normal conduction system that affect the heart’s rhythm can interfere with heart contractions; altered contractions can decrease cardiac output (CO), the amount of blood pumped with each heartbeat. If the decreased CO is severe enough, death can result.

Arrhythmias can also result from a change in heart rate and rhythm. **Bradycardia** (slow heart rate) or **tachycardia** (faster-than-normal heart rate) can trigger an arrhythmia. Premature cardiac contractions such as premature atrial contractions (PACs) or premature ventricular contractions (PVCs), atrial flutter, or atrial fibrillation (AF) and heart blocks can also occur because of altered heart rate. Further, electrolyte imbalances (potassium, sodium, or calcium levels), decreased oxygen to the heart by any medical event, and structural damage that changes the conduction pathway through the heart and acidosis (a chemical imbalance in cellular metabolism) can contribute to arrhythmias.

Arrhythmias are diagnosed by an electrocardiogram (ECG). Various configurations are recorded on graph paper as the client is connected to an electrocardiograph (EKG) that monitors the heart’s rate and rhythm. Review of each rhythm strip is beyond the scope of this publication. It is important to remember that life-threatening arrhythmias are cause for immediate drug intervention. Drugs used to correct life-threatening arrhythmias (for example, PVCs and VT) are stored in the cardiac emergency drug cart. As these emergency drugs are given IV, it is outside your scope of practice; you cannot administer them and must respectfully deny a nurse’s delegating the task to you. Kindly explain why you cannot give the drugs.

Elder clients often take antidysrhythmic medications. Due to the aging process, they are also more likely to develop adverse effects of these powerful drugs due to slow metabolic rates, decreased **renal clearance**, or the inability to effectively detoxify and excrete drugs or by underlying medical conditions. Therefore, elder clients can develop further arrhythmias, hypotension, congestive heart failure, or renal or liver impairment from taking antidysrhythmics. For these reasons, the dosage for elder clients should be started at a lower level, increased slowly, monitored carefully for severe side effects, and adjusted to achieve the desired effect with the least number of complications.

Table 7.4 outlines drugs used to treat arrhythmias, their indications, and usual dosages.
TABLE 7.4 Drugs for Treating Arrhythmias

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Usual Dosage</th>
<th>Usual Indications (Treatment For)</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procainamide</td>
<td>Pronestyl</td>
<td>50mg/kg daily PO in divided doses (given IM or IV as well)</td>
<td>Life-threatening ventricular arrhythmias</td>
<td>Watch carefully for severe side effects: hypotension, palpitations (“heart running away with me”), signs of CHF. CNS disturbances: Dizziness, drowsiness, muscle twitching, mouth numbness, slurred speech, vision changes, tremors that can lead to convulsions. GI disturbances: Changes in taste, dry mouth, N &amp; V, bloating. Respiratory depression; Derm: Rash, itching; rash; Monitor electrolytes closely. Watch for drug-drug interactions.</td>
</tr>
<tr>
<td>Disopyramide</td>
<td>Norpace</td>
<td>400mg to 800mg daily PO in divided doses</td>
<td>Life-threatening ventricular arrhythmias</td>
<td></td>
</tr>
<tr>
<td>Propanolol</td>
<td>Inderal</td>
<td>10mg to 30mg PO three times daily</td>
<td>Supraventricular (above the ventricles) arrhythmias, hypertension, angina, migraines</td>
<td></td>
</tr>
<tr>
<td>Digoxin</td>
<td>Lanoxin</td>
<td><strong>Digitization</strong> (giving large loading dose to build up drug): 0.75mg to 1.25mg PO, then 0.125mg to 0.25mg daily</td>
<td>Atrial flutter, atrial fibrillation, atrial tachycardia</td>
<td>Check apical pulse (AP) quality and rhythm x one minute before giving drug; withhold if AP ≤ 60 BPM and notify the nurse. Check I &amp; O for hydration. Watch low body mass. Watch for drug-drug interactions: verapamil, quinidine, erythromycin, tetracycline, cyclosporine, or thyroid hormone; other cardiac drugs. Watch with alternative therapies (drug may be less effective). Watch for drug toxicity: N &amp; V, halos around lights, EKG changes. Digibind is the antidote drug used to treat digoxin toxicity. Consult with the nurse to obtain order if Digibind is needed.</td>
</tr>
</tbody>
</table>

From the Library of Scott Kruse
TABLE 7.4  Continued

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Usual Dosage</th>
<th>Usual Indications (Treatment For)</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diltiazem</td>
<td>Cardizem</td>
<td>See table of antihypertensive drugs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amiodarone</td>
<td>Cordarone</td>
<td>800mg to 1600mg daily in divided doses x one to three weeks; then 600mg to 800mg daily x 30 days</td>
<td>Supraventricular tachycardias; atrial fibrillation (AF), atrial flutter (AF), ventricular tachycardia (VT), ventricular fibrillation (VF)</td>
<td>Sleep disturbances, coordination problems, confusion, <strong>dyspnea on exertion</strong>, nonproductive cough, chest pain with respirations, blurred vision, narrowed peripheral vision, halos, anorexia, N &amp; V, constipation, dysrhythmias, skin reactions, photosensitivity.</td>
</tr>
</tbody>
</table>

**Drugs Used for Congestive Heart Failure**

Congestive heart failure was once called dropsy. These conditions include the following:

- **Coronary artery disease (CAD),** in which the heart becomes an inefficient pump after many years of myocardial oxygen starvation, also called **hypoxia**.

- **Cardiomyopathy** (heart muscle disease), the result of a viral infection, alcohol or steroid abuse, or a collagen disorder. The heart no longer contracts or pumps efficiently.

- **Hypertension,** which eventually leads to an enlarged heart muscle (cardiomegaly) due to the heart working harder to maintain normal output against the high pressure in the arteries. The hypertension puts unreasonable demands for oxygen as the heart is forced to work excessively hard all the time.

- **Valvular heart disease,** a condition in which the valves can no longer close effectively (heart valve prolapse). Leakage of high volumes of blood back into the ventricles forces them to work harder to handle the increased blood volume as well as the increased pressure on the ventricles by the overload. The ventricles, stretched over time, wear out from the excessive work demand and, eventually, dilate or enlarge (ventricular hypertrophy) in another attempt to compensate for the increased blood volume.

The entire vascular system suffers as a result of all of these conditions. The heart muscle cannot pump blood effectively, leading to a host of symptoms and complications. If the left ventricle fails to pump efficiently, **left-sided heart failure** can develop. Blood backs up into the lungs, leading to pulmonary vessel congestion. The undue pressure from the backflow forces fluid into the air spaces (**alveoli**) and lung tissue. This causes swelling in the lungs, a life-threatening event called **pulmonary edema.** The client presents with wheezes, gurgling sounds in the lungs, blood-tinged sputum, and dyspnea. The client becomes very anxious in these situations because breathing is difficult. Clients can die from this severe emergency.
If the right side of the heart is affected, blood returning to the right atrium (upper chamber) becomes backlogged in the veins, causing peripheral edema (swelling in the lower extremities); this condition is called right-sided heart failure. When one side of the heart is affected, the other side can fail, which leads to total congestive heart failure (CHF).

Clients in congestive heart failure present with cardiomegaly (seen with ECG or echocardiogram, a sound wave recording the activity of the heart chambers), tachycardia, electrical conduction problems such as atrial flutter or fibrillation, and anxiety. They may also have an audible heart murmur (noising swooshing of blood through a diseased heart valve). CHF clients suffer from edema as described earlier, with left-sided or right-sided involvement. An enlarged liver (hepatomegaly) and decreased blood flow to the GI tract lead to nausea and abdominal pain. Pitting edema (severe pooling of fluid of the lower extremities) can be seen in clients with right-sided failure. Their neck veins bulge. The increased blood flow to the kidney results in a higher volume of urine production, forcing the client to get up and down during the night to void (condition called nocturia). Nocturia can place the CHF client at high risks for falls.

Clients in left-sided failure suffer from dyspnea, difficult and uncomfortable breathing that leads to a panicky feeling. They may need to sleep on more than one pillow to breathe comfortably; this situation is called orthopnea, or dyspnea experienced when lying down. All CHF clients are extremely weak and easily fatigued. Their blood pressure may fall; their skin is pale, but, in severe CHF, they may become cyanotic (blue skin).

The goals of drug therapy in CHF are to prolong life by reducing signs and symptoms, improve exercise tolerance, and improve the client's quality of life. Cardiotonic drugs work to meet these goals by improving the heart's contracting ability, increasing its muscular contraction. Vasodilators, discussed in the section on hypertension, also decrease the workload of the overworked myocardium by relaxing smooth vascular muscle, which decreases the pressure against which the heart muscle has to pump. Relaxation in the veins also causes a pooling of blood in them, decreasing blood volume returning to the heart. Nitrates accomplish vasodilation very well and are particularly effective in treating more severe CHF.

Digitalis, described earlier to treat arrhythmias, also plays an important role in treating CHF. It is an inotropic agent; that is, it increases the force of cardiac contractions. This leads to increased cardiac output, which improves the overall blood supply to the entire body.

Diuretics, also described earlier to treat hypertension, work to increase urination that also serves to increase excretion of sodium and water, reducing the workload on the heart.

**Other Cardiovascular Medications**

**Peripheral Vascular Disease**

Peripheral vascular disease (PVD) affects the vessels in the extremities—that is, the blood vessels (both arteries or veins) in the arms and legs. If arterial in nature, the following examples occur:
Arteriosclerosis obliterans: The term refers to a hardening (sclerosis) in the artery. In the legs, major arteries become narrowed over time by hypertension, diabetes, high blood cholesterol levels, and smoking. A clot can form anywhere along the leg, obstructing normal blood flow and oxygen to the tissues. The tissue hypoxia (lack of oxygen to the tissues) causes an aching or cramp-like pain in the calf of the affected leg, which increases while walking. This on-again, off-again pain is known as intermittent claudication (intermittent, stops and starts; claudication, limping). The pain is relieved with rest. With advanced PVD, the pain does not subside with rest; gangrene is a risk at this point due to prolonged tissue hypoxia.

Deep vein thrombosis (DVT): In this condition, a blood clot forms in the large veins in the lower extremity, causing pooling of blood in the extremity below the clot, pain, purplish discoloration, swelling, and difficulty in walking without severe discomfort.

Raynaud’s disease: Raynaud’s disease is caused by sudden spasms of the blood vessels (vasospasms) in the nose, ears, fingers, or toes, which leads to vasoconstriction (mechanism that reduces, or constricts, the vessel opening of the vessels). Constriction causes tissue hypoxia, which leads to tissue death. The affected tissues whiten from reduced blood flow and then turn blue (cyanotic). Color returns when blood flow returns. Vasospasms can last for a few minutes to hours. In severe cases, ulcers and gangrene may occur. Exposure to cold temperatures, repeated trauma by repetitive motion of fingers (playing piano, for example), arterial diseases, certain drugs, and strong emotions predispose vulnerable adults to Raynaud’s, which affects women more than men. In dark-skinned clients, the color darkens even further.

The goal of drug therapy in peripheral vascular diseases is to improve blood flow and prevent complications related to tissue hypoxia. Pain relief is important to the PVD sufferer as well. Table 7.5 lists common agents used to accomplish these goals.

### TABLE 7.5 Common Agents Used in PVD Cases

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dosage Form</th>
<th>Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vasodilators</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cilostazol</td>
<td>Pletal</td>
<td>50mg, 100mg tabs</td>
<td>≤ 200mg daily</td>
<td>Give 30 minutes ac or 2 hrs post breakfast and dinner. Dizziness, headache, indigestion, diarrhea, <strong>CP, palpitations, shortness of breath</strong>. Notify nurse STAT.</td>
</tr>
<tr>
<td>Papaverine hydrochloride</td>
<td>Pavagen TD</td>
<td>150mg q8 hrs or 300mg q12 hrs</td>
<td>≤ 600mg daily</td>
<td>Measure VS and watch for tachycardia, flushing, sweating, abdominal distress, dizziness, drowsiness, headache.</td>
</tr>
</tbody>
</table>
Thromboembolic diseases: Diseases associated with abnormal clotting within blood vessels are described as thromboembolic (thrombus, or clot; embolic, clot that travels from one location to another). Several diseases in this category can cause death:

- DVT, or deep vein thrombosis (condition of a clot)
- MI (myocardial infarct)
- Dysrhythmias with clot formation
- Coronary artery spasm that causes a clot.

Precipitating events (that is, conditions that give rise to clot formation) include the following:

- Surgery and postoperative recovery period
- Heart failure
- Cancer
- Pregnancy
- Oral contraceptives (OC)
- Immobility that causes pooling of blood in the lower extremities
- Leg trauma

As described in the section on CAD, blood clots in the blood vessels lead to decreased blood flow and oxygen to the cells. Ischemia follows long-term blood flow restriction and, if untreated or severe, the affected tissues die (infarction).

Drug therapy includes the use of platelet inhibitors (drugs that prevent or inhibit platelet aggregation, which is the clumping of those blood cells responsible for blood clotting, or coagulation). Another descriptor used for this drug classification is antiplatelet agent. Aspirin, dipyridamole, clopidogrel, and ticlopidine are categorized this way.
Table 7.6 lists key information about each of these antiplatelet agents.

<table>
<thead>
<tr>
<th>TABLE 7.6 Antiplatelet Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generic Name</strong></td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Aspirin (salicylate)</td>
</tr>
<tr>
<td>Clopidogrel</td>
</tr>
<tr>
<td>Dipyridamole</td>
</tr>
<tr>
<td>Ticlopidine</td>
</tr>
<tr>
<td>Warfarin (anticoagulant)</td>
</tr>
</tbody>
</table>

Many of the clients you care for in the long-term care facility have a cardiovascular condition that requires many different medications. This is why you need to understand as much as you can about how the cardiovascular system works. Much of the information presented in this chapter is very scientific in nature and can be complex. It is important for you to learn about the pathophysiology of cardiac diseases so that you can better understand the way the drugs work in the system.
The best way to learn and remember drugs is to learn their classifications, a broad description of their use, how they act on the body, and common side effects and adverse reactions to expect from them. Remember that classifications that begin with *anti* (against) work to prevent or treat a condition (like hypertension, which is treated with antihypertensive agents). Vasodilators dilate narrowed vessels; hence, the suffix *-dilator*. It is exhaustive and almost impossible for you to know every cardiovascular drug. Those listed in the tables in this chapter are the most commonly used cardiac medications. What you can do is to remember information dealing with the particular classification. By knowing classifications, you can quickly familiarize yourself when new drugs are ordered. If you learn the new drug is classified as an antihypertensive, for example, you already know basic information about the drug. You'll then just need to learn specific dosages, how the drug is given, its side effects, and what to watch for in the client that could be detrimental.

Keeping abreast of new drugs helps keep your client safe while arming you with information with which to answer the client's questions about the need for and the precautions necessary when taking cardiovascular drugs. Cardiovascular drugs are very strong medication that can have severe and life-threatening side effects. Dosages must be absolutely correct to prevent complications because most severe drug reactions come from too strong a dose and from long-term use of the drug. For these reasons, it is crucial that you observe the client closely for any side effects or adverse reactions. Report any changes in the client's condition immediately to the nurse.

Listening is one of the most important skills you can develop in this regard. Your clients know their bodies better than anyone. Do not dismiss the slightest complaint, even if you are unsure of its meaning. Explore further with clients, report and record their statements, and act quickly to report them.

Remember, too, that clients taking cardiovascular medications are often very anxious about their condition. They need your support and patience. To help ease their anxiety, explain the reason, dose, and side effects for each medication you give as best you can. The nurse will answer more in-depth questions to help allay client fears.

Your clients who take cardiovascular medications most likely have been advised by their physician to change their lifestyle (stop smoking, control their diet, and improve their exercise, for example). Long-time habits are hard to break. Clients may wonder why, at their age, they need to stop enjoying high-fat foods, smoking, or other activities (or lack thereof). For these reasons and more, clients may object to taking so many medications. Helping them to focus on the benefits of drug therapy and lifestyle changes can be challenging, but it is necessary to help improve their health and well-being.
Exam-Prep Questions

1. Antidysrhythmic medications are used to treat all of the following conditions except for what?
   - A. Tachycardia
   - B. Hypertension
   - C. Irregular heartbeat
   - D. Hyperlipidemia

2. When starting a patient on a beta blocker for hypertension, the Medication Aide knows that if the patient has which of the following conditions the patient needs to be observed closely?
   - A. Vascular hypertension
   - B. Asthma
   - C. Hyperlipidemia
   - D. Angina

3. Nutrients and oxygen-rich blood are transported to organs and tissues by what system?
   - A. Urinary system
   - B. Lymphatic system
   - C. Cardiovascular system
   - D. Pulmonary system

4. The blood pressure measures the amount of pressure on the arteries. These sounds can be heard with which of the following instruments?
   - A. Sphygmomanometer
   - B. Stethoscope
   - C. Cardiac monitor
   - D. Defibrillator

5. All statins (potent antilipemic medications) have all the following possible side effects except for what?
   - A. Muscle weakness
   - B. Muscle soreness
   - C. Diarrhea
   - D. Anorexia
6. Which of the following medications is used with other antihypertensive medications to enhance their effect?
   ○ A. ACE inhibitor
   ○ B. Beta blocker
   ○ C. Diuretic
   ○ D. Calcium channel blocker

7. Which of the following is not used to treat a patient with high cholesterol?
   ○ A. Lipitor
   ○ B. Persantine
   ○ C. Mevacor
   ○ D. Pravachol

8. Which of the following are two side effects of vasodilators such as nitroglycerin?
   ○ A. Headache and hypotension
   ○ B. Dizziness and weakness
   ○ C. Nausea and vomiting
   ○ D. Anorexia and fatigue

9. Before giving a cardiac glycoside, the Medication Aide first needs to know which of the following about the patient?
   ○ A. Heart rate
   ○ B. Blood pressure
   ○ C. Temperature
   ○ D. Pain level

10. Which of the following statements shows that the Medication Aide needs more education about the medication Cardizem XL?
    ○ A. Hypotension can occur when taking the drug.
    ○ B. The medication can be crushed if needed.
    ○ C. This medication may decrease episodes of angina attacks.
    ○ D. There are no difficulties in taking this medication and antacids at the same time.
Rationales

1. The correct answer is D, the term for high cholesterol levels in the blood. Antidysrhythmics will not affect the cholesterol level. Choice A, tachycardia, is an abnormally fast heartbeat above 100 BPM. Choice B, hypertension, is the term for high blood pressure that be controlled with certain antidysrhythmics. Antidysrhythmics can also be used to treat irregular heartbeats, as in choice C.

2. The correct answer is B. Beta blockers may precipitate severe and potentially fatal bronchospasms when used by a patient with severe asthma. Choice A is incorrect because beta blockers lower the blood pressure. Choice C, hyperlipidemia, is incorrect because beta blockers do not have any effect on cholesterol levels. Choice D is incorrect because beta blockers are used on persons who have had a heart attack to prevent further damage to the heart.

3. The correct answer is C. The cardiovascular system transports oxygen-rich blood from the lungs to the body. As for choice A, the urinary system helps to clean the blood of waste products. As for choice B, the lymphatic system is responsible for transporting and cleaning waste. As for choice D, the pulmonary system transports gases in the body to the cardiovascular system and then transports them out of the body.

4. The correct answer is B. The sounds of the blood pressure are heard through the earpieces of a stethoscope. As for choice A, a sphygmomanometer is used to measure the blood pressure. As for choice C, a cardiac monitor is used to visualize the rhythm of the heartbeat. As for choice D, a defibrillator is used to deliver an electrical shock to the heart to correct an irregular heartbeat.

5. The correct answer is C. Diarrhea is not a usually a side effect of statins. Muscle weakness, muscle soreness, and anorexia are the usual side effects to look for.

6. The correct answer is C. A diuretic is used to enhance the effects of many of the antihypertensive medications. Choices A, B, and D can be used together in some cases if they are not effective on their own.

7. The correct answer is B. All other medications are used to treat high cholesterol levels in the blood.

8. The correct answer is A. Headaches and hypotension are the two most common side effects of a vasodilator. Dizziness and weakness are side effects of hypotension. Nausea and vomiting have not been reported in large numbers as side effects of vasodilators. Anorexia and fatigue are signs of digoxin toxicity.

9. The correct answer is A. Cardiac glycosides work by slowing the heart rate and strengthening the contractions. As for choice B, when the heart begins to pump more effectively, it may lower the blood pressure to a normal range. As for choices C and D, temperature and pain level are not affected by this medication.

10. The correct answer is B. Long-acting medications (XL) are not to be crushed or dissolved. Choices A, C, and D are all correct actions.
This page intentionally left blank
# Chapter Eight

## Medications Affecting the Respiratory System

### Medical Term Hot List

- Acute
- Allergen
- Allergen-antibody response
- Alveoli
- Antibiotic
- Anti-inflammatory agent
- Antihistamines
- Antitussives
- Aortic bodies
- Arterial blood gases (ABGs)
- Arterial carbon dioxide (PACO₂)
- Arterial oxygen (PAO₂)
- Asbestosis
- Aspiration
- Asthma
- Atelectasis
- Barrel chest
- Bronchiectasis
- Bronchi
- Bronchioles
- Bronchitis
- Bronchodilators
- Bronchospasm
- Carbon dioxide (CO₂)
- Carotid bodies
- Cheyne-stokes respiration
- Chronic
- Chronic obstructive pulmonary disease
- Cilia
- Congestion
- Corticosteroids
- Cough reflex
- Cough suppressants
- Decongestants
- Debilitated
- Diaphragm
- Diffusion
- Dyspnea
- Dyspneic
- Edema
- Epiglottis
- Emphysema
- Expiration
- Expectorants
- Expectorate
- Expiration
- Extrinsic
- Exudate
- Hemoptysis
- Histamine
- Humidifier
- Hyperpnea
- Influenza
- Intranasal
- Inspiration
- Intercostal muscles
- Intrinsic
- Larynx
- Mucolytic agents
- Mucus
- Nasal turbinates
- Otitis media
- Oximeter

From the Library of Scott Kruse
## Structure and Function of the Respiratory System

The respiratory system contains two lungs, conducting airways, and associated blood vessels. The job of the system is to deliver the essential gas needed for life, oxygen ($O_2$), to the body tissues, organs, and systems and to exchange it for carbon dioxide, a cellular waste product. Gaseous exchange takes place as air enters the body on inhalation (**inspiration**) and travels through respiratory passages to the lungs. Oxygen in the lungs replaces carbon dioxide ($CO_2$) in the blood; the $CO_2$ is removed from the body on **expiration**, called expiration. Conducting airways move air into and out of the structures (alveoli) in the lungs.

The upper airway is the entryway for air; it contains the nose, mouth, **pharynx** (throat), and **larynx** (voice box). Through these structures, incoming air is warmed and filtered to protect the lower airway from debris. Debris-filled air enters the nose, where it is trapped in the large nose hairs in the nostril, allowing it to be caught in the mucus produced there and removed when the client blows his or her nose. Cilia, tiny hairlike structures in the back of the nasal passage, sweep material/debris back toward the nasopharynx (back of nasal cavity and throat); particulate matter in this area can then be swallowed or **expectorated** (spit out). The expectorated material is called **sputum**, or **phlegm**.

Nervous stimulation in the nasal area acts to cause blood vessels to dilate or constrict in response to an outside to an event; this causes congestion in the nasal passages as a way of protecting the respiratory system from injury. Sneeze is another autonomic nervous system mechanism that helps clear the nasal passages of irritating materials. Air passes from the pharynx into the **larynx** (voice box) and then reaches the **trachea** (windpipe), bypassing the **epiglottis**, a cartilage that closes to protect the airways when you swallow food.
The lower airway contains the trachea, right and left main stem bronchi (large air tubes), secondary bronchi (branches of air tubes), and the bronchioles (smallest airway tubules). The lower airways aid in the gas exchange process. It is in the lower airways that millions of tiny paper-thin air sacs, the pulmonary alveoli, hold inspired air until the oxygen moves across its tiny walls (by diffusion) into the tiny blood capillaries and then to the bloodstream to be delivered to the body. It is in the alveoli, also, where carbon dioxide crosses the thin walls of the alveoli and is exhaled from the body.

The lower airway also protects the body by clearing mechanisms (cough reflex) and by producing mucus, which lines the inner surfaces to the trachea-bronchial tree (respiratory tract—airway and airway tubes that branch out to the alveoli). Special glands within the respiratory tract produce the jellylike substance as a protective response to a “foreign invader” (for example, smoke, bacteria, and other airborne particles); cilia work hard here as they do in the nasopharynx to sweep the foreign particles upward to the upper airway to be expectorated.

EXAM ALERT

The lungs are spongy organs filled with alveoli, blood vessels, and nerves. They are inflated with air and separated from the abdominal organs by the diaphragm (membranous partition separating the abdominal and thoracic cavities). The lungs contain lobes or segments—three on the right, two on the left. The lobes further divide into smaller lobules. It is within the lobules where the alveoli live and work.

Ventilation and perfusion play a key role in determining how much O₂ and CO₂ is exchanged in the lungs. Ventilation is the amount of air in the alveoli; perfusion is the amount of blood in the pulmonary capillaries. The ratio of ventilation to perfusion must be very close for gaseous exchange to be effective. Normally, the alveoli receive air at about 4L per minute; the capillaries supply blood to the alveoli to make gaseous exchange possible at about 5L per minute.

The control center in the brain stem sends neurological impulses down through the phrenic nerves to the diaphragm, then to the intercostal (between the ribs) nerves to the intercostal muscles located between the ribs. There, the impulses control the rate and depth of respirations. Chemical reactions in the blood also help regulate ventilation and perfusion by altering the chemical nature of the blood (that is, the pH), the arterial carbon dioxide (PaCO₂), and the pressure of arterial oxygen (PaO₂). Ratios of these chemicals is crucial in controlling respirations via complex chemical processes. Chemical activity also regulates respirations as the respiratory center receives information from the carotid and aortic bodies (small neurovascular structures in the carotid as well as in the aorta).

EXAM ALERT

Reaction to decreased PaO₂ and PaCO₂ helps increase the drive to breathe as a compensatory mechanism. When the ventilation/perfusion ratio is mismatched, impaired gas exchange occurs. This occurs in most respiratory disorders. Altered gas exchange affects every body system by altering the oxygen delivered to the cells.
Inflammation of the upper respiratory tract leads to several common respiratory disorders. **Rhinitis** (*rhino*, nose; *itis*, inflammation) involves the mucous membranes of the nose. Tissues in the nasal passages swell, becoming ingested; sneezing and nasal discharge (runny nose, or **rhinorrhea**) follow as attempts to protect the nose but become very annoying for the client. Rhinitis occurs as a reaction to allergens, foreign bodies, a deviated **septum** (cartilage separating the two sides of the nose become displaced by an injury), or chronic infection in the sinuses (**chronic sinusitis**).

Seasonal viral infections define the common cold. Sneezing and a watery nasal drip are early signs of a cold; nasal **congestion** (stuffy nose) follows. Other symptoms may include a mild fever, scratchy/throat, and hoarseness. Headache and malaise often accompany a cold, which can last up to a week. Complications might develop, such as **otitis media** (middle ear infection) or **sinusitis** (inflamed/infected nasal sinuses).

All of the previously mentioned symptoms coincide with allergic rhinitis, but the causes are not a virus but a response to an allergen (pollen, house dust mites, grasses, and so on). An **allergen-antibody response** occurs when an allergen sensitizes the body to respond protectively. The body releases **histamine** to fight off the offending allergen. Histamine causes several reactions to occur:

- Dilation of arterioles and capillaries in the offended area that send more blood to the area
- Leakage of fluid from capillaries into extracellular spaces

Both reactions cause signs of rhinitis: redness in affected area; **edema** (swelling) of nasal passages (mucous membranes and **turbinates**); and itchy, watery eyes.

If the reaction is severe enough, hypotension can occur. Edema becomes severe; severe itching follows, and, most alarming, the bronchiole tubes swell and suffer from spasms, which leads to **severe dyspnea**. Unless corrected quickly, the client could die. Instances of sudden death due to a severe allergic reaction are well documented and include death from an insect bite or from food allergy (for example, peanut allergy).

Pneumonia is an **acute** (short-term, lasting less than six months) lung infection of the lower respiratory tract that often impairs gas exchange. It is the leading cause of death from infectious disease, especially in **debilitated** clients (those who are seriously weakened). Pneumonia occurs when a pathogen enters the lower respiratory tract through inhalation, aspiration, the blood vessels, or direct contact with contaminated medical equipment, like a suction catheter.
The lungs look heavy and resemble the liver in bacterial infections. Like bacterial infections, viral pneumonia attacks the outer cells in the bronchi, causing inflammation and a shedding of the cells. As in bacterial pneumonia, the alveoli fill with blood and fluid. Severe infections can lead to acute respiratory distress syndrome (ARDS), a potentially lethal complication.

In aspiration pneumonia, the surfactant, a “Teflon-like” coating in the alveoli that help keep them open, is reduced over a large area; this causes the alveoli to collapse. The high acid level in gastric juices aspirated into the lungs can damage the airways and alveoli alike. Airways become obstructed mechanically by the aspirated particles, causing reduced airflow, which, in turn, leads to secondary bacterial pneumonia.

Many medical conditions, diseases, and procedures put clients at risk for bacterial and viral pneumonia, including the following:

- Chronic illness and debilitation (severe weakening)
- Prolonged bed rest
- Immobility
- Cancer
- Abdominal and thoracic surgery
- Anesthesia
- Colds or other viral respiratory infections
- Chronic respiratory disease, such as COPD, asthma, bronchiectasis, or cystic fibrosis
- Influenza
- Alcoholism
- Sickle cell disease (blood disorder which affects use of oxygen in the cells)
- Tracheostomy (surgical opening into the trachea)
- Smoking
- Malnutrition
- Exposure to toxic gases
- Immunosuppressive therapy (treatment with agents that reduce the immune response)
Elders or debilitated patients, those receiving nutrition via tube feedings, clients with poor oral hygiene, those with a decreased level of conscience (LOC), and patients with poor gag reflex are more susceptible to contracting aspiration pneumonia.

Dyspnea, extreme fatigue, productive cough (often rust-colored sputum), and chest pain are classic symptoms of pneumonia. Chest pain occurs during inspiration; a stabbing, intermittent, severe chest pain can also occur spontaneously. Weight loss, fever, sweats, and chills are also common symptoms.

Drug treatment for pneumonia involves judicious use of antimicrobial agents (those that destroy or lessen microbes/germs) and antibiotics based on blood culture results (blood test to identify bacteria or virus); anti-inflammatory agents help reduce the edema in the respiratory tract.

Pain management and use of oral antitussives (drugs that decrease coughing) and expectorants (drugs that break down/liquefy mucus) are an important aspect of care so that the client can cough more effectively. Mucolytic agents (breaks up mucus) also help manage the exhaustive coughing involved in pneumonia. Details about antitussives, cough suppressants, and expectorants follow. A thorough discussion of antimicrobial and antibiotic drugs follows in subsequent chapters.

Asthma is also a reactive airway disorder, usually chronic in nature (long-term, lasting more than six months); that is, it does not resolve or go away, but can last for years or a lifetime. Asthma involves obstruction of the airway from bronchospasms, increased sputum production, and edema of the lower respiratory tract mucosa. Asthma attacks occur suddenly, are acute in nature, and can be life threatening if untreated.

In asthma, the smooth muscles in the airways become severely constricted by an overstimulation from various sources. Extrinsic sources (sources outside the body) include allergens such as dust, pollen, animal dander, cigarette smoke, feather pillows, food additives, exposure to noxious fumes and temperature and humidity changes, and any other agent that causes sensitization (reaction to a stimulus). Inside the body (sensitization from intrinsic sources), episodes can occur after a severe respiratory infection, emotional stress, or fatigue. As airway obstruction is the main feature of asthma, it is considered as an obstructive lung disorder.

Mild asthmatic clients have no breathing difficulties between attacks. When suffering an attack, they may wheeze (breathe noisily due to constricting airways), cough, or become dyspneic (have difficulty breathing) with exertion. The attacks usually last less than an hour, but can occur once or twice a week.

Clients with moderate asthma have normal to abnormal air exchange, suffer from distress at rest, and develop hyperpnea (abnormally deep and fast respirations) and tachycardia. Attacks can last several days.

Asthmatic clients present with severe respiratory distress and wheezing (indicating marked airway constriction) and contractions (retractions) of the chest wall. They may become cyanotic and gasp for air. Clients under attack from asthma become very frightened, which only makes the attack worse.

Chronic bronchitis is among the chronic obstructive diseases. It develops after several bouts of bronchitis, an inflammation of the bronchi. Risk factors include infections, industrial pollution, and air pollution. Smokers have the highest risk for developing chronic bronchitis. One of the earliest signs is a dry
cough (without mucus), called smoker's cough. It is dry at first, but then, with time, becomes produc-
tive (the cough brings up mucus) and more frequent. Fatigue and dyspnea become a way of life as the
airflow becomes more and more obstructed by inflamed breathing passages and mucus. Respiratory
infections are particularly dangerous to clients with this chronic condition and should be avoided as
much as possible. Once contracted, infections should be treated promptly and aggressively.
Chronic bronchitis can eventually lead to pulmonary hypertension due to inflamed bronchial wall and
spasms of pulmonary blood vessels from prolonged hypoxia (abnormal levels of oxygen). Right ven-
tricular hypertrophy develops with right-sided heart failure, liver engorgement, and edema in the
lower extremities. Drug therapy is a crucial part of the care plan, which includes respiratory therapy,
lifestyle changes (for example, stopping smoking), and breathing exercises to improve respirations.
Enlarged, stretched alveoli account for one of the most dreaded chronic diseases, emphysema. In
emphysema, affected alveoli lose the elasticity needed to help them exchange oxygen and carbon
dioxide at the capillary level. Damaged alveoli trap the air inside them, eventually causing the client
to develop a barrel chest, in which the front-to-back diameter (AP) of the chest increases in an attempt
to compensate for the damage.
Smoking is a primary cause of emphysema. Other pollutants cited previously that cause asthma con-
tribute to this disease as well.
Clients with emphysema present with shortness of breath (SOB) on exertion; later, they become dysp-
neic at rest and cough frequently, which only adds to their fatigue. They struggle to breathe in and out,
using accessory muscles to help them breathe (for example, intercostal muscles as well as neck mus-
cles). They often try to sit up and lean forward in an effort to ease their dyspnea.
Emphysema is an incurable illness but can be controlled with respiratory therapy, smoking cessation,
expectorants, bronchodilators, and antibiotics for specific infections. The goals of therapy are to pre-
vent complications, ease discomfort, and improve the client's way of life.
Cancers of the upper respiratory tract include head and neck cancer. While incidences of oral and
laryngeal cancer are relatively low (about 5% of all cancers), their effects are devastating. Loss of
speech and disfigurement are among the features of cancers in these areas. Although the cause of
upper respiratory tract cancers is unknown, smoking and alcohol are high on the list of causative fac-
tors. Hoarseness that does not go away is one of the first signs of upper respiratory cancer. Surgical
removal of the cancer is the treatment of choice, often followed by chemotherapy and radiation if the
cancer is extensive.
Lung cancer is the leading cause of all cancer deaths. It may be considered primary, or begin in the
lungs or be identified as a metastatic cancer, meaning it develops from cancer elsewhere in the body.
Cigarette smoke, again, is directly linked to lung cancer.
Vague symptoms occur early in the disease; for example, a productive cough may prolong a trip to the
physician. Clients with chronic bronchitis, often smokers, may ignore this symptom as they endure
coughing episodes every day. Others may mistake the cough for a stubborn cough or lung infection.
Later, unexplained weight loss, anorexia (loss of appetite), severe fatigue, spitting up blood (hemopty-
sis), and dyspnea become alarming and prompt clients to seek medical attention. Surgery, chemother-
apy, and radiation are necessary to treat the cancer.
The Upper Respiratory Tract

EXAM ALERT

Antihistamines are the drugs of choice to treat allergic rhinitis. Antihistamines do not prevent histamine release but lessen associated symptoms related to it. They act to reduce histamine release that gives rise to itchy, watery eyes, sneezing, and tearing. They are given in oral form or sprayed into the nose. They do not reduce nasal congestion. They work best when taken on a schedule an hour or so before exposure to an allergen. They increase heart rate and dry secretions and dilate the pupil. Carefully supervise their use in clients with glaucoma, prostate enlargement, or asthma, common conditions in elders. Table 8.1 outlines common antihistamines.

<table>
<thead>
<tr>
<th>TABLE 8.1 Antihistamines</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generic Name</strong></td>
</tr>
<tr>
<td>Cetirizine</td>
</tr>
<tr>
<td>Chlorpheniramine maleate</td>
</tr>
<tr>
<td>Diphenhydramine hydrochloride</td>
</tr>
<tr>
<td>Loratadine</td>
</tr>
</tbody>
</table>

Decongestants work to temporarily relieve congestion in the nasal mucosa by constricting their engorged blood supply, which, in turn, shrinks swollen mucous membranes and turbinates (soft skin folds in the nares that help filter incoming air). They are intended for short-term use only because prolonged use can produce a rebound effect and worsen the...
symptoms. They must be used cautiously with hypertensive clients and with those with heart disease, diabetes, and prostate enlargement. Because older clients are among these clients, they are at risk for complications from the use of these drugs. Table 8.2 outlines common nasal decongestants.

**TABLE 8.2 Nasal Decongestants**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Adult Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epinephrine</td>
<td>Adrenalin</td>
<td>0.1% solution</td>
<td>One to two drops in each nostril every four to six hrs</td>
<td>Measure blood pressure. Watch for burning of the nasal passage. Same as previously listed.</td>
</tr>
<tr>
<td>Phenylephrine</td>
<td>Neo-Synephrine</td>
<td>0.125%, 0.25%, 0.5% solution</td>
<td>Nasal solution: 0.25% every three to four hrs</td>
<td></td>
</tr>
<tr>
<td>Pseudoephridine</td>
<td>Sudafed</td>
<td>7.5mg / 0.8mL drops, 15mg, 30mg, 60mg, 120mg, 240mg tabs</td>
<td>60mg PO every six hrs, not to exceed 240mg daily</td>
<td></td>
</tr>
</tbody>
</table>

Decongestants and antihistamines often work together but for different effect. Decongestants reduce swelling but can be sedating. Antihistamines act to reduce the sedation caused by the decongestants. Antihistamines also cause drowsiness and can be used to encourage sleep.

Anti-inflammatory agents are delivered mostly by the intranasal route. They relieve symptoms caused by allergic rhinitis. They are not used to treat colds because most cold symptoms resolve before the agents would have time to work.

Intranasal corticosteroids work when other anti-inflammatory agents are ineffective in treating allergic rhinitis.

**EXAM ALERT**

Nasalcrom (Nasacort; -cort, steroid) is often used in combination with other drugs to prevent histamine release and reduce rhinorrhea, sneezing, and itching. To be most effective, it should be used for a two-week to four-week period and discontinued as soon as possible. Nasacort can be given in oral form as a concentrate (100 mg / 5mL). Table 8.3 outlines common intranasal corticosteroids.
### TABLE 8.3 Intranasal Corticosteroids

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Adult Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budesonide</td>
<td>Rhinocort</td>
<td>180 doses/</td>
<td>One or two sprays</td>
<td>Stuffiness, sneezing,</td>
</tr>
<tr>
<td></td>
<td>Aqua</td>
<td>nasal spray</td>
<td>in each nostril</td>
<td>itching, burning of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>canister,</td>
<td>twice daily</td>
<td>nasal passages.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>once daily</td>
<td></td>
<td>Watch for tolerance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>with long-term use.</td>
</tr>
<tr>
<td>Fluticasone</td>
<td>Flonase</td>
<td>120 doses/nasal spray bottle</td>
<td>Two sprays in each nostril once daily</td>
<td></td>
</tr>
<tr>
<td>Mometasone</td>
<td>Nasonex</td>
<td>Same dose as budesonide</td>
<td>Same range as budesonide</td>
<td></td>
</tr>
</tbody>
</table>

### Lower Respiratory Tract

Drugs used to treat lower respiratory tract diseases include expectorants, antitussives, mucolytic agents, and bronchodilators. Two expectorants commonly used in the long-term care setting are guaifensin and potassium iodide. Guaifenesin (Robitussin) helps remove thick mucus, and increase the flow of secretions. Tablets, capsules of liquid forms of guaifensin are given in conjunction with other drugs described previously for this purpose. The drug is well tolerated.

Potassium iodide (SSKI) acts on the bronchial glands to increase secretions and to liquefy mucous plugs and help remove them from bronchial tubes. Used with mucolytics, it is an effective treatment for COPD.

SSKI should be diluted in eight ounces of water, fruit juice, or milk and given three to four times daily.

Unless contraindicated, the client taking the previously mentioned expectorants should drink at least eight to twelve 8-ounce glasses of water daily to help liquefy secretions and improve the effect of these drugs.

Tables 8.4 and 8.5 describe other drugs used to treat lower respiratory tract diseases.

### TABLE 8.4 Antitussives

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Adult Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dextromethorphan</td>
<td>Robitussin, Delsym, Bepylin DM</td>
<td>5mg, 7.5mg, 10mg, 15mg lozenges 7.5mg, 10mg. syrup 5mg, 7.5mg, 10mg, 15mg / 5mL liquid 300mg / 5mL oral, extended release (ER)</td>
<td>10mg to 30mg q4–8 hrs PRN (maximum &lt;60mg to 120 mg daily)</td>
<td>Watch drowsiness, dizziness, N &amp; V.</td>
</tr>
<tr>
<td>Hydrocodone bitartrate</td>
<td>Hycodan</td>
<td>5mg tabs 5mg / 5mL syrup</td>
<td>5mg q4–6 hrs</td>
<td>Controlled substance. May be habit forming with long-term use. Watch sedation.</td>
</tr>
</tbody>
</table>
Beta-adrenergic bronchodilating agents open airways by dilating smooth muscles in the bronchial tree. This dilating effect eases air hunger symptoms in COPD (chronic bronchitis, asthma, and emphysema). Unfortunately, they also stimulate the heart, central nervous system, gastrointestinal system, the uterus, and urinary system. Tachycardia (fast heart rate), palpitations, tremors, nervousness, anxiety, headache, N & V, and dizziness are dose related and causes for careful observation and safety measures. Using inhalation routes for these drugs can reduce serious side effects.

**TABLE 8.5 Bronchodilators**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Adult Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beta-Adrenergic Agonists</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albuterol</td>
<td>Proventil</td>
<td>2mg, 4mg tabs 90mcg aerosol</td>
<td>2mg to 4mg, PO</td>
<td>Give with food. Check pulse rate and rhythm. Report tachycardia post treatment.</td>
</tr>
<tr>
<td></td>
<td>Ventolin</td>
<td>2mg / 5mL syrup Inhalation solution</td>
<td>three to four times daily/Inhalations: Two every 4–6 hrs</td>
<td>Report dysrhythmias, nervous/jittery feelings or palpitations. Exercise safety precautions for dizziness. Reassure for anxiety. Report side effects to nurse: N &amp; V, epigastric pain, abdominal cramps from increased gastric juices. Give with food or milk.</td>
</tr>
<tr>
<td>Metaproterenol</td>
<td>Alupent</td>
<td>0.65mg puff 0.4%, 0.6%, 5% nebulizer</td>
<td>Per package insert instructions</td>
<td></td>
</tr>
<tr>
<td>Terbutaline</td>
<td>Brethine</td>
<td>2.5mg., 5mg. tabs 5mg. every 6 hrs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Xanthine Derivatives</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theophylline</td>
<td>Theolair</td>
<td>100mg, 200mg, 250mg caps; 80mg /15 mL, elixir</td>
<td>9mg to 20mg / kg / 24 hours in divided doses</td>
<td>Give in the evening with food or milk to lessen GI disturbance.</td>
</tr>
<tr>
<td>Montelukast</td>
<td>Singulair</td>
<td>5mg, 10mg. tabs 4mg chewable tabs 4mg granules</td>
<td>10mg once daily</td>
<td></td>
</tr>
</tbody>
</table>

Note: For all inhalants, rinse mouth carefully after inhalation and observe good oral hygiene.
Bronchospasm in COPD can be effectively treated with anticholinergic bronchodilators. These drugs, given with beta-cholinergic agents, work to ease breathing and decrease rhinorhea. Agents such as ipratropium bromide (Atrovent) and tiotropium bromide (Spiriva) are inhaled using a metered dose (carefully measured dose) inhaler per schedule or PRN. Atrovent acts within one to two hours to provide more immediate relief; Spiriva is slower acting and is used to maintain relief over time. Along with the side effects listed in Table 8.5, mild throat irritation and mouth dryness are common complaints when using these two drugs; the symptoms usually disappear with continued use.
Exam-Prep Questions

Match the following medications with the correct classification.

1. Theophylline  
   - A. Beta-adrenergic agonists
2. Sudafed  
   - B. Antihistamine
3. Benedryl  
   - C. Xanthine-derivative
4. Robitussin  
   - D. Nasal decongestant
5. Proventil  
   - E. Antitussive

6. Which two expectorants are commonly used in the long-term care setting?
   - ○ A. Spiriva and Benedryl
   - ○ B. Robitussin and SSKI
   - ○ C. Atrovent and Proventil
   - ○ D. Singular and Loratadine

7. Singulair (Montelukast) is most often used with other medications to control asthma. The most important factor to remember when using Singulair is what?
   - ○ A. Singulair is not a fast-acting drug and cannot be used in the place of a rescue bronchodilator.
   - ○ B. It may reduce the use of a fast-acting bronchodilator over time.
   - ○ C. It may lead to fewer symptoms during the night.
   - ○ D. It may lead to fewer asthma attacks.

8. Bronchospasms in COPD can be effectively treated with which of the following medications?
   - ○ A. Afrin
   - ○ B. Zyrtec
   - ○ C. Hycodan
   - ○ D. Albuterol

9. Which of the following types of pneumonia result in damage to the surfactant level in the lungs?
   - ○ A. Viral
   - ○ B. Bacterial
   - ○ C. Primary
   - ○ D. Aspiration
10. In asthma, the smooth muscles in the airways become severely constricted by an overstimulation from various sources, which may be either extrinsic or intrinsic. Which of the following is not an extrinsic source?

- A. Pollen
- B. Cigarette smoke
- C. Dust
- D. Anxiety

Rationales

1. The correct answer is C. Theophylline is a xantine derivative bronchodilator.

2. The correct answer is D. Sudafed is also known as pseudoephridine. It works to decrease nasal congestion.

3. The correct answer is B. Benedryl is an antihistamine.

4. The correct answer is E. Robitussin decreases the cough response and is classified as an antitussive.

5. The correct answer is A. Proventil is a beta-adrenergic agonists bronchodilator.

6. The correct answer is B. Robitussin and SSKI are both expectorants. As for choice A, Spiriva's classification is a long-acting bronchodilator, and Benadryl is an antihistamine. Choice C is incorrect because both Atrovent and Proventil are bronchodilators. As for choice D, Singular is an leukotriene inhibitor, and Loratadine is an antihistamine.

7. The correct answer is A. All the choices contain correct information about Singular, but the most important information to remember is not to attempt to use Singular as a rescue inhaler.

8. The correct answer is D. Albuterol is a beta 2 adrenergic agonist that results in bronchial smooth muscle relaxation. Afrin is a nasal decongestant. Zyrtec is an antihistamine, and Hycodan is an antitussive with hydrocodone (a narcotic), which, when used in high doses, can cause respiratory depression.

9. The correct answer is D. In aspiration pneumonia, the surfactant is reduced and causes the alveoli to collapse. Aspiration pneumonia results from inhaling foreign matter such as food particles or vomitus into the bronchi. Choice A, viral pneumonia, is an inflammatory response of the lungs to infection. As for choice B, in bacterial pneumonia, the alveoli become inflamed and edematous. Low ventilation follows, but perfusion remains normal. As for choice C, primary pneumonia is caused by breathing in of a pathogen either viral or bacterial.

10. The correct answer is D. Choices A, B, and C are all extrinsic factors that can trigger an asthma attack. Emotions such as anxiety are considered intrinsic factors.
# Medications Affecting the Digestive System

<table>
<thead>
<tr>
<th>Medical Term Hot List</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Antacid</td>
</tr>
<tr>
<td>✓ Antagonist</td>
</tr>
<tr>
<td>✓ Antidiarrheal</td>
</tr>
<tr>
<td>✓ Antiemetic</td>
</tr>
<tr>
<td>✓ Antiflatulent</td>
</tr>
<tr>
<td>✓ Antispasmodic</td>
</tr>
<tr>
<td>✓ Anorexia</td>
</tr>
<tr>
<td>✓ Anus</td>
</tr>
<tr>
<td>✓ Ascites</td>
</tr>
<tr>
<td>✓ Astringent</td>
</tr>
<tr>
<td>✓ Bile</td>
</tr>
<tr>
<td>✓ Bowel incontinence</td>
</tr>
<tr>
<td>✓ Bowel movement (BM)</td>
</tr>
<tr>
<td>✓ Cachexia</td>
</tr>
<tr>
<td>✓ Chyme</td>
</tr>
<tr>
<td>✓ Cirrhosis</td>
</tr>
<tr>
<td>✓ Coating agent</td>
</tr>
<tr>
<td>✓ Colon</td>
</tr>
<tr>
<td>✓ Colorectal cancer</td>
</tr>
<tr>
<td>✓ Constipation</td>
</tr>
<tr>
<td>✓ Crohn's disease</td>
</tr>
<tr>
<td>✓ Defecation</td>
</tr>
<tr>
<td>✓ Dental caries</td>
</tr>
<tr>
<td>✓ Diarrhea</td>
</tr>
<tr>
<td>✓ Digestant</td>
</tr>
<tr>
<td>✓ Distal</td>
</tr>
<tr>
<td>✓ Diverticulosis</td>
</tr>
<tr>
<td>✓ Duodenum</td>
</tr>
<tr>
<td>✓ Dysphagia</td>
</tr>
<tr>
<td>✓ Emesis</td>
</tr>
<tr>
<td>✓ Enzyme</td>
</tr>
<tr>
<td>✓ Eructation</td>
</tr>
<tr>
<td>✓ Esophagitis</td>
</tr>
<tr>
<td>✓ Esophagus</td>
</tr>
<tr>
<td>✓ Feces</td>
</tr>
<tr>
<td>✓ Flatulence</td>
</tr>
<tr>
<td>✓ Gallbladder</td>
</tr>
<tr>
<td>✓ Gastric</td>
</tr>
<tr>
<td>✓ Gastric carcinoma</td>
</tr>
<tr>
<td>✓ Gastritis</td>
</tr>
<tr>
<td>✓ Gastroenteritis</td>
</tr>
<tr>
<td>✓ Gastroesophageal reflux disease (GERD)</td>
</tr>
<tr>
<td>✓ Gastrointestinal prostaglandin</td>
</tr>
<tr>
<td>✓ Gastrointestinal tract (GI tract)</td>
</tr>
<tr>
<td>✓ Gastrostomy</td>
</tr>
<tr>
<td>✓ Halitosis</td>
</tr>
<tr>
<td>✓ Heartburn</td>
</tr>
<tr>
<td>✓ Hematemesis</td>
</tr>
<tr>
<td>✓ Hemorrhoids</td>
</tr>
<tr>
<td>✓ Hepatitis</td>
</tr>
<tr>
<td>✓ Hiatal hernia</td>
</tr>
<tr>
<td>✓ Histamine-receptor antagonist</td>
</tr>
<tr>
<td>✓ Hyperacidity</td>
</tr>
<tr>
<td>✓ Intestinal motility</td>
</tr>
<tr>
<td>✓ Jaundice</td>
</tr>
<tr>
<td>✓ Lavage</td>
</tr>
<tr>
<td>✓ Laxative</td>
</tr>
<tr>
<td>✓ Melena</td>
</tr>
<tr>
<td>✓ Nausea</td>
</tr>
<tr>
<td>✓ Pancreas</td>
</tr>
<tr>
<td>✓ Pancreatitis</td>
</tr>
<tr>
<td>✓ Paracentesis</td>
</tr>
<tr>
<td>✓ Peptic</td>
</tr>
<tr>
<td>✓ Peptic ulcer</td>
</tr>
</tbody>
</table>
Chapter 9: Medications Affecting the Digestive System

Structure and Function of the Digestive System

The work of the digestive system is to change food into nourishment at the cellular level. To do this, food passes through the mouth, where it is chewed and swallowed, broken into smaller pieces. Food travels down through the gastrointestinal (GI) tract/alimentary canal through peristalsis, wavelike muscular contractions that propel the food forward. This long tube contains the mouth, pharynx, esophagus, stomach, small intestine, large intestine, and rectum, ending at the anus (opening at far end of the tract).

The stomach, one of the organs of digestion, is located in the upper-left portion of the abdominal cavity. Its strong muscular contractions and highly acidic juices (gastric juices) break down food into a semisolid solid mass called chyme.

As the chyme makes its way through the GI tract, chemical and mechanical processes act on it. Digestive enzymes, chemical substances, aid in digestion through a series of processes that break the chyme down into basic nutrients that can be used by cells; these include amino acids (made up of proteins), fats, minerals, vitamins, sugars, and water.

It is in the small intestine that nutrients are absorbed into the bloodstream. Each of the three sections of the small intestine, the duodenum, ilium, and jejunum, absorb different nutrients that become fuel for energy production and growth.

The large intestine absorbs water from undigested substances from food. It prepares these solid wastes for elimination through the rectum, the far end, or distal end, of the large intestine.

Disorders of the Gastrointestinal Tract

Gastrointestinal (GI) disorders are among the most common disorders in clinical practice. Causes of GI disorders range to dietary intake, stress, esophageal reflux (backflow of food into the esophagus), and adverse drug effects to more serious peptic ulcer disease (PUD).

Clients who have poor eating habits or who are under high stress, often complain of heartburn, a burning sensation in the pit of the stomach, chest, or throat, and indigestion, and a gassy, bloated feeling in the stomach. Eructation (belching) and passing gas (flatus) are also
common. Belching may also be part of the problem; it is induced by swallowing air along with food and liquids. Passing gas (flatulence) results from the chemical reactions on food that release gases into the GI system.

1. **Gastroesophageal reflux disease (GERD)** is the most common GI disorder, affecting millions of individuals. In this disease, stomach contents, very acidic in nature, flow back into the esophagus (regurgitation); clients describe this backflow as **heartburn**, or a sour stomach. The hyperacidity of the regurgitated material irritates the lining of the esophagus, which causes an inflammatory process called **esophagitis** (-itis, inflammation). Clients suffering from GERD complain of heartburn, its most common symptom.

**EXAM ALERT**

Other signs and symptoms of GERD include the following:

- Bad breath (halitosis)
- Chest pain (especially when lying down)
- Choking sensation (increased pressure of the esophagus on the trachea)
- Dry cough (due to irritated throat)
- Dysphagia (difficulty swallowing)
- Feeling of food stuck in back of throat (esophagitis)
- Hoarseness
- Sore throat (irritated mucosal lining of pharynx)

Foods can be culprits involved in GERD; they include chocolates, caffeinated drinks, fried or spicy foods, onions, garlic, and certain sauces.

**Obese** clients (extremely overweight), those who smoke or use alcohol, and pregnant clients are at risks for GERD. Clients suffering from a hiatal hernia or those with a weakened lower esophagus often develop GERD. A hiatal hernia develops when part of the stomach bulges upward through the diaphragm, the muscle that divides the abdominal contents from the thoracic cavity. Symptoms include chest pain, dysphagia, and heartburn. Unfortunately, clients suffering from a heart attack (myocardial infarction [MI]), often dismiss these symptoms as indigestion.

Mild cases of GERD pass quickly. More severe cases can cause erosions (ulcers) of the lower esophagus; scar tissue in the lower esophagus with prolonged GERD can predispose clients to esophageal cancer.

Lifestyles changes, dietary restrictions, and position adjustments (for example, not lying down after eating and raising the height of the bed) may be enough to relieve symptoms. Drugs that help move food faster through the esophagus and stomach (prokinetics such as Reglan) can help combat GERD. When these changes are not effective, surgery may be needed to prevent further complications.
2. Peptic ulcer disease (PUD). Peptic ulcer disease involves the mucosal lining of the stomach, duodenum, or other part of the GI system. Highly acidic gastric juices irritate these tissues, causing a wearing away or erosion of the mucous membrane; the erosion is called an ulcer. The term peptic refers to digestion by enzymes and secretions in the GI tract. Normally, the walls of the GI tract are protected from gastric secretions. In PUD, the protective barrier is lost and susceptible tissues are damaged by exposure to the powerful enzymes, sometimes described as battery acid.

Pain is a feature of PUD, presenting at different times due to the location of the ulcer. Epigastric pain, a burning, gnawing pain, occurs in the middle of the upper abdomen, when the stomach is empty or between meals. With food intake or antacid drugs (anti-, against acid), the pain usually subsides. Clients with PUD also complain of nausea (sick, uncomfortable feeling in the stomach), vomiting (stomach contents expelled forcefully up through the GI tract through the mouth), and anorexia (loss of appetite). In duodenal ulcers, clients experience pain after eating.

Clients most at risk are those with a family history of PUD, clients under stress, smokers, and those who ingest alcohol and/or spicy foods. Nonsteroidal anti-inflammatory drugs (NSAIDs) can also expose clients to ulcer development.

Acute ulcers, called stress ulcers, can occur with prolonged illness, severe burns, and trauma. This occurs when blood flow to the GI tract is reduced, causing a weakening of the stomach layer and acid erosion. Helicobacter pylori (H. pylori) bacteria have been identified as the cause of chronic ulcers. It is treated by a combination of antibiotics.

Four types of drugs are used to treat ulcers:
- Antipeptic agents
- Histamine-2 (H2) Antagonists
- Prostaglandins
- Proton pump inhibitors (PPIs)

**Antacids**

Antacids (ant, against; acid, sour) / antipeptic agents are popular drugs that are often to neutralize, buffer, or absorb hydrochloric acid (HCL) in the stomach. They do this by reducing the chemical acid level (pH) of the gastric juices. For example, antacids, alkaline in chemical make-up (pH above 3.75), increase the gastric pH from a level of 1 (highly corrosive, battery acid) to a 3 or 4. When alkalines are mixed with acids, they cancel each other out, thus relieving pain and protecting the GI tract. The main ingredients in antacids are magnesium salts (Milk of Magnesia), aluminum salts (Amphogel), calcium carbonate (Tums), and sodium bicarbonate (an alkaline commonly called baking soda). These ingredients may be given alone or combined to provide relief with fewer side effects than if taken alone. Sodium bicarbonate is
seldom prescribed because of its high sodium content and because it can increase gastric acid. Elders may use common baking soda (they call “sodey” or “salts”) for GI upsets. Due to its high sodium level, overuse of bicarbonate is a danger for clients with hypertension (HTN), heart disease, or renal disorders. Further, taking excessive antacids that are absorbable in the intestine can cause **alkalosis**, a dangerous chemical imbalance.

Calcium salts (for example, calcium carbonate), aluminum hydroxide (aluminum salt), and magnesium salts (magnesium hydroxide) are common antacids. Amphogel is the trade name for aluminum hydroxide. Milk of Magnesia is the brand name for magnesium hydroxide.

Calcium and aluminum salts can cause **constipation** (difficulty moving the bowels, or stool); **diarrhea** (loose, watery stool) is a common complaint when using magnesium salts.

Combination drugs include Maalox, Mylanta, Gelusil, and Ampho-Gel.

OTC drugs are readily available and relatively cheap. Because they are not regulated, client education is important to prevent adverse effects of these popular drugs.

Special considerations and instructions to clients should include the following:

- When giving chewable antacids, they must be chewed slowly; do not follow with water.
- Shake antacids given in suspension form.
- Do not give calcium carbonate antacids with milk and milk products.
- Consult with the nurse before giving antacids containing sodium to clients with HTN or cardiac or renal disease.
- Check blood pressure before giving high-sodium antacids to clients with HTN; report to nurse if elevated blood pressure (BP).
- Avoid giving antacids with certain antibiotics such as tetracycline.
- Watch for coffee-ground **emesis** (vomit), which signals GI bleeding.
- Observe for constipation or diarrhea.
- Give antacids one after or two hours before giving other medications (prevents other drugs from being neutralized by the highly alkaline environment that antacids promote in the GI tract).

**Histamine-2 Antagonists**

Histamine release is an immune response to allergic reaction to an allergen or infection. As reviewed in Chapter 8, “Medications Affecting the Respiratory System,” histamine affects the respiratory system by producing protective mechanisms that work to combat an allergen. In the digestive system, histamine stimulates hydrochloric acid (HCL) release in response to a stressor. The increased HCL leads to ulcers and, therefore, must be prevented. **Histamine (H2)-receptor antagonists** (working **against** the action of another drug), or **blockers**, fight against histamine by
competing for receptor sites. When these drugs “win the fight,” they block the histamine from being released, raising the pH of the stomach contents. Table 9.1 outlines common H2 receptor blockers.

### TABLE 9.1 Common H2 Receptor Blockers

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Oral Dose Forms</th>
<th>Adult Dosage Forms</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cimetidine</td>
<td>Tagamet</td>
<td>200mg, 300mg, 400mg, 800mg orally four times a day with meals and at bedtime; 800mg at bedtime; 300mg / 5mL suspension</td>
<td>800mg to 1600mg at bedtime for gastric and duodenal ulcers, GERD: 800mg twice a day or 400mg four times daily</td>
<td>Give with food or milk or as ordered on the Medication Administration Record (MAR). Watch for and report GI disturbances: Anorexia, N &amp; V, Jaundice, Constipation, Diarrhea. Watch for and report CNS changes: Dizziness, Headache, Sleepiness, Slurred speech, Disorientation, Hallucinations.</td>
</tr>
<tr>
<td></td>
<td>Tagamet HB suspension</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>famotidine</td>
<td>Pepcid</td>
<td>10mg, 20mg, 40mg tabs or 10 mg chewable 40mg / 5mL suspension</td>
<td>For duodenal and gastric ulcers: 40mg once daily at bedtime; 20mg twice daily GERD: 20mg twice daily</td>
<td>More potent than other H blockers. Reduce dose in renal or geriatric clients as doctor prescribes.</td>
</tr>
<tr>
<td></td>
<td>Pepcid AC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nizatidine</td>
<td>Axid</td>
<td>150mg, 300mg caps 75mg tabs 15mg / mL suspension</td>
<td>Duodenal, gastric ulcers: 300mg at bedtime; 150mg twice daily GERD: 150mg twice daily</td>
<td>Give 30 minutes before eating to prevent heartburn. Renal and elderly clients need reduced dose as doctor prescribes.</td>
</tr>
<tr>
<td>Ranitidine</td>
<td>Zantac</td>
<td>75mg, 150mg, 300mg tabs; 15mg / mL syrup</td>
<td>300mg at bedtime or 150mg twice daily for gastric, duodenal ulcers GERD: 150mg twice daily</td>
<td>Give 30 minutes before eating to prevent heartburn. Renal and elderly clients need reduced dose as doctor prescribes.</td>
</tr>
</tbody>
</table>

More and more of these H2 blockers are now available OTC. Client education is vital to avoid serious side effects. Note that these drugs should be used on a short-term basis only. Further, excessive doses of these drugs can cause cardiac dysrhythmias and should be used cautiously in clients with coronary heart disease.
**Prostaglandins**

Prostaglandins, fatty acids, live in the GI tract. They act to protect the stomach from the corrosive action of two gastric juices: gastric acid and pepsin. They are given to protect the lining of the stomach lining. Called gastrointestinal prostaglandins, these agents inhibit gastric acid secretion. Misoprostol (Cytotec) inhibits gastric acid secretion and increases bicarbonate and mucous production in the stomach; these two actions protect the stomach lining to prevent gastric ulcers for clients who take NSAIDs and aspirin. High-risk clients (for example, elderly and debilitated clients with a history of ulcers) benefit from Cytotec. The drug is also effective in treating duodenal ulcers in those clients who do not respond to H₂ antagonists. The drug is given with food during NSAIDs therapy. Dosages are 100mcg and 200mcg tablets. Side effects are GI related: N & V, diarrhea, abdominal pain, dyspepsia, and constipation. Symptoms are usually mild and stop after a week or so.

**Proton Pump Inhibitors**

Proton pump inhibitors (PPIs) disrupt the parietal cells’ ability to secrete gastric acid, a key feature of the enzyme system. PPIs work at the secretory sites to block the final step in acid production; stomach acid is decreased as a result. They are intended for short-term use only because gastric cancer has been linked to their long-term use. Table 9.2 lists five PPIs.

<table>
<thead>
<tr>
<th>Table 9.2 Five PPIs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generic Name</strong></td>
</tr>
<tr>
<td><em>Esomeprazole</em></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Generic Name</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>Lansoprazole</td>
</tr>
<tr>
<td>Omeprazole</td>
</tr>
<tr>
<td>Pantoprazole</td>
</tr>
<tr>
<td>Rabeprazole</td>
</tr>
</tbody>
</table>

*Memory tip:* These are best remembered as the *zoles.*
Antispasmodics

The central nervous system (CNS) controls the impulses that affect the GI tract. Special fibers, called cholinergic fibers, release a powerful neurotransmitter (nerve fiber that transmits impulses), acetylcholine. These fibers stimulate the GI tract to produce saliva (spit) and increase peristalsis. Cholinergic fibers act on other areas of the body, as well; that is, they increase body responses, or have a sympathetic effect: increased respirations, blurred vision, increased oral and bronchial secretions, and constriction of the pupils. Antispasmodic agents act on the GI tract as well as on other systems in the body by inhibiting cholinergic activity. The following effects are noted:

- Blurred vision
- Delusions
- Dilated pupils
- Euphoria
- Hallucinations
- Mental confusion
- Orthostatic hypotension
- Paranoia
- Reduced oral and bronchial secretions
- Tachycardia and palpitations

Table 9.3 lists representative antispasmodic agents.

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Adult Dose Forms</th>
<th>Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atropine</td>
<td>Atropine</td>
<td>0.4mg tabs</td>
<td>0.4mg to 0.6mg</td>
<td>Consult with the nurse to measure apical pulse and BP; note the rhythm and report abnormalities. <strong>Watch for CNS symptoms:</strong> Confusion Depression Hallucinations</td>
</tr>
<tr>
<td></td>
<td>Sulfate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dicyclomine</td>
<td>Bentyl</td>
<td>20mg tabs; 10mg, 20mg caps; 10mg / 5mL syrup</td>
<td>20mg to 40mg three to four times daily</td>
<td></td>
</tr>
<tr>
<td>Glycopyrrolate</td>
<td>Robinul</td>
<td>1mg, 2mg tabs</td>
<td>1mg two to three times daily</td>
<td></td>
</tr>
<tr>
<td>Propantheline</td>
<td>Pro-Banthine</td>
<td>7.5mg, 15mg</td>
<td>15mg a.c.; 30mg at bedtime</td>
<td></td>
</tr>
<tr>
<td>Scopolomine</td>
<td>Scopace</td>
<td>0.4mg tabs</td>
<td>0.4mg to 0.8mg</td>
<td></td>
</tr>
</tbody>
</table>
Antiemetics

Nausea and vomiting (N & V) are common conditions that often occur due to a variety of causes. They are not diseases, but signs and symptoms of illness. Nausea is defined as a sick, uneasy feeling in the stomach. Often described as “feeling sick to my stomach,” nausea can occur without vomiting, but is often a signal that vomiting is likely. To vomit is to expel stomach contents, vomitus/emesis, through the mouth by a retching involuntary contraction of the stomach muscles. Vomiting can occur without vomitus, known as the dry heaves. In vomiting, nerves in the vomiting center are stimulated that, in turn, send signals to the salivary, vasomotor, and respiratory centers. The signals produce saliva to aid expulsion of vomitus; the client becomes pale due to vasomotor constriction; sweating and tachycardia are all part of the automatic responses involved in the vomiting process. Common causes of vomiting include the following:

- Overeating
- Irritation of the stomach by certain foods or liquids
- Pain
- Unpleasant odors or sights
- Emotional distress or illness
- Motion sickness
- Chemotherapy
- Drug therapy
- Radiation therapy
- Surgical procedures
- Pregnancy

Vomiting can occur in response to various noxious stimuli like a poison. Vomiting early after ingesting the offending source is desirable to rapidly rid the body of the toxic substance. Vomiting can be produced by physical stimulating of the back of the throat. In serious cases, gastric lavage (wash) may be needed to wash out the dangerous material from the stomach before it can be absorbed.

Although vomiting is uncomfortable for all clients, it can be dangerous for infants, small children, and elders because of the increased likelihood of dehydration and electrolyte imbalances. Excessive vomiting (hyperemesis) is also dangerous to the pregnant client. Inhaling vomitus into the lungs can cause aspiration pneumonia and tracheal damage from the stomach acid.
Table 9.4 describes antiemetic drugs used to prevent or control vomiting.

**TABLE 9.4 Antiemetic Drugs Used to Prevent or Control Vomiting**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Adult Dose Forms</th>
<th>Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phenothiazines</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethazine</td>
<td>Phenergan</td>
<td>25mg PO, (rectal)</td>
<td>12.5mg to 25mg</td>
<td>Sedation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>q4–6 hrs PRN; IV or IM</td>
<td></td>
</tr>
<tr>
<td>Thiethylperazine</td>
<td>Torecan</td>
<td>10mg to 30mg daily in divided doses;</td>
<td>300mg PO three to five times daily</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IM also</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trimethobenzamide</td>
<td>Tigan</td>
<td>300mg caps; 100mg, 200mg suppositories</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>300mg PO three to four times daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Anticholinergics/Antihistamines</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meclizine</td>
<td>Antivert</td>
<td>25mg to 50mg PO 1 hr before travel</td>
<td>50mg daily</td>
<td>Dry mouth</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Watch I &amp; O</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sedation</td>
</tr>
<tr>
<td>Ondansetron</td>
<td>Zofran</td>
<td>4, 8, 24mg tabs; 4mg / 5mL liquid</td>
<td>8mg 30 minutes before chemotherapy; 8mg after 7 hrs</td>
<td>Headache Constipation Diarrhea Sedation</td>
</tr>
<tr>
<td>Dimenhydrinate</td>
<td>Dramamine</td>
<td>50mg tabs 12.5mg / 4mL, 15.6mg / 5mL liquid</td>
<td>50mg to 100mg q4–6 hrs; 400mg maximum per 24 hrs</td>
<td>Sedation</td>
</tr>
<tr>
<td>Diphenhydramine</td>
<td>Benadryl</td>
<td>25mg, 50mg tabs 25mg, 50mg caps 12.5mg / 5mL elixir; 6.25mg, 12.5mg / 5mL liquid</td>
<td>25mg to 50mg three to four times daily</td>
<td></td>
</tr>
<tr>
<td>Lorazepam</td>
<td>Ativan</td>
<td>0.5mg, 1mg, 2mg tabs 2mg / mL liquid</td>
<td>2mg daily</td>
<td>Sedation Highly addictive</td>
</tr>
</tbody>
</table>

**Antidiarrheals**

Diarrhea (*di*, through; *rrhea*, flow) is a common side effect of many drugs as well as a sign of a viral or bacterial illness, irritable bowel syndrome, chronic bowel disease, fecal impaction, cancer, or emotional distress.
Table 9.5 lists common antidiarrheals.

**TABLE 9.5** Common Antidiarrheals

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Adult Dose Form</th>
<th>Dosage Range</th>
<th>*Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bismuth</td>
<td>Pepto-Bismol</td>
<td>524mg PO q30–60 minutes PRN</td>
<td>≤ 8 doses per day</td>
<td>Pepto-Bismol can cause black-colored stool (so inform client).</td>
</tr>
<tr>
<td>subsalicylate</td>
<td>Kapectate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loperamide</td>
<td>Imodium</td>
<td>4mg PO, then 2mg PO after each loose stool</td>
<td>≤ 16mg daily</td>
<td></td>
</tr>
<tr>
<td>Difenoxin</td>
<td>Motofen</td>
<td>1mg difenoxin with 0.025mg atropine</td>
<td>Two tabs, then one tab each loose stool; max. ≤ eight tabs in 24 hrs</td>
<td>Dry mouth.</td>
</tr>
<tr>
<td>with atropine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lactobacillus</td>
<td>Lactinex</td>
<td>Granules, caps, tabs</td>
<td>Two to four tabs or caps, two to four times daily w/milk; Granules: 1 pkt. Added to cereal, fruit juice, milk three to four times daily</td>
<td>Not for use during acute diarrhea.</td>
</tr>
<tr>
<td>acidophilus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EXAM ALERT**

All antidiarrheals can cause abdominal distention, nausea, or constipation, especially if used excessively.

**Laxatives**

**Constipation**—that is, difficulty in defecation (evacuating of feces/solid wastes from the rectum) or infrequent defecation—is a common symptom of a sluggish bowel. For various reasons (for
example, low water intake, drug effects, aging process or surgical anesthesia, or GI obstruction), clients suffer bloating, a gripping and uncomfortable pain in the lower abdomen, nausea, or anorexia.

Drugs may be used to stimulate the GI tract to speed up or improve movement of feces along the tract, to increase the tone of the GI tract to improve movement through the system, or to soften the feces (stool) and thus make passage easier.

Laxatives or cathartic drugs work in several ways to speed movement of feces through the GI tract. They may be stimulants that act directly and locally by irritating the intestinal wall. The chemical irritation causes the waste matter to move along. Bulk laxatives increase fecal matter, which helps their movement through the GI tract. Lubricants add water and oils to the feces, which helps it move more smoothly. Oral laxatives act within 6 to 10 hours, as they must be absorbed in the intestine; rectal agents act more quickly because they affect the intestinal wall directly, usually within 60 to 90 minutes.

Laxatives may be used with other drugs to rid the body of foreign matter, like poisons or helminthes (worms, for example). In certain poisonings, the body needs to rid itself of the offending organism by flushing it out through the large intestine.

Most laxatives are available OTC. They are intended for short-term use only, but are often abused and become habit forming for those who use them instead of trying other nonpharmaceutical methods to improve defecation. They have been abused by young clients with anorexia or bulimia. Anorexic or bulimic clients who use them can suffer deadly complications such as electrolyte disturbances that cause cardiac events.

Laxatives are contraindicated in acute abdominal disorders, including appendicitis, diverticulitis, and ulcerative colitis because their use could cause rupture of the bowel.

Table 9.6 outlines laxatives.

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Adult Dose Forms</th>
<th>Dosage Range</th>
<th>CNS effects:</th>
</tr>
</thead>
</table>
| Chemical Stimulants | Bosacodyl | Dulcolax | 10mg to 15mg PO; 2.5g in water (enema) | 15mg PO; 2.5g in enema | Dizziness  
Sweating  
Headache and weakness  
Palpitations  
Flushing and fainting  
GI effects:  
Gripping abdominal discomfort  
Pain  
Tenderness  
Distention  
Vomiting  

From the Library of Scott Kruse
### TABLE 9.6 Laxatives

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Adult Dose Forms</th>
<th>Dosage Range</th>
<th>*Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senna</td>
<td>Senokot</td>
<td>One to eight tabs per day at bedtime; 10mL to 25mL syrup</td>
<td>Eight tabs</td>
<td></td>
</tr>
<tr>
<td><strong>Bulk Laxatives</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lactulose</td>
<td>Chronulac</td>
<td>15mL to 30mL PO</td>
<td>30mL</td>
<td>CNS effects: Dizziness; Sweating; Headache and Weakness; Palpitations; Flushing and fainting; GI effects: Gripping abdominal discomfort; Pain; Tenderness; Distention; Vomiting</td>
</tr>
<tr>
<td>Magnesium citrate</td>
<td>Citrate of Magnesia</td>
<td>One glass</td>
<td>One glass daily</td>
<td></td>
</tr>
<tr>
<td>Magnesium hydroxide</td>
<td>Milk of Magnesia</td>
<td>15mL to 30mL PO</td>
<td>30mL PO</td>
<td></td>
</tr>
<tr>
<td>Psyllium</td>
<td>Metamucil</td>
<td>1tsp/packet in a full glass of water, one to three times daily</td>
<td>One packet daily; drink quickly to solution solidifying</td>
<td></td>
</tr>
<tr>
<td>Polycarbophil</td>
<td>FiberCon</td>
<td>1g PO, one to four times daily PRN</td>
<td>6g per day</td>
<td></td>
</tr>
<tr>
<td><strong>Lubricants (Stool Softeners)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Docusate</td>
<td>Colace</td>
<td>50mg to 240mg PO</td>
<td>240mg</td>
<td>CNS effects: Dizziness; Sweating; Headache and weakness; Palpitations; Flushing and fainting</td>
</tr>
<tr>
<td>Mineral oil</td>
<td>Agoral Plain</td>
<td>5mL to 45mL PO</td>
<td>45mL</td>
<td></td>
</tr>
</tbody>
</table>
Exam-Prep Questions

1. Baking soda is commonly used by the elderly for heartburn. Which of the following is not a possible side effect of the medication?
   - A. Edema
   - B. Alkalosis
   - C. Acidosis
   - D. Dehydration

2. When a person has an antacid and other medications ordered, the antacid should be administered how?
   - A. At the same time as the other medications to prevent GI upset
   - B. 30 minutes after the rest of the medication
   - C. 1 hour before or 2 hours after the rest of the medication
   - D. When the patient says he or she usually takes the antacid

3. Which of the following is not a proton pump inhibitor?
   - A. Aciphex
   - B. Nexium
   - C. Pepcid
   - D. Prevacid

4. A side effect of most antiemetics that may lead to harm, especially for the elderly, is what?
   - A. Sedation
   - B. Dry mouth
   - C. Headache
   - D. Constipation

5. A medication that makes food move more quickly through the GI tract is known as which of the following?
   - A. PPI
   - B. H₂ blocker
   - C. Antiemetic
   - D. Prokinetic
6. Which of the following is not a risk factor for Peptic Ulcer Disease (PUD)?
   - A. A family history of PUD
   - B. Stress
   - C. Smoking
   - D. Being a male

7. When giving a patient a histamine blocker, it is important to watch for what?
   - A. Confusion
   - B. Weakness
   - C. Nausea
   - D. Hallucinations

8. A patient reports to the Medication Aide that he or she is having black stools. After notifying the nurse, the Medication Aide examines the Medication Administration Record and sees that the patient is taking which medication that may explain the black stools?
   - A. Prilosec
   - B. Tagamet
   - C. Pepto-Bismol
   - D. Reglan

9. Laxatives are contraindicated in patients who have which of the following conditions?
   - A. Headaches
   - B. Severe constipation
   - C. PUD
   - D. Appendicitis

10. The correct adult dosage for lactulose is what?
    - A. 1 teaspoon
    - B. 3 teaspoons
    - C. 2 teaspoons
    - D. 1/2 teaspoon
Rationales

1. The correct answer is **B**. Baking soda is a bicarbonate and can change the pH from an acid to an alkaline. Edema (choice A) can be caused by other antacids that have a large amount of sodium, such as calcium carbonate, aluminum salt, and magnesium hydroxide. Choice C is incorrect because the pH of the body is slightly acidotic. Dehydration (choice D) occurs from excessive loss of body fluids and not from the use of antacids.

2. The correct answer is **C**. Antacids need to be given 1 hour before or 2 hours after the rest of the medication to avoid blocking the absorption of the medication. Choice A may block the absorption of the other medications. Choice B does not give enough time for the antacid to be absorbed. Choice D is incorrect because the patient may not be taking the medication correctly.

3. The correct answer is **C**. Pepcid is an H$_2$ receptor blocker. Aciphex, Nexium, and Prevacid are PPIs.

4. The correct answer is **A**. The elderly have difficulty with balance. When a medication is given that affects their alertness, falls can occur. Choices B, C, and D are all side effects of the medication, but they do not present as great a potential for harm.

5. The correct answer is **D**. A prokinetic medication such as Reglan increases peristalsis and increases the activity of the GI track. As for choice A, PPI disrupts the parietal cells’ ability to secrete gastric acid. As for choice B, an H$_2$ blocker fights against a histamine by competing for receptor sites and blocker acid production. Choice C is an antiemetic that works via the CNS to decrease vomiting.

6. The correct answer is **D**. Males and females are equally at risk for PUD. Choices A, B, and C are all risk factors for PUD.

7. The correct answer is **D**. Hallucinations are common side effects of histamine receptor blockers. Choices A, B, and C are common side effects of most GI medications.

8. The correct answer is **C**. Pepto Bismol may turn the stool black. It is still important to report the change in stool color rather than assuming that the change is due to the medication. Choice A, Prilosec, may cause diarrhea. Choice B, Tagamet, is known for causing constipation. As for choice D, the use of Reglan can lead to diarrhea.

9. The correct answer is **D**. Laxatives should not be given to any person who has acute abdomen symptoms, including appendicitis, irritable bowel, or Crohn’s disease. Choices A, B, and C are not contraindications for the use of laxatives.

10. The correct answer is **C**. The adult dosage for lactulose is 15mL to 30 mL, which equals 3 teaspoons for 15mL. The other choices are dosages that are too low according to the recommended adult dose.
This page intentionally left blank
CHAPTER TEN
Antibiotics and Other Anti-Infective Agents

Medical Term Hot List
✓ Aerobe
✓ Active immunity
✓ Attenuated virus
✓ AIDS
✓ Anaerobe
✓ Antifungal agents
✓ Antibiotics
✓ Antimicrobial agents
✓ Aseptic
✓ Bacteremia
✓ Bacteria
✓ Bactericide
✓ Bacteriostatic
✓ Broad-spectrum antibiotics
✓ Carrier
✓ Culture and sensitivity
✓ Disease
✓ Disease carrier
✓ Disinfectant
✓ Dormant
✓ Escherichia Coli (E.coli)
✓ Fungi
✓ Fungicide
✓ Germs
✓ Hepatitis B virus (HBV)
✓ Human immunodeficiency virus (HIV)
✓ Healthcare-associated infection (HAI)
✓ Herpes
✓ Herpes simplex type I
✓ Herpes simplex type II (genital herpes)
✓ Host
✓ Hypersensitivity
✓ Hepatotoxic
✓ Immunity
✓ Immunization
✓ Immunocompromised
✓ Infection
✓ Infectious disease
✓ Inoculation
✓ Isolation
✓ Leukocytes (WBCs)
✓ Local infection
✓ Microbe
✓ Microorganism
✓ Mycoses
✓ Nephrotoxic
✓ Neutrophils
✓ Nonpathogen
✓ Normal flora
✓ Opportunistic illness
✓ Orifice
✓ Ototoxic
✓ Pancreatitis
✓ Parenterally
✓ Passive immunity
✓ Pathogen
✓ Photosensitivity
✓ Resistance
✓ Standard precautions
✓ Staphylococcus aureus
✓ Superinfection
✓ Systemic infection
✓ Tuberculosis
✓ Universal precautions
✓ Vaccination
✓ Viruses
The Infection Process

Microbes, tiny one-celled plants and animals, are also called germs. They are found in the air, the soil, and the water and on foods, animals, inanimate objects, and people. Many are harmless and even beneficial. For example, certain bacteria (a kind or microbe or germ) live in the intestine and help produce important vitamins out of the waste products of digestion. They are considered nonpathogenic, or noninfectious. Normal flora are microbes that live in a certain area of the body (for example, on the skin, in the respiratory tract, and in the intestines). They do not cause infection as long as they remain in their normal locale. Some microbes, however, cause infection and disease. These disease-causing germs, known as pathogens, include bacteria, fungi, protozoa, rickettsiae, and viruses. Normal flora become pathogenic when they are carried from their natural site to another site (referred to in infectious disease as a host). E. coli is an example of normal flora found in the intestine; it becomes pathogenic when it is transferred to the urinary tract, causing a urinary tract infection.

An infection is an invasion by pathogens that reproduce, multiply, and cause disease. Certain environmental conditions must be present for an infection to develop:

- Food
- Oxygen (the presence or absence of it)
- Moisture
- Heat
- pH of 5 to 8 (slightly alkaline)
- Darkness

Pathogens need some type of nutrition to survive. Some live and thrive on organic matter, such as Clostridium perfringens, which causes gangrene. Others, like E. coli, get their nutrition from undigested food within the colon. Aerobic microbes require oxygen to survive; anaerobic microbes, in contrast, can live without oxygen. This describes an infection deep within the body (for example, a joint infection), because it does not require oxygen to live. Moisture is also necessary for most pathogens to survive. Tetanus and botulism, however, can live without water. Pathogens also require an alkaline (base) and dark environment to flourish.

The immune system protects the client against infection and disease. Two parts of the system, the external immune system and the internal system, play equally important roles in immunity, referred to as protection from an infection or disease.

The external immune system uses normally functioning defenses to protect against infection. The most important of these defenders is the skin. The skin forms a tough physical barrier to microbes. When the skin is damaged, however (for example, a cut or a burn), microbes can enter the body and cause infection.
Antibodies either destroy or stop the growth of specific types of microbes. They are carried in the bloodstream and can readily move to a site of microbe entry.

Specific antibodies fight specific microbes. When an unknown microorganism enters the body, the blood is stimulated to produce a special antibody to fight against it. The next time that particular microbe enters the body, the body recalls its exposure to it and proceeds to destroy it. In this way, antibodies make the body immune to many infections. Immunity can develop temporary or permanent immunity to an infection, depending on the type of antibody produced.

**Immunization** is a process that stimulates the body to make more antibodies to stave off infections. This is accomplished by introducing a tiny amount of dead or weak disease germs into the body through **inoculation** or **vaccination**. The small dose stimulates the body to produce necessary antibodies specific to the microbe without causing illness. This protects clients from a future illness due to a later exposure to the microbe. Clients vaccinated against a specific microorganism are said to have **passive immunity** to it, as they did not contract the disease directly. Clients with infections who are later immune to a future infection are considered to have **active immunity** because they contracted the disease themselves. Vaccination has been very successful in protecting thousands of people with passive immunity to widespread epidemics such as polio and smallpox. Many vaccinations are given **parenterally** (that is, in some other way than through the gastrointestinal tract; such as, subcutaneously, intramuscularly, intravenously, and so on). Because these drug administration techniques are beyond the responsibilities of the Medication Aide, they are purposely omitted from this review.

*EXAM ALERT*

Internally, microscopic substances (cells with specialized function to fight infection) provide immunity. These include neutrophils in the blood that surround and eat microbes. Leukocytes (*leuko*, white; *cyte*, cell), or white blood cells (WBCs), produce antibodies (*anti*, against) that are proteins whose job is to help destroy microorganisms as they enter the body. The number of leukocytes increases to handle an infection; this increase is reflected in analyzing a blood sample that records the number and kind of leukocytes as well as other blood cells responsible for reacting to a foreign invader such as a pathogen.

If in good health, most clients can avoid infections. If in good health, their natural defenses prevent the spread of pathogens. Even if they become ill, healthy clients can survive while the infection runs its course. Unhealthy clients, however, are at high risk for infection. Age, nutritional status, stress, medical conditions, or an actual medical treatment may put these individuals at risk.
Weakened clients have a harder time shaking off infections and avoiding complications from them.

**EXAM ALERT**

Despite normal defenses by the immune system, microorganisms can multiply and spread; the result is infection. Infectious diseases (those that result from direct or indirect spread of pathogens from one person to another) have specific sets of symptoms that help in identifying/diagnosing them:

- Fever
- Chills
- Headache
- Tachycardia and hyperpnea
- Pain or tenderness
- Muscles aches
- Joint pain
- Listlessness or loss of energy
- Malaise (feeling bad generally)
- Confusion
- Anorexia
- Nausea
- Vomiting
- Diarrhea
- Rash
- Redness (erythema) or swelling (edema) of a body part
- Pus formation at the infection site
- Discharge or drainage from the infected area
- Local heat and warmth at the infection site
- Limited use of the affected body part
- Sores (lesions) on mucous membranes

Other signs may also distinguish infections. A **local infection** is one that affects a body part. When the entire body is affected, the disease is called a **systemic infection**.
Recovery from an illness takes longer in older clients. Likewise, when older clients contract an infection, they may not display signs and symptoms like other younger clients do. For example, they may not spike a fever, or they might have only a slight temperature elevation. They often have a higher tolerance for pain and so might not complain of aching or painful sensations. The most common sign of an infection in an older client is confusion. Therefore, any change in the client’s behavior may be the only early signal of an infection.

**EXAM ALERT**

Clients with lowered resistance because of other conditions, such as AIDS (acquired immune deficiency syndrome), are especially at high risk for opportunistic infections. These infections take advantage of an already weakened immune system. Immunocompromised clients are likewise at high risk for infection. These are clients who may be receiving long-term steroid therapy for a chronic condition or who are receiving anticancer drugs that produce such side effects.
Common Infections

Staphylococcus Infection
Infections with *Staphylococcus aureus* (staph) bacteria occur in the general public, but they are a common danger for hospitalized clients. Due to overprescribing antibiotics to fight staph and other infections plus the debilitated condition of certain clients and the exposure of hospitalized clients to staph, resistant strains of the pathogens make treatment especially challenging.

EXAM ALERT
Hospitals and other healthcare facilities have large numbers of at-risk clients. Healthcare-associated infections (HAIs) are those that occur in clients who are hospitalized or cared for in an organized health care setting. The infection is related to the care given to the client. Such infections are occurring at an alarming rate, despite efforts to prevent their occurrence. These infections can spread rapidly because so many clients are housed in the same area. Likewise, many hospitalized clients are already compromised, as previously mentioned, and because of their condition are at the greatest risk for infection. Consider the example of the skin being a great defender against infection: Clients with surgical wounds or who undergo other invasive procedures, including catheterization, intravenous therapy, or exposure to healthcare personnel, are likely targets for HAIs. Common sites for HAIs other than entry through open skin include the urinary and respiratory systems and the bloodstream. The Joint Commission for Accreditation of Hospitals and Other Healthcare Organizations has admonished healthcare facilities to improve efforts to prevent HAIs through hand-washing campaigns, strict medical and surgical asepsis, standards for handling blood and body fluids, and isolation procedures; programs that stress infection research and prevention plus close surveillance of HAI cases and the like are also stressed.

Standard precautions and other infection prevention strategies have been reviewed in earlier chapters. Remember that hand washing still remains a primary strategy that can effectively prevent HAIs and cannot be overemphasized.

Success in controlling HAIs has been sporadic and continues to challenge many facilities from a systems-wide perspective. HAIs themselves have become an epidemic, costing millions of dollars and thousands of lives each year.

EXAM ALERT
Clients may also become disease carriers for the microbe. They might not become actively ill, but they put others at risk who may meet them in either the hospital or long-term care setting. Once identified, these clients, like those with active infections, must be isolated (or kept from close contact with other patients or personnel unless protected according to infection control protocols).

Hepatitis

Hepatitis B is a common infection caused by the *Hepatitis B virus* (HBV), which causes an inflammation of the liver. The virus is present in the blood and body fluids (saliva, semen, or vaginal secretions) of infected individuals. Hepatitis B is spread by the following:
The Infection Process

- Body piercing or tattoo instruments
- Sharing personal care items by an infected client (toothbrush, razor, or nail scissors)
- Accidental needle sticks
- IV drug use and sharing needles
- Unprotected sex, especially anal sex without use of a condom

Treatment for Hepatitis B is mainly supportive because antibiotics are ineffective in destroying a viral illness. Bed rest and nutritional support are mainstays during recovery.

**Hepatitis C**, spread via the blood by the Hepatitis C virus (HCV), may be a mild viral illness at first, but it can become chronic with severe liver disease and liver damage years after contracting the disease. Clients may become a Hepatitis C carrier, never having any symptoms themselves. The Hepatitis C virus can be spread in the same way as Hepatitis B. Hepatitis is treated with specific drugs to offer support to maintain tissue health.

**Herpes.** There are various types of herpes infections. Herpes zoster (shingles) is a viral illness. It may lie dormant (inactive) in the body for years, later developing into what is called a secondary invasion or by reactivation of infection that has been dormant for years.

Clients with shingles complain of burning or tingling in the affected area; later, painful blisters or a rash develops over the affected area, usually on one side of the body along a nerve route. Pain and itching are common. Clients are often miserable for several weeks. Antiviral drugs and analgesics are given for relief.

The herpes simplex virus type I causes blistering lesions on the mouth, face, or nose. Its common name is a fever blister or cold sore. The lesions may appear during stress (emotional, physical, or psychological) and often accompany another viral illnesses. Treatment is mostly supportive, although antiviral drugs and ointments have been proven effective in controlling herpes simplex type I.

Herpes simplex virus type II causes genital herpes (painful, weeping lesions found on the penis in males or the vagina, perineum, or cervix in females). It is a highly contagious and chronic condition with painful flare-ups followed by quiet periods with an absence of lesions. Antivirals are also used to relieve symptoms.

**Tuberculosis (TB)** is a bacterial disease caused by mycobacterium tuberculosis, which may affect almost any tissue or organ of the body. The most commonly affected organs are the lungs, although the disease can be found in the kidneys, nervous system, muscles, bones, and joints. The disease is a droplet infection; that is, it is spread by inhaling the bacterium from infected persons through their expired air. Coughing, sneezing, speaking, and laughing are also modes of transmission. Close contact with a client who is actively ill is also a common mode of spreading the infection. Clients can carry TB and not become ill for many years. Left untreated, TB can be fatal.
Clients who are at risk are those who have other infections, those who are IV drug users, and those who are infected with HIV/AIDS.

**Acquired Immunodeficiency Syndrome (AIDS).** This disease is caused by the human immunodeficiency virus (HIV).

**EXAM ALERT**

The HIV virus is spread through body fluids (blood, semen, vaginal secretions, and breast milk). It is not spread by casual contact, as previously believed in the early days of HIV infections. Because it is very fragile in composition, the virus cannot live outside the body. Using public restrooms, using public telephones, swimming in public pools or using hot tubs, or drinking from water fountains are not avenues for contracting the virus. Hugging, talking closely with an infected person, or dancing with an infected person is also not a risk for contracting HIV.

The virus can infect clients through the following:

- Needle and syringe sharing among other IV drug users
- Unprotected anal, vaginal, or oral sex with an infected person
- HIV-infected mothers, pre-pregnancy or during childbirth
- Breast-feeding by mothers infected with the HIV virus

The virus enters the body through any body orifice (opening) or broken skin (including the mouth, vagina, rectum, or penis). Rough sexual acts may cause a skin tear in the vagina or rectum, allowing entry of the virus. The virus can also enter the bloodstream through breakage of mucous membranes. Further, infected body fluids can enter through the same areas as long as the skin is disrupted in any way. Contaminated devices such as needles or syringes can be a source of viral entry. This is especially risky for drug users who inject themselves with drugs and share their paraphernalia. Healthcare personnel who work with needles, syringes, and other devices that contain a client's blood or body fluids are also at risk.

Some HIV clients may not develop AIDS, the disease, for many years, but may carry the virus. Many AIDS clients develop signs and symptoms within months of infection with the virus, and may include the following:

- Listlessness
- Headache
- Flu-like symptoms
- Fever
- Night sweats
- Weight loss
- Swollen glands in neck, underarms, and groin
- Diarrhea
- Cough
- Memory loss, confusion
- Shortness of breath
- Pneumonia
- Sores, white patches or purple spots and blotches on mouth/tongue
- Depression
- Dysphagia
- Vision disturbances

Recent developments in combination drugs have been effective in combating AIDS; clients with AIDS are living longer due to such advancements in drug therapy. A healthful diet, exercise, and prevention of exposure to opportunistic infections also contribute to a longer life. The goal of all these strategies is to improve the infected person's quality of life as well as longevity.
Antibiotics and Other Anti-Infective Agents

What follows is a brief review of classifications of antimicrobial agents commonly used for hospitalized clients or those receiving drug therapy in a long-term care setting. Tables describing some representative drugs in these classes are included in later chapters because they have more specific therapeutic indications.

**EXAM ALERT**

Antimicrobial agents are those that kill pathogens. An antimicrobial (against microbes) agent is a man-made chemical intended to have an antiseptic (cleansing) effect.

**Aminoglycosides.** Aminoglycosides are derived from living organisms or produced synthetically to kill bacteria by destroying their proteins. They are designed to kill gram-negative germs that cause gram-negative infections, including the following:

- **Meningitis:** Inflammation or infection of the membranes that cover the brain and spinal cord.
- **Septicemia:** A systemic blood infection, which can result from infection in any body part.
- **Urinary tract infections:** See Chapter 11, “Medications Affecting the Urinary System,” for specific drugs used to treat UTIs.
- **Wound infections:** Acute infections caused by invasive bacteria entering pre-existing wounds caused by violence, surgery, or trauma.

Most aminoglycosides, with the exception of neomycin, are given IM or IV. Neomycin may be given orally to prepare the GI tract for surgery.

**Antibiotics.** Antibiotics are antimicrobials made from live microorganisms such as molds. The first true antibiotic harvested from a mold was penicillin, and these are still the most widely used. Penicillins act on the cell wall of fast-growing bacteria (also called germs), keeping them from synthesizing or growing. Some bacteria react to penicillins as an invader and build up a barrier to them; this protective process is called resistance. For this reason, many types of penicillin, as well as other antibiotics, must be modified to combat this problem. Penicillins are ordered for many infections. They may also be given before invasive procedures, such as dental work or surgery, to prevent infection. In this way, they are considered to be given prophylactically (prophylassein, to guard against).

**NOTE**

It is important to remember that, like other antibiotics, penicillins can change the normal flora in mucous membranes, making the client susceptible to what is known as a superinfection, or an infection due to the use of antibiotics. An example of this type of infection is the development of a vaginitis from overgrowth of yeast. Penicillins are especially worrisome because they may cause anaphylaxis.
The following is a recap of safety considerations when giving antimicrobial agents:

- Observe the client carefully; some signs and symptoms of a severe allergic reaction may not happen for hours or days.
- Observe the client closely for signs and symptoms of an allergic reaction:
  - Dyspnea
  - Fever
  - Hives
  - Itching
  - Nasal congestion/discharge
  - Rash
  - Severe respiratory distress (dyspnea)

If an allergic reaction occurs:

- Notify the nurse immediately and assist in relieving client distress.
- Dispatch the emergency crash cart to the client’s room.
- Assist with CPR.
- Hold future doses of suspected drug until further orders are received.

**Topical antifungal (fungicidal) agents.** Fungi that cause disease come from a group called *fungi imperfecti*. In susceptible clients (those who are immunocompromised or receiving immunosuppressive drugs), fungi can cause opportunistic infections such as those on the nails, mucous membranes, or skin. If a fungus infection occurs in an AIDS client, it can cause death.

Fungi need nutrients to grow. Antifungal agents inhibit cell growth by interfering with protein and electrolyte use. They are used to treat athlete’s foot, diaper rash, jock itch, ringworm, thrush, and vaginal yeast infections. Table 10.1 lists common antifungal agents.
<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Dose Limits</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butenafine</td>
<td>Lotrimin</td>
<td>1% cream</td>
<td>Use scant amount to cover lesions. Apply topically once or twice daily x 1–4 weeks.</td>
<td>Redness, swelling, oozing from affected site may signal allergic response to drug. Withhold next application and notify the nurse.</td>
</tr>
<tr>
<td></td>
<td>Ultra</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clotrimazole</td>
<td>Gyne-Lotrimin</td>
<td>200mg vaginal tablet</td>
<td>For candidiasis: Insert one 200mg tab intravaginally at bedtime x 3–7 nights.</td>
<td>Burning, itching, swelling or soreness should abate with continued therapy. Wear white cotton underwear that is well ventilated.</td>
</tr>
<tr>
<td></td>
<td>Lotrimin AF</td>
<td>1% solution tab</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Econazole</td>
<td>Spectazole</td>
<td>1% cream</td>
<td>For athlete’s foot, jock itch, ringworm, or tinea versicolor, apply sparingly over affected area once daily. Cutaneous candidiasis: Apply each morning and evening.</td>
<td>Wear clean white socks and change two to three times daily. Wear nonconstrictive clothing that is well ventilated.</td>
</tr>
<tr>
<td>Ketoconazole</td>
<td>Nizoral</td>
<td>2% cream</td>
<td>Indications as noted previously; apply once daily to affected area as well as surrounding tissues once daily x 2–4 weeks. For seborrheic dermatitis: Same schedule. For dandruff: Apply shampoo to dampened hair, lather gently for one minute, reapply after first rinse and leave in for three minutes, and then rinse thoroughly and dry hair. Repeat procedure twice weekly for 4 weeks. Wait at least 3 days between shampoos.</td>
<td>Wear clean white socks and change two to three times daily. Keep affected areas clean and dry.</td>
</tr>
<tr>
<td>Miconazole</td>
<td>Monistat 3</td>
<td>200mg vaginal suppositories</td>
<td>Vaginal candidiasis: Insert one suppository intravaginally each night at bedtime for 3 days. Insert one full applicator of cream or one suppository intravaginally each night for 3–7 nights.</td>
<td>Same as for other suppositories.</td>
</tr>
<tr>
<td></td>
<td>Monistat 7</td>
<td>100mg vaginal suppositories</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2% vaginal cream</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nystatin</td>
<td>Mycostatin</td>
<td>100,000 units, vaginal tablets</td>
<td>Vaginal candidiasis: Insert one tablet intravaginally nightly for 2 weeks. Oral candidiasis: 6mL four times a day; hold suspension in mouth as long as possible before swallowing.</td>
<td>As for vaginal suppositories. Avoid eating or drinking for 1 hour after taking suspension.</td>
</tr>
<tr>
<td></td>
<td>Nilstat</td>
<td>100,000 per mL oral suspension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terbinafine</td>
<td>Lamisil AT</td>
<td>1% cream or spray</td>
<td>Massage into affected area twice daily for 2–4 weeks.</td>
<td>Use gloves when applying any topical medication.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Systemic antifungal agents. Several systemic fungicidal drugs can be given orally. They include fluconazole (Diflucan), flucytosine (Ancobon), griseofulvin (Fulvicin), ketoconazole (Nizoral), and terbinafine (Lamisil). Dosages of these antifungal agents range from 50mg to 250mg tablets or oral suspension. Dosage is primarily disease dependent. Aside from GI upsets, these drugs can cause nephrotoxicity, suspected when hematuria (bloody urine) or smoky urine is observed in clients taking antifungals.

Antiviral agents. Viruses are pathogens that grow and reproduce only after infecting a host cell. More than 400 types are known to cause a variety of diseases; the more potent or most virulent agents can be lethal. Viruses are responsible for the common cold, childhood illnesses such as varicella/chickenpox, measles, and rubella, and herpes simplex illnesses. The Epstein-Barr virus causes some cancers or lymphomas; viruses can cause disease in all body organs systems. Attenuated viruses are those that have been specially prepared through complex processes to serve as vaccines, given in tiny amounts to protect clients against the virus. Clients with AIDS or those receiving drugs that suppress immunity are at high risk for contracting a viral illness, which may become fatal.

Several antiviral agents (antivirals) are effective in treating viral infections. They include abacavir (Ziagen), acyclovir (Zovirax), amantadine hydrochloride (Symmetrel), oseltamivir (Tamiflu), and ribavirin (Virazole and Rebetol). Most of these drugs come in oral forms, with capsules, suspensions, and oral solutions being available. The dosage varies according to the viral type. Side effects are similar to those of antibiotics. Some of the antivirals can be hepatotoxic (poisonous to the liver) or predispose the client to pancreatitis (inflammation of the pancreas).

Other anti-infective agents with multiple indications. Protozoa are single-cell animals that can infect the brain, blood, intestines, and other body systems. Metronidazole (Flagyl), a bacteriostatic agent, is also effective in treating protozoan infections such as amebic dysentery (severely inflamed intestines causing bloody diarrhea), anaerobic bacterial infections, and giardiasis (diarrhea caused by contaminated water; traveler's diarrhea). Flagyl is available in 250mg and 500mg tablets and capsules and in 750mg extended-release tablets. The dose is disease specific. Safety precautions are required in clients taking Flagyl because central nervous system (CNS) changes can put them at high risks for falls.

Vancomycin (Vancocin) is a potent anti-infective agent that is reserved for critically ill clients or those allergic to penicillins or cephalosporins. It can be given orally and is available in 125mg and 250mg capsules. Vancomycin is often given via IV at 1g every 12 hours. Clients should be closely monitored when taking Vancomycin because the drug can become ototoxic (causes hearing loss) as well as nephrotoxic (causes kidney damage). Secondary infections such as thrush (fungal infection in the mouth), vaginitis, and anal itching can occur.
**Antitubercular agents.** Drugs prescribed to treat tuberculosis (TB) include ethambutol (Myambutol), isoniazid (INH), and rifampin (Rifadin). Myambutol works to slow the growth of mycobacteria. It is given in combination with at least one other drug to prevent resistance from potent bacterial strains. The drug is available in 100mg and 400mg tablets; the dose is weight dependent and is given once daily. Clients should be closely observed for blurred vision as visual disturbances is a major side effect. Visual side effects raise safety concerns; clients should be protected against falls. Nausea and vomiting (N & V), diarrhea, and abdominal cramps are common, mild, and tend to disappear with continued therapy.

Isoniazid, INH, acts by interfering with bacterial cell growth by invading the cell wall. It can be used to prevent as TB as well as treat it. For clients testing positive for TB, INH is given to prevent its development. If used for treatment active TB, INH is given in combination with other antitubercular drugs such as rifampin. INH is available in 50mg, 100mg, and 300mg tablets or in syrup at 50mg / 5mL. Like rifampin, the dose is weight dependent and given in a single daily dose or in divided doses. Side effects of INH are dose related: dizziness, anorexia, N & V, jaundice, and tingling and numbness of hands and feet.

Rifampin (Rifadin) is also used with other drugs to treat TB. It prevents cell growth by blocking key pathways for cellular replication. Rifadin is effective in treating carriers of other life-threatening bacteria such as N. meningitis, which causes meningitis or septicemia; it helps combat the H. influenzae type B (Hib disease) responsible for pneumonia, meningitis, and joint or bone infections in young infants, toddlers, and preschool children. Rifadin is available in oral forms of 150mg and 300mg capsules. It is given on an empty stomach. Clients/children and their parents/caregivers should be apprised that a reddish-orange tinge could appear in the urine, feces, saliva, sputum, sweat, or tears while children are taking Rifadin; the color changes are harmless and should disappear with continued therapy. Gastrointestinal (GI) disturbances as well as chills, muscle aches, and jaundice may signal complications of taking the drug and must be reported to the nurse.

**Cephalosporins.** Cephalosporins are chemically related to the penicillins and may be used for clients who are allergic to penicillin. They kill bacteria by attacking their cell walls. Cephalosporins are used effectively to treat the following infections:

- Abdominal infections
- **Bacteremia** (bacteria in the blood)
- Meningitis
- **Osteomyelitis** (bone and/or bone marrow infection)
- Urinary tract infection (UTIs)

Table 10.2 outlines common cephalosporins.


<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Names</th>
<th>Oral Dose Forms</th>
<th>Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefaclor</td>
<td>Ceclor</td>
<td>250mg, 500mg caps; 375mg, 500mg extended-release (ER) tabs 125mg, 187, 250mg, 375mg chewable tabs 125mg, 187, 250mg, 375mg / 5mL suspension</td>
<td>250mg to 500mg every 8 hrs; not to exceed 4g/day</td>
<td>Safety alert: Check allergies to penicillins and cephalosporins! Watch for the following: Diarrhea Secondary yeast infections Decreased platelets, leading to bleeding Electrolyte imbalance Confusion/disorientation N &amp; V Muscle cramps Take with food if GI upset. Avoid alcohol or alcohol-containing medications because they interact with cephalosporins and may cause abdominal pains, N &amp; V, hypotension, tachycardia, and sweating. Long-term use may damage the liver or kidneys.</td>
</tr>
<tr>
<td>Cefadroxil</td>
<td>Duricef</td>
<td>500mg caps 1000mg tabs 125mg, 250mg, 500mg / 5mL suspension</td>
<td>1g to 2g daily (divided doses)</td>
<td></td>
</tr>
<tr>
<td>Cefixime</td>
<td>Suprax</td>
<td>100mg / 5mL suspension</td>
<td>200mg every 12 hrs; 400mg once daily</td>
<td></td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>Zinacef Ceftin</td>
<td>125mg, 250mg, 500mg tabs 125mg, 250mg / 5mL suspension</td>
<td>250mg to 500mg every 12 hrs</td>
<td></td>
</tr>
<tr>
<td>Cephalexin</td>
<td>Keflex</td>
<td>250mg, 500mg caps 125mg, 250mg / 5mL suspension</td>
<td>250mg to 500mg every 6 hrs; not to exceed 8g/day</td>
<td></td>
</tr>
<tr>
<td>Cephradine</td>
<td>Velosef</td>
<td>250mg, 500mg caps 125mg, 250mg / 5mL suspension</td>
<td>Not to exceed 8g daily</td>
<td></td>
</tr>
</tbody>
</table>
**Macrolides.** Macrolides are both bacteriostatic (slow growth of bacteria) or bactericidal (kill bacteria). This class of drugs may be used when other antibiotics are ineffective for infections involving the respiratory tract, GI system infections, soft tissue and skin infections, or sexually transmitted diseases (STDs).

Table 10.3 outlines common macrolides.

**TABLE 10.3 Macrolides**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Dosage Limits</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azithromycin</td>
<td>Zithromax</td>
<td>250mg, 500mg, 600mg tabs 100mg, 167mg, 200mg, 1000mg / 5mL suspension</td>
<td>500mg single dose on first day; 250mg once daily for days two through five (total dose = 1.5g)</td>
<td>Safety alert for allergies: Give on an empty stomach, 1 hour before meals, with a full glass of water. Watch for liver impairment with extended use.</td>
</tr>
<tr>
<td>Clarithromycin</td>
<td>Biaxin</td>
<td>250mg, 500mg tabs 125mg, 500mg/ 5-mL suspension 500mg, 1000mg extended-release tabs</td>
<td>250mg to 500mg every 12 hrs x 7–14 days</td>
<td></td>
</tr>
<tr>
<td>Erythromycin</td>
<td>Eryc</td>
<td>333mg, 500mg enteric-coated tabs 250mg, 500mg chewable tabs 250mg, 500mg film-coated tabs 333mg, 500mg enteric-coated caps 125mg, 200mg, 250mg, 400mg / 5mL suspension</td>
<td>250mg 4 times daily x 10–14 days</td>
<td></td>
</tr>
</tbody>
</table>

**Quinolones and tetracyclines.** Quinolones and tetracyclines are reviewed in depth in the following chapter.

**Sulfonamides.** Sulfonamides are primarily bacteriostatic; they slow the growth of pathogens by keeping them from producing folic acid, which is necessary for cell growth. Without folic acid, the bacterial cells die. Sulfonamides, often referred to as sulfa drugs, treat a variety of infections including otitis media (middle ear infection) and other infections for clients who are allergic to penicillin. Sulfa drugs should be used with caution in clients with kidney disease because diseased kidneys do not excrete drugs efficiently to prevent toxicity.
Exam-Prep Questions

1. Which of the cells below creates antibodies to fight infection?
   - A. Erythrocytes
   - B. Leukocytes
   - C. Adipocytes
   - D. Astrocytes

2. Which of the following routes is permissible for the Medication Aide to administer immunizations?
   - A. IM
   - B. SQ
   - C. PO
   - D. IV

3. All of the following are signs of infection except for what?
   - A. Pink color
   - B. Fever
   - C. Cough
   - D. Swollen glands

4. Which group below has the highest risk for infection?
   - A. Persons 5–10 years old
   - B. Persons 30–50 years old
   - C. Persons 18–29 years old
   - D. Persons 80 years and over

5. Staph infections are transmitted by which of these disease carriers?
   - A. Hospitals
   - B. People
   - C. Furniture
   - D. Equipment
6. Which of the following is an example of an antimicrobial medication that acts against gram negative microbes?
   ○ A. Penicillin
   ○ B. Econozole
   ○ C. Aminoglycoside
   ○ D. Flagyl

7. The most effective antiviral for the flu is what?
   ○ A. Abacavir
   ○ B. Acyclovir
   ○ C. Amantadine hydrochloride
   ○ D. Oseltamivir

8. When a patient is receiving INH for active TB, it is given how?
   ○ A. By itself
   ○ B. With rifampin
   ○ C. With myambutol
   ○ D. With zitromax

9. All of the following are fungal infections except for what?
   ○ A. Ringworm
   ○ B. Athletes’ foot
   ○ C. Thrush
   ○ D. Shingles

10. Which of the following medications is a macrolide?
    ○ A. Amoxicillin
    ○ B. Zithromax
    ○ C. Keflex
    ○ D. Tetracycline
Rationales

1. The correct answer is B. Leukocytes, or white blood cells, produce antibodies that are proteins whose job is to help destroy microorganisms as they enter the body. Choice A, erythrocytes, are red blood cells. Choice C, adipocyte, creates fat cells, and choice D, astrocyte, is a brain cell.

2. The correct answer is C. If the Medication Aide is asked by the licensed nurse to give a vaccine in any way other than the oral route, he/she must refuse the delegation, politely reminding the nurse of his/her practice limitations. Choices A, B, and D are parental routes.

3. The correct answer is A. A pink color to the skin is a sign of healthy skin. Choices B, C, and D are signs of infection, along with diarrhea, weakness, and several other signs.

4. The correct answer is D. Older clients are at greater risk for infection because they have a greater risk of decreased cough reflex, decreased sensitivity, and poor nutrition.

5. The correct answer is B. People become disease carriers for the microbe, not becoming actively ill but putting others at risk who may meet them, in either the hospital or long-term care setting.

6. The correct answer is C. Aminoglycoside are the antimicrobials of choice to fight gram negative bacteria. Choices A, B, and C are not aminoglycosides.

7. The correct answer is D. Oseltamivir (Tamiflu) is the antiviral of choice for the flu.

8. The correct answer is B. Choice A is incorrect because, when INH is given for active TB, another drug is needed. Choice C is given when resistance to regular TB medications is evident. Choice D is an antibiotic.

9. The correct answer is D. Shingles is a form of the herpes virus. Choices A, B, and C are all fungal infections.

10. The correct answer is B. Zithromax is a macrolide. Choice A is a form of penicillin. Choice C is a cephalosporin. Choice D is a tetracycline.
CHAPTER ELEVEN

Medications Affecting the Urinary System

Medical Term Hot List

✓ Alkalosis
✓ Analgesic
✓ Anemia
✓ Antidiuretic hormone
✓ Ascites
✓ Bacteriostatic
✓ Benign prostatic hyperplasia (BPH)
✓ Cerebral edema
✓ Cystitis
✓ Diuresis
✓ Diuretic
✓ Dysuria
✓ Edema
✓ Electrolytes
✓ Erythropoiesis
✓ Erythropoietin
✓ Escheria coli
✓ Filtration
✓ Glaucoma
✓ Hyperglycemia
✓ Hypocalcemia
✓ Hypokalemia
✓ Kidney tubule
✓ Micturition
✓ Nephron
✓ Nephrosclerosis
✓ Nocturia
✓ Normal flora
✓ Overactive bladder (OAB)
✓ Prophylactic
✓ Prostate gland
✓ Pulmonary edema
✓ Pyelonephritis
✓ Reabsorption
✓ Renin-angiotensin system
✓ Secretion
✓ Sulfa drugs
✓ Superinfection
✓ Tinnitus
✓ Ureter
✓ Urethra
✓ Urgency
✓ Urinary frequency
✓ Urinary meatus
✓ Urination
✓ Urine
✓ Vaginitis
✓ Void

From the Library of Scott Kruse
Urinary Structure and Function

The renal/urinary system works to collect the body's waste products and eliminate them as urine; it serves as the body's waste treatment plant.

The filtering function in the plant belongs to the kidneys—small, fist-sized, bean-shaped organs that lie on each side of the abdomen near the lower back. The lower edges of the rib cage on each side of the body serve to protect the kidneys.

The by-product of this amazing workhorse part of the system is urine, straw-colored liquid waste that contains water and waste products. Urine produced by the kidneys passes through the urinary system via the ureters, one muscular tube arising from each kidney. The ureters contract to move urine downward to the bladder (-cyst), a muscular collection sac that holds the urine for expulsion from the body via the urethra. It is through the urethra that urine leaves the body, a process called micturition, or urination. The bladder signals the need to urinate when it holds around 250mL of urine, or approximately a cup of fluid. Urine is expelled (voided) from the body via the distal end of the urethra, called the urinary meatus.

The kidneys also work in a complex fashion to regulate the chemical balance in the body by concentrating electrolytes, chemically charged elements important to cellular functions like hydrogen, sodium, and bicarbonate and phosphate salts to keep the chemical level of the blood at its normal level, or pH of 7.37 to 7.43. Acidosis occurs when the pH falls below 7.35; alkalosis, the opposite end of the chemical balance, occurs when the pH of the blood is greater than 7.45. An imbalance in the blood's pH causes serious problems in maintaining normal cellular functions, which can lead to life-threatening effects on the client if not corrected.

Two important hormones, the antidiuretic hormone (ADH), a pituitary hormone, and aldosterone, produced in the adrenal cortex of the adrenal gland, work to regulate the amount of water reabsorbed by the kidney as well the concentration of urine. When these functions become problematic, the amount of sodium and potassium, two essential electrolytes, fluctuates, which affects a primary function of the kidney (that is, to regulate the blood pressure). Hormone concentration abnormalities like these as well as the renin-angiotensin cycle (see Chapter 7, “Medications Affecting the Cardiovascular System”) can lead to hypertension (HTN). Hypertension causes the kidney to harden (nephrosclerosis) due to lack of blood flow, one of the leading causes of chronic renal failure.

The kidneys filter toxins and other wastes from the blood to keep the body's systems in good working order and to avoid illness and body system injury. To do this, the kidneys must filter out the toxins in the blood through the powerhouse unit in the kidney, the tiny nephron. Nearly two million nephrons act on the blood to rid it of toxins, to reabsorb fluid through tiny capillaries close to the encapsulated nephrons that then flows into the kidney's tubules. Once filtered, the tubules drain urine from the kidney, through a process called clearance. Clearance is commonly called creatinine clearance, or clearance of the metabolic waste; it is one of the most important functions of the kidney, and is the most accurate measure of the
health of the nephron. If the clearance is delayed, the working nephrons can be damaged because of overwork, or compensation; these enlarged, damaged nephrons cannot keep up with demands on the kidney and eventually die.

The amount of substances that can be reabsorbed or excreted is finite, meaning that there is a limit to what the kidney tubules (small draining tubes within the kidneys) can reabsorb. Once they are supersaturated, or at capacity, those substances remain in the blood or are excreted as well in the urine. In diabetes mellitus (DM), for example, large amounts of glucose (blood sugar) molecules overwhelm the renal tubules and, because they cannot all be absorbed, they appear in the blood (hyperglycemia, too much glucose in the blood) or the urine (glycosuria).

Red blood cell production (erythropoiesis) is an important part of the kidney’s work. Erythropoietin is a hormone secreted by the kidneys that signals the bone marrow to step up red blood cell (RBC) production. RBCs carry oxygen to the cells and are essential to life. When the oxygen supply is low, the kidney comes to the rescue. The kidneys also secrete vitamin D, which helps keeps calcium levels adequate to keep bone marrow metabolism healthy. When the kidneys are damaged, erythropoietin and calcium levels drop; this leads to chronic anemia (a, without; emia, blood) and hypocalcemia (too little calcium in the blood).

Disorders of the Urinary System

Urinary Tract Infections

Urinary tract infections (UTIs) are very common bacterial infections anywhere along the urinary tract. Clients receiving care in a hospital or other healthcare institution, especially women, are at risk. In these cases, the infection is an HAI, hospital-acquired infection. Urinary catheterization, urological examinations, poor perineal hygiene, lack of fluid intake, and immobility are among the causes of HAIs.

NOTE

The issue of HAIs has become so common and expensive that many health insurance carriers have refused to pay for treatment if a client develops a UTI while in the hospital.

Women are at higher risk for UTIs due to a shorter urethra than those in males. Because the female urethra is shorter and closer to the anus, pathogens travel easier up to the bladder/kidney.

Males are also more protected by antibacterial-like fluid secreted by the prostate gland. Men, however, can become more prone to UTIs when their prostate gland enlarges and puts pressure on the urethra. This condition is called benign prostatic hypertrophy (BPH), a common condition in almost one half of males 55 years old and older. An infection of the prostate, prostatitis, can cause similar urinary problems.

Older clients are especially prone to UTIs because of underlying conditions such as obstructions, need for catheterization, or HAIs.
Types of infections of the urinary tract describe their location or the structures affected by the infection. They include **cystitis**, inflammation of the bladder; **urethritis**, inflammation of the urethra; **pyelonephritis** (pyelo, pelvis area of the kidney; nephr, kidney), kidney infection.

*Escherichia coli* (E. coli), normally located and growing in the colon (described as **normal flora**), can travel to the urinary tract via a contaminated urethra as a result of poor perineal hygiene. In the urinary tract, E. coli can cause infection. The body reacts to this invader by an immune reaction. The immune system protects the body from infection and disease through complex processes that include an attack by specialized cells in the blood (for example, phagocytes and lymphocytes in the white blood cells [WBCs]). These specialized cells increase in number to attack the pathogen (also called an **antigen**) in an attempt to destroy it. In response to a disease caused by certain antigens, the body builds up protection, or antibodies to it, which prevents reinfection in the future. This is called **acquired immunity**. An example of acquired immunity is **varicella**, or chicken pox.

In other situations, clients may be vaccinated against certain pathogens by receiving a tiny dose of the pathogen to avoid a future infection. This process is called **passive immunity**, as the client did not contract the disease directly. The measles vaccine is an example of passive immunity.

Signs and symptoms of UTIs vary, but all cause discomfort and pain. Clients with bladder infections complain of **dysuria**, or having difficulty voiding, as well as voiding that is painful. They may have urinary **urgency**, or the need to void frequently, as well as **frequency** (or voiding often). The amount of urine voided may be decreased (**oliguria**). **Anuria**, or voiding less than 100mL in 24 hours, may signal a serious kidney disease. Further, painless hematuria may be an early sign of kidney cancer.

With UTIs, the urine may be concentrated, have a foul-smelling odor, and have a cloudy appearance, which can indicate pus in the urine, called **pyuria**. If the urine is smoky or bright red, it may contain blood (hematuria).

Older clients may refuse to eat and be weak and often confused. They may also become disoriented. These may be the only outward signs of a UTI in this age group. Without aggressive therapy, a UTI can quickly progress to a severe and widespread infection known as **urosepsis/uricemia**, which requires hospitalization with IV antibiotic drug treatment and general systems support.

The goal of drug therapy for UTIs is to rid the system of **pathogens** (harmful microbes) and restore normal function. Clients with UTIs should also increase their fluid intake to at least 2 liters (2000mL) per day to help flush the urinary tract.

Drug choice for UTIs depends on the pathogen. Until a urine culture identifies it, a broad-spectrum antibiotic/antimicrobial is often ordered. An **antimicrobial** (against microbes) **agent** is a man-made chemical intended to have an **antiseptic** (cleansing) effect on the urinary tract as well as the urine.

Antibiotics are the primary drug classifications given to treat UTIs. They include the penicillins, sulfa drugs, tetracyclines, and the quinolones.
Table 11.1 lists common drugs in the penicillin drug classification that are effective in treating UTIs.

**TABLE 11.1 Common Drugs Effective in Treating UTIs Within the Penicillin Drug Classification**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin</td>
<td>Amoxil</td>
<td>50mg, 200mg, 250mg, 400mg / 5mL suspension</td>
<td>250mg to 500mg/8 hrs</td>
<td>*Anaphylaxis/allergy alert! Double-check for allergies to penicillins or cephalosporins. Observe carefully after giving medication x 20–30 minutes. Report signs of allergic reaction to the nurse STAT and withhold next dose until further instructions. Can give with or without food, depending on GI tolerance to drug. Capsules can be emptied and swallowed with liquids. Chewable tabs should be crushed or chewed before swallowing with liquids. Shake oral suspension well before administering. Give suspension straight or mix with milk, fruit juice, water, or ginger ale. Give immediately after mixing. Discard mixed suspension after 10 days. Watch for the following: Nausea Diarrhea Rash CNS changes Muscles cramps (electrolyte imbalance)</td>
</tr>
<tr>
<td></td>
<td>Trimox</td>
<td>500mg caps</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50mg/mL and 1250mg, 875mg tabs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>125mg, 200mg, 250mg, 400mg chewable tabs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>250mg, 500mg caps</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50mg/mL and 125mg, 200mg, 250mg, 400mg / 5mL suspension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ampicillin</td>
<td>Omnopen</td>
<td>250mg, 500mg caps</td>
<td>200mg to 500mg/8 hrs</td>
<td>Give at least 1 hour before or 2 hours after meals on an empty stomach with a full glass of water. (Acidic juices may decrease absorption.) Caps can be opened and mixed with water. Watch for the following: Fever Diarrhea Muscle cramps</td>
</tr>
<tr>
<td></td>
<td>Principen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxacillin</td>
<td>Oxacillin</td>
<td>250mg / 5mL suspension</td>
<td>500mg/4–6 hrs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bactocill</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the Library of Scott Kruse
TABLE 11.1  
Continued

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin</td>
<td>Augmentin</td>
<td>125mg, 200mg, 250mg, 400mg chewable tabs</td>
<td>250mg–600mg /8 hrs.</td>
<td>Safety concerns as above. Give at the start of a meal to enhance absorption, decrease GI side effects. Do not give with high-fat meals. (Fat decreases clavulanate absorption.)</td>
</tr>
<tr>
<td>and potassium</td>
<td></td>
<td>250mg, 500mg, 875mg tabs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>clavulanate</td>
<td></td>
<td>125mg, 200mg, 250mg, 400mg, 600mg / 5mL suspension</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Watch for signs and symptoms of anaphylaxis: Rash, pruritis, laryngeal edema, wheezing, dyspnea, severe respiratory distress.

**Signs and symptoms of severe allergic reaction:** Nausea & vomiting (N & V), diarrhea, malaise, fever, hives, itching, nasal congestion, and discharge.

Sulfonamides are among the most widely used class of antibiotics, especially in treating UTIs. Table 11.2 outlines common sulfa drugs.

### TABLE 11.2  Common Sulfa Drugs

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
</table>
| Co-trimoxazole | Bactrim, Bactrim DS | Tabs, suspension | 2–4 tabs daily, according to diagnosis | Watch drug brand name! Do not confuse single-strength preparation (Bactrim, for example) with DS preparation, meaning “double strength” (Bactrim DS).

**Allergy Alert!**

Follow safety precautions as for penicillins!

May give around the clock as ordered to maintain drug blood levels.

Maintain adequate fluid intake to increase absorption, flush the bladder and urinary tract; measure I/O.

Give with full glass of water.

Drink high acid juices (for example, cranberry juice) to keep urine acidic. |
### Table 11.2  Continued

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erythromycin-</td>
<td>Eryzole, Pediazole</td>
<td>Suspension</td>
<td>2.5mL to 10mL every 6 hrs, depending on client weight</td>
<td>Watch allergy to erythromycin as well as sulfa drugs.</td>
</tr>
<tr>
<td>sufisoxazole</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfadiazine</td>
<td>Sulfadiazine</td>
<td>500mg tabs</td>
<td>Initially: 2–4 grams; then 4–8 grams / 24 hrs in divided doses</td>
<td>Same as Bactrim.</td>
</tr>
<tr>
<td>Sulfasalazine</td>
<td>Azulfidine</td>
<td>500mg tabs, 500mg delayed-release tabs</td>
<td>Initially: 3–4 grams daily in divided doses; 2 grams daily, maintenance dose</td>
<td>Same as Sulfadiazine.</td>
</tr>
<tr>
<td>Sulfasoxazole</td>
<td>Sulfasoxazole, Gantrisin</td>
<td>500mg tabs, 500mg / 5mL suspension</td>
<td>Initially: 2–4 grams; 4–8 grams / 24 hrs in divided doses, maintenance dosage</td>
<td>Same as Azulfidine.</td>
</tr>
</tbody>
</table>

Tetracyclines are semisynthetic antibiotics derived from common soil mold. They were the first antibiotics developed for wide-spectrum use, meaning they were effective against a wide variety of bacteria. Tetracyclines act on the protein of susceptible bacteria, which keeps microbes from multiplying. They are used for clients allergic to the penicillins. Although they work well in treating UTIs, they have met with widespread resistance from certain bacteria, which has limited their use. Pregnant women and children under 8 years of age should not use tetracyclines because they permanently stain teeth. They also pose a greater risk of superinfection than other antimicrobials; therefore, clients must be more closely observed for signs of secondary infection.

Table 11.3 outlines common tetracyclines.
A relatively new class of antibiotics, fluoroquinolones/quinolones, has a broad-spectrum effect on many bacterial infections. These synthetic drugs are popular because they have rather mild adverse reactions. Ciprofloxacin (Cipro) is widely used and effective against a wide spectrum of gram-negative bacteria. Levaquin, also popular, is used to treat UTIs and many other gram-negative infections. If given with other drugs such as antacids, GI barrier drugs, or mineral supplements, their effectiveness decreases. These drugs should be spaced at least 4 hours apart.

Table 11.4 lists quinolones used for UTIs.

**TABLE 11.3 Common Tetracyclines**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demeclocycline</td>
<td>Declomycin</td>
<td>150mg, 300mg tabs</td>
<td>150mg four times a day; 300mg twice daily</td>
<td><strong>Allergy Alert!</strong> As for penicillins. Give on empty stomach to increase absorption. Avoid milk (interferes with absorption). Watch for same signs and symptoms as for sulfa drugs.</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>Vibramycin</td>
<td>50mg, 100mg tabs</td>
<td>Day 1: 200mg; then 100mg in two divided doses</td>
<td>Same as above.</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>Sumycin</td>
<td>250mg, 500mg caps and tabs</td>
<td>250mg to 500mg four times a day</td>
<td>Same as above.</td>
</tr>
</tbody>
</table>

**TABLE 11.4 Quinolones Used for UTIs**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>ciprofloxacin</td>
<td>Cipro</td>
<td>100mg, 250mg, 500mg caps</td>
<td>Uncomplicated UTI: every 12 hrs x 3 days or 500mg every 24 hrs x 3 days (extended release)</td>
<td><strong>Allergy Alert!</strong> Watch for the following: Dizziness Drowsiness Headache Insomnia Altered taste GI upset Photosensitivity Double vision, problems focusing Hematuria</td>
</tr>
<tr>
<td>ciprofloxacin</td>
<td></td>
<td>500mg caps (extended release)</td>
<td>100mg</td>
<td></td>
</tr>
</tbody>
</table>

Chapter 11: Medications Affecting the Urinary System
Other antibacterial agents may be effective against UTIs. These include methenamine mandelate (Mandelamine) and nitrofuran (Macrodantin). These drugs are used to combat chronic, recurrent UTIs.

Mandelamine is available in 500mg and 1g enteric-coated tablets. It should be given with meals and at bedtime at the rate of 1 gram four times daily. Observe closely for N & V, belching, hives and itching, or a rash.

Macrodantin and Furandantin are available in 25mg, 50mg, and 100mg capsules; 25mg / 5mL suspension is also available for clients who cannot swallow capsules. Clients should receive 50mg to 100mg four times on a 6-hour schedule to maintain adequate blood levels of the drug. Therapy should be extended over a 10 to 14 day period. Aside from the side effects possible with Mandelamine, clients should be observed for a rusty brown to yellowish urine, a harmless side effect but one that can cause anxiety for clients. Foul-smelling odor of urine or dysuria could suggest a recurrent infection.

Dysuria

Urinary tract pain can be very uncomfortable for clients with UTIs. A special synthetic dye called phenazopyridine (Azo-Standard, Baridium, and Pyridium) is often prescribed as an analgesic (that is, to relieve pain). These agents act quickly and directly on the urinary tract lining (mucosa) to relieve the burning, urgency, frequency, and pain. They are also effective in relieving urinary tract irritation from trauma or surgery. Clients receiving phenazopyridine should be advised that the drug colors the urine a reddish-orange and can stain fabrics.

The drug should be given with at least one glass of water. Therapy with phenazopyridine should be limited to no more than 2 days to avoid its toxic effects, especially when combined with antibacterial agents.
Overactive Bladder (OAB)

Inflammation in the urinary tract, such as cystitis, prostates, and urethritis, can cause the smooth muscles along the tract to spasm, which leads to dysuria, urgency, incontinence, and nocturia. Antispasmodic drugs help relieve the spasms by blocking parasympathetic activity and relaxing the detrusor and other urinary tract muscles involved in voiding. As these drugs have anticholinergic effects on the body, clients should be observed closely for GI disturbances and tachycardia, along with dry mouth and anorexia.

Table 11.5 describes some commonly used antispasmodics.

| Table 11.5 Common Antispasmodics |
|-------------------------------|-----------------|----------------------|---------------------------|
| **Generic Name** | **Brand Name** | **Dose Forms** | **Dosage Range** | **Special Considerations** |
| Darifenacin | Enablex | 7.5mg, 15mg tabs | Initially: 7.5mg daily | Watch for the following: |
| | | | May increase to 15mg daily. | Tachycardia |
| | | | | Dry mouth |
| | | | | Blurred vision |
| | | | | Constipation |
| | | | | Bloating |
| | | | | Urinary retention |
| | | | | Give with or without food. |
| Oxybutynin | Ditropan | 5mg tabs; | Initially: 5mg three times daily (20mg max) | Watch for tachycardia, dry |
| | | 5mg / 5mL syrup | Initially: 5mg once daily; adjust at weekly intervals (5mg increments) | mouth. |
| | | 5mg, 10mg, 15mg (extended release) | (30mg maximum daily) | Do not crush! |
| Tolterodine | Detrol | 1mg, 2mg tabs | Initially: 1mg to 2mg twice a day | Do not crush. |
| | | 2mg, 4mg (extended release) | Initially: 2mg to 4mg once a day | Swallow whole. |
Urinary Retention

Urinary retention is included here, not as a primary disorder that affects the urinary tract but as a secondary condition resulting from heart failure, hypertension, or other disease that results in fluid retention. Fluid retention resulting from cardiovascular conditions can put added stress on the urinary tract and the kidneys, causing pain and swelling in the lower extremities and lower back as well as pulmonary edema, an accumulation of fluid in the lungs. Other conditions can cause cerebral edema (swelling of the brain tissues), glaucoma (increased fluid and pressure in the eyes), and ascites, or abdominal distention caused by liver disease in which excessive fluid accumulates in the peritoneal cavity of the abdomen.

The goal of drug therapy in these cases is to decrease tissue damage, organ failure, and other complications associated with edema by increasing the formation and excretion of urine. Diuretics (dia, through; and ur, urine) increase urinary flow by acting on certain structures within the kidney to increase sodium excretion, the primary element that holds water in the body. Loop diuretics such as bumetanide (Bumex), furosemide (Lasix), and ethacrynic acid (Edecrin) act on the descending limb or the renal tubule called the loop of Henle; it is there that they stop reabsorption of sodium and chloride. Loop diuretics, with the exception of Edecrin, act within 30 to 60 minutes to promote diuresis. Their action peaks lasts 4 to 6 hours (maximum time of action) and is effective for 4 to 6 hours. Edecrin acts within 30 minutes of administration and lasts for 6 to 8 hours.

Lasix is one of the most widely used and strongest diuretics. It can be given alone or in combination with antihypertensive agents to treat HTN. Available in 20mg, 40mg, and 80mg tablets, Lasix is given as a daily dose from 20mg to 80mg. The ideal time for administering Lasix is in the morning to avoid nocturia, or voiding during the night. It should be given with food to avoid GI upset. A chief side effect of Lasix is orthostatic hypotension, dizziness, weakness, or fainting. For these reasons, the client should be assisted to ambulate and should avoid rising too quickly and should be assisted from falling. Diabetic clients are at risk for hyperglycemia. Allergic reactions can occur with Lasix. If signs of allergies occur, hold the next dose and notify the nurse immediately.

Thiazide diuretics act on the distal tubules of the kidney to block reabsorption of sodium and chloride. Thiazides act to reduce blood pressure in HTN as well as promoting diuresis for clients with heart failure, kidney disease, liver disease, obese clients, and women with premenstrual syndrome. Low potassium (hypokalemia) is a common side effect of thiazide-type diuretics; for this reason, the physician should check potassium levels regularly.

Table 11.6 lists common thiazide diuretics.
### TABLE 11.6 Common Thiazide Diuretics

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Dosage Range</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorothiazide</td>
<td>Diuril</td>
<td>250mg, 500mg tabs</td>
<td>1–2 grams</td>
<td>Give before mid-afternoon! For HTN, give in divided doses before mid-afternoon. For edema, give in single dose. Watch for hypotension, confusion, weakness, fainting. CNS effects: Change in alertness Orientation Confusion Muscle cramps GI symptoms: N &amp; V Stomach upset Constipation Dry mouth Hyperglycemia in diabetic clients Rash, hives, itching</td>
</tr>
<tr>
<td></td>
<td></td>
<td>250mg / 5mL suspension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrochlorothiazide</td>
<td>Oretic</td>
<td>25, 50, 100mg tabs</td>
<td>12.5mg to 100mg</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.5mg caps</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50mg / 5mL solution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methyclothiazide</td>
<td>Enduron</td>
<td>2.5mg, 5mg tabs</td>
<td>2.5mg to 5mg</td>
<td></td>
</tr>
<tr>
<td>Chlorthalidone</td>
<td>Hygroton Thalitone</td>
<td>15mg, 25mg, 50mg, 100mg</td>
<td>50mg to 200mg</td>
<td></td>
</tr>
</tbody>
</table>

The potassium-sparing diuretics are widely used today because of their ability to excrete sodium but retain potassium. Spironolactone (Aldactone) blocks aldosterone, responsible for retaining sodium while excreting sodium and water from the body. It may be given in combination with other diuretics to relieve edema unresponsive to other diuretics alone. The oral dose is available in 25mg, 50mg, and 100mg tablets. The initial dose is 50mg to 100mg daily, with a maintenance dose of 100mg to 200mg each day. Spironolactone may be combined with a thiazide-type product such as Aldactazide (spironalactone 25mg and hydrochlorothiazide 25mg) or Dyazide (trimeterene 37.5mg and hydrochlorothiazide 25mg) tablets daily. Clients receiving these combination products are high risk for side effects particular to each drug. High potassium and low sodium have been reported with use of these combination drugs. Therefore, lab values for potassium and sodium must be closely monitored.
Exam-Prep Questions

1. Another term for urination is which of the following?
   - A. Defecation
   - B. Micturation
   - C. Excretion
   - D. Excision

2. The clearance of metabolic wastes is one of the most important functions of the kidney and is the most accurate measure of the health of which part of the kidney?
   - A. Tubules
   - B. Urethea
   - C. Nephrons
   - D. Bladder

3. The term for painful or difficult urination is which of the following?
   - A. Dysuria
   - B. Anuria
   - C. Polyuria
   - D. Glycosuria

4. Which of the medications below is prescribed for a urinary tract infection?
   - A. Detrol
   - B. Thalitone
   - C. Diuril
   - D. Bactrim DS

5. After an antibiotic is given for the first time, the MA-C should observe clients for at least how long?
   - A. 5 minutes to assess any side effects
   - B. 10 minutes after the first dose is given
   - C. 20 minutes after the first dose is given
   - D. 20 to 30 minutes after the first dose and each dose following
6. Antispasmodic drugs help relieve the spasms by blocking parasympathetic activity and relaxing the detrusor and other urinary tract muscles involved in voiding. Which of the following are side effects of these medications?
  - A. Dry mouth
  - B. Bradycardia
  - C. Hypotension
  - D. Diarrhea

7. What is the best time to administer a diuretic?
  - A. Before 6 a.m.
  - B. After 10 p.m.
  - C. Between 8 a.m. and 10 a.m.
  - D. At bedtime

8. True or false. Clients receiving diuretic combination products are high risk for side effects specific to each drug.

9. Which of the following are the electrolytes most affected by combination diuretics?
  - A. Potassium and sodium
  - B. Calcium and magnesium
  - C. Sodium and magnesium
  - D. Calcium and potassium

10. All of the following are loop diuretics except which one?
   - A. Bumex
   - B. Lasix
   - C. Edecrin
   - D. Diuril
Rationales

1. The correct answer is B. Micturation, urination, and voiding are terms to describe the act of emptying the bladder. Choice A is the term used for emptying the rectum. Choice C is the term for the removal of waste products. Choice D is the term for the cutting out of a growth.

2. The correct answer is C. The nephrons are the functioning unit of the kidneys. The renal tubules (choice A) drain urine from the kidney. The urethra (choice B) is a muscular tube that passes the urine from the bladder to the urinary meatus. The bladder (choice D) is a muscular collection sac that holds the urine for expulsion from the body via the urethra.

3. The correct answer is A. Dysuria is painful or difficult urination. Anuria (choice B) is the term for producing less than 100mL of urine in 24 hours. Polyuria (choice C) is excessive urination. Glycosuria (choice D) is the term for excessive glucose in the urine.

4. The correct answer is D. Bactrim DS is an important antibiotic for UTI. Detrol (choice A) is used for overactive bladder. Thalitone (choice B) and Diuril (choice C) are diuretics.

5. The correct answer is C. After administering the first dose of an antibiotic (which is to be done by the nurse), the resident needs to be observed for 20 to 30 minutes for signs of a reaction.

6. The correct answer is A. Antispasmodic drugs help relieve the spasms by blocking parasympathetic activity and have anticholinergic effects on the body. Clients should be closely observed for GI disturbances and tachycardia, along with dry mouth and anorexia.

7. The correct answer is C. It is best to give a diuretic early in the morning, especially to older residents, so that they do not need to go to the bathroom late at night.

8. The correct answer is True. Clients receiving diuretic combination products are high risk for side effects particular to each drug.

9. The correct answer is A. High potassium and low sodium have been reported with use of these combination drugs. Therefore, lab values for potassium and sodium must be closely monitored.

10. The correct answer is D. Duril is the only diuretic listed that is a thiazide diuretic and not a loop diuretic.
## Medications Affecting the Musculoskeletal System

<table>
<thead>
<tr>
<th>Medical Term Hot List</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Abduction</td>
</tr>
<tr>
<td>✓ Abductor muscles</td>
</tr>
<tr>
<td>✓ Adduction</td>
</tr>
<tr>
<td>✓ Adolescence</td>
</tr>
<tr>
<td>✓ Appendicular skeleton</td>
</tr>
<tr>
<td>✓ Axial skeleton</td>
</tr>
<tr>
<td>✓ Bone resorption inhibitor</td>
</tr>
<tr>
<td>✓ Bones</td>
</tr>
<tr>
<td>✓ Bony joints</td>
</tr>
<tr>
<td>✓ Bursae</td>
</tr>
<tr>
<td>✓ Cardiac muscles</td>
</tr>
<tr>
<td>✓ Carpals</td>
</tr>
<tr>
<td>✓ Cartilage</td>
</tr>
<tr>
<td>✓ Circumduction</td>
</tr>
<tr>
<td>✓ Clonus</td>
</tr>
<tr>
<td>✓ Cushingnoid</td>
</tr>
<tr>
<td>✓ Estrogen</td>
</tr>
<tr>
<td>✓ Eversion</td>
</tr>
<tr>
<td>✓ Extension</td>
</tr>
<tr>
<td>✓ External rotation</td>
</tr>
<tr>
<td>✓ Femur</td>
</tr>
<tr>
<td>✓ Fibula</td>
</tr>
<tr>
<td>✓ Flexion</td>
</tr>
<tr>
<td>✓ Flexor muscles</td>
</tr>
<tr>
<td>✓ Fracture</td>
</tr>
<tr>
<td>✓ Gouty arthritis</td>
</tr>
<tr>
<td>✓ Humerus</td>
</tr>
<tr>
<td>✓ Hyoid bone</td>
</tr>
<tr>
<td>✓ Hyperreflexia</td>
</tr>
<tr>
<td>✓ Hypertonia</td>
</tr>
<tr>
<td>✓ Hypocalcemic agent</td>
</tr>
<tr>
<td>✓ Internal rotation</td>
</tr>
<tr>
<td>✓ Inversion</td>
</tr>
<tr>
<td>✓ Joint degeneration</td>
</tr>
<tr>
<td>✓ Joint</td>
</tr>
<tr>
<td>✓ Lactic acid</td>
</tr>
<tr>
<td>✓ Ligaments</td>
</tr>
<tr>
<td>✓ Lyse</td>
</tr>
<tr>
<td>✓ Mandible</td>
</tr>
<tr>
<td>✓ Maxilla</td>
</tr>
<tr>
<td>✓ Menopause</td>
</tr>
<tr>
<td>✓ Metabolic disease</td>
</tr>
<tr>
<td>✓ Muscle spasticity</td>
</tr>
<tr>
<td>✓ Muscles</td>
</tr>
<tr>
<td>✓ Osteoporosis</td>
</tr>
<tr>
<td>✓ Patella</td>
</tr>
<tr>
<td>✓ Primary disease</td>
</tr>
<tr>
<td>✓ Pronation</td>
</tr>
<tr>
<td>✓ Protraction</td>
</tr>
<tr>
<td>✓ Secondary disease</td>
</tr>
<tr>
<td>✓ Sedation</td>
</tr>
<tr>
<td>✓ Sedentary lifestyle</td>
</tr>
<tr>
<td>✓ Sesamoid</td>
</tr>
<tr>
<td>✓ Skeletal muscles</td>
</tr>
<tr>
<td>✓ Spasm</td>
</tr>
<tr>
<td>✓ Spasmolytic agent</td>
</tr>
<tr>
<td>✓ Striation</td>
</tr>
<tr>
<td>✓ Supination</td>
</tr>
<tr>
<td>✓ Synovial fluid</td>
</tr>
<tr>
<td>✓ Tarsals</td>
</tr>
<tr>
<td>✓ Tendons</td>
</tr>
<tr>
<td>✓ Tibia</td>
</tr>
<tr>
<td>✓ Tophi</td>
</tr>
<tr>
<td>✓ Ulna</td>
</tr>
<tr>
<td>✓ Uricemia</td>
</tr>
<tr>
<td>✓ Vertebrae</td>
</tr>
<tr>
<td>✓ Visceral muscles</td>
</tr>
<tr>
<td>✓ Voluntary muscles</td>
</tr>
</tbody>
</table>

From the Library of Scott Kruse
Structure and Function of the Musculoskeletal System

The human body contains around 600 skeletal muscles (those muscles attached to bones that are responsible for movement). Each muscle group is classified according to the kind of movement for which it is associated. To bend, joints must be surrounded with flexor muscles; one type of bending motion in joints is called flexion. Abductor muscles help move the extremities away from the body (arms and legs, hands and feet).

Muscle cells are formed in long bands, strips called striations. The striations are made from muscle fibers that grow and whose strength and size vary according to genetic makeup, sex, and nutrition. They are considered voluntary muscles, in that they can be contracted, moved at will.

More than 200 bones make up the body’s structure, or skeletal frame. Bones are formed by calcified matrices having spaces within them by specialized cells. Bone layers are arranged around central canals. Small cavities lying between the canals contain tiny cells that produce mature bone. It is in these structural units of bone where nutrition for the health of the bone and other vital functions take place.

Bones are classified by:

1. Shape
   - **Long bones**: Upper arm (humerus); forearm (radius and ulna); the femur, or thigh bone; and the tibia and fibula, two bones making up the lower leg
   - **Short bones**: Wrists, ankle bones (carpals and tarsals)
   - **Flat bones**: Scapula, or shoulder blade; ribs, and skull
   - **Sesamoid**: Patella, or kneecap
   - **Irregular**: Bones of the spine, the vertebrae; the jaw; that is, the maxilla and mandible

2. Location
   - **Axial skeleton**: Bones of the head and trunk
     - Facial and cranial bones (head)
     - Hyoid bone (bone at base of the tongue, under the thyroid cartilage)
     - Ribs
     - Vertebrae
     - Sternum (breast bone)
Appendicular skeleton:
- Clavicle (collar bone)
- Scapula
- Humerus
- Radius
- Ulna
- Metacarpals (hand bones)
- Pelvic bone
- Femur
- Patella
- Fibula
- Tibia
- Metatarsals (foot bones)

Bones cover and protect internal organs, support the body, and provide a surface for muscle, ligament, and tendon attachment, which allows for movement. Bones also play a critical role in metabolism by producing red blood cells (RBCs), white blood cells (WBCs), and other cells in the bone marrow, a process called hematopoiesis. The bones also store almost 100% of the body's calcium supply.

Cartilage is elastic, fibrous connective tissue. It hardens through a process called endochondral ossification (occurring within cartilage to form bone). In this process, bone is formed by osteoblasts in a cartilage model, and the cartilage cells die out slowly, to be replaced by bone cells (osteoclasts). This takes place before birth for all bones except those of the wrists and ankle. Growth continues in long bones until adolescence, just before the teen years. During adolescence, the growth plates at the ends of the long bones close. Bone growth continues throughout life, and then slows with age.

Cartilage is bloodless and has no nerves. It supports and helps shape and cushion body structures. Cartilage is of three types:

1. **Fibrous cartilage**: Provides good cushioning and strength to the symphysis pubis (pubic bone) and the disks between the vertebrae, bones that make up the spine.

2. **Hyaline cartilage**: Covers those bony surfaces that meet together (articular surfaces); the trachea, bronchi, nasal septum, and the entire fetal skeleton (growing baby); this cartilage serves as a shock absorber.
3. **Elastic cartilage**: In the auditory canal, the outer/external ear and the epiglottis; this cartilage provides flexibility as well as support.

**EXAM ALERT**

Research shows that estrogen, the hormone responsible for female secondary sexual characteristics, plays an important role in storing and using calcium. It also helps regulate bone formation. Decreased estrogen levels experienced after menopause (stopping of ovulation and menstruation in women) is linked to decreased bone formation.

Race, sex, and age also influence bone, affecting its mass/size, ability of bone to withstand stress, and bone loss. The skeletal density of African Americans is more intense than Caucasians, and bones of men are more dense than those of women. Women over 30 years of age and men over age 45 begin to lose bone density and structure. After age 45, both sexes continually lose bone density and strength at a steady rate.

Where two or more bones unite, a **joint** is created. Joints allow the bones to move. Some joints provide more movement than others. In a free-moving joint, fluid fills the spaces between the bones; this is called synovial fluid, which lines a space or cavity, keeping that area lubricated (oiled) to keep the bone ends from grating against each other. Ligaments, muscles, and tendons help strengthen the joint.

**Bursae** are small sacs of synovial fluid, acting as cushions for such areas as the shoulders and knees while easing stress on structures near those joints. **Tendons** are fibrous connective tissues that attach muscles to bones. They allow bones to move when muscles contract. **Ligaments** are denser, flexible connective tissues that tie bones together. Ligaments connecting bones ends provide stability and ease in movement.

Most muscle movement involves mechanically moving groups of muscles instead of single muscles moving by themselves. Consult your Nursing Assistant basic textbook materials for a review of their diagrammatic appearance and detailed descriptions: Muscle contractions begin with nerve impulses in the body. As the body moves in various directions, that movement is reflected in the following terms:

- **Circumduction**: Moving in a circular motion
- **Flexion**: Bending, which decreases the joint angle
- **Extension**: Straightening, which increases the joint angle
- **Internal rotation**: Turning toward the midline of the body
- **External rotation**: Turning away from the midline
- **Abduction**: Moving away from midline
Disorders of the Musculoskeletal System

Muscle Spasms

Muscle spasms are sudden and painful involuntary contractions of the muscles caused by an injury to the musculoskeletal system, such as overstretching a muscle, wrenching/twisting a joint, or tearing a ligament or tendon. The spasms result from a flooding of stimuli from the sensory nerves that causes the motor nerves to signal the muscles in question to contract violently. The contraction limits blood supply to the muscle fibers in the injured area; lactic acid, a by-product of muscle action, builds up, resulting in pain. Muscle spasms can be ongoing for a time due to the chain reaction that occurs with spasms; that is, the new flood of impulses caused by the pain from the first spasm may lead to further muscle spasms. Although the muscles affected by spasms can still function, the client suffering from muscle spasms has limited use of them.

Muscle Spasticity

Muscles can lose their function from long-term hypertonia, or excessive state of having too much tone. This is caused by excessive stimulation of opposing groups of muscles as well as the muscle groups being contracted. This is an imbalance in muscle control, as seen in chronic nervous disorders such as cerebral palsy and paraplegia (paralysis of the lower body). The damaged motor nerves that cause muscle spasticity can also prevent normal movement and coordination.

Skeletal muscle relaxants are drugs that act on the central nervous system (CNS) to interfere with the nervous reflexes that cause muscle spasms. They are also called spasmolytics as they lyse, or destroy spasms.
Chapter 12: Medications Affecting the Musculoskeletal System

Table 12.1 describes centrally acting muscle relaxants.

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dosage</th>
<th>Dosage Limitations</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carisoprodol</td>
<td>Soma</td>
<td>350mg four times daily</td>
<td>1.4g daily</td>
<td>Safety alert: Do not confuse with soma compound; soma compound contains aspirin! Watch for the following: Sedation Weakness Headache Lethargy Dizziness GI discomfort Anorexia Jaundice Urinary urgency Drug-drug interaction with other CNS depressant a caution! Be cautious when taking this drug with herbals (can increase effect). Use with caution with older clients due to anticholinergic effects. Give with food.</td>
</tr>
<tr>
<td>Cyclobenzaprine</td>
<td>Flexeril</td>
<td>10mg three times daily (PO)</td>
<td>30mg daily</td>
<td>Safety alert as for Soma. Has fewer side effects than other spasmodyltics. Intended for short-term use (two to three weeks) only.</td>
</tr>
<tr>
<td>Methocarbamol</td>
<td>Robaxin</td>
<td>1g to 1.5g four times daily</td>
<td>6g daily</td>
<td>Safety precautions as previously listed in this table.</td>
</tr>
<tr>
<td>Orphenadrine</td>
<td>Norflex</td>
<td>100mg twice daily (PO)</td>
<td>200mg daily</td>
<td>Relieves pain (analgesic effect). Contraindicated in clients with glaucoma or enlarged prostate.</td>
</tr>
<tr>
<td>Tizanidine</td>
<td>Zanaflex</td>
<td>4mg to 8mg every 6 to 8 hrs</td>
<td>36mg daily</td>
<td>Safety precautions as with Flexeril. Watch for hypotension.</td>
</tr>
</tbody>
</table>

Table 12.1 Centrally Acting Muscle Relaxants

**NOTE**

Although the goal of drug therapy with muscle relaxants is to relieve muscle spasms, these drugs act on the upper levels of the CNS, causing some degree of **sedation** (calming effect). They can also cause **depression** in clients (a mood disorder with loss of interest or pleasure in living).
Osteoporosis

Osteoporosis is a metabolic bone disorder in which bone is reabsorbed at a faster rate than normal and the rate of new bone formation decreases. These two processes cause a decrease in bone mass. Bones affected by osteoporosis lose calcium and phosphate and become porous, brittle, and prone to fracture or bone breaks.

The goals of treatment in osteoporosis are to control bone loss and fractures. Calcium supplements with vitamin D may be given at a dose of 1200mg/day to support normal bone metabolism. The client should be observed for urinary tract calculi due to accumulation of calcium. Fluids should be forced as well. Bone density drugs (bone resorption inhibitor) such as ibandronate (Boniva) can be given once a month to promote bone metabolism. The dose is 2.5mg once a day or 150mg once monthly. It is given on an empty stomach with a full glass of water 30 minutes before other medications, food, or beverages. If giving a monthly dose, give on the same date each month. The drug should be used cautiously in older clients with kidney impairment as well as those clients who take aspirin or nonsteroidal anti-inflammatory drugs (NSAIDs). A key side effect of Boniva is pain in arms or legs. Other bone density drugs may be given via IV, which is beyond the scope of practice of the Medication Aide-Certified (MA-C).

EXAM ALERT

The cause of osteoporosis is unknown; several factors are known to contribute to its development:

- Mild but prolonged lack of calcium. Poor intake of calcium in the diet plus slow absorption of calcium in the intestine.
- Hormonal imbalance to an endocrine disorder.
- Estrogen deficiency, which causes protein to be metabolized abnormally.
- Sedentary lifestyle (little or no exercise; sitting-around type of lifestyle).
- Age-related causes. Postmenopausal osteoporosis occurs in women ages 51 to 75 because of decreased estrogen and its protective effect on bone. Clients in this category are high risk for fractures of the vertebrae and wrists. Senile osteoporosis occurs mostly in sedentary women between ages 70 and 85 because of shrinkage of bone-forming cells. These clients are at high risk for fractures of the humerus, tibia, femur, and pelvis.

Osteoporosis can be a secondary disease, meaning it results from an underlying condition such as prolonged steroid or heparin therapy, bone disuse, malnutrition, alcoholism, rheumatoid arthritis, or hyperthyroidism.

Gout

Gout is a metabolic disease, due to an error in the body's metabolism. The underlying cause of gout is unknown. Primary gout occurs when uric acid (a waste product of the breakdown of purines) accumulates instead of being excreted from the body via the urine. It can build up when an excess of acid occurs, when the kidneys do not excrete it in sufficient quantity to avoid a problem or when the client eats too many high-purine foods (liver, dried beans, anchovies, or peas).
Untreated gout progresses in stages. Initially, clients are asymptomatic (no symptoms); as uric acid levels increase in the blood, uricemia is evident. In late-stage gout, clients develop painful, swollen, inflamed joints and tophi, clusters of urate crystals that pool in cartilage, synovial membranes, tendons, and soft tissue. The most common site for tophi is the big toe. Although rare, the heart may also be affected; kidney involvement can cause kidney dysfunction due to development of kidney stones (renal calculi). Complications of gout are atherosclerosis, hypertension (HTN), and CVAs (cerebral vascular accidents).

Clients suffering from gout attacks cannot bear weight on the affected foot, even the pressure of bed linens over their lower extremities can cause extreme discomfort. Chills and fever can accompany chronic gout attacks. Chronic inflammation can lead to joint degeneration (destruction of joint), deformity, and disability.

Gout attacks are sporadic, with frequent attacks followed by long periods (sometimes years) of being symptom free. Stress, trauma, infections elsewhere in the body, hospitalization, surgery, and weight reduction can signal an acute attack of gout. Some medications and alcohol may also be linked to gout attacks.

Secondary gout may occur as a secondary infection due to other diseases, such as diabetes, HTN, leukemia and other blood disorders, bone cancer, and kidney disease.

Clients who receive treatment for gout have a good prognosis. The treatment varies according to whether gout is acute or chronic. Dietary changes and weight loss may also be part of the care plan. The goals of therapy are to stop an acute attack, reduce uric acid levels, and prevent future gout attacks as well as developing renal stones.

Drugs used to treat gout include corticosteroids, NSAIDs, corticosteroids, and other antigout medications. The corticosteroids are reserved for clients who are not responding to NSAIDs and for chronic sufferers.

**NOTE**

Corticosteroids are powerful hormones that can affect many body systems and, therefore, can cause widespread and potentially life-threatening side effects with long-term use. They should not be used in active infections.

Table 12.2 outlines common corticosteroid preparations.
### TABLE 12.2 Common Corticosteroids

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dosage</th>
<th>Dosage Limits</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cortisone</td>
<td>Cortisone</td>
<td>2mg to 300mg/day in divided doses</td>
<td>300mg every 24 hrs</td>
<td>Safety alert: Watch for the following: Thrombophlebitis (blood clot, inflammation in lower extremity) HTN Depression Euphoria Headache Personality Changes Psychoses Restlessness Cataracts Increased Intraocular Pressure Anorexia Nausea Vomiting Acne Decreased wound healing Ecchymoses Petechiae Hirsutis (increased hairiness) Hyperglycemia Fluid retention (long-term high doses) Hypokalemia Hypokalemic alkalosis Weight gain Weight loss Muscle wasting Osteoporosis Aseptic necrosis of joints Muscle pain Cushingoid appearance (moon face) Buffalo hump Increased susceptibility to infection</td>
</tr>
<tr>
<td>Prednisone</td>
<td>Deltasone</td>
<td>5mg to 60mg/day in divided doses</td>
<td>60mg/day</td>
<td>Same considerations as for all steroids described above</td>
</tr>
<tr>
<td></td>
<td>Orasone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triamcinolone</td>
<td>Aristocort</td>
<td>4mg to 48mg/day in divided doses</td>
<td>60mg/day</td>
<td>Same considerations as for all steroids described above as above</td>
</tr>
<tr>
<td></td>
<td>Kenalog</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NSAIDs are the first choice for treating gout in its early stages. NSAIDs are prostaglandin inhibitors; that is, they block pain impulses. Their analgesic (pain-relieving) property is one of three beneficial effects on gout of these drugs. NSAIDs are also popular choices for reducing fever and inflammation. (NSAIDs are used for a variety of painful conditions and fever. They are available over the counter. Their side effects are less worrisome than aspirin, but they can cause life-threatening gastrointestinal [GI] bleeding, myocardial infarction [MI], or cerebrovascular accident [CVA].)

The following table lists common NSAIDs.

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dosage</th>
<th>Dosage Limits</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Celocoxib</td>
<td>Celebrex</td>
<td>100mg, 200mg, 400mg caps</td>
<td>400mg</td>
<td>Safety alert: Watch for signs of GI bleeding. Watch for the following: Confusion Dizziness Rash Decreased urine Anorexia Nausea and vomiting (N &amp; V) Jaundice Weakness Sore throat Fever (blood cell changes) with long-term use</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>Motrin</td>
<td>50mg, 100mg, 200mg, 400mg, 600mg, 800mg tabs</td>
<td>200mg caps 100mg / 2.5mL suspension</td>
<td>2400mg daily</td>
</tr>
<tr>
<td>Naproxen</td>
<td>Naprosyn</td>
<td>200mg, 375mg, 500mg tabs 375mg, 500mg extended release</td>
<td>125mg / 5mL suspension</td>
<td>1100mg per 24 hrs</td>
</tr>
<tr>
<td>Tolmetin</td>
<td>Tolectin</td>
<td>200mg, 600mg tabs 400mg caps</td>
<td></td>
<td>2000mg per 24 hrs</td>
</tr>
</tbody>
</table>
Disorders of the Musculoskeletal System

Other antigout agents include allopurinol (Aloprim), colchicines, and probenicid. Each acts differently to reduce uric acid blood levels or reduce the frequency and severity of gout attacks.

Aloprim acts by decreasing uric acid production, which prevents a gout attack and protects the kidneys from damage. The dosage is 600mg to 800mg/day in divided doses. It should be given with milk to offset any GI disturbance. Its main side effect is a rash. Fluids should be encouraged to prevent toxicity due to accumulation of the drug.

In large doses, colchicine is very effective in relieving the pain and inflammation of gouty arthritis (joint pain); in smaller doses, it helps prevent recurrent gout attacks. It can be toxic to older or debilitated clients. For acute attacks, administer 0.5mg to 1.2mg orally, then 0.5mg to 0.6mg every one to two hours or 1mg to 1.2mg every two hours until relief; the daily limit is 8mg. To prevent future attacks (prophylactic use), administer 0.5mg to 0.6mg daily.

Probenicid acts by preventing renal tubules from reabsorbing uric acid, thereby boosting secretion of uric acid. It should be used cautiously in clients with a history of kidney stones, clients with renal disease, or those with a history of ulcers. The drug should be given with food to prevent GI upsets. Encouraging fluids helps prevent stone accumulation. Adult clients should receive 250mg of probenicid twice a day for one week; increase to 500mg twice daily, then increase by 500mg/day every four weeks. The dosage should not exceed 3g daily.
Exam-Prep Questions

1. Bones store almost 100% of the body’s calcium. Which of the following hormones aids in the storage of calcium?
   - A. Testosterone
   - B. Estrogen
   - C. Progesterone
   - D. Insulin

2. When given with calcium, which of the following supplements increases the body’s absorption of the calcium?
   - A. Vitamin D
   - B. Vitamin C
   - C. Vitamin A
   - D. Vitamin E

3. Muscle relaxants can cause all of the following effects except for what?
   - A. Sedation
   - B. Depression
   - C. Urinary urgency
   - D. Hyperactivity

4. NSAIDs should be given with
   - A. Water, and at least 30 minutes before other medications.
   - B. Water, and can be given with other medications.
   - C. Food.
   - D. Water and food without restrictions.

5. Which of the following effects can be attributed to long-term prednisone treatment?
   - A. Blurry vision
   - B. Dry skin
   - C. Thin skin
   - D. Loss of hearing
6. The MA-C may be responsible for administering a medication to improve bone density. Which of the following side effect is most common side effect of the medication Boniva?
   - A. GI upset
   - B. Pain in arms or legs
   - C. Weakness
   - D. Jaw discomfort

7. Of the following factors, all can lead to osteoporosis except for what?
   - A. A mild but prolonged lack of calcium
   - B. A hormonal imbalance to an endocrine disorder
   - C. An increase in estrogen
   - D. A sedentary lifestyle

8. Allopurinol is used to treat which of the following diseases?
   - A. Arthritis
   - B. Gout
   - C. Rheumatoid arthritis
   - D. Muscle spasms

9. Which of the following is a serious side effect of NSAIDs?
   - A. GI bleed
   - B. GI upset
   - C. Constipation
   - D. Frequent urination

10. The goal in treating osteoporosis includes all of the following reasons except for what?
    - A. Control bone loss
    - B. Prevent fractures
    - C. Control pain
    - D. Produce new bone
Rationales

1. The correct answer is **B**. Estrogen, the hormone responsible for the secondary sexual characteristics of females, is also important in the storage and usage of calcium. Testosterone, progesterone, and insulin are all hormones, but they have differing functions not related to the storage of calcium.

2. The correct answer is **A**. Calcium and Vitamin D work together to help the body absorb calcium. Choice B is needed for wound and cell repair. As for choices C and D, vitamin A is important for vision, and vitamin E is good for the health of your skin and hair.

3. The correct answer is **D**. Side effects of muscle relaxants include depression, urinary urgency, and sedation. Choice D is incorrect because the medication is a central nervous system (CNS) depressant that can cause drowsiness and sedation, not hyperactivity.

4. The correct answer is **C**. NSAIDs are to be given with food to decrease the chances of a GI bleed and GI upset. Choices B and C can be implemented at the desire of the patient. Choice A would increase the resident's chances of suffering from GI upset and could lead to GI bleeding.

5. The correct answer is **C**. The long-term use of steroids causes thinning of the skin. The other choices are not side effects of the medication class known as steroids.

6. The correct answer is **B**. The most common reported side effect of Boniva is pain in either the arms or the legs. Choices A and B are possible side effects, but are not reported as frequently. Choice D is a serious side effect. If this side effect occurs, the medication will be stopped and the RN notified so that he/she can report the complaint to the physician.

7. The correct answer is **C**. Mild but prolonged lack of calcium, hormonal imbalances, and sedentary lifestyles are all factors that can lead to osteoporosis. Choice C is incorrect because it is a decrease in estrogen and not an increase that can contribute to osteoporosis.

8. The correct answer is **B**. Allopurinol acts by decreasing the uric acid production, which is responsible for the development of gout. Allopurinol is not used for the diseases mentioned in choices A, C, or D.

9. The correct answer is **A**. NSAIDs can erode the lining of the stomach and cause bleeding. Choices B and C are possible side effects, but are not life threatening. Choice D is not a side effect of NSAIDs.

10. The correct answer is **C**. The goal of treatment for osteoporosis is decreasing bone loss by slowing the process, but not by producing new bone. Pain is not a problem with osteoporosis unless a fracture is present.
CHAPTER THIRTEEN

Medications Affecting the Central Nervous System

Medical Term Hot List

✓ AD
✓ Acetylcholine
✓ Adrenergic fiber
✓ Adrenergic blocking agent
✓ Agonist
✓ Anticholinergic agent
✓ Arachnoid layer
✓ Akinesia
✓ Axons
✓ Basal ganglia
✓ Barbiturate
✓ Brain stem
✓ Central nervous system
✓ Cholinergic fiber
✓ Chorea
✓ Cerebellum
✓ Cerebral cortex
✓ Cerebrospinal fluid (CSF)
✓ Cerebrum
✓ Dopaminergic
✓ Dorsal
✓ Dura mater
✓ Dysarthria
✓ Enuresis
✓ Equilibrium
✓ Euphoria
✓ Exacerbation
✓ Gray matter
✓ Homeostasis
✓ Hypnentic
✓ Hypoglycemia
✓ Inhibitor
✓ Insomnia
✓ mcg
✓ mL
✓ Mnemonic
✓ Motor activities
✓ Narcotic
✓ Narcotic antagonist
✓ Neuron
✓ Neurotransmitter
✓ Norepinephrine
✓ Oculogyric crises
✓ Opiate
✓ Pain
✓ Parasympathetic
✓ Peripheral nervous system
✓ Pia mater
✓ Phantom pain
✓ Precipitating factors
✓ Preoperatively
✓ Reticular formation
✓ Sedative
✓ Semisynthetic
✓ Sensory activities
✓ Substernal
✓ Sympathetic
✓ Sympathomimetic
✓ Synapse
✓ Synthetic
✓ Ventral
✓ Wong-Baker Pain Faces Scale

From the Library of Scott Kruse
Structure and Function of the Nervous System

The nervous, or neurologic, system is the body's communication network: its switchboard. It coordinates, organizes, and controls all body systems and their functions. The system contains two main divisions: the central nervous system (CNS) and the peripheral nervous system.

The Central Nervous System

The brain and spinal cord (the body's control center—CNS) make up this division. Both structures are fragile; they are protected by the skull, the vertebrae, and the cerebrospinal fluid (CSF), a liquid composed of water and traces of organic materials such as protein, glucose, and minerals. The CSF acts as a shock absorber from jolts and blows to the CNS. Three membranes cushion the brain and spinal cord: the dura mater, a tough, leatherlike fibrous tissue made of two layers (the endosteal dura and the meningeal dura) that cover, support, and protect the brain; the arachnoid, the middle layer; and the innermost layer, the pia mater.

The cerebrum, the largest part of the brain, houses the nerve center that controls sensory (signals to the brain) and motor activities (nervous responses to the signals). The outer layer of the cerebrum is the cerebral cortex; it contains gray matter and neuron cell bodies. The inner layer consists of white matter (axons) plus basal ganglia, which control motor coordination and steadiness.

The cerebrum is divided into the right and left hemispheres (areas/lobes). Motor impulses cross in the area of the medulla when descending from the brain. This results in controls for the left side of the body coming from the right side of the brain and vice versa. Lobes, or divisions, of the cerebrum have specialized functions that control the body.

In the center of the cerebrum is the thalamus, a relay station that further organizes cerebral function by transmitting impulses to and from appropriate areas of the cerebrum. The thalamus is also responsible for emotional responses such as fear and for distinguishing pleasant stimuli from unpleasant ones.

The hypothalamus (hypo, under), located under the thalamus, has autonomic (involuntary) connections with the brain, spinal cord, and the pituitary gland. It is responsible for temperature regulation, appetite control, blood pressure, breathing, sleep patterns, and peripheral nerve impulses that occur with behavioral and emotional expression. It partially controls stress reaction and also partially controls the pituitary gland.

The cerebellum and the brain stem make up the other main parts of the brain. The cerebellum, which lies beneath the cerebrum at the base of the brain, coordinates muscle movements, controls posture, and maintains equilibrium, or balance.
At the base of the brain lie the midbrain, the pons, and medulla oblongata. The brain stem holds most of the cranial nerves. Also in this area is a nerve network that acts as an arousal mechanism: the reticular formation.

The midbrain, pons, and medulla provide two-way conduction between the brain and spinal cord as follows:

- Pupillary reflexes and eye movements are controlled in the midbrain.
- The pons helps regulate respirations, chewing, taste, saliva secretion, hearing, and equilibrium.
- The medulla controls cardiac, respiratory, and vasomotor functions. It is also the center for the vomiting, coughing, and hiccupping reflexes.

The spinal cord also serves as a two-way nerve conduction pathway between the brain stem and the peripheral nervous system. The spinal cord extends downward from the brain to the second lumbar vertebra. It is in the cord that sensory messages are received and motor responses to sensory messages are generated to the muscles.

**The Peripheral Nervous System**

This division contains the cranial and spinal nerves connected to the CNS to outlying areas of the body. The cranial nerves conduct impulses between the brain and the head, neck, chest, and abdomen. They are responsible for the senses of smell, vision, hearing, pain, touch, temperature, and pressure. Touch receptors are in the skin and are most sensitive in the fingertips and toes. Taste buds are sensors in the tongue. Receptors in the nose provide the ability to smell.

This division relays and receives messages from those body parts. This system begins with 32 pairs of spinal nerves arranged in segments, which are attached to the spinal cord by two roots: the anterior (ventral) route, which contains motor fibers that relay nerve impulses from the spinal cord to the glands and muscles. The posterior or dorsal root contains sensory fibers that relay information from receptors to the spinal cord.

The autonomic nervous system is a subdivision of the peripheral nervous system. It controls digestion, respirations, and cardiovascular function. **Homeostasis** (steady state) is accomplished by two opposing subdivisions of this system:

1. The **sympathetic nervous system** controls how much energy is expended, which speeds up functions especially during stressful situations. Stress causes release of the **adrenergic** (epinephrine-releasing) catecholamine called norepinephrine. Norepinephrine is also described as a **sympathommetic** (-mimeticos, imitating). Sympathetic responses are in play during anger, excitement, or exercise.
2. The parasympathetic nervous system helps save energy, slowing body functions by releasing the cholinergic neurohormone called acetylcholine. When you are relaxed, the parasympathetic is operating; the same result can occur with overstimulation of the sympathetic nervous division.

Both of these systems help balance each other, maintaining homeostasis.

**Drugs That Affect the Autonomic Nervous System**

Many drugs cause sympathetic or parasympathetic effects on the body; they may also be given to cause an opposing therapeutic effect. For example, a parasympathetic effect may be needed to reverse a sympathetic response in clients who, during highly stressful situations, develop tachycardia and hypertension. A drug having a parasympathetic effect helps slow the pulse and lower the blood pressure.

Drugs responsible for affecting the autonomic system in a stimulating way are (1) adrenergic sympathomimetic (mimics adrenergic response like epinephrine to speed up functions) or (2) acetylcholine-like drugs, called cholinergics (that is, they slow body functions). These drugs are also referred to as parasympathomimetic drugs (mimic the parasympathetic nervous system); they block or slow cholinergic activity.

Drugs can have both adrenergic and cholinergic effects on the body because most organs contain both adrenergic and cholinergic fibers that are sensitive to such drugs. Clinically, adrenergic or cholinergic drugs are effective in treating disorders of the cardiovascular system such as angina, arrhythmias, heart failure, myocardial infarction, hypertension, and hypotension. In the respiratory system, conditions such as bronchospasm and emphysema respond to the effects of these drugs. Disorders of the gastrointestinal (GI) tract, such as indigestion, irritable bowel syndrome, pylorospasm, and peptic ulcer, also respond to these drugs. Several of these conditions have been reviewed in earlier chapters. Although various classifications of drugs used to treat these conditions were reviewed for their specific clinical indications (intended uses), their ability to act with adrenergic or cholinergic effects may not have been highlighted. One example is cetirizine (Zyrtec), classified as an antihistamine for treatment of allergies, as discussed in Chapter 9, “Medications Affecting the Digestive System.” Zyrtec primarily acts to antagonize the effect of histamine, relieving allergy symptoms. However, the drug also has an anticholinergic effect. Because it is has anticholinergic properties, it can slow body functions, namely the central nervous system.
Drugs That Affect the Autonomic Nervous System

Exams Alert
Dizziness and dizziness are common side effects of this drug and others that have anticholinergic effects.

Adrenergic Drugs
The autonomic nervous system has special receptors that can be stimulated by chemical of certain make up to in certain ways. These types are known as alpha, beta, and dopaminergic (caused by dopamine) receptors. Each receptor responds in predictable ways:

- **Alpha 1 receptor stimulation**: blood vessels constrict.
- **Alpha 2 receptor stimulation**: Norepinephrine is not released.
- **Beta 1 receptor stimulation**: Pulse (heart rate) is increased.
- **Beta 2 receptor stimulation**: Bronchi, uterine, and peripheral arterial blood vessels dilate, or relax.
- **Dopamine receptor stimulation**: Relief of Parkinson’s disease and increased urinary output in the kidney.

NOTE
A memory aid: For Alpha 1 and 2 receptors, the effect is primarily heart (one heart). For beta 2 receptors, remember the respiratory system (two lungs).

Adrenergic Agents
Table 13.1 lists the clinical uses of common adrenergic agents.

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Adrenergic Receptor</th>
<th>Action and Clinical Use</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuterol</td>
<td>Proventil</td>
<td>90mcg per puff (aerosol)</td>
<td>Beta 2</td>
<td>Bronchodilator in asthma, emphysema</td>
<td>Watch for and report dose-related side effects. Cardiovascular side effects: Angina Dizziness Dysrhythmias Orthostatic hypotension Palpitations Skin flushing Tachycardia Tremors GI side effects: N &amp; V</td>
</tr>
</tbody>
</table>

From the Library of Scott Kruse
Alpha-receptor stimulants act to vasoconstriction (constriction, or narrowing of blood vessels).

**Alpha- and Beta-Adrenergic Blocking Agents**

Alpha blockers relax, or dilate, blood vessels, making them ideal for treating clients with conditions that cause vasoconstriction, such as hypertension (HTN). Clients recovering from a myocardial infarction may develop dysrhythmias and continue to complain of angina (chest pain). They, too, can benefit from beta blockers that dilate the coronary arteries to allow for more effective oxygen delivery to the heart muscle, relieving the chest pain. A more oxygenated heart muscle helps prevent or relieve dysrhythmias.

Table 13.2 lists common beta-adrenergic blocking agents (beta blockers).
### TABLE 13.2 Beta-Adrenergic Blocking Agents (Beta Blockers)

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Clinical Use</th>
<th>Oral Dose Forms</th>
<th>Dosage Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atenolol</td>
<td>Tenormin</td>
<td>Hypertension</td>
<td>25mg, 50mg, 100mg tabs</td>
<td>Initially: 400mg daily For maintenance: 800mg to 1200mg daily</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ventricular dysrhythmias</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carvedilol</td>
<td>Coreg</td>
<td>Hypertension Heart failure Myocardial infarction</td>
<td>3.125mg, 6.25mg, 12.5mg, 25mg tabs</td>
<td>Initially: 6.25mg twice daily For maintenance: Up to 50mg daily</td>
</tr>
<tr>
<td>Metropolol</td>
<td>Lopressor</td>
<td>Hypertension Myocardial infarction Angina Heart failure</td>
<td>50mg, 100mg tabs 25mg, 50mg, 100mg, 200mg extended-release tabs</td>
<td>Initially: 100mg daily For maintenance: 100mg to 450mg daily</td>
</tr>
<tr>
<td></td>
<td>Toprol XL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nadolol</td>
<td>Corgard</td>
<td>Angina Hypertension</td>
<td>20mg, 40mg, 80mg, 120mg, 160mg</td>
<td>Initially: 40mg once daily For maintenance: 8mg to 320mg daily; maximum 640mg daily</td>
</tr>
<tr>
<td>Propranolol</td>
<td>Inderal</td>
<td>Dysrhythmias Hypertension Angina Myocardial infarction Migraine Tremors Hypertrophic subaortic stenosis</td>
<td>10mg, 20mg, 40mg, 60mg; 80mg tabs 60mg, 80mg, 120mg, 160mg sustained-release caps</td>
<td>Initially: 40mg twice daily For maintenance: 120mg to 160mg</td>
</tr>
<tr>
<td></td>
<td>Inderal LA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sotatol</td>
<td>Betapace</td>
<td>Dysrhythmias</td>
<td>80mg, 120mg, 160mg, 240mg tabs</td>
<td>Initially: 80mg twice daily For maintenance: up to 320mg daily</td>
</tr>
<tr>
<td>Timolol</td>
<td>Biocadren</td>
<td>Hypertension Myocardial infarction Migraine Angina</td>
<td>5mg, 10mg, 20mg tabs</td>
<td>Initially: 10mg twice daily For maintenance: Up to 30mg twice daily</td>
</tr>
</tbody>
</table>

Beta blockers can be dangerous when used for clients with respiratory disorders such as bronchitis, asthma, and emphysema because they can cause severe bronchoconstriction.

**NOTE**

An important fact to remember is that agents that cause vasodilation constriction can also cause bronchoconstriction. For this reason, dosage of these beta blockers must be carefully calculated, and these clients with chronic respiratory diseases receiving beta blockers should be carefully monitored for severe side effects.
Although many drugs are given for a specific indication as listed previously, they can act on more than one receptor. This can cause severe side effects when excessive dosing of the drug overly stimulates the unintended receptor. If the following systemic side effects are noted, the drug dose must be adjusted:

- **Cardiovascular**: Bradycardia, purple, mottled skin (results from peripheral vasoconstriction); increase in edema, dyspnea, orthopnea in CHF
- **Endocrine**: Signs and symptoms of hypoglycemia (low blood sugar) in diabetic clients (blurred or double-vision, headache, hunger, sweating, or weakness)
- **Respiratory**: Bronchospasm, wheezing

**Cholinergic Agents**

These agents, also called parasympathomimetics, directly stimulate the parasympathetic nervous system. Their effects are similar to naturally occurring acetylcholine. Cholinergic agents act to produce the following effects:

- Decrease blood pressure
- Decrease pressure inside the eye (**intraocular pressure**)  
- Increase GI motility and secretions
- Increase urinary bladder contractions
- Increase bronchial secretions
- Increase the force of skeletal muscle contractions

Because cholinergic fibers are present throughout the body, most systems are affected by cholinergic agents. Because not all cholinergic fibers respond in the same way to the same dosage, adverse effects such as nausea and vomiting, diarrhea, and abdominal cramping can occur. Therefore, they are dose dependent and usually resolve by adjusting the dosage of the drug. Dizziness and hypotension are common side effects, which require safety precautions and education for the client receiving a cholinergic. If the client develops wheezing, bradycardia, or bronchospasm, withhold the next dose and notify the nurse immediately.
Anticholinergics are given to treat conditions affecting the GI and GU tract, the eye, Parkinson’s disease (see the review of Parkinson’s disease later in this chapter), and bradycardia. They are used preoperatively (prior to surgery) to decrease respiratory secretions so that clients do not aspirate them during anesthesia. They also assist in endotracheal intubation (passing a breathing catheter through the vocal cord into the bronchi to assist with breathing while the client is anesthetized for an operative procedure).

Side effects of anticholinergics are linked to higher doses. Because the drugs dry up secretions, a dry mouth, nose, and throat are common side effects. Urinary retention may also result from the drugs’ effects. Orthostatic hypotension raises safety concerns for clients receiving anticholinergics. It is important to report to the nurse any change in the client’s behavior such as confusion, depression, hallucinations (hearing or seeing objects or persons who are not present), or nightmares. These effects can be very frightening to the client and must be relieved by adjusting the drug dosage.

Table 13.3 outlines common cholinergic agents.

**TABLE 13.3 Cholinergic Agents**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Clinical Use</th>
<th>Dose Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bethanechol</td>
<td>Urecholine</td>
<td>Restores urinary bladder tone</td>
<td>5mg, 10mg, 25mg, 50mg tabs</td>
</tr>
<tr>
<td>Pyrodostigmine</td>
<td>Mestinon</td>
<td>Treatment of myasthenia gravis</td>
<td>60mg tabs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>60mg / 5mL syrup</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>180mg sustained-release tabs</td>
</tr>
<tr>
<td>Neostigmine</td>
<td>Prostigmin</td>
<td>Treatment of myasthenia gravis</td>
<td>15mg tabs</td>
</tr>
</tbody>
</table>

**Anticholinergic Agents**

Anticholinergic agents, also called cholinergic blockers, block acetylcholine in the parasympathetic nervous system. These agents prevent acetylcholine from acting, thus reducing the parasympathetic response.

**EXAM ALERT**

The effects of blocking acetylcholine are opposite of those listed previously for cholinergic drugs and include the following:

- Drying secretions of the oropharynx and bronchi
- Decreasing secretions and motility (peristaltic movement) of the GI tract
- Decreasing sweating
- Increasing the heart rate
- Dilating the pupil, relieving pressure in clients with glaucoma
Table 13.4 outlines common anticholinergic agents.

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Clinical Indication</th>
<th>Dose Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atropine</td>
<td>Atropine sulfate</td>
<td>Spastic conditions of the GI tract</td>
<td>0.4mg tabs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Urethral and biliary colic</td>
<td></td>
</tr>
<tr>
<td>Belladonna</td>
<td>Belladonna tincture</td>
<td>Peptic ulcer Indigestion</td>
<td>30mg / 100mL tincture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Enuresis (bedwetting)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parkinson’s disease</td>
<td></td>
</tr>
<tr>
<td>Dicyclomine</td>
<td>Bentyl</td>
<td>Irritable bowel syndrome</td>
<td>20mg tabs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10mg caps</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10mg / 5mL syrup</td>
</tr>
<tr>
<td>Glycopyrrolate</td>
<td>Robinul</td>
<td>Peptic ulcer disease</td>
<td>1mg, 2mg tabs</td>
</tr>
<tr>
<td>Propantheline</td>
<td>Pro-Banthine</td>
<td>Peptic ulcer disease</td>
<td>7.5mg, 15mg tabs</td>
</tr>
</tbody>
</table>

**Sedative-Hypnotic Drugs**

Sedative-hypnotic drugs are used to assist clients to fall/stay asleep. An hypnotic (*hypnos*, sleep) produces sleep by rendering clients insensitive to pain by inhibiting sensory impulses or inhibiting the client’s ability to receive sensory impressions in the center of the brain, causing partial or complete unconsciousness. A sedative has a relaxing, restful effect on the client. Given in combination or singly, sedative-hypnotic preparations extend the total time for sleeping. Their effects are largely dose dependent. In small doses, they have a sedating effect; sleep results from the hypnotic effect of a larger dose. Sedative-hypnotics are clinically indicated for insomnia, anxiety, and relaxation. They may be given preoperatively to promote sleep.

Side effects of sedative-hypnotics cause safety concerns for clients; that is, they depress the CNS, which can cause oversedation, decreased alertness, and the inability to perform normal motor activities. Clients should be assisted with activities of daily life (ADLs) and protected from potential injuries or falls.

Barbiturates act as sedatives or hypnotics. Some are used in anesthesia and for treating seizures. Their effects on the CNS can range from mild sedation to deep coma and death. Coma and death result either from an accidental overdose or from death by suicide. Barbiturates are highly addictive and, for that reason, may be taken in larger and larger quantities to provide the same effect on a client; therefore, accidental overdose is possible with self-administration.

Short-acting barbiturates, like pentobarbital (Nembutal) or secobarbital (Seconal), are commonly prescribed before certain diagnostic procedures. Long-acting forms of the drug, such as phenobarbital, are effective in preventing seizures.
Side effects of barbiturates are similar to their effects, but the effects are taken to the extreme: sedation lethargy (feeling sleepy), sluggish or extremely drowsy; headache, mental depression, and muscle or joint pain may be observed. Older clients and clients in severe pain may react adversely to the intended effects of barbiturates by becoming overexcited, restless, or confused. Observe and report these responses immediately. Such clients must be protected from injury until the side effects resolve.

Barbiturates can cause allergic reactions such as hives, pruritis, fever, or rash. If these occur, report observations to the nurse, hold the next dose, and wait for further instructions from the nurse.

Table 13.5 outlines common barbiturates.

**TABLE 13.5 Barbiturates**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Clinical Indications</th>
<th>Dose Forms</th>
<th>Dose Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pentobarbital</td>
<td>Nembutal</td>
<td>Short acting <em>(Schedule II)</em></td>
<td>100mg caps, 20mg / 5mL elixir</td>
<td>For sedation: 32mg to 100mg three to four times daily. As anticonvulsant: 400mg to 600mg daily</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Daytime sedative</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypnotic for sleep</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-anesthetic sedative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phenobarbital</td>
<td>Luminal</td>
<td>Long acting (Schedule IV) Anticonvulsant</td>
<td>8, 15mg, 30mg, 60mg, 100mg caps</td>
<td>Long-acting (Schedule IV) Anticonvulsant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Daytime sedative</td>
<td>16mg caps, 15mg, 20mg / 5mL elixir</td>
<td>Daytime sedative, pre-anesthetic hypnotic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-anesthetic or hypnotic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secobarbital</td>
<td>Seconal</td>
<td>Short acting <em>(Schedule II)</em></td>
<td>100mg caps</td>
<td>For hypnotic effect: 100mg to 200mg at bedtime</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Daytime sedative</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypnotic for sleep</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Scheduled drugs require close monitoring and inventory.

**Benzodiazepines**

Benzodiazepines are short-acting sedative-hypnotics whose actions are similar to those having CNS effects but are more selective than other drugs like barbiturates. Because of their selectivity, they are the commonly used sedative-hypnotics as they are also effective in treating anxiety, muscle spasms, and convulsions. Benzodiazepines serve well as mild sedatives, short-term sleep aids, and preoperative sedatives. They must not be used for long periods because a dependence and tolerance to them can occur, which gradually decreases the quality of sleep; clients who discontinue using them may experience rebound insomnia or disturbing dreams. Rapid discontinuation of these drugs after long-term use may produce dangerous withdrawal symptoms similar to those with alcohol withdrawal. For this reason, benzodiazepines must be withdrawn gradually over a two to four-week period, under the care of a physician.
The side effects of benzodiazepine use closely resemble those for barbiturates with the additional problem of amnesia and liver toxicity. Clients receiving these medications must be closely observed for any memory loss and monitored for changes in liver function.

Table 13.6 lists common benzodiazepines.

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Clinical Indications</th>
<th>Dose Forms</th>
<th>Oral Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flurazepam</td>
<td>Dalmane</td>
<td>Long acting (Schedule IV) Short-term treatment of insomnia</td>
<td>15mg, 30mg caps</td>
<td>15mg to 30mg at bedtime</td>
</tr>
<tr>
<td>Lorazepam</td>
<td>Ativan</td>
<td>Insomnia can be used as anti-anxiety agent</td>
<td>0.5mg, 1mg, 2mg tabs 2mg / 5mL oral solution 2mg / 5mL syrup</td>
<td>For hypnotic effect: 2mg to 4mg at bedtime</td>
</tr>
<tr>
<td>Temazepam</td>
<td>Restoril</td>
<td>Intermediate acting (Schedule IV) Insomnia</td>
<td>7.5mg, 15mg, 22.5mg, 30mg caps</td>
<td>Hypnotic effect: 15mg to 30mg at bedtime</td>
</tr>
<tr>
<td>Rizolam</td>
<td>Halcion</td>
<td>Short acting (Schedule IV) Insomnia if used for up to two weeks only</td>
<td>0.125mg, 0.25mg tabs</td>
<td>For hypnotic effect: 0.125mg to 0.5mg at bedtime</td>
</tr>
</tbody>
</table>

### Non-Barbiturate, Non-Benzodiazepine Sedative-Hypnotic Agents

The added benefit of these sedative-hypnotic agents is that they do not cause daytime drowsiness. Their side effects differ from the barbiturate-benzodiazepine class in that if taken before falling asleep, they can produce restlessness, moodiness, and anxiety prior to falling asleep. Clients taking these drugs can become moody, feel lethargic, and develop coordination problems. They can also experience a “morning hangover.” Take care with older clients because they may react to the drug in an opposite way of their intended effect (for instance, become excited, restless, or confused). These changes in behavior can be very disturbing, requiring the nursing staff to calm and assist them to remain oriented to person, place, and time. Caution must be exercised to protect and prevent them from injury.

Table 13.7 outlines non-barbiturate, non-benzodiazepine sedative-hypnotic agents.
**TABLE 13.7** Non-Barbiturate and Non-Benzo-diazepine Sedative-Hypnotic Agents

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Clinical Indications</th>
<th>Dose Forms</th>
<th>Dose Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloral hydrate</td>
<td>Aquachloral</td>
<td>Schedule IV drug, Bedtime hypnotic, Preoperative sedative</td>
<td>500mg caps, 250mg, 500mg / 5mL syrup, 324mg to 648 mg suppositories</td>
<td>For sedation: 250mg three times daily after meals, Hypnotic effect: 500mg to 1g 15–30 minutes before bedtime</td>
</tr>
<tr>
<td>Diphenhydramine</td>
<td>Bendaryl</td>
<td>Mild insomnia</td>
<td>12.5mg, 25mg, 50mg tabs, 25mg, 50mg caps, 12.5mg / 5mL liquid</td>
<td>25mg to 50mg at bedtime</td>
</tr>
<tr>
<td>Eszopiclone</td>
<td>Lunesta</td>
<td>Hypnotic effect</td>
<td>1mg, 2mg, 3mg</td>
<td>Hypnotic effect: 2-3mg</td>
</tr>
<tr>
<td>Zolpidem</td>
<td>Ambien</td>
<td>Schedule IV drug, Hypnotic effect</td>
<td>5mg, 10mg tabs, 6.25mg, 12.5mg controlled release</td>
<td>Hypnotic effect: 10mg at bedtime</td>
</tr>
</tbody>
</table>

**Analgesics**

Pain is described as a discomfort, an aching, burning, stabbing, griping, or soreness that occurs anywhere in the body. Pain impulses, generated by pain receptors at the site of the injury, travel to the spinal cord, and then travel up to the brain.

Pain is subjective; that is, it cannot be visualized by another but is reported by the client, as the client perceives it. Pain is not a disease, but instead is a warning that something is wrong in the body; it signals tissue damage that causes the client to seek medical attention.

Signs and symptoms of pain occur in terms of how the body responds to the pain or how the client behaves in response to it.

**Body System Responses**

- **Cardiovascular:** Increase in pulse and blood pressure
- **GI:** Appetite changes, N & V
- **Nervous:** Dizziness, numbness, pale skin, sleeping, sweating, tingling, shaking
- **Behavior and other changes:**
  - Crying to screaming
  - Gasping or holding breath
  - Grimacing
  - Groaning

From the Library of Scott Kruse
Grunting
Holding body part
Irritability
Mood changes
Positioning for attempted comfort or refusal to move a body part
Quietness
Restlessness
Slow or rapid speech in variety of volumes

Pain occurs as part of a variety of clinical disorders and is one of the most difficult experiences for the client to deal with because of the clinical condition or disease. Clients may describe different types of pain.

Pain can be constant, come and go (intermittent), or might occur in a serial fashion (for example, the pain of a migraine headache). The intensity of pain can range to a slightly uncomfortable sensation to debilitating or excruciating degree that can become unbearable. Pain perception is an individual experience. What causes some clients to hurt tremendously may cause others only a slight ache or discomfort. This is known as a client’s pain tolerance or threshold. When a client complains of pain, the client has pain, so it must be believed because the examiner cannot see, hear, smell, feel, or otherwise examine pain directly.

A client may respond to pain differently from one episode to another, based on a variety of factors.

**Age.** The very young have had few experiences with pain and often do not understand it, and they may have few words to describe it. Adults must be aware of behavior changes in children to detect their discomfort.

Parents learn to discern an infant’s cry, for example, to distinguish between hunger or hurt.

Older clients have decreased sensations to pain because of age-related changes in the central and peripheral nervous systems. With age, certain nerve cells die and pathways are blocked by disease or pathways that no longer transmit nerve impulses effectively. Therefore, pain signals are unreliable for older clients, putting them at risk for disease or injury. Older individuals may also ignore pain as “just part of getting old,” when, in fact, an illness is developing that requires attention. Past experiences, culture, and the meaning of illness all play a part, as well, in clients reporting pain.

Behavior changes are often the best indicators of pain for the caregiver. Once chatty, a client in pain may become very quiet. Other clients who are otherwise sociable may stay in bed and isolate themselves from normal activities when in pain. Clients may also become anorexic,
often an early sign of pain. It is important to know clients well so that subtle changes in behavior and activity can be reported and investigated so that all clients can be cared for efficiently and effectively to promote their comfort.

**The value and meaning of pain.** Cultural beliefs can influence a client’s response to pain. In some cultures, expressing pain is viewed as a personal character weakness. Clients in severe pain may ignore pain or appear as stoic (that is, show no response in the presence of an obviously painful experience). In other cultures, expressing pain is welcomed and encouraged. Some persons welcome pain as a means of gaining attention; in this way, pain is useful to them. Clients may ignore pain because they believe that ignoring it will mean it has no importance or they are afraid to acknowledge pain as a sign of a serious condition.

**Previous experience with pain.** First experiences with pain may trigger a severe response from the client due to fear of the unknown. For example, women in labor for the first time might not handle the pain as well as when having a second child. In laboring with their second infant, they may have better control over pain because it is not a new experience.

**Illness.** Illnesses that dull pain sensations or prevent them, such as a paralysis, may influence the client’s pain perception. Although the situation seems merciful, clients are at high risk for injury or illness because they do not respond to painful stimuli and, therefore, do not benefit from pain as a warning.

Pain assessment is important when diagnosing a particular illness or condition. Using the mnemonic (memory aid) COLDER, examiners ask clients to describe the following:

**Character of pain.** Clients describe the intensity of their pain on a pain continuum scale; the scale is part of the *Wong-Baker Faces Pain Rating Scale*, designed for children to identify the kind of face they would make when in pain at differing levels, with a slight frown being a level 1 to crying continuously at a level 10. It is used for clients of all ages. A level 1 pain means that the pain is annoying but does not interfere with ADLs. A level 10 pain means that the client is crying and cannot function normally. Pain scales are important gauges for clients describing the pain and the need for relief. It is important for anyone administering analgesics (an, without; algesic, pain) to ask the client the extent of their pain according to the pain scale and to record their pain level when charting the medication. The healthcare provider should also evaluate the effectiveness of the analgesic within an hour of its administration, noting the client’s pain level at that time. If unrelieved, the nurse should be notified to reassess the appropriateness of the drug’s dosage or to determine whether another clinical situation has developed. In some cases, another more effective analgesic drug may be ordered.

**Onset and duration of pain.** Clients report when the pain begins and how long it lasts:

- **Acute pain** occurs suddenly from injury, disease, trauma, or surgery. Acute pain lasts for a short time and lessens with healing of injured tissues.
Chronic pain lasts longer, usually more than six months. It may accompany a chronic illness or condition such as cancer or arthritis. Chronic may come and go (recurring), or be a constant burden.

Phantom pain is pain reported by the client in a body part that has been amputated or is no longer there for any reason.

**Location.** Clients point to or describe the location of their pain. Pain may be experienced in more than one location.

Radiating pain is felt at the site of tissue damage and nearby areas, such as pain from a heart attack (myocardial infarction [MI]). Pain in the left chest area pain is also felt; that is, it radiates to the jaw, left arm, or left shoulder. This is due to the pain pathways on the left side of the body. The pain from gallbladder disease (gallbladder colic) is felt in the upper-right side of the abdomen, the back, and the right shoulder.

**Exacerbation of pain.** Clients describe what makes their pain worse. Precipitating factors (that is, those causes of returning pain, such as exercise) may cause exacerbations of pain.

**Relief of pain.** Clients share what makes the pain go away or lessen.

To use the mnemonic data regarding chest pain, the examiner might chart an assessment of chest pain: The pain is described as dull or heavy, gradual in onset, and located substernally (beneath the sternum). It may increase with activity and is relieved by nitroglycerin.

The goals of pain management are to prevent suffering and disability, prevent pain from worsening, control the side effects of managing pain, and improve the client's ability to resume ADLs at an optimum level.

Analgesic agents interact with opiate (opion, poppy juice) receptors in the CNS to control pain. When stimulated, the receptors block pain. An opiate is a drug that contains opium or that has opium-like activity. Opium is a natural ingredient in the poppy plant, which, when harvested, yields substances such as morphine (Morpheus, god of sleep), codeine, heroin (a morphine-like drug), and papaverine, all potent alkaloids.

**Opiate analgesics.** Analgesics other than those derived from poppy pods act in the same way as the original opiates. A group of semisynthetic (partially natural, partly altered chemically) or synthetic (manufactured or put together) opiate agonists are used to relieve moderate to severe pain. They are advantageous due their ability to relieve pain without loss of consciousness.

Opiate agonists are specialized drugs in that they work by stimulating opiate receptors in the CNS to produce the following effects:

- Analgesia
- Cough reflex suppression
Drugs That Affect the Autonomic Nervous System

- Drowsiness
- Euphoria (inflated feeling of physical or mental well-being)
- Mental clouding
- Nausea and vomiting
- Respiratory depression
- Sedation

Clinical indications (uses) of opiate agonists include the following:
- Acute or chronic pain relief, moderate to severe in nature
- Adjunct to anesthesia
- Anxiety reduction
- Preoperative sedation

Although relatively rare, addiction can occur with use of opiate analgesics for acute pain management. Used recreationally, they are highly addictive. Signs and symptoms of opiate withdrawal include the following:
- Muscle and abdominal cramping
- Hot and cold flashes
- Diarrhea
- Goose flesh
- Nausea and vomiting
- Perspiration
- Restlessness
- Sneezing
- Elevated TPR and BP
- Dramatic behavioral changes

If any of these physical changes occur, report them immediately to the nurse.

Table 13.8 lists common opiate agonists.
## TABLE 13.8 Opiate Agonists

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Adult Dose</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Codeine</td>
<td>Codeine Sulfate</td>
<td>15mg, 30mg, 60mg tabs, 15mg / 5mL solution</td>
<td>For analgesia: 15mg to 60mg every 4 hours</td>
<td>Safety precautions! CNS depressants. Watch decreased respirations.</td>
</tr>
<tr>
<td></td>
<td>Codeine Phosphate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydromorphone</td>
<td>Dilaudid</td>
<td>2, 4, 8mg tabs 12, 16, 24, 32mg caps extended-release 1mg/mL liquid 3mg suppositories</td>
<td>2mg every 4–6 hrs orally 3mg every 6–8 hrs rectally</td>
<td>Check Medication Administration Record (MAR) for last dose before giving PRN (as-needed) medication.</td>
</tr>
<tr>
<td>Morphine</td>
<td>Roxanol</td>
<td>15mg, 30mg tabs 15mg, 30mg caps 15mg, 30mg, 60mg, 100mg, 200mg sustained-release 10mg, 20mg, 100mg / 5mL 20mg / mL solution 5mg, 10mg, 20mg, 30mg suppositories</td>
<td>10mg to 30mg every 4 hrs 10mg to 20mg every 4 hrs rectally</td>
<td>Observe, report constipation, force fluids; add fiber to diet. Give stool softeners or laxatives. Watch for urinary retention. Measure I &amp; O.</td>
</tr>
<tr>
<td></td>
<td>Morphine Sulfate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Duramorph</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MS Contin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kadian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxycodone</td>
<td>Oxycontin (Percocet w/aspirin)</td>
<td>10mg, 20mg, 40mg, 80mg, 160mg (tabs or controlled release) 5mg / 5mL 20mg/mL solution 5mg tabs</td>
<td>5mg every 6 hrs</td>
<td>Watch for opiate abuse: Frequent requests for analgesia.</td>
</tr>
<tr>
<td>Meperidine-Like Derivatives</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fentanyl</td>
<td>Actiq</td>
<td>200mg, 400mg, 600mg, 800mg, 1200mg, 1600mg lozenges</td>
<td>200mcg buccal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Duragesic</td>
<td>100mg, 200mg, 300mg, 400mg, 600mg, 800mg buccal 12mcg, 25mcg, 50mcg, 75mcg, 100mcg / hr transdermal patch</td>
<td>25mcg / hr every 72 hrs</td>
<td></td>
</tr>
<tr>
<td>Meperidine</td>
<td>Demerol</td>
<td>50mg, 100mg tabs 50mg / 5mL syrup</td>
<td>50mg to 150mg every 3–4 hrs</td>
<td></td>
</tr>
</tbody>
</table>
Drugs That Affect the Autonomic Nervous System

Methadone-Like Derivatives

Methadone

**Methadone**

- **Methadone 5mg, 10mg, Analgesia:** 2.5mg to 5mg every 3–4 hrs
- **Dolophine 40mg tabs 10mg:**
  - **5mg, 10mg / Maintenance:**
    - **5mL solution 10mg / mL oral concentration**

Tramadol

**Ultram 50mg tabs 50mg to 100mg**

Nonsteroidal Anti-Inflammatory Agents

Mild to moderate pain relief, a reduction of inflammation, and control of a fever are possible with nonsteroidal anti-inflammatory agents (NSAIDs). Chemically, they act to block prostaglandins and are similar to aspirin. They relieve minor aches and pains, headaches, toothaches, and joint pain from arthritis as well as menstrual cramps. NSAIDS should not be given to clients who are allergic to aspirin. Although the side effects from NSAIDs appear to be less than other analgesics such as aspirin, they can cause life-threatening complications such as GI bleeding, a stroke, or heart attack.

Table 13.9 describes common NSAIDs.

**TABLE 13.9 NSAIDs**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Clinical Indications</th>
<th>Dose Forms</th>
<th>Maximum Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Celecoxib</td>
<td>Celebrex</td>
<td>Rheumatoid and osteoarthritis</td>
<td>100mg, 200mg, 400mg caps</td>
<td>400mg daily</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For arthritis: 100mg to 200mg twice daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>For acute pain and dysmenorrheal: 400mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>initially, then 200mg twice daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fenoprofen</td>
<td>Nalfon</td>
<td>Mild to moderate pain</td>
<td>200mg, 300mg tabs</td>
<td>3200mg daily</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>Motrin, Advil</td>
<td>Mild to moderate pain Rheumatoid and</td>
<td>400mg every 4–6 hrs</td>
<td>2400 mg daily</td>
</tr>
<tr>
<td></td>
<td></td>
<td>osteoarthritis:</td>
<td>300mg to 600mg three to</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>four times daily</td>
<td></td>
</tr>
<tr>
<td>Indomethacin</td>
<td>Indocin</td>
<td>Acute pain Rheumatoid, osteoarthritis</td>
<td>25mg to 50mg three to</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gouty arthritis</td>
<td>four times daily Same</td>
<td>200mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50mg three times daily</td>
<td></td>
</tr>
</tbody>
</table>
242
Chapter 13: Medications Affecting the Central Nervous System

**TABLE 13.9 Continued**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Clinical Indications</th>
<th>Dose Forms</th>
<th>Maximum Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ketoralac</td>
<td>Toradol</td>
<td>Rheumatoid, osteoarthritis Mild pain</td>
<td>75mg three times daily (reduce dose in older clients) 25mg to 50mg three to four times daily</td>
<td>300 mg daily</td>
</tr>
<tr>
<td>Nabumetone</td>
<td>Relafen</td>
<td>Rheumatoid osteoarthritis</td>
<td>1000mg to 1500mg daily in one or two doses</td>
<td>2000mg daily</td>
</tr>
<tr>
<td>Naproxen</td>
<td>Naprosyn</td>
<td>Rheumatoid, osteoarthritis</td>
<td>250mg to 375mg daily</td>
<td>1000mg daily</td>
</tr>
<tr>
<td>Oxaprozin</td>
<td>Daypro</td>
<td>Rheumatoid, osteoarthritis</td>
<td>1200mg once daily</td>
<td>1800mg daily</td>
</tr>
<tr>
<td>Sulindac</td>
<td>Clinoril</td>
<td>Rheumatoid, osteoarthritis Acute shoulder pain</td>
<td>150mg twice daily; 200mg twice daily</td>
<td>400mg daily</td>
</tr>
</tbody>
</table>

**Salicylates**

Salicylates slow the production of prostaglandins, which are responsible for activating pain receptors. They have an analgesic effect, decrease inflammation, and reduce fever. They produce no mental slowness or sedation, neither do they affect memory.

Aspirin, a salicylate, treats painful conditions and also has anticoagulating (anti-blood clotting) effect in blood vessels. Aspirin reduces platelet activity by preventing platelets from forming clots responsible for heart attacks, thrombophlebitis, and stroke.

Because aspirin prevents clotting, it can cause GI bleeding. The emesis (vomit) from a GI bleed may be bright red (fresh blood from upper GI tract) or dark brown or black and coffee-ground appearing (blood coming from lower GI tract). Black and tarry (sticky) stools also signal bleeding in the GI tract and must be reported immediately.

Salicylates can become toxic with high doses or continued use. Signs of toxicity include tinnitus (ringing in the ears), hearing loss, dimmed vision, sweating, fever, dizziness, confusion, or nausea and vomiting. Any signs of toxicity should be reported so that the drug dose can be reduced to resolve the toxic effects of the drug.

Table 13.10 lists common salicylates.

**TABLE 13.10 Salicylates**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Clinical Indications</th>
<th>Dose Forms</th>
<th>Maximum Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin</td>
<td>ASA</td>
<td>Minor aches/pains</td>
<td>81, 165mg, 325mg, 500mg, 600mg tabs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zoprin</td>
<td>Myocardial infarction prophylaxis</td>
<td>120mg, 200mg, 300mg, 500mg suppositories</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Empirin</td>
<td></td>
<td>81mg to 325mg daily</td>
<td></td>
</tr>
</tbody>
</table>

From the Library of Scott Kruse
Drugs That Affect the Autonomic Nervous System

Difunisal
Dolobid
Mild to moderate pain
Osteoarthritis, rheumatoid arthritis
250mg, 500mg
Initially: 1000mg; then 500mg every 8 hrs
250mg to 500mg twice daily
1500mg

Sodium salicylate
Sodium Salicylate; ReagentPlus
Mild pain
Mild pain: 325mg to 650mg every 4–8 hrs
3900mg

Other Analgesic Products
Other opiate and opiate-like drugs offer analgesia. These synthetic drugs may be single preparations or combination drugs, as listed in the Table 13.11.

TABLE 13.11 Opiate and Opiate-Like Drugs Offering Analgesia

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Noncontrolled Ingredients</th>
<th>Controlled Substance</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anacin</td>
<td>Aspirin</td>
<td></td>
<td>400mg</td>
</tr>
<tr>
<td></td>
<td>Caffeine</td>
<td></td>
<td>32mg</td>
</tr>
<tr>
<td>Tylenol</td>
<td>Acetaminophen</td>
<td></td>
<td>325mg to 650mg</td>
</tr>
<tr>
<td>Tempra</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Datril</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BC powder</td>
<td>Aspirin</td>
<td></td>
<td>650mg</td>
</tr>
<tr>
<td></td>
<td>Caffeine</td>
<td></td>
<td>65mg</td>
</tr>
<tr>
<td></td>
<td>Salicylamide</td>
<td></td>
<td>125mg</td>
</tr>
<tr>
<td>Darvon</td>
<td>Propoxyphene</td>
<td></td>
<td>65mg to 100mg</td>
</tr>
<tr>
<td>Darvocet-N 50</td>
<td>Acetaminophen</td>
<td>Propoxyphene Napsylate</td>
<td>325mg</td>
</tr>
<tr>
<td>Empirin</td>
<td>Aspirin</td>
<td>Codeine</td>
<td>325mg</td>
</tr>
<tr>
<td>Codeine #3</td>
<td>Caffeine</td>
<td></td>
<td>30mg</td>
</tr>
<tr>
<td>Excedrin</td>
<td>Aspirin</td>
<td>Acetaminophen</td>
<td>250mg</td>
</tr>
<tr>
<td></td>
<td>Caffeine</td>
<td></td>
<td>250mg</td>
</tr>
<tr>
<td>Fiorinol w/codeine</td>
<td>Aspirin</td>
<td>Codeine</td>
<td>325mg</td>
</tr>
<tr>
<td></td>
<td>Caffeine</td>
<td></td>
<td>40mg</td>
</tr>
<tr>
<td></td>
<td>Butalbital</td>
<td></td>
<td>50mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30mg</td>
</tr>
<tr>
<td>Lortab 10/500</td>
<td>Acetaminophen</td>
<td>hydrocodone</td>
<td>500mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10mg</td>
</tr>
<tr>
<td>Percodan</td>
<td>Aspirin</td>
<td>Oxycodone</td>
<td>325mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4.5mg</td>
</tr>
<tr>
<td>Percogesic</td>
<td>Acetaminophen</td>
<td>Phenytoxolamine</td>
<td>325mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30mg</td>
</tr>
</tbody>
</table>

From the Library of Scott Kruse
TABLE 13.11  Continued

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Noncontrolled Ingredients</th>
<th>Controlled Substance</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tylenol w/codeine #2</td>
<td>Acetaminophen</td>
<td>Codeine</td>
<td>300mg 15mg</td>
</tr>
<tr>
<td>Vicodin</td>
<td>Acetaminophen</td>
<td>Hydrocodone</td>
<td>500mg 5mg</td>
</tr>
</tbody>
</table>

Side effects of these drugs mimic those of other opiate and opiate-like analgesics. Safety precautions should be observed with their use. Because these drugs can cause GI irritation, they should be given with food or milk. Allergic reactions are common and can be life-threatening.

NOTE

Acetaminophen can have life-threatening effects, causing liver damage. Clients should be warned that acetaminophen is a common ingredient in many combination analgesics and that overdose is to be avoided. The maximum dose of acetaminophen should not exceed 1300mg every eight hours for adults and children over 12 years of age. Daily doses of acetaminophen should not exceed four (4) grams daily for clients with hepatic or renal dysfunction.

Drugs Used for Alzheimer’s Disease

Alzheimer’s disease (AD) is a form of dementia, which means a progressive, irreversible decline in mental function, marked by memory impairment, diminished capacity to reason, problem-solve, complete daily tasks, learn, and understand. The client with AD loses social, occupational, and intellectual abilities. AD is a chronic, progressive degenerative disorder of the cerebral cortex. Degeneration is most evident in the frontal lobes, but atrophy occurs in all areas of the cortex.

Although early onset AD can occur, it strikes older clients 85 years of age or older. Despite recent promising research and advances in drug therapy, the disease is progressive prognosis is poor for the millions of clients afflicted by dementia.

The cause of AD is unknown. Several factors are believed to contribute to its development:

- Genetic factors. Researchers believe that up to 70% of AD cases may result from a genetic abnormality on chromosome 21. Amyloid, a brain protein, has also been identified as characteristic of AD.
- Viral factors. Slow-growing viruses.
- Trauma.

The brain of AD clients has three distinct features: neurofibrillary (tiny branching neurofibers) tangles, neuritic plaques/masses, and degenerated neurons. Early cerebral changes include
microscopic plaques, made up of a core surrounded by fibrous tissue. Later, atrophy of the cortex becomes strikingly apparent. The ventricles within the brain enlarge. Clients with large numbers of neuritic plaque (lesions) will experience more severe disease. The plaques contain amyloid, causing neurotoxic effects. Plaques are responsible for the death of these affected neurons.

The severity of AD is directly related to the reduced amount of acetylcholine in the brain. At autopsy, the brains of AD clients contained as little as 10% of the normal amount of acetylcholine.

AD clients are at risk for injury due to their erratic and sometimes violent behavior, wandering, or unsupervised activity that puts them in harm’s way. Other complications include pneumonia and other infections, often due to decreased physical activity. They may also become malnourished and dehydrated due to their refusal to eat or their inability to remember how to chew food.

Although prognosis is poor, early detection and treatment can improve the client’s quality of life and slow progression of the disease. Although there is currently no cure for AD, treatment can help allay symptoms, slow progression of the illness, and improve functioning.

Four cholinergic drugs are currently available to slow the progression of AD: tacrine (Cognex), the first drug developed for treating mild to moderate dementia; galantamine (Reminyl), also given for mild to moderate dementia; rivastigmine (Exelon); and donepezil (Aricept). Aricept is popular because of its once-a-day dosing, which is easier for clients to remember early in their disease process. These drugs can cause insomnia, fatigue, rash, N & V, diarrhea, abdominal pain, muscle cramps, and other CNS effects. Adverse effects include GI bleeding if given with NSAIDs.

Aricept should be discontinued, to decrease the risk of severe adverse effects, if excessive salivation, diarrhea, vomiting, or frequent urination becomes a problem.

**Drugs Used for Parkinson’s Disease**

Parkinson’s disease (also called parkinsonism) is a progressive and crippling disease that slowly robs the muscles of their ability to move normally, making them rigid. Eventually, muscles lose their ability to move (akinesia), causing them to become rigid. Involuntary muscle tremors (on one side of the body) become a common feature of this disease.

Parkinson’s disease affects the extrapyramidal system, which influences the beginning, control, and completion of movement. In Parkinson’s, basal ganglia are deficient in dopamine via the dopamine-releasing pathway. Reduction in dopamine disturbs the normal balance between transmitters that excite acetylcholine and inhibit dopamine. With a deficiency in dopamine, acetylcholine activity increases. This imbalance prevents affected brain cells from performing their normal functions, which causes most Parkinsonian symptoms.
Because of akinesia, gait and movements become abnormal. The Parkinsonian client walks with body bent forward, taking a long time to start to move; he cannot pivot without difficulty and easily loses his balance. Parkinson’s causes a masklike facial expression, inability to lift eyelids, and oculogyric crises (acute situations during which the eyes are fixed upward and tremor involuntarily). Other symptoms develop over time and include the following:

- Drooling
- Dysarthria (impaired speech due to poor muscle control)
- Dysphagia (difficulty swallowing, a safety risk)
- Fatigue
- Muscle cramps in legs, neck, and trunk
- Insomnia
- Mood changes
- Depression
- Oily skin
- Increased perspiration
- Memory loss and slow thinking

Parkinsonism is one of the most common crippling diseases in the United States. It affects men more than women in their middle age or later. The disease strikes 1 out of 100 people over age 60. Although Parkinson’s disease is not fatal, death can result from aspiration pneumonia or other infections.

The cause of primary Parkinson’s disease is unknown. Parkinson-like tremors can occur because of brain damage. Some cases of Parkinson’s disease have been found to result from exposure to toxic chemical dusts like manganese and carbon monoxide; these chemical are toxic to the substantia nigra cells of the brain.

Parkinson’s disease is not fatal, but death occurs from complications such as falls and other injuries, aspiration pneumonia, or other infections.

The goal of treatment for Parkinson’s disease is to relieve symptoms and keep clients functioning as long as possible. Drug therapy is aimed at restoring dopamine activity to near normal levels.
Drugs That Affect the Autonomic Nervous System

**Dopamine agonists.** Dopamine agonists act on specific receptor sites in the brain to restore dopamine activity. They include amantadine hydrochloride (Symmetrel), bromocriptine mesylate (Parlodel), carbidopa (Sinemet), levodopa (Paracopa), and ropinirole (Requip). These drugs share common effects on the CNS. Pramipexole (Mirapex) and ropinirole (Requip), however, can cause nightmares and hallucinations as well as sudden sleep events. Described as sleep attacks, including daytime napping, these episodes put clients at risk for accidents. Sinemet and Paracopa, two drugs given together, are effective in delivering dopamine to brain cells. They can cause disturbing side effects, however, such as involuntary movements: chewing motions, facial grimacing, and rocking and bobbing. It is important to observe clients for any new and unusual movements when they are taking these drugs. Entacapone (Comtan and Stalevo), another drug combination, can also cause chorea, which means to dance. Clients develop rapid involuntary movements such as raising their shoulders, flexing their fingers, and grimacing; the movements have no purpose and are very disturbing to clients. Chorea episodes require close monitoring to keep clients safe from falling.

**Anticholinergic agents used to treat Parkinson’s disease.** Anticholinergic agents reduce the over stimulation of acetylcholine caused by the imbalance of dopamine.

Table 13.12 lists common agents used for this purpose.

**TABLE 13.12 Anticholinergic Agents**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Adult Dose</th>
<th>Maximum Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benztropine mesylate</td>
<td>Cogentin</td>
<td>0.5mg, 1mg, 2mg tabs</td>
<td>0.5mg to 1mg at bedtime</td>
<td>6mg</td>
</tr>
<tr>
<td>Diphenhydramine hydrochloride</td>
<td>Benadryl</td>
<td>12.5mg, 25mg, 50mg tabs 25mg, 50mg caps 12.5mg, 5mL elixir 12.5mg syrup</td>
<td>25mg to 50mg three to four times daily</td>
<td>400mg</td>
</tr>
<tr>
<td>Trihexyphenidyl</td>
<td>Artane</td>
<td>2.5mg, 5mg tabs 2mg / 5mL elixir 5mg sustained release</td>
<td>1mg to 2mg daily</td>
<td>12mg to 15mg</td>
</tr>
</tbody>
</table>
Exam-Prep Questions

1. Anticholinergic drugs can cause drowsiness because of their effect on which system?
   ✍ A. Cardiovascular
   ✍ B. Respiratory
   ✍ C. Central nervous system
   ✍ D. Peripheral vascular system

2. Residents who have asthma and receive beta blockers should be closely monitored for which adverse effect?
   ✍ A. Febrile response
   ✍ B. Bronchial constriction
   ✍ C. Hypertension
   ✍ D. Tachycardia

3. Which of the following medications is an alpha 1 adrenergic receptor?
   ✍ A. Proventil
   ✍ B. Alupent
   ✍ C. Brethine
   ✍ D. Neo-Synephrine

4. Anticholinergics are given to treat all of the following conditions except for what?
   ✍ A. Irritable bowel disease
   ✍ B. Urinary retention
   ✍ C. Parkinson disease
   ✍ D. COPD

5. Which of the following are side effects of anticholinergic medications?
   ✍ A. Dry mouth and urinary retention
   ✍ B. Excessive thirst and hunger
   ✍ C. Urinary urgency and excessive salvia
   ✍ D. Bradycardia and dizziness
6. Sedative-hypnotic drugs are used to help clients do what?
   - A. Stay alert
   - B. Reduce hyperactivity
   - C. Wake up
   - D. Fall asleep

7. True or false: Sedative-hypnotic medications are Schedule II–IV drugs.

8. Benzodiazepines are short-acting sedative-hypnotics. Which of the following is a benzodiazepine?
   - A. Diazepam
   - B. Percodan
   - C. Ultram
   - D. Oxycodone

9. What is the one side effect of an anti-Parkinson's medication?
   - A. Blurred vision
   - B. Rapid involuntary movement
   - C. Skin discoloration
   - D. Rapid weight loss

10. A reduction in which substance causes the symptoms of Parkinson's disease?
    - A. Dopamine
    - B. Dobutamine
    - C. Serotonin
    - D. Norepinephrine
Rationales

1. The correct answer is C. Anticholinergic medications cause drowsiness because of their effect on the CNS. They also affect the systems presented in choices A, B, and D, but their effects on those systems do not cause drowsiness.

2. The correct answer is B. Beta blockers can be dangerous when used for clients with respiratory disorders such as bronchitis, asthma, and emphysema because they can cause severe bronchoconstriction. Choice A is incorrect because beta blockers do not affect the body’s temperature. Choices C and D are conditions opposite to the effects of beta blockers.

3. The correct answer is C. Choice C is the only alpha 1 stimulant, and it acts by vasoconstriction of blood vessels. Choices A, B, and D are beta 2 adrenergic.

4. The correct answer is B. Selective anticholinergic medication is used to treat choices A, C, and D. Choice B is an adverse effect that an anticholinergic medication can cause.

5. The correct answer is A. Anticholinergic medications work at slowing the CNS. They decrease body secretion. The symptoms in choice B are signs of hyperglycemia. Choice C is incorrect because anticholinergic medications may cause urinary retention. Choice D is incorrect because, although these medications may cause dizziness, they do not cause bradycardia.

6. The correct answer is D. Sedative-hypnotics are ordered to reduce anxiety and to help the resident to fall asleep or stay asleep. They work to depress the CNS. Choices A, B, and C work by exciting the CNS.

7. The correct answer is True. Sedative-hypnotic medications are on the controlled substance list.

8. The correct answer is A. Benzodiazepines are short-acting sedative-hypnotics whose actions are similar to medications that cause CNS effects, but they are more selective in action. Examples are diazepam (Valium), lorazepam, and temazepam. Choices B, C, and D are opioid or opioid-like analgesics.

9. The correct answer is B. Clients develop rapid involuntary movements such as raising their shoulders, flexing their fingers, and grimacing; the movements have no purpose. Choices A, C, and D are not related to chorea.

10. The correct answer is A. Dopamine is a neurotransmitter. A reduction in dopamine disturbs the normal balance between transmitters that excite acetylcholine and inhibit dopamine, thus causing the symptoms. Choice B is a cardio-specific drug. Choices C and D are both neurotransmitters, but they are not involved in the treatment of Parkinson’s disease.
CHAPTER FOURTEEN

Medications Affecting the Endocrine System

Medical Term Hot List

- Antidiabetic agents
- Antithyroid agents
- Cretin
- Exophthalmos
- Hyperglycemia
- Hyperthyroidism
- Hypoglycemia
- Hypothyroidism
- Insulin
- Iodine
- Lactic acid
- Lactic acidosis
- Myxedema
- Thyroid-stimulating hormone
- Thyroid-replacement hormones
- Thyroxine
- Trophic
Structure and Function of the Endocrine System

NOTE
The review here is restricted to the thyroid and pancreas glands.

Secretion of hormones from specialized glands that regulate metabolic activities is the work of the endocrine system (namely, the thyroid and the pancreas). **Hormones** are chemical transmitters secreted by the glands in response to stimulation from the hypothalamus in the brain. Neural paths connect the hypothalamus to the pituitary gland in the brain to release **trophic** (or gland-stimulating) hormones whose purpose is growth of the body. These hormones, in turn, stimulate their target glands, such as the thyroid.

Thyroid-stimulating hormone (TSH) is secreted by the anterior pituitary gland. TSH stimulates the thyroid to release iodine-containing hormones, Tri-iodothyronine (T₃), and Thyroxine (T₄). These hormones are responsible for regulating the following metabolic functions:

- Carbohydrate, protein, and fat metabolism
- Cardiovascular functions
- Growth and development
- Lactation
- Reproduction
- Temperature control

Medications Used to Treat Endocrine Disorders

The following subsections cover medications used to treat select endocrine disorders.

**Thyroid Diseases**

Thyroid disorders are serious conditions that can affect almost every body system.

**Hyperthyroidism**

An overproduction of thyroid hormone, a deficiency or underproduction, or inflammation and enlargement of the gland causes disease of the thyroid. With treatment, the prognosis for clients with thyroid disorders is good. If left untreated, thyroid disease can become a very serious emergency, such as thyroid crisis or storm. Thyroid disease complications can also lead to irreversible conditions such as blindness.
Hyperthyroidism (excessive thyroid hormone production) or hypothyroidism (too little thyroid hormone) cause a metabolic imbalance. Hyperthyroidism, Graves’ disease, is a result of overstimulation of the thyroid-stimulating hormone, TSH. The exact cause is unknown, but genetic factors play a role. Auto-immune diseases are also linked to this disorder. For clients with latent hyperthyroidism (the disease hides), too much iodine intake and stress can cause the disease to appear. Classic features of Graves’ disease are an enlarged thyroid (goiter), exophthalmos (protrusion of the eyes), heat intolerance, weight loss, and tremors. Because the thyroid hormone affects nearly all body systems, hyperthyroidism causes myriad signs and symptoms. Cardiac dysrhythmias and decompensation/insufficiency in addition to dyspnea, muscle weakness, and atrophy are only a few of the more troublesome complications.

Besides Graves’ disease, other forms of hyperthyroidism include a TSH-secreting pituitary tumor, a viral illness (thyroiditis), and toxic adenoma. Toxic adenoma is a small benign nodule (lesion) in the thyroid gland that secretes thyroid hormone. It occurs more often in older clients, causing symptoms similar to Graves’ disease. Hyperthyroidism is treated with surgery, radioactive iodine, and antithyroid drugs such as propylthiouracil (Propyl-Thyracil). Propyl-Thyracil is an adjunct to palliative treatment of hyperthyroidism and is given prior to the thyroid surgery or radiation.

Myxedema
Myxedema is hypothyroidism resulting from insufficient thyroid hormone production in adults. The overuse of antithyroid drugs and radiation exposure can also cause myxedema. Infants born with a hypoactive or absent thyroid are called cretins. Symptoms include the following:

- Anemia
- Anorexia
- Bradycardia
- Swollen face
- Easy fatigue
- Low body temperature
- Hypotension
- High cholesterol levels
- High susceptibility to infections
- Intolerance to cold
- Constipation
- Generalized weakness
Myxedema responds to the thyroid-replacement hormones listed in Table 14.1.

### TABLE 14.1 Thyroid-Replacement Hormones

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Composition</th>
<th>Dose Forms</th>
<th>Dosage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levothyroxine</td>
<td>Synthroid</td>
<td>Thyroxine (T4)</td>
<td>0.025mg, 0.05mg, 0.075mg, 0.080mg, 0.1mg, 0.112mg, 0.125mg, 0.137mg, 0.15mg, 0.175mg, 0.2mg, 0.3mg</td>
<td>Initially: 0.025mg daily Maintenance: 0.1 to 0.2mg daily</td>
</tr>
<tr>
<td></td>
<td>Levoxil</td>
<td></td>
<td>0.075mg, 0.080mg, 0.1mg, 0.112mg, 0.125mg, 0.137mg, 0.15mg, 0.175mg, 0.2mg, 0.3mg</td>
<td>tabs</td>
</tr>
<tr>
<td>Liothyronine</td>
<td>Cytomel</td>
<td>Liothyroxine (T3)</td>
<td>5mcg, 25mcg, 50mcg tabs</td>
<td>Initially: 25mcg daily Maintenance: 25mcg to 75mcg daily</td>
</tr>
<tr>
<td>Thyroxin-1/4</td>
<td>Thyrolar-1/4/2</td>
<td>T4 and T3 (4:1 ratio)</td>
<td>Thyrolar-1/4: 12.5mcg/3.1mcg tabs Thyrolar-1/2: 25/6.25mcg Thyrolar-2: 50/12.5mcg Thyrolar-3: 100/25mcg</td>
<td>1/4 or 1/2 adjusted at two-week intervals PRN</td>
</tr>
<tr>
<td>Thyroxin-1/2</td>
<td>Thyrolar-1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thyroxin-2</td>
<td>Thyrolar-2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thyroxin-3</td>
<td>Thyrolar-3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thyroid, USP</td>
<td>Thyrolar-1/4</td>
<td>T4 and T3 (unpredictable ratio)</td>
<td>16mg, 32mg, 65mg, 98mg, 130mg, 195mg, 260mg, 325mg tabs</td>
<td>Maintenance: 65mg to 195mg daily</td>
</tr>
<tr>
<td></td>
<td>Thyrolar-1/2</td>
<td></td>
<td>65mg, 130mg, 195mg, 325mg caps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thyrolar-2</td>
<td></td>
<td>32mg, 65mg, 130mg extended-release tabs</td>
<td></td>
</tr>
</tbody>
</table>

### Diabetes Mellitus

Diabetes mellitus (DM) is a chronic disorder in which the pancreas cannot produce or use the insulin hormone properly. **Insulin** is a vital hormone responsible for moving glucose (fuel necessary for energy) into the body’s cells. Normally, insulin allows glucose to enter the cells. Once inside the cells, glucose is stored as glycogen, ready to respond when needed to meet the body’s increased demands for fuel. Insulin levels rise after a meal when the blood glucose rises.

Insulin also influences protein building and free fatty acid storage in fatty tissue. When insulin is deficient, glucose and other nutrients (proteins and fats) cannot reach the cells to be used for fuel or fuel stores. Further, when the pancreas cannot screen insulin to move glucose, it accumulates in the blood; this is known as hyperglycemia (**hyper**, excessive; **glyc**, glucose; **emia**, of the blood).
Signs and symptoms of hyperglycemia include the following:

- Blurred vision
- Coma (late)
- Convulsions (late)
- Dry skin
- Headache
- Hunger
- Hypotension
- Nausea and vomiting
- Leg cramps
- Frequent urination
- Sweet breath odor
- Slow, deep, labored respirations
- Tachycardia
- Drowsiness
- Flushed face
- Headache
- Dizziness
- Faintness
- Hypotension
- Rapid, shallow respirations
- Cold, clammy skin
- Tingling around mouth
- Unconsciousness (late)

Two types of diabetes mellitus occur: (1) Type 1: insulin-dependent diabetes mellitus (IDDM) and (2) type 2: non-insulin-dependent diabetes mellitus (NIDDM). Type 2 DM is the most common form, effecting millions of people, especially older clients. Due to the obesity epidemic in the United States, DM is occurring at an alarming rate.
A family history of DM puts clients at risk for contracting the disease. Type 1 DM occurs more in whites than non-whites. Older and overweight clients are more prone to Type 2 diabetes. Ethnic groups such as African-Americans, Hispanics, and Native Americans are prone to developing Type 2 as well.

Several signs and symptoms exist with both types of diabetes, as follows:

- Dry, itchy skin
- Blurred vision
- Fatigue
- Excessive hunger
- Tingling in feet
- Sores that heal slowly
- Thirst
- Unexplained weight loss
- Urinary frequency

Two acute complications can occur with diabetes: diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic nonketotic syndrome (HHSN). These life-threatening complications require immediate medical attention to prevent coma or death. DKA may be the first indication of DM type 1. Other conditions that increase insulin deficiency can cause DKA, such as illness, stress, infection, and noncompliance (that is, those DM clients who do not take their insulin). In DKA, while insulin deficiency is occurring at the cellular level, another simultaneous process unfolds that leads to metabolic acidosis, a serious condition that must be corrected to avoid life-threatening consequences. When insulin is not available for energy, the cells turn to breaking down fats in fatty acids and glycerol. These acids cannot be metabolized as quickly as they are released, so they build up in the liver, where they are converted to ketones (specialized proteins). The ketones accumulate in the blood and urine, resulting in acidosis. Acidosis causes tissues to break down, setting off a vicious cycle/cascade of more ketosis, more acidosis, and so on that eventually leads to shock, coma, and death. In HHSN, similar complications occur without releasing ketones.

Chronic complications that affect nearly all body systems can occur in clients with DM:

- Cardiovascular disease, which leads to stroke or myocardial infarction (MI)
- Peripheral vascular disease
- Vascular changes in the eye (retinopathy) and blindness
- Kidney failure
Skin disease
- Slow wound healing, leading to infection and amputation of lower extremities
- Peripheral and autonomic neuropathy (nerve pain)

Diabetes must be tightly controlled to prevent complications. Blood sugar readings must be kept lower than previously believed to avoid complications. Type 1 diabetes is treated with daily insulin, dietary changes, and exercise. Treatment for Type 2 diabetes does not usually require insulin; instead, oral diabetic agents are prescribed that improve insulin use as well. Diet therapy, weight loss, and exercise are equally important.

An overdose of insulin or diabetic agents can lower blood sugar to dangerous levels (hypoglycemia). If hypoglycemia or hyperglycemia are left untreated, both conditions can lead to coma and death. Hypoglycemia also occurs with excessive exercise, missing meals, alcohol use, and vomiting.

Signs and symptoms of hypoglycemia are the opposite of those seen in hyperglycemia.

**NOTE**
A memory aid for comparing hypoglycemia and hyperglycemia: Cold and clammy? Need some candy! Red and hot? Need a shot!

Drug therapy for type 1 diabetes (and for some type 2 clients) requires daily insulin. The route of insulin administration is subcutaneous or intravenous. Because these are parenteral routes, the Medication Aide-Certified (MA-C) does not give insulin. Some states allow MAs to give insulin subcutaneously or by inhalation. Unless authorized, you must not give insulin and must decline any delegation by the nurse to do so. As always, politely remind the nurse of your practice limitations and offer to assist the nurse in another way.

Although you may not administer insulin, observe and report any untoward side effects when you give other medications to clients who receive insulin. Also, be aware that giving food with medications can influence blood glucose levels; these calories must be part of the prescribed diet, often a closely calculated balance of carbohydrates, proteins, and fats. Likewise, giving food at bedtime with medications can cause complications with the diabetic client's glucose levels. If nighttime snacks are ordered, it is wise to use them as food to accompany medications.

Oral hypoglycemic agents are drugs that are effective when the pancreas can still secrete insulin; therefore, they are effective in treating DM type 2. Sulfonylureas (which are oral hypoglycemics) lower blood glucose levels by stimulating the pancreas to release insulin. This drug class also reduces the amount of glucose produced and metabolized by the liver, which helps prevent hypoglycemia. Most side effects of the hypoglycemic agents are dose related. They include signs and symptoms of hypoglycemia as previously mentioned.
Sore throat, fever, or jaundice may indicate dangerous alterations in red blood cells (RBCs) and in white blood cells (WBCs). Rashes and itching may also signal an allergic reaction to the sulfonylureas. If these occur, withhold the next dose and notify the nurse immediately. Table 14.2 describes sulfonylureas agents.

**TABLE 14.2 Sulfonylureas Agents**

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Dosage Range</th>
<th>Average Duration of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorpropamine</td>
<td>Diabinese</td>
<td>100mg, 250mg tabs; give 100mg daily</td>
<td>100mg daily</td>
<td>24–72 hrs</td>
</tr>
<tr>
<td>Tolbutamide</td>
<td>Orinase</td>
<td>500mg tabs; give 1g twice daily</td>
<td>250mg to 3g daily</td>
<td>6–12 hrs</td>
</tr>
<tr>
<td>Glipizide</td>
<td>Glucotrol</td>
<td>5mg, 10mg tabs; give 2.5mg to 5mg daily</td>
<td>1mg to 8mg daily</td>
<td>24 hrs</td>
</tr>
<tr>
<td>Glyburide</td>
<td>Glynase</td>
<td>1.5mg, 3mg, 6mg PresTabs; give 1.5mg to 3mg daily</td>
<td>PresTabs: 0.75mg to 12mg daily</td>
<td>24 hrs</td>
</tr>
<tr>
<td></td>
<td>Micronase</td>
<td>1.25mg, 2.5mg, 5mg tabs; give 2.5mg to 5mg daily</td>
<td>1.25mg to 20mg daily</td>
<td>24 hrs</td>
</tr>
</tbody>
</table>

Thiazolidinedione antibiotic agents (TZD) help sensitize muscle and fat cells to insulin, making insulin more effective in type 2 DM. Such sensitization helps lower blood glucose levels. They also act on the liver to decrease glucose production and release. The side effects of TZDs mimic those for hypoglycemia, and weight gain is an additional concern. It should not be confused with formation of edema from another source. Pioglitazone (Actos) and rosiglitazone (Avandia) are popular TZDs. They are given orally once daily. Actos is given in doses between 15mg and 30mg, and Avandia is given in doses of 2mg twice daily or 4mg once a day.
Exam-Prep Questions

1. Which of the following types of diabetes occurs more frequently in older persons?
   - A. Gestational
   - B. Diabetes 1
   - C. Diabetes 2
   - D. Juvenile diabetes

2. Hyperglycemia symptoms include which of the following?
   - A. Diarrhea
   - B. Shaking
   - C. Diaphoresis
   - D. Excessive thirst

3. A goiter is found on which of the following organs?
   - A. Spleen
   - B. Liver
   - C. Thyroid
   - D. Gallbladder

4. Insulin is administered by which route?
   - A. Intravenously
   - B. Subcutaneously
   - C. Intramuscularly
   - D. Orally

5. Which of the following is not a sign of hypoglycemia?
   - A. Hyperactivity
   - B. Shakiness
   - C. Diaphoresis
   - D. Excessive thirst
6. The definition of hypoglycemia is which of the following?
   ○ A. Too much glucose in the blood
   ○ B. Too much sodium in the blood
   ○ C. Too little sodium in the blood
   ○ D. Too little glucose in the blood

7. All of the following are medications for hypothyroidism except for what?
   ○ A. Propylthiouracil
   ○ B. Cytomel
   ○ C. Synthroid
   ○ D. Thyrolar-1

8. If the Medication Aide is asked by the nurse to give insulin, he or she should do what?
   ○ A. Draw up the correct amount of insulin and administer it as directed
   ○ B. Decline the delegation given by the nurse
   ○ C. Check the medication administration and prepare the medication for the nurse to administer
   ○ D. Make sure that he or she is familiar with the procedure before administering the medication

9. Which of the following is not a sulfonylurea medication used to treat hyperglycemia in type 2 diabetes?
   ○ A. Diabinese
   ○ B. Glynase
   ○ C. Orinase
   ○ D. Glucotrol

10. Because the main side effect of a TZD is hypoglycemia, it should be administered when?
    ○ A. 30 minutes to 60 minutes before a meal
    ○ B. Less than 90 minutes after a meal
    ○ C. Less than 30 minutes before a meal
    ○ D. More than 30 minutes after a meal
Rationales

1. The correct answer is C. Of the two types of diabetes mellitus, type 2 DM is the most common form, affecting millions of people, especially older clients. Choice A, gestational diabetes, occurs when a person has hyperglycemia while pregnant. Choices B and D, type 1 and juvenile diabetes, are both due to lack of insulin production and occur more often in younger patients.

2. The correct answer is D. Choice D is the only sign of hyperglycemia. Other signs include excessive hunger and urination. Choices A, B, and C are signs of hypoglycemia.

3. The correct answer is C. Goiters are a growth on the thyroid gland. Choices A, C, and D name organs that do not develop goiters.

4. The correct answer is B. Insulin given by the subcutaneous or intravenous route only. Regular insulin can be given by inhalation, subcutaneously, and intravenously.

5. The correct answer is D. Choice D is a sign of hyperglycemia. Choices A, B, and C are signs of hypoglycemia.

6. The correct answer is D. Hypoglycemia is a condition that occurs when blood sugar (glucose) is too low. Choice A is hyperglycemia. Choice B is hypernatremia. Choice C is hyponatremia.

7. The correct answer is A. Choice A is used for hyperthyroidism. Choices B, C, and D are medications used for hypothyroidism.

8. The correct answer is B. As these are parenteral routes, the MA-C does not give insulin. Some states allow an MA-C to give insulin subcutaneously or by inhalation. Unless authorized, you must not give insulin and must decline any delegation by the nurse to do so.

9. The correct answer is B. Glynase is a TZD. Choices A, C, and D are sulfonylurea.

10. The correct answer is C. To prevent hypoglycemia, TZDs need to be given from 1 to 30 minutes before a meal.
This page intentionally left blank
CHAPTER FIFTEEN

Medications for the Eye and Ear

Medical Term Hot List

✓ Acoustic
✓ Air conduction
✓ Arcus senilis
✓ Auricle
✓ Blepharitis
✓ Canthus
✓ Cataract
✓ Central hearing loss
✓ Cerumen
✓ Choroid
✓ Cochlea
✓ Conductive hearing loss
✓ Conjunctiva
✓ Conjunctivitis
✓ Cycloplegic agent
✓ Diplopia
✓ Eardrum
✓ External auditory meatus
✓ External otitis
✓ Floaters
✓ Glaucoma
✓ Hordeolum
✓ Impacted
✓ Keratitis
✓ Lacrimal duct
✓ Labyrinth
✓ Lacrimal glands
✓ Miotic drugs
✓ Mydriatic drugs
✓ Ophthalmic
✓ Optic nerves
✓ Otic
✓ Pinna
✓ Photophobia
✓ Presbycusis
✓ Refraction
✓ Retina
✓ Sclera
✓ Sensorineural hearing loss
✓ Tinnitus
✓ Tragus
✓ Vertigo
✓ Vitreus humor

From the Library of Scott Kruse
The Eye

Structure and Function of the Eye

The eye is the organ of vision. It is located in the bony eye socket and is surrounded by fatty tissue and muscles that protect and move it. The eyelids, lashes, and tears also protect the eye from injury and from becoming dry. The eyelid covers the outer eye and closes through blinking, thereby protecting the eye from foreign bodies. Lashes on the eyelid protect it from dust and dirt. The lacrimal duct is located at the lower edge of the eyelid; it carries tears produced by the lacrimal gland to keep the eye moist and rinses away dust particles. Tears drain from the eye through mucous membranes of the duct.

The eye globe/orb has three layers: the external protective layer (cornea and sclera); the middle layer (choroid, iris, and ciliary body); and the retina, which allows light to be refracted. It is within these layers that sight is possible.

Vitreous humor is a soft gel-like substance in the posterior portion of the eye. It keeps the eye from collapsing by maintaining pressure within the organ. The sclera is responsible as the white of the eye; the sclera is continuous with the choroid, the nontransparent fibrous tissue in the outer layer.

The optic nerves, one from each eye, carry information back to the brain; the brain decodes the information into visual images.

Every structure of the eye changes with aging. Presbyopia (farsightedness) occurs in clients between 40 and 45 years of age. Eye fatigue and blurred vision also develop around middle age. Table 15.1 outlines the effects of aging on the anatomy of the eye. Although many age-related changes to the eyes are insignificant, some may cause visual problems.

**TABLE 15.1 Effects of Aging on the Eye**

<table>
<thead>
<tr>
<th>Anatomical Structure</th>
<th>Effects of Aging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acrochordons</td>
<td>Skin tags around the eyes</td>
</tr>
<tr>
<td>Conjunctiva</td>
<td>Small yellow spots (plaques)</td>
</tr>
<tr>
<td>Cornea</td>
<td>Yellow ring around the cornea (arcus senilis)</td>
</tr>
<tr>
<td>Eyebrows and eyelashes</td>
<td>Graying of brows and lashes</td>
</tr>
<tr>
<td>Eyelids</td>
<td>Weakened muscles; loss of orbital fat</td>
</tr>
<tr>
<td>Iris</td>
<td>Decrease pupil size; slower dilation after exposure to light; decrease near vision and accommodation (ability to adjust to approaching object)</td>
</tr>
<tr>
<td>Lacrimal ducts</td>
<td>Decrease tear production; dry, irritated eyes</td>
</tr>
<tr>
<td>Lens</td>
<td>Cataracts (opacity); yellowing</td>
</tr>
<tr>
<td>Retina</td>
<td>Change in color perception; decreased sharpness of vision; loss of central vision; vascular changes resulting from hypertension and arteriosclerosis</td>
</tr>
</tbody>
</table>
The Eye

Vitreus humor

Floaters (cells looking like specks inside the visual field of the eye); can signal impending detachment of the retina that, if left untreated, can cause blindness in the affected eye.

Disorders of the Eye

Glaucoma

Increased intraocular pressure (IOP) inside the eye defines glaucoma. Glaucoma, the second leading cause of blindness in the United States, does so by damaging the optic nerve. Often, the condition goes unnoticed because the client has no symptoms until the loss of vision becomes significant. All forms of glaucoma are treatable: primary, secondary, and congenital. Primary glaucoma is either narrow angle or wide angle in nature. Narrow-angle glaucoma is treatable with surgery; wide-angle glaucoma requires life-long drug therapy. Secondary glaucoma occurs secondary to a previous disease or following cataract removal; it, too, is dependent on drug therapy for control. Congenital glaucoma, diagnosed at birth, is treated with surgery. Drug therapy of choice for treating glaucoma is miotics, carbonic anhydrase inhibitors, and beta-adrenergic blocking agents (see Table 15.2). Side effects of these drugs include diplopia, double vision.

EXAM ALERT

Ophthalmic drugs (ophthalmos, pertaining to the eye; ocular) are agents intended to be administered directly into the conjunctiva of the eyes. These include the following:

- Miotic drugs that constrict the pupil of glaucoma clients, relieving intraocular pressure by preventing resistance to aqueous flow
- Mydriatics that dilate the pupil, which allows the examiner to view the retina and associated intraocular structures
- Cycloplegic agents that paralyze eye muscles that control the lens, aiding in refraction (bending light rays onto the retina that provides visual images)
- Anti-infectives for eye infections
- Analgesics to relieve pain and inflammation

Memory note here: To help remember the difference between miotics and mydriatics, think “little name (miotic), little pupil” (pupil constricts); for mydriatics, think “big name (mydriatic), large pupil” (pupil enlarges).

Eye Infections

Viruses, fungi, or bacteria can cause eye infections. Floaters, or shadowy debris in the vitreous humor of the eye, are seen as moving dark spots; they are more likely to appear in eye infections. Conjunctivitis is an inflammation of the mucous membrane lining the back of the eyelids.
and the front of the eyelid. Often referred to as pink eye, conjunctivitis is a common disorder; it is highly contagious among children. Symptoms include redness (often recorded by the examiner as injected), itching, excessive tearing, and photophobia (extreme sensitivity to light). Blepharitis is a bacterial infection of the eyelids, causing crusting, redness, and irritation of the lids. When a sebaceous (oil) gland on the eyelid becomes infected with a pathogen, a hard cyst, called a hordeolum, or sty, develops. If the hard cyst is not infected, it is called a chalazion, or blocked sebaceous (oil) gland.

**EXAM ALERT**

Treatment for eye infections begins after a laboratory culture and sensitivity identifies the offending microorganism and its susceptibility to a particular drug or agent. Table 15.2 outlines a representative sample of the many drugs used to treat other eye conditions and disorders.

**TABLE 15.2 Medications for Treating Eye Conditions and Disorders**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Indication</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imatroprost (Lumigan)</td>
<td>Open-angle glaucoma or ocular hypertension</td>
<td>Used for clients intolerant to other IOP-lowering drugs or for those with poor response to other IOP-lowering agents.</td>
</tr>
<tr>
<td>Carbachol (Carbastat, Mistat, Carboptic, Isopto Carbachol)</td>
<td>Direct-acting miotic; treatment of glaucoma; miosis use during surgery</td>
<td>Can give with other agents: 1 drop three times daily; give 10 minutes apart from any other agents. Surgical dose: one instillation only. For glaucoma: 1–2 drops up to three times a day PRN.</td>
</tr>
<tr>
<td>Cyclopentolate (Ak-Pentolate, Cyclogyl, Pentolair)</td>
<td>Diagnostic procedures; cycloplegia/mydriasis</td>
<td>Higher doses may be necessary for clients with dark-pigmented irises. Compress lacrimal sac x 1–2 minutes after instilling drops to decrease systemic absorption.</td>
</tr>
<tr>
<td>Dorzolamide 2% and timolol 0.5% (Cosopt)</td>
<td>Open-angle glaucoma</td>
<td>Instill 1 drop in affected eye twice daily; monitor for cardiac failure; if absorbed, may mask symptoms of hypoglycemia or thyrotoxicosis.</td>
</tr>
<tr>
<td>Emedastine (Emadine)</td>
<td>Temporary relief of allergic conjunctivitis</td>
<td>Instill 1 drop in affected eye up to four times daily. Avoid contacts if eyes are red; may cause headache, blurred vision.</td>
</tr>
<tr>
<td>Fluorometholone (Flarex, Fluor-Op)</td>
<td>Inflammatory conditions of the eye; topical corticosteroid</td>
<td>Discontinue if swelling of the eye occurs or if no improvement within several days, or not at all.</td>
</tr>
<tr>
<td>Fomivirsen sodium (Vitravene)</td>
<td>Retinal cytomegalovirus in AIDS clients who cannot tolerate other agents</td>
<td>Use in affected eye every other week x 2 weeks, then once monthly.</td>
</tr>
<tr>
<td>Idoxuridine (Herplex)</td>
<td>Herpes simplex keratitis</td>
<td>Instill 1 drop every hour during the day, every 2 hours at night; can be used with corticosteroids.</td>
</tr>
<tr>
<td>Levocabastine (Livostin)</td>
<td>Allergic conjunctivitis</td>
<td>Shake solution well; do not use if discolored. Treatment x 2 weeks.</td>
</tr>
</tbody>
</table>
Levofloxin (Quixin)  
**Bacterial conjunctivitis (pink eye)** caused by susceptible bacteria  
1–2 drops per day in affected eye.

Natamycin (Natacyn)  
**Fungal blepharitis** (infection of the eyelid), conjunctivitis, and keratitis  
Shake well before each use; store at room temperature; reevaluate if no response in 7–10 days.

Polydimethylsiloxane (AdatoSil)  
**Retinal detachment** when other therapy is ineffective  
Monitor for cataracts.

Suprofen (Profenal)  
**Inhibits intraoperative miosis; NSAID**  
Monitor for cross-sensitivity to other NSAIDs.

Vidarabine (Vira-A)  
**Acute kerato-conjunctivitis and recurrent epithelial keratitis due to herpes simplex types 1 and 2**  
Treat additional week after epithelialization (new tissue) appears.

---

**EXAM ALERT**

It is important to remember the following when administering eye medications:

- Check allergies before administering eye medications.
- Observe pre-administration protocol as for other medications.
- If eye medication administration is interrupted or is delayed at the bedside, do not leave medication; instead, remove it from the client’s room.
- Before administering eye medications, soak the affected eyes with warm saline and/or clean crusty eyes.
- Wear gloves when administering eye treatment agents.
- If giving eye medications with other medications, give all other medications first.
- Position clients appropriately when instilling eye drops to help ensure adequate delivery of the medication.
- Instruct clients to avoid squeezing eye tightly or rubbing the eye after eye medication administration (which might otherwise result in incomplete delivery of the medication).
- Eye medications must be kept sterile; avoid touching the tip of tubes or other eye drop containers to the eye.
- Eye ointments and other preparations are expensive; use only a tiny amount/as directed.
- Do not use the same opthalmic ointment on another client, because of potential cross-contamination of the medication.
- Store eye medications as directed on the drug label.
- Discard out-of-date eye medications.
- If instilling more than one opthalmic solution, wait at least 10 minutes between drugs.
- If eye drops and ointment are ordered, instill drops first; ointment last.
- Provide for safety for clients immediately after administering eye medications to avoid injury.
- Report any adverse reactions to eye medications promptly to the nurse.
- Unless directed otherwise, occlude (close) the lacrimal duct with a gloved finger when instilling eye drops to prevent systemic absorption.
The Ear

The following section is a review of the ear.

Structure and Function

The ear is a complex organ designed for hearing. Aside from hearing, the ear plays a vital role in the balance process. The ear has three parts: the external ear, the middle ear, and the inner ear. The external ear contains a canal, called the external auditory meatus. The pinna, or auricle, is the outside edge of the ear. Glands in the external ear produce cerumen, or wax, which protects the ear by trapping foreign material and dust. The external ear is responsible for collecting and transmitting sound waves to the tympanic membrane; this membrane divides the external and the middle ear.

The middle ear is connected to the nasopharynx by the auditory tube, or Eustachian tube. Usually collapsed, it opens when people swallow, chew, yawn, or move the jaw. The Eustachian tube equalizes air pressure on both sides of the tympanic membrane, which prevents it from rupturing. The external and middle ear work together to conduct and amplify sound waves from the environment. This process is called air conduction. The sound waves from the external ear are felt as vibrations in the ear drum/tympanic membrane and picked up by three tiny bones in the middle ear: the malleus, incus, and stapes. These specialized bones transmit the vibrations to specialized hearing cells in the inner ear. If problems develop in either the external or the middle ear, hearing is impaired; this is known as conductive hearing loss, a problem of mechanics.

EXAM ALERT

In the vestibule, the beginning of the inner ear, equilibrium is maintained. Because of its complicated shape, the inner ear is also called the labyrinth. It is the inner ear where the cochlea is located; the cochlea is the organ of hearing. When the inner ear is injured or diseased, a sensorineural hearing loss results; this is a problem of nerves. When a problem with the central auditory system in the central nervous system occurs, the client suffers a central hearing loss, in which the client has difficulty understanding the meanings of words heard or is unable to understand the meaning of sounds or words.

Table 15.3 lists changes in the auditory structures that occur with aging.

<table>
<thead>
<tr>
<th>Auditory Structure</th>
<th>Effects of Aging</th>
</tr>
</thead>
<tbody>
<tr>
<td>External ear</td>
<td>Cerumen becomes drier and increases; hair in external ear increases.</td>
</tr>
<tr>
<td>Middle ear</td>
<td>Conductive hearing loss occurs.</td>
</tr>
<tr>
<td>Inner ear</td>
<td>Clients have difficulty hearing high-pitched sounds (presbycusis), experience tinnitus (ringing in the ears), and have more difficulty with balance (labyrinthitis).</td>
</tr>
</tbody>
</table>

From the Library of Scott Kruse
Because people are now living longer, hearing loss has increased. Hearing loss for any can be depressing, especially for older clients who most likely have experienced other age-related limitations. Older clients may withdraw from socializing and neglect activities of daily living (ADLs).

**Disorders of the Ear**

The following is a review of select ear disorders.

**External Otitis**

External otitis is an inflammation and infection of the epithelium (outer layer) of the auricle and ear canal. Commonly called *swimmer’s ear*, external otitis occurs more often in the summer months and is associated with swimming in contaminated water. The offending microbes may be bacteria or fungi. Topical antibiotics appropriate to the identified pathogen are given to treat the infection.

Cerumen can also become impacted (hardened, large mass) in the ear canal and often occurs in elders. Treatment consists of irrigating the ear or lubricating the ear canal with drops to soften the earwax, resulting in making cerumen easier to remove.

Topical antibiotics for external ear disorders include polymyxin B, neomycin, and chloromycetin. Nystatin is effective for fungal infections. Once irrigated, the infected ear canal is filled with a drug-soak wick of cotton (pledget) so that the antibiotics can reach the affected area. Irritation of the canal and itching are common side effects of topical antibiotics. It is important that the client be instructed to keep the ear wick in place and not push it farther into the canal, which could damage the tympanic membrane.

**EXAM ALERT**

*Ear (otic) drops should be given at room temperature to avoid vertigo (dizziness). As with using ophthalmic medication containers, the medicine dropper or other otic medication container tip should not touch the surface of the ear, to avoid contaminating the entire container of medications.*

Table 15.4 outlines representative otic drugs.
TABLE 15.4 Representative Otic Drugs

<table>
<thead>
<tr>
<th>Drug Name, Route of Administration</th>
<th>Indications</th>
<th>Actions</th>
<th>Adult Dose and Instructions</th>
<th>Side Effects and Adverse Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polymyxin B, neomycin, hydrocortisone (Cortisporin Otic) Topical</td>
<td>Bacterial infections of outer ear, postsurgical ear infection</td>
<td>Bactericidal; suppresses inflammation and itching</td>
<td>3–4 drops three times or four times daily</td>
<td>Superinfection; hypersensitivity</td>
</tr>
<tr>
<td>Chloramphenicol (Chloromycetin Otic) Topical</td>
<td>Infections of the ear canal</td>
<td>Bacteriostatic or bactericidal</td>
<td>2–3 drops into ear canal three times daily</td>
<td>Ear irritation and itching</td>
</tr>
<tr>
<td>Triethanolamine polypeptide oleatecondensate (Cerumenex) Topical</td>
<td>Cerumen buildup</td>
<td>Softens earwax</td>
<td>Soak cotton ball in solution and insert in affected ear</td>
<td>Ear redness and itching</td>
</tr>
</tbody>
</table>

EXAM ALERT

The following is a review of administration of otic medications:

- Follow pre-administration procedures as for all other routes of drug administration.
- As with administering eye medications, ear medications must be given with donned gloves.
- Check the expiration date on the otic medication container.
- If an ear dropper is used, be sure that it is clean and in working order.
- Follow the six rights of medication administration.
- If cerumen or drainage is blocking the outermost portion of ear canal, gently wipe it with a cotton-tip applicator.
- Position the client in the side-lying position if client is able to do so.
- Gently grasp the pinna/auricle with nondominant hand and gently pull the auricle up and outward.
- For drops, hold the dropper half an inch above the ear canal and dispense ordered number of drops.
- For ointment, gently dispense the order amount of medication into the external ear canal.
- If ordered, place a clean cotton ball gently into the external ear canal. Instruct the client to leave it in place.
- Gently massage the tragus of the ear (soft skin just in front of the external ear meatus to distributed the medication.
- Instruct the client to remain in the side-lying position for 2 to 3 minutes. Place the call light in reach.
- Follow post-administration procedures as for all other medications.
- Report client response to the procedure or any untoward effects.

Never insert any object in the ear; you risk ear canal damage otherwise, potentially causing pain. The eardrum may also become damaged, causing extreme pain and hearing loss. Cerumen can also become impacted if an object is inserted into the ear canal.

From the Library of Scott Kruse
Exam-Prep Questions

1. When giving two eye medications at the same time, you should wait how long between the first and second medications?
   ○ A. 1 minute
   ○ B. 3 minutes
   ○ C. 5 minutes
   ○ D. 10 minutes

2. When administering eye medications, which of the following statements is false?
   ○ A. Follow the six rights of medication administration.
   ○ B. Place medication directly on the conjunctiva.
   ○ C. Touch the tip of tubes or other eye drop containers to the eye.
   ○ D. Do not use the same ophthalmic ointment on another client.

3. A resident is taking Cosopt and has tachycardia and nervousness. You are responsible for:
   ○ A. Documenting the symptoms
   ○ B. Calling the doctor
   ○ C. Telling the nurse
   ○ D. Telling a family member

4. Fluorometholone is a what?
   ○ A. Fluoroquinolone
   ○ B. Corticosteroid
   ○ C. Bacteriostatic
   ○ D. Bacteriocidal

5. Timolol 0.5% is used for what?
   ○ A. Open-angle glaucoma
   ○ B. Eye infections
   ○ C. Eye inflammation
   ○ D. Eye redness
6. Ophthalmic drugs are given where?
   - A. In the ears
   - B. In the eyes
   - C. In the nose
   - D. In the mouth

7. Otic drugs are given where?
   - A. In the ears
   - B. In the eyes
   - C. In the nose
   - D. In the mouth

8. When giving ear drops, do all of the following except what?
   - A. Follow the six rights of medication administration.
   - B. After checking with the nurse, gently wipe the ear with a cotton-tip if cerumen is blocking the canal.
   - C. Position the client in the side-lying position.
   - D. Disregard any redness or irritation at the site.

9. To administer ear medication to an adult, what do you do?
   - A. Pull the ear down and out.
   - B. Pull the ear back and upward.
   - C. Push the tragus open.
   - D. Do not touch the ear while giving the medication.

10. Which of the following medications is effective for ear fungal infections?
    - A. Corticosporin
    - B. Nystatin
    - C. Cerumenex
    - D. Herplex
Rationales

1. The correct answer is D. When more than one eye medication is to be used, they need to be given 10 minutes apart from any other agents. Choices A, B, and C do not give enough time to allow the medication to be absorbed.

2. The correct answer is C. When surfaces touch the eye, they may scratch the cornea or introduce infection. Choices B, C, and D are all correct actions for administering eye medications.

3. The correct answer is C. Cosopt can cause problems with the heart and the thyroid. The Medication Aide must report adverse symptoms to the nurse.

4. The correct answer is B. Fluorometholone is a corticosteroid. Choice A is incorrect because a fluoroquinolone is an antibiotic. Choices C and D are actions of antibiotics.

5. The correct answer is A. Timolol is used for choice A, open-angle glaucoma. Choices B, C, and D are incorrect uses for Timolol.

6. The correct answer is B. Ophthalmic drugs are given in the eyes (choice B). Choice A is otic. Choice C is considered nasal, and choice D is considered oral.

7. The correct answer is A. Otic drugs are given in the ears. Ophthalmic drugs are given in the eyes (choice B). Choice C is considered nasal, and choice D is considered oral.

8. The correct answer is D. Any redness and irritation that occurs should be reported to the nurse. Choices A, B, and C are correct actions for administering ear medication.

9. The correct answer is B. To administer ear medications to adults, the ear is gently pulled upward and out to fully open the ear canal. Choice A relates to children; for children, the ear is gently pulled down and out. Choices C and D are not considered appropriate for the administration of otic medication.

10. The correct answer is B. Choice A is no longer available as an ear drop. Choice C is used for cerumen buildup. Choice D is used for a herpes infection that has affected the ear.
# Chapter Sixteen

## Medications Used in the Treatment of Cancer

### Medical Term Hot List

| ✓ Adenocarcinoma | ✓ Chemotherapy | ✓ Metastasis |
| ✓ Alkylating agents | ✓ DNA | ✓ Mitotic inhibitor |
| ✓ Antimetabolites | ✓ Gynecomastia | ✓ Myeloma |
| ✓ Alopecia | ✓ Hormonal therapy | ✓ Polyp |
| ✓ Benign neoplasm | ✓ Intraductal cancer | ✓ Purpura |
| ✓ Cancer | ✓ Leukopenia | ✓ Sarcoma |
| ✓ Carcinogenesis | ✓ Lobular cancer | ✓ Stomatitis |
| ✓ Carcinogenic | ✓ Malignant melanoma | ✓ Thrombocytopenia |
| ✓ Carcinoma | ✓ Malignant tumor | ✓ Tumor |
| ✓ Carcinoma in situ | ✓ Mastectomy | |

From the Library of Scott Kruse
Introduction to Cancer

Cancer is a **malignant neoplasm (tumor)**, which is a group of new, abnormal clumps of cells forming tissues that are uncontrolled. Normal cells divide and grow at a controlled rate and in an orderly manner. When uncontrolled, erratic cell growth occurs and cancer results.

**EXAM ALERT**
The cells of cancer are malignant, meaning they are harmful, continue to grow, resist treatment, and may lead to death. Further, cancerous cells tend to invade normal cells, which allows for their growth. In reference to the nature of a neoplasm, the description malignant is opposite of the term benign. For example, benign neoplasms are abnormal tissues that live at the expense of healthy ones and can enlarge to various sizes but do not spread by metastasis (break off and spread from the site of origin to a distant site). Benign neoplasms do not cause death, but may recur after they are removed.

**Carcinogenesis** is the process by which normal cells become cancerous. Carcinogenesis has no single cause but most likely results from a complex interactive process involving physical and chemical carcinogens. The following factors place individuals at risk for developing cancer:

- **Aging**: Cancers can occur in any age group, but clients older than 65 years of age are at higher risk.

- **Alcohol use**: Cancers of the breast, esophagus, larynx, liver, mouth, and throat are linked to alcohol use and abuse.

- **Chemicals and other toxic substances**: Paints, pesticides, unused engine oil, and other chemicals encountered by workers in the chemical industry predispose individuals to cancer. Asbestos and airborne aromatic hydrocarbons are linked to lung cancer. Alkylating agents cause leukemia.

- **Inadequate diet, obesity, and lack of physical exercise**: Cancers of the breast, colon, esophagus, kidney, and uterus place overweight clients who eat a high fat diet and who do not exercise regularly at risk for these cancers. Clients who eat high protein/fat diets are at high risk for colon cancer. Food additives, such as nitrates, and charbroiled foods may also contribute to cancer.

- **Hormones**: Hormone replacement therapy (HRT) has a link to breast cancer in women; men taking testosterone are also at a higher risk for prostate cancer. The perplexing dilemma is the beneficial effect of some hormones to prevent some cancers while exposing clients to other forms of malignancy.

- **Ionizing radiation**: X-ray exposure is one source of radiation exposure. Radon gas is another source. Miners are susceptible to exposure of radon gas, which may form in the soil. Radioactive fallout is another concern; so, people living near a nuclear power plant may be at a higher risk than the general population.
Smoking and tobacco: Using tobacco in any form and exposure to second-hand smoke are proven carcinogens. Smoking is linked with cancer of the bladder, esophagus, kidney, lung, and pancreas.

Sunlight: Sun exposure and use of sunlamps and tanning are linked with malignant skin cancers (melanomas). Concerned citizens have campaigned to require tanning bed manufacturers and tanning salon operators to post signs for patrons warning them of the danger that ultraviolet rays may lead to cancer from using these products. Sunburn has also been named as a common precursor to melanoma.

Certain viruses: Viral infections can lead to cancers of the cervix (human papillomavirus), liver, lymph system, and stomach. The Epstein-Barr virus that causes infectious mononucleosis is associated with Burkett’s lymphoma and nasopharyngeal cancer. Infection with the hepatitis B virus can lead to liver cancer. The human T-cell lymphotropic (HTLV-1) virus is held suspect in cases of T-cell leukemia.

The term carcinogenic means cancer causing (genesis, beginning); it is applied to known sources that cause cancer, like those listed previously. Research is ongoing to identify other carcinogenic substances; warning labels on products like those on cigarette packets are more likely to appear in the future as new carcinogenic products are identified. Even drugs intended to cure illness are not exempt from potentially being a direct or a contributing factor in malignancy development.

Cancer is the second-leading cause of death in the United States. Some researchers predict that it will outrank cardiovascular disease, the number one killer, by 2017. Cancer attacks more than a million U.S. citizens, and more than 500,000 clients die each year of cancer-related causes.

Classifications of cancer describe the tissues or blood cells in which it originates. Most cancers derive from epithelial tissues and are called carcinomas. Others develop from the following cells and tissues:

- **Adenocarcinomas**: Glandular tissues
- **Gliomas**: Supportive tissue of the brain and spinal cord
- **Erythroleukemia**: From erythrocytes
- **Leukemia**: Leukocytes
- **Lymphomas**: Lymphatic tissue
- **Myelomas**: Pigmented cells
- **Sarcomas**: Connective, muscle, and bone tissues

Common sites for cancer are the breast, colon and rectum, kidney, lung and bronchi, mouth and pharynx, ovary, pancreas, thyroid gland, urinary bladder, and uterus.
Drug Therapy for Cancer

EXAM ALERT

Drugs used to treat cancers are chemotherapeutic agents; that is, they are developed to act on and kill or alter human cells in a variety of ways. Specifically, these drugs are called antineoplastic drugs, because they fight neoplasms, or cancers. Their action is intended to have a greater impact on the cancerous cells than on normal cells. Cancer chemotherapy is most effective when the tumor is small and localized.

Through advances in pharmacology, this classification of drugs now includes those that act on or are part of the immune system. They fight cancers using parts of the immune system instead of destroying cells directly.

Antineoplastics are also used to shrink a tumor prior to surgery. Shrinking a tumor prior to surgery helps in removing it and helps prevent unnecessary manipulation of the tumor. Other goals of chemotherapy are to prevent metastasis and relieve cancer-related symptoms, such as severe pain.

Cancer cells metastasize in three ways: (1) through blood and lymphatic circulation; (2) through accidental surgical transplantation of cancer cells; and (3) by spreading directly to adjacent tissues and organs.

EXAM ALERT

Signs and symptoms of cancer include the following:
- Change in bowel or bladder habits
- Unusual bleeding or discharge
- Bloating
- Dysphagia
- Persistent hoarseness or cough
- Changes in an existing mole (nevus) or a new mole with irregular edges
- A sore that is slow to heal
- Thickening or lump in the breast or any other part of the body
- Generalized weakness or fatigue
- Unexplained weight loss or weight gain

Cancer cells metastasize in three ways: (1) through blood and lymphatic circulation; (2) through accidental surgical transplantation of cancer cells; and (3) by spreading directly to adjacent tissues and organs.

From the Library of Scott Kruse
Chemotherapeutic agents are very potent drugs. While they kill cancer cells, these agents can also damage normal cells, causing severe side effects and, possibly, predisposing the cancer client to infections because of the immunosuppressive effects of these powerful drugs. Depending on the drug, clients can experience nausea and vomiting and diarrhea (most common side effects), alopecia (hair loss), sores on mucous membranes (stomatitis), anorexia, weight loss, generalized weakness, and depression of CNS functions. The most serious side effect of many antineoplastic agents is their effect on the immune system, which can affect the bone marrow as well: leukopenia, or low white blood cells; thrombocytopenia, decreased platelets; and myeloblastic disease, large immature blood cells in the bone marrow. Such side effects expose cancer clients to infections and bleeding, which could be life threatening.

Antineoplastic agents have potentially toxic effects as noted in the upcoming table. The benefits of these drugs must be weighed against their risks. Drugs given to relieve clients of the side effects of chemotherapy include antiemetics for nausea and vomiting; Imodium for diarrhea; cytoprotective agents (cyto, cell) to ease stomatitis symptoms; and transfusion with blood products to combat anemia and other blood disorders encountered as a result of chemotherapy. Vitamins and minerals may help treat fatigue; parenteral nutrition may be necessary in response to some forms of chemotherapy. Anti-infectives may be given prophylactically to prevent infections.

Chemotherapeutic agents also interact with other drugs given for various noncancerous conditions. For this reason, drug plans must be carefully examined to ensure that all drugs are effective and not contraindicated so that additional adverse reactions or ineffective treatments do not occur.

Older clients may be more at risk for infections because of normal age-related changes in their immune systems. They may also have reduced renal and liver function. They are more susceptible to the CNS and gastrointestinal (GI) effects of some of these drugs. Older clients undergoing chemotherapy should be monitored closely for side effects of their antineoplastic agents; adequate hydration and nourishment must be encouraged. Drug dosages must be adjusted to keep these complications at a minimum while maintaining an effective drug level to combat the cancer.

(1) Alkylating Agents. Alkylating agents kill cancers by interrupting the DNA, RNA, or other cellular proteins of cancer cells. Because their action is nonspecific to certain active cancer cells, the DNA is attacked in all cells. These agents are most effective in treating slow-growing cancers such as melanomas, various lymphomas, leukemias, and some testicular and breast cancers. These cancers have many cells in the resting phase of maturation and growth, which makes them very susceptible to alkylating agents.

Alkylating agents should be given cautiously to clients with a known allergy to any of the agents and to those individuals with diminished renal (kidney) or hepatic (liver) function. As previously stated, older clients receiving alkylating agents are particularly vulnerable to renal and hepatic complications and should be closely monitored to prevent them from occurring.
Table 16.1 outlines representative alkylating agents.

### TABLE 16.1 Representative Alkylating Agents

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>*Brand Name</th>
<th>Acute</th>
<th>Toxicity</th>
<th>Delayed</th>
<th>Major Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboplatin</td>
<td>Paraplatin</td>
<td>N &amp; V</td>
<td>Anemia, bone marrow suppression, nephrotoxicity</td>
<td>Ovarian carcinoma</td>
<td></td>
</tr>
<tr>
<td>Chlorambucil</td>
<td>Leukeran</td>
<td>None</td>
<td>With high doses: Anemia, leukopenia, thrombocytopenia</td>
<td>Chronic lymphocytic leukemia, Hodgkin's disease, non-Hodgkin's lymphoma, trophoblastic neoplasms</td>
<td></td>
</tr>
<tr>
<td>Cisplatin</td>
<td>Platinol-AG</td>
<td>N &amp; V</td>
<td>Blurred vision; changes in color perceptions; nephrotoxicity; ototoxicity</td>
<td>Bladder cancer; testicular and ovarian cancers</td>
<td></td>
</tr>
<tr>
<td>Lomustine</td>
<td>CGNU</td>
<td>Anorexia, N &amp; V</td>
<td>Alopecia, ataxia, confusion, lethargy, thrombocytopenia</td>
<td>Brain, Hodgkin's disease</td>
<td></td>
</tr>
<tr>
<td>Melphanan</td>
<td>Alkeran</td>
<td>Diarrhea, N &amp; V</td>
<td>Bone marrow depression</td>
<td>Multiple myeloma, ovarian carcinoma, testicular seminoma</td>
<td></td>
</tr>
<tr>
<td>Streptozocin</td>
<td>Zanosar</td>
<td>Hypoglycemia, N &amp; V</td>
<td>Anemia, hypoglycemia, leucopenia, renal and hepatic toxicity</td>
<td>Pancreatic islet cell carcinoma</td>
<td></td>
</tr>
<tr>
<td>Thiopeta</td>
<td>Thioplex</td>
<td>Anorexia, dizziness, headache</td>
<td>Bone marrow depression</td>
<td>Bladder cancer, breast and ovarian cancer, Hodgkin's disease</td>
<td></td>
</tr>
</tbody>
</table>

* Many antineoplastic drugs are given parenterally, which is beyond the scope of practice of the MA-C. If asked to give these drugs via the parenteral route, politely decline the delegated task and offer to assist with another task within your job description.

### Antimetabolites

Antimetabolites are drugs that have chemical structures comparable to those of various natural metabolites and are necessary for the growth and division of fast-growing cancer cells and normal cells. Antimetabolites replace needed metabolites for malignant cells and prevent normal cellular function. Rapid resistance to these drugs by neoplasms has limited their use somewhat. To combat resistance, these drugs are usually given in combination with another chemotherapeutic agent. Table 16.2 lists representative antimetabolites.
TABLE 16.2 Representative Antimetabolites

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>*Brand Name</th>
<th>Acute Toxicity</th>
<th>Delayed Toxicity</th>
<th>Major Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cladribine</td>
<td>Leustatin</td>
<td>Dizziness, fever early in treatment, headache, nausea, rash</td>
<td>Bone marrow depression, purpura (large bruised areas on skin)</td>
<td>Hairy cell leukemia, lymphomas</td>
</tr>
<tr>
<td>Fluorouracil</td>
<td>5-FU, FU</td>
<td>Nausea</td>
<td>Bone marrow depression, oral and GI ulceration</td>
<td>Breast, colon, ovarian, pancreatic and stomach carcinoma; topical treatment of basal cell carcinoma; solar keratoses (lesions caused by exposure to sunlight)</td>
</tr>
<tr>
<td>Gemcitabine</td>
<td>Gemzar</td>
<td>N &amp; V</td>
<td>Bone marrow suppression, edema, rashes</td>
<td>Breast, lung, pancreatic cancer</td>
</tr>
<tr>
<td>Methotrexate</td>
<td>MTX</td>
<td>Diarrhea, liver cell death (cirrhosis)</td>
<td>Anemia, leukopenia, thrombocytopenia, oral and GI ulcerations and cirrhosis</td>
<td>Acute lymphocytic leukemia, cervical carcinoma, head and neck cancer, solid cancers (choriocarcinomas)</td>
</tr>
<tr>
<td>Pemetrexed</td>
<td>Alimta</td>
<td>N &amp; V and diarrhea</td>
<td>Bone marrow depression, renal dysfunction</td>
<td>Malignant pleural mesothelioma, non-small cell lung cancer</td>
</tr>
<tr>
<td>Thioguanine</td>
<td>TG, Tabloid</td>
<td>N &amp; V</td>
<td>Bone marrow depression, uric acid stones</td>
<td>Acute nonlymphocytic leukemia</td>
</tr>
</tbody>
</table>

**Mitotic Inhibitors**

Considered natural products, mitotic inhibitors kill cells as the process of cell division (mitosis) occurs. These cell cycle-specific agents slow DNA synthesis. Like other antineoplastics, adverse effects occur in the bone marrow, GI tract, and skin, (where cellular activity is the most rapid). Table 16.3 lists these drugs for the treatment of a variety of tumors and leukemias.

TABLE 16.3 Medications for Treating Tumors and Leukemias

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>*Brand Name</th>
<th>Acute Toxicity</th>
<th>Delayed Toxicity</th>
<th>Major Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Docetaxel</td>
<td>Taxotere</td>
<td>N &amp; V</td>
<td>Bone marrow suppression, rashes</td>
<td>Breast cancer, prostate cancer</td>
</tr>
<tr>
<td>Paclitaxel</td>
<td>Taxol</td>
<td>N &amp; V and diarrhea, hypotension</td>
<td>Bone marrow suppression, peripheral neuropathy</td>
<td>Breast carcinoma, lung cancer, Kaposi’s sarcoma, ovarian carcinoma</td>
</tr>
<tr>
<td>Vincristine sulfate</td>
<td>Oncovin</td>
<td>Local irritant</td>
<td>Mild bone marrow depression, paralyticileus, peripheral neuritis</td>
<td>Acute lymphocytic leukemia, Hodgkin’s disease, and other solid cancers</td>
</tr>
</tbody>
</table>
Antineoplastic Antibiotics

Antineoplastic antibiotics, like mitotic inhibitors, are cell-cycle specific. Therefore, they are useful in treating certain slower-growing cancers: breast cancer, leukemias, lymphomas, non-small cell carcinoma of the lung, squamous cell carcinoma of the head and neck, and testicular carcinoma; miscellaneous sarcomas (solid tumors) and carcinoma in situ (primary site) of the bladder. As with mitotic inhibitors, antineoplastic antibiotics carry the same risks for similar side effects in rapidly multiplying normal cells in the bone marrow, GI tract, and skin. Common drugs in this class are bleomycin (Blenoxane), doxorubicin (Adriamycin), and mitomycin (Mutamycin). All of these drugs and other antineoplastic antibiotics are given intraparenterally, which is outside the scope of the MA-C. The MA-C can assist the nurse, however, in observing and reporting major side effects to help ease the discomfort of clients receiving these drugs.

Hormones

Breast, ovarian, and uterine cancers respond to estrogen stimulation. When normal estrogen circulates, it bind to estrogen receptor sites on the tumor, causing tumor cells to grow and divide. Some antineoplastic agents block or interfere with these receptor sites, which not only prevents growth of the cancer but also, in some cases, actually causes cancer cells to die. Some hormones block the release of gonadotropic hormones (sex hormones) in breast or prostate cancer, providing the tumors are sensitive (responsive) to gonadotropic hormones. Others may inhibit androgen (male hormone) receptor sites directly, and they are useful in treating advanced prostate cancers.

GI toxicity, menopausal symptoms in men and women, bone marrow suppression, and hepatic dysfunction are adverse reactions to these hormones. Clients receiving them require monitoring because hypercalcemia (increased calcium levels in the blood) can occur as the calcium is pulled out of the bones without estrogen activity to promote calcium deposition.

Table 16.4 outlines hormones and their major indications.
### TABLE 16.4 Hormone Indications

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>*Brand Name</th>
<th>Acute</th>
<th>Delayed</th>
<th>Major Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abarelix</td>
<td>Plenaxis</td>
<td>Headache, sleep disturbances</td>
<td>Hot flashes, gynecomastia (breast tissue enlargement in males)</td>
<td>Prostate cancer</td>
</tr>
<tr>
<td>Anastrozole</td>
<td>Arimidex</td>
<td>Headache, N &amp; V</td>
<td>Diarrhea, constipation, edema, hot flashes, pelvic pain</td>
<td>Breast cancer in post-menopausal women with disease progressions despite tamoxifen administration</td>
</tr>
<tr>
<td>Ethinyl estradiol</td>
<td>None</td>
<td>None</td>
<td>Feminization in male clients, fluid retention, hypercalcemia, uterine bleeding</td>
<td>Breast and prostate carcinomas</td>
</tr>
<tr>
<td>Tamoxifen</td>
<td>Nolvadex</td>
<td>Hot flashes, N &amp; V, retinopathy, visual changes</td>
<td>Increased bone tumor pain, edema, hypercalcemia, Leukopenia Thrombocytopenia</td>
<td>Estrogen-sensitive breast cancer; advanced breast cancer in men and women; preventive for women at high risk for breast cancer</td>
</tr>
<tr>
<td>Triptorelin pamoate</td>
<td>Trelstar Depot</td>
<td>Fatigue, vomiting</td>
<td>Hot flashes, insomnia, impotence</td>
<td>Prostate cancer</td>
</tr>
</tbody>
</table>
Exam-Prep Questions

1. Signs of cancer in the body include all of the following except what?
   - A. Weight gain and increased energy
   - B. Change in bowel or bladder habits
   - C. Unusual bleeding or discharge
   - D. Change in a mole or sore

2. Drugs used to treat cancers are called what?
   - A. Antivenin drugs
   - B. Antineoplastic drugs
   - C. Antibiotics
   - D. Antifungal drugs

3. Chemotherapeutic medications have some similar side effects. Which of the following would be considered a serious (fatal) side effect?
   - A. Alopecia
   - B. Stomatitis
   - C. Anorexia
   - D. Leukopenia

4. What are the normal age-related changes that make older clients more at risk for infections?
   - A. Age-related changes in the immune system
   - B. Increased renal and liver function
   - C. Decreased susceptibility to the CNS
   - D. Fewer problems with gastrointestinal effects

5. Which of the following chemotherapeutic drugs is an alkylating agent?
   - A. Cisplatin
   - B. 5 FU
   - C. Oncovin
   - D. Ethinyl estradiol
6. Chemotherapeutic medications that replace the cancer-causing metabolites with different cells and prevent continued cell growth are known as what?
   - A. Alkylating agents
   - B. Hormone agents
   - C. Antimetabolites
   - D. Mitotic inhibitors

7. All of the following are side effects of antineoplastic antibiotics except what?
   - A. Bone marrow depression
   - B. Alopecia
   - C. Hypertension
   - D. Skin irritation

8. Which of the following is not a hormone used as a chemotherapeutic agent?
   - A. Tamoxifen
   - B. Estradiol
   - C. Thyroid-stimulating hormone
   - D. Abaralix

9. Which of the following medications are cell cycle-specific agents that slow DNA synthesis?
   - A. Alkylating agents
   - B. Hormone agents
   - C. Antimetabolites
   - D. Mitotic inhibitors

10. What does the term *carcinogenic* mean?
    - A. Causing death
    - B. Cancer causing
    - C. Genetically predisposed to cancer
    - D. Having past history of cancer
Chapter 16: Medications Used in the Treatment of Cancer

Rationale

1. The correct answer is A. Weight gain and increased energy are generally signs of good health. Choices B, C, and D are all signs that should be reported to a provider for further evaluation.

2. The correct answer is B. These drugs fight neoplasms, or cancers. With regard to choice A, although cancer is a poison to the body, the drugs that fight it are not antivenin. Choices C and D are incorrect; neither antibiotics nor antifungal medications are used to treat cancer.

3. The correct answer is D. A low white blood cell count caused by bone marrow depression is a serious side effect. Choices A, B, and C are all side effects seen with these medications. They are not serious.

4. The correct answer is A. Older clients have greater changes to their immune systems. Choice B is incorrect because older clients have less renal and liver function. With regard to choice C, they are more susceptible to the CNS. With regard to choice D, they have more problems with GI effects.

5. The correct answer is A. Cisplatin is the alkylating agent. 5 FU is an antimetabolite. Choice B is incorrect; Oncovin is a mitotic inhibitor. Choice D, ethinyl estradiol, is a hormone.

6. The correct answer is C. Chemotherapeutic medications that replace needed metabolites for malignant cells and prevent normal cellular function are known as antimetabolites.

7. The correct answer is B. Hypertension is not a side effect of chemotherapeutic medications. Choices A, C, and D are all side effects commonly seen with the use of these medications.

8. The correct answer is C. TSH is called a thyroid-stimulating hormone, but it is not used as a chemotherapeutic agent. Choices A, B, and D are all hormones used for treatment of some cancers.

9. The correct answer is D. Mitotic inhibitors are cell cycle-specific agents that slow DNA synthesis. Choices A, B, and C all work in different ways to inhibit the growth of cancer.

10. The correct answer is B. The term carcinogenic means cancer causing.
CHAPTER SEVENTEEN

Medications Used to Treat Mental Health Disorders

Medical Term Hot List

✓ Affect✓ Delusions✓ Neuroleptic
✓ Alcoholism✓ Depression✓ Paranoia
✓ Antagonist✓ Euphoria✓ Psychosis
✓ Anti-anxiety drugs✓ Extrapyramidal effects✓ Sedatives
✓ Antidepressant agents✓ Hallucinations✓ Serotonin
✓ Anxiolytic agents✓ Insomnia✓ Suicidal ideation
✓ Anxiety✓ Mental health✓ Tardive dyskinesia
✓ Catatonic✓ Mental illness✓ Tranquilizers

From the Library of Scott Kruse
Chapter 17: Medications Used to Treat Mental Health Disorders

The Nervous System and Emotions

To better understand how psychotherapy drugs work, knowledge of how the nervous system functions is helpful. Chapter 15, “Medications for the Eye and Ear,” reviewed the central nervous system and how it controls bodily functions. How the central nervous system influences behavior is the focus of this chapter.

Neurohormonal agents in the brain are responsible for transmitting behavioral reactions. This transmission involves acetylcholine released from the nervous system tissue to the cerebrospinal fluid. Norepinephrine also plays a role, along with dopamine, in transmitting signals affecting sleep, arousal, and memory. Levels of serotonin, another transmitter, affect changes in behavior. Neurotransmitters, amino acids, histamine, and prostaglandin play an important role in maintaining mental health.

Mental health is a state of psychological well-being in which a person achieves a satisfactory integration of instinctual drives that are acceptable to self and others. Mentally healthy individuals achieve an appropriate balance of love, work, and leisure pursuits and can cope with life stresses in acceptable ways.

Mental illness is a broadly inclusive term, generally describing a disease of the brain, with predominant behavioral symptoms. Mental illness is a disease of the mind, or personality, evidenced by abnormal behavior; it is subjective in that only affected clients can describe it. Mentally ill clients cannot cope well with stressors. Their inadequate coping mechanisms (how they deal with life) have various adverse effects on their minds and influences on their behavior.

Common Mental Health Disorders

The following is a review of selected mental health disorders

Anxiety

Anxiety (anxius, distressed) is a dread, an apprehensive feeling of danger to a real or imagined threat. Anxiety often occurs when clients’ needs are not met. The anxious client responds to stressful situations in abnormal or irrational ways that disrupt daily living.

Mentally healthy individuals experience some level of anxiety but can cope with it. Mentally ill clients have higher levels of anxiety; anxiety levels determine the severity of the following symptoms:

- Anorexia
- Overeating
- Diarrhea
- Difficulty following directions
- Dry mouth
- Nausea
- Sleep problems
- Queasy stomach
- Sweating
- Voice changes (often high-pitched)
- Rapid respirations
- Rapid speech
- Tachycardia
- Increased blood pressure
- Urinary frequency
- Difficulty swallowing

From the Library of Scott Kruse
Anxiety disorders are acute and they may last as long as 6 months. They often accompany physical disorders affecting the cardiovascular, digestive, endocrine, and pulmonary systems. Anxiety is often part of many mental health disorders, including depression, bipolar disorders, and substance abuse. With these mental health disorders, anxiety can persist. A thorough history and examination can determine whether the anxiety is primary or secondary to a physical or mental illness.

Anti-anxiety drugs, also called tranquilizers (triquillus, calm), help reduce anxiety as well as tension, agitation, and hyperactivity. Described in Chapter 15, benzodiazepines are also used to treat anxiety. They are beneficial because their effectiveness is consistent; they are less likely to interact with other drugs, they have a lower risk for abuse than other anti-anxiety agents, and they are less likely to cause an overdose. These drugs act to inhibit (prevent or restrict) chemical transmission of impulses that cause excitation. They act quickly to decrease anxiety and its physical signs.

Table 17.1 lists benzodiazepines effective in treating anxiety. These drugs are intended for short-term therapy to avoid drug tolerance and dependence on them. Although less likely, clients can abuse them and suffer withdrawal symptoms.

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Initial Dose</th>
<th>Maximum Daily Dose and Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alprazolam</td>
<td>Xanax; Xanax</td>
<td>0.25mg, 0.5mg, 1.2mg tabs</td>
<td>0.25mg to 0.5mg three times daily</td>
<td>10mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5mg, 2mg, 3mg extended-release tabs</td>
<td>0.5mg to 1mg daily</td>
<td>6mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1mg / 5mL solution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlordiazepoxide</td>
<td>Librium</td>
<td>5mg, 10mg, 25mg</td>
<td>5mg to 10mg three to four times daily</td>
<td>30mg</td>
</tr>
<tr>
<td>Diazepam</td>
<td>Valium</td>
<td>2mg, 5mg, 10mg 5mg / 5mL</td>
<td>2mg to 10mg two to four times daily</td>
<td>40mg</td>
</tr>
<tr>
<td>Lorazepam</td>
<td>Ativan</td>
<td>0.5mg, 1mg, 2mg 2mg / mL</td>
<td>2mg to 3mg two to three times daily</td>
<td>10mg</td>
</tr>
<tr>
<td>Oxazepam</td>
<td>Serax</td>
<td>15mg tabs 10, 15, 30mg caps</td>
<td>10mg to 15mg three to four times daily</td>
<td>120mg</td>
</tr>
</tbody>
</table>

Because benzodiazepines act on the central nervous system (CNS), they impose side effects with the same symptoms but with less intensity as other CNS depressants. However, providing for client safety is a priority. Flumazenil (Romazicon) is an antagonist to benzodiazepines and should be kept on hand in case of a benzodiazepine overdose.
The following drugs also provide relief from anxiety (also called anxiolytics; lysis, to gradually decline):

- **Buspirone (BuSpar):** Has less sedating effects than other anxiolytics, does not alter motor functions and acts rapidly (7 to 10 days).
- **Fluvoxamine (Luvox):** Is effective in treating obsessive-compulsive disorder (OCD); reduces frequency of OCD symptoms, assists OCD clients to control them but does not prevent obsessions or compulsions.
- **Atarax and hydroxyzine (Vistaril):** Considered mild tranquilizers, these drugs decrease anxiety, control itching from allergic reactions, produce sedation and relaxation perioperatively and reduce the amount of analgesia needed preoperatively.

These drugs are available in tablets, capsules, or suspension; the usual dose is 25mg to 100mg given three to four times daily. Along with CNS side effects (drowsiness and sedation), these drugs can cause dryness of the mouth and nasopharynx.

**Mood Disorders**
Select mood disorders are reviewed in this section.

**Depression**
Mood, or affect, relates to emotions and feelings. Mood disorders are those in which feelings and emotions are exaggerated. These exaggerations range on a continuum from being mildly or moderately depressed (feeling down, in which emotions are expressed as sadness, slowness of thought, disinterest in activities, and a poor outlook on life) to bipolar clients (extreme mood changes in phases). At the mildly or moderately depressed end of the spectrum, individuals might continue to work, interact with family and friends, and carry out activities of daily living (ADLs), but with more apathy (lack of pleasant or positive feelings). Anxiety can accompany depression in some clients as they become fearful, worried about themselves or other real or imagined threats to their safety; these suspicious feelings describe paranoia.

Moderately depressed clients feel more and more hopeless, useless, and needy; they may miss work, withdraw from social activities, and may need assistance in maintaining normal activities. When clients are severely depressed, they may withdraw from all daily activities, have little or no appetite, and may neglect their ADLs. Unless treated, these clients may attempt or successfully carry out suicide.
Several classes of mood disorder drugs effectively treat depression. These drug classifications include monoamine oxidase inhibitors (MAOIs), tricyclic antidepressants (TCAs), and selective serotonin re-uptake inhibitors (SSRIs). These three classifications work by prolonging the

With effective treatment, depression may improve, which, on the surface, is a positive outcome. However, when a severely depressed client improves, he or she may begin to have thoughts of suicide (called suicidal ideation) and, because his or her energy level and thought processes are improved, is able to plan a suicide attempt. Talking about death or suicide, giving away personal belongings, and increased agitation or other changes in behavior are signs of a pending suicide attempt. Observe and immediately report to the nurse any or all of these warning signs the client may exhibit. These may be signs of the client's need for help. It is equally important to assist the nurse in checking for harmful objects in the client's environment.

Certain medications can also have the side effects of depression. Few cause euphoria unless taken recreationally to reach an elevated mood (in street language, a high).

NOTE

EXAM ALERT

Older clients are more susceptible to depression because of their experience with loss: death of a spouse, other family members, or friends; loss of independence due to frailty or infirmity; and changes in their lifestyle due to the loss of certain body functions. Depressed older clients often develop the following signs and symptoms of depression:

- Agitation (excessive restlessness)
- Anxiety
- Decreased interest in sexual activity
- Dry mouth
- Difficulty completing ADLs
- Increased dependency
- Fatigue
- Feelings of uselessness, hopelessness, and helplessness
- Focus on the past to more pleasant times
- Poor grooming
- Slow or unreliable memory
- Muscle aches and pains, headaches
- Nausea and vomiting
- Paranoia
- Sleep disturbances
- Thoughts of death or suicide
- Withdrawal from people and interests
- Loss of religious faith/practices
action of dopamine (sometimes referred to as the feel good hormone), norepinephrine, and serotonin. Serotonin, a neurotransmitter and powerful vasoconstrictor, acts on cellular receptors and plays important roles in intestinal motility, nausea and vomiting, sleep-wake cycles, obsessive-compulsive behaviors, depression, and eating.

MAOIs prevent the breakdown of neurotransmitters such as epinephrine, dopamine, norepinephrine, and serotonin. These neurotransmitters control mood and emotions. MAOIs act quickly, usually within 2 to 4 weeks.

**EXAM ALERT**

Exercise caution when MAOIs are given with certain drugs, food, and fluids. To prevent serious side effects, for example, tyramine, present in certain foods and fluids, can stimulate the release of epinephrine and norepinephrine, which can cause a hypertensive crisis. Clients taking MAOIs should also avoid the following:

- **Dairy**: Certain aged cheeses
- **Meats**: Chicken livers, corned beef, smoked or pickled meats, pepperoni, poultry and fish, salami and sausage, aged or fermented meats (chicken or beef pate, game fish, poultry)
- **Breads**: Yeast products
- **Fruits**: Avocados
- **Vegetables**: Sauerkraut
- **Fluids**: Beer and red wines

Hypertension is a specific side effect of MAOIs; other side effects are similar to those with anti-anxiety drugs. Blood pressure monitoring should be ongoing and reviewed prior to giving MAOIs.

TCAs act to prolong norepinephrine, dopamine, and serotonin actions by blocking the reabsorption of these three neurotransmitters. TCAs work within 2 to 4 weeks to calm clients and improve mood. Clients experience an increase in their appetite and awareness. TCAs also relieve chronic pain, treat eating disorders, and decrease symptoms in premenstrual syndrome (PMS).

Side effects of TCAs include constipation, CNS effects (tremors, numbness, Parkinson-like symptoms, sedation, and seizures), and cardiac dysrhythmias and heart failure. As with other antidepressants, these drugs may increase suicidal ideation.

SSRIs act just as their name implies: They block the reabsorption of serotonin by certain nerve cells, improving the client’s mood. Because they are safer than other antidepressants, they are the most widely used. They act within 2 weeks to relieve depression. Their major side effects are CNS related, including gastrointestinal (GI) irritation; therefore, they should be given with food. Protection from suicidal behavior is vital when administering these drugs.

Table 17.2 summarizes representatives of antidepressants.
### TABLE 17.2 Antidepressants

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Initial Dose and Daily Maintenance</th>
<th>Maximum Daily Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAOIs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isocarboxazid</td>
<td>Marplan</td>
<td>10mg tabs</td>
<td>Initially: 10mg twice daily</td>
<td>60mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Maintenance: 40mg</td>
<td></td>
</tr>
<tr>
<td>Pheneizine</td>
<td>Nardil</td>
<td>15mg tabs</td>
<td>Initially: 15mg three times daily</td>
<td>90mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Maintenance: 15mg to 60mg</td>
<td></td>
</tr>
<tr>
<td>Tranylcypromine</td>
<td>Parnate</td>
<td>10mg tabs</td>
<td>Initially: Twice daily</td>
<td>60mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Maintenance: 30mg</td>
<td></td>
</tr>
<tr>
<td><strong>TCAs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amitriptyline</td>
<td>Elavil</td>
<td>10mg, 25mg, 50mg, 75mg, 100mg, 150mg tabs</td>
<td>Initially: 25mg three times daily; Maintenance: 150-250mg</td>
<td>300mg</td>
</tr>
<tr>
<td>Doxepin</td>
<td>Sinequan</td>
<td>10mg, 25mg, 50mg, 75mg, 100mg, 150mg caps; 10mg / mL oral concentrate</td>
<td>Initially: 25mg three times daily; Maintenance: 150mg</td>
<td>Same</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imipramine</td>
<td>Tofranil</td>
<td>10mg, 25mg, 50mg tabs</td>
<td>Initially, 30mg to 75mg daily; Maintenance: 150mg to 250mg</td>
<td>Same</td>
</tr>
<tr>
<td>Nortriptyline</td>
<td>Aventyl</td>
<td>10mg, 25mg, 50mg, 75mg caps; 10mg / 5mL solution</td>
<td>Initially: 25mg three or four times daily; Maintenance: 50mg to 75mg</td>
<td>100mg</td>
</tr>
<tr>
<td>Trimipramine</td>
<td>Surmontil</td>
<td>25mg, 50mg, 100mg caps</td>
<td>Initially: 25mg three times a day; Maintenance: 50mg to 150mg</td>
<td>200mg</td>
</tr>
<tr>
<td><strong>SSRIs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Citalopram</td>
<td>Celexa</td>
<td>10mg, 20mg, 40mg tabs 10mg / 5mL liquid</td>
<td>Initially: 20mg daily; Maintenance: 20mg to 40mg</td>
<td>60mg</td>
</tr>
<tr>
<td>Duloxetine</td>
<td>Cymbalta</td>
<td>20mg, 30mg, 60mg sustained-release capsules</td>
<td>Initially: 40mg daily; Maintenance: 60mg</td>
<td>60mg</td>
</tr>
<tr>
<td>Escitalopram</td>
<td>Lexapro</td>
<td>5mg, 10mg, 20mg tabs 5mg / 5mL liquid</td>
<td>Initially: 10mg daily; Maintenance: 10mg to 20mg</td>
<td>20mg</td>
</tr>
<tr>
<td>Fluoxetine</td>
<td>Prozac</td>
<td>10mg, 20mg, 40mg caps 10mg, 20mg tabs 20mg / 5mL solutions</td>
<td>Initially: 20mg daily; Maintenance: 20mg to 60mg</td>
<td>80mg</td>
</tr>
<tr>
<td>Paroxetine</td>
<td>Paxil, Paxil CR</td>
<td>10mg, 20mg, 30mg, 40mg tabs 10mg / 5mL suspension 12.5mg, 25mg, 37.5mg sustained-release tabs</td>
<td>Initially: 20mg daily; Maintenance: 20mg to 50mg</td>
<td>50mg</td>
</tr>
<tr>
<td>Sertraline</td>
<td>Zoloft</td>
<td>25mg, 50mg, 100mg tabs 20mg / mL oral concentration</td>
<td>Initially: 50mg daily; Maintenance: 50mg to 200mg</td>
<td>200mg</td>
</tr>
</tbody>
</table>
On the other end of the feelings spectrum, bipolar clients are those clients whose extreme moods occur in phases. The term bipolar (bi, two; polus, a pole) replaces the diagnosis of manic-depressive disorder.

Bipolar clients experience a depressive phase (and experience episodes of extreme depression) followed by a manic phase (a state of euphoria, which is a prolonged episode marked by an exaggerated sense of well-being or elation). It is in this phase that bipolar clients may become irritable and belligerent, especially when their grandiose/exaggerated thoughts and actions are thwarted. These phases may have psychotic features, represented by breaks with reality, which is a more serious condition and is more difficult to manage.

Other antidepressants act to help relieve symptoms of depression more quickly than the classifications reviewed previously; relief is often within a few days. However, improvement in depressive disorders often takes several weeks. These drugs include the following:

- Buproprion (Wellbutrin)
- Maprotiline hydrochloride
- Mirtzapine (Remeron)
- Nefazodone
- Trazodone hydrochloride (Desyrel)
- Venlafaxine (Effexor)

Maprotiline and venlafaxine elevate mood but also reduce anxiety. Buproprion (Wellbutrin) is effective for clients who do not respond to TCAs or who cannot tolerate the side effects of TCAs. Nefazodone works well to reduce depression and elevate mood but can cause orthostatic hypotension in addition to liver failure.

Desyrel has multiple indications such as depression, depression associated with psychoses; anxiety, depression, and tremors associated with alcohol abuse; and insomnia in clients with substance abuse. Desyrel can cause orthostatic hypotension and dysrhythmias.

**EXAM ALERT**

Psychosis is a severe mental disorder in which clients are unable to understand reality or cope with life’s demands. Psychotic clients are those who behave in bizarre ways; they react to delusions (false beliefs resistant to reasoning) and hallucinations involving one of the five senses (sight, hearing, smell, and so on). Psychotic clients are paranoid; that is, they falsely believe that others are plotting against them. Delusional thinking such as a delusion of grandeur may exaggerate their sense of self-worth, often inflating it to the extreme; for example, psychotic clients may believe they are the powerful leaders like a king or the president of the United States or God. On the opposite end of grandeur scale is persecution; a delusion of persecution falsely victimizes clients who believes that others are harassing or mistreating them.
Schizophrenia is the most common form of mental illness; it includes delusions and hallucinations as well as grossly disorganized speech and behavior. Schizophrenic clients (schizein, to divide; phren, the mind) have no rational pattern to their speech, they withdraw from society, and they lack interpersonal relationship skills. They also have poor insight and lack cognitive function. Schizophrenic clients may become catatonic (tonos, tension), meaning they may assume a particular position and remain there while being unable to speak.

Schizophrenia is a disease of exclusion, as none of its symptoms are diagnostic. Organic causes of bizarre behavior may include epilepsy, poisoning, or adverse effects of psychoactive drugs.

Schizophrenia is responsive to antipsychotic drugs, also called neuroleptics, and major tranquilizers. These drugs are used along with psychotherapy to restore psychotic clients to as near a normal life as possible. Despite their use, antipsychotic drugs do not cure psychoses. Antipsychotics block the action of dopamine and serotonin receptors at various sites in the brain.

There are two classifications of antipsychotic agents:

- **First-generation (or typical) antipsychotics**: These drugs work against the effects of dopamine (antagonizing effect) in the CNS.
- **Second-generation (or atypical) agents**: These drugs inhibit dopamine and serotonin receptors.

The main side effects of antipsychotics are CNS related. They can also cause extrapyramidal side effects (EPS). These include bradykinesia (slow movement), tardive dyskinesia (abnormal muscle movements around the mouth, lips, and tongue), difficulty walking, a shuffling gait, and tremors; EPS is also called drug-induced parkinsonism. Other adverse effects include anorexia, dysrhythmias, endocrine disorders, hyperglycemia, hypotension, and liver toxicity.

Table 17.3 outlines classifications of various antipsychotic agents.
TABLE 17.3 Classifications of Antipsychotic Agents

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
<th>Dose Forms</th>
<th>Dose Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Typical (First-Generation) Antipsychotic Agents</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorpromazine</td>
<td>Thorazine</td>
<td>10mg, 25mg, 50mg, 100mg, 200mg tabs</td>
<td>30mg to 1000mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100mg / mL syrup</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>100mg suppository</td>
<td></td>
</tr>
<tr>
<td>Fluphenazine</td>
<td>Prolixin</td>
<td>1mg, 2.5mg, 5mg, 10mg tabs</td>
<td>0.5mg to 20mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5mg / 5mL elixir</td>
<td></td>
</tr>
<tr>
<td>Prochlorperazine</td>
<td>Compazine</td>
<td>5mg, 10mg, 25mg tabs</td>
<td>15mg to 150mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30mg sustained-release caps</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5mg / mL syrup</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5mg, 5mg, 25mg suppository</td>
<td></td>
</tr>
<tr>
<td>Haloperidol</td>
<td>Haldol</td>
<td>0.5mg, 1mg, 2mg, 5mg, 10mg, 20mg tabs</td>
<td>1mg to 15mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2mg / mL concentrate</td>
<td></td>
</tr>
<tr>
<td>Loxapine</td>
<td>Loxitane</td>
<td>5mg, 10mg, 25mg, 50mg caps</td>
<td>10mg to 15mg</td>
</tr>
<tr>
<td><strong>Atypical (Second-Generation) Antipsychotics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aripiprazole</td>
<td>Abilify</td>
<td>5mg, 10mg, 15mg, 20mg, 30mg tabs</td>
<td>10mg to 15mg</td>
</tr>
<tr>
<td>Olanzapine</td>
<td>Zyprexa</td>
<td>2.5mg, 5mg, 7.5mg, 10mg, 15mg, 20mg tabs</td>
<td>10mg to 15mg</td>
</tr>
<tr>
<td>Quetiapine</td>
<td>Seroquel</td>
<td>25mg, 100mg, 200mg, 300mg</td>
<td>50mg to 800mg</td>
</tr>
<tr>
<td>Risperidone</td>
<td>Risperdal</td>
<td>0.25mg, 0.5mg, 1mg, 2mg, 3mg, 4mg tabs</td>
<td>4mg to 16mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1mg / mL solution</td>
<td></td>
</tr>
</tbody>
</table>
Exam-Prep Questions

1. Which of the following medications is not a benzodiazepine?
   - A. Chlordiazepoxide
   - B. Lorazepam
   - C. Citalopram
   - D. Alprazolam

2. The resident who is started on an antidepressant should be assessed in the first 2 to 4 weeks for which potential side effect?
   - A. Weakness
   - B. Increased libido
   - C. A hangover effect
   - D. Suicidal tendencies

3. Which words best help the MA-C to understand the meaning of the term mental illness?
   - A. Brain damaged
   - B. A disease of the brain with behavioral symptoms
   - C. Dangerous behavior
   - D. A person who has seizures

4. All of the following are symptoms of anxiety except what?
   - A. Increased appetite
   - B. Dry mouth
   - C. Nausea
   - D. Sleep problems

5. Bradykinesia and tardive dyskinesia are of particular interest to which group of CNS medications?
   - A. Benzodiazepines
   - B. Neuroleptics
   - C. Antipsychotic agents
   - D. Antidepressants
6. Which side effect below is not due to taking tricyclic antidepressants?
   - A. Constipation
   - B. Incontinence
   - C. CNS effects
   - D. Cardiac dysrhythmias

7. Many of CNS medications should be taken at night, before bed, to avoid which of the following side effects?
   - A. Dizziness
   - B. Blurred vision
   - C. Sedation
   - D. Confusion

8. Which choice would be a dangerous side effect for a resident receiving Abilify?
   - A. Chest pain
   - B. Dry mouth
   - C. Weight loss
   - D. Dizziness

9. True/false. It is important for antipsychotic medications to be administered close to the same time every day.

10. When a resident is taking a CNS medication, he or she must avoid which of the following?
    - A. Eating vegetables
    - B. Eating all fruits
    - C. Drinking carbonated beverages
    - D. Drinking alcohol
Rationales

1. The correct answer is C. All the medications are benzodiazepines except choice C, citalopram, which is prescribed for major depressive disorders.

2. The correct answer is D. Anytime an antidepressant is started, the patient may experience an increase in suicidal ideation. Choice C, a hangover effect, can occur in the first few weeks. Choices A and B are not side effects of antidepressants.

3. The correct answer is B. Mental illness is a broadly inclusive term, generally describing a disease of the brain, with predominant behavioral symptoms. Choice A is a negative connotation to mental illness and is inappropriate. Choice C is not a definition, and choice D is used to describe epilepsy.

4. The correct answer is A. Choices B, C, and D are the most common symptoms of anxiety. Choice A can be seen with manic behavior and as a positive side effect of treatment.

5. The correct answer is C. The main side effects of antipsychotics are CNS related. They can cause extrapyramidal side effects such as bradykinesia (slow movement), tardive dyskinesia (abnormal muscle movements around the mouth, lips, and tongue), difficulty walking, a shuffling gait, and tremors.

6. The correct answer is B. Persons who are taking tricyclic antidepressants can have side effects of problems with the rhythm of the heart, constipation, and CNS effects. Choice B, loss of urinary or bowel control, is not a side effect of taking tricyclic antidepressants.

7. The correct answer is C. CNS medications can cause sedation and is best given at night.

8. The correct answer is A. Chest pain and heart attacks are serious side effects of Abilify.

9. The correct answer is True. It is important for those who are taking antipsychotic medications to take them close to the same time each day and to not miss doses.

10. The correct answer is D. CNS medications already alter the sensorium and should never be taken with alcohol.
Practice Exam I

1. What is the best way to verify a provider’s illegible order?
   - A. Ask a fellow Medication Aide to verify the order
   - B. Ask the pharmacist what he/she thinks the providers means
   - C. Call the provider to verify the order
   - D. Compare the writing to other orders that the provider has written

2. A resident is scheduled to receive oral ibuprofen for chronic arthritic pain; however, the resident is unable to swallow. The nurse must be informed because this is a problem with which of the following rights of medication administration?
   - A. The right time
   - B. The right dose
   - C. The right route
   - D. The right medication

3. When the Medication Aide is asked by a resident about how medications work when taken into the body, what would be his/her response?
   - A. Medications can cause the growth of abnormal cells.
   - B. Medications enhance or block some functions of the body.
   - C. Medications can change the function of some of the cells of the body.
   - D. Medications can cause the body to develop new cells.

4. What is the best action for a Medication Aide who is administering medication to an alert and competent resident who refuses to take his/her medication as directed?
   - A. Realize the resident has the right to refuse medications
   - B. Attempt to talk the resident into taking his/her medication by telling him/her how much better he/she will feel if he/she takes it
   - C. Let the resident know you will return to see whether he/she will be ready to take the medication in a few minutes
   - D. Explain to the resident that his/her loved ones want him/her to take the medication so that he/she can get better
5. Which of the following may be a cause for a medication’s failure to elicit the desired effect?
   - A. The resident’s past history of drug abuse
   - B. Using the generic form instead of the brand-name medication
   - C. The resident’s diet and nutritional status
   - D. Provider orders for several different medications for the resident

6. What does the term *polypharmacy* mean?
   - A. The resident takes many different medications for various medical conditions.
   - B. The resident or a family member obtains the resident’s medications from several different pharmacies.
   - C. The resident is able to take many different medications without any adverse effects.
   - D. The resident takes the same medication several times a day.

7. Which of the following questions is open-ended?
   - A. Are you allergic to aspirin?
   - B. Have you ever taken aspirin before?
   - C. When you took the aspirin, did you have a reaction?
   - D. What medications are you allergic to?

8. A resident is taking Coumadin and enjoys eating green leafy vegetables. The response of Coumadin to green leafy vegetables is considered which type of interaction?
   - A. Food
   - B. Bioavailability
   - C. Additive
   - D. Polymorphism

9. Which complaint by a resident would indicate an adverse effect to aspirin?
   - A. Stomach upset
   - B. Increased red blood cell count
   - C. Ringing in the ears
   - D. Headaches
10. Which of the following would be considered a side effect of a medication?
   ○ A. Lips and tongue feeling numb
   ○ B. Irregular heartbeat
   ○ C. Ringing in the ears
   ○ D. Nausea

11. A resident is ordered ferrous sulfate 325mg three times a day for anemia. Which of the following things about administering the medication is it important for the Medication Aide to know?
   ○ A. Give with milk
   ○ B. Administer on an empty stomach
   ○ C. Give with orange juice
   ○ D. Allow the resident to take with other medications

12. Common side effects of nitrates include which of the following?
   ○ A. Headache, flushing, postural hypotension
   ○ B. Blurred vision and dry mouth
   ○ C. Weight gain or worsening CHF
   ○ D. Dizziness

13. HMG-CoA inhibitors belong to a class of medications known as statins. Statins are known for at least one serious adverse affect on which major system?
   ○ A. Cardiovascular
   ○ B. Respiratory
   ○ C. Musculoskeletal
   ○ D. Gastrointestinal

14. Before giving metoprolol, the Medication Aide should know if the resident has a history of which of the following?
   ○ A. Headaches
   ○ B. Bronchospasms
   ○ C. Angina
   ○ D. Constipation
15. A resident has been ordered synthroid and wants to know what it is prescribed for. The correct answer is what?
   ☐ A. Hypothyroidism
   ☐ B. Hypertension
   ☐ C. Hyperthyroidism
   ☐ D. Hypotension

16. A serious adverse effect of synthroid is which of the following?
   ☐ A. Tachycardia
   ☐ B. Malignant hyperthermia
   ☐ C. Fatigue
   ☐ D. Hypotension

17. A resident is taking metformin. The Medication Aide knows this medication is taken for which of the following conditions?
   ☐ A. Diabetes mellitus type 1
   ☐ B. Diabetes mellitus type 2
   ☐ C. Diabetes insipidus
   ☐ D. Hypothyroidism

18. If a resident is to have a test that utilizes dye, which medication must be withheld for 24 hours before and 48 hours after the test?
   ☐ A. Starlit
   ☐ B. Precose
   ☐ C. Actos
   ☐ D. Glucophage

19. The Medication Aide explains to a resident's family member that the most effective treatment for acne is which of the following?
   ☐ A. Soap and water
   ☐ B. Cryotherapy
   ☐ C. Dietary restrictions
   ☐ D. Astringent medication

From the Library of Scott Kruse
20. Which of the following medications is used for fast relief from increased wheezing and shortness of breath for a resident who suffers from asthma?
   - A. Aminophylline
   - B. Azmacort
   - C. Proventil
   - D. Spiriva

21. Which of the following is the generic name for Zithromax?
   - A. Clarithromycin
   - B. Azithromycin
   - C. Erythromycin
   - D. Oxamycin

22. The most common side effect of acyclovir is what?
   - A. Hypertension
   - B. Tachycardia
   - C. Bradycardia
   - D. Headache

23. When can an MA-C refuse an assignment?
   - A. When it is almost time for his or her shift to end
   - B. When he or she is too busy
   - C. When the task is unclear
   - D. When the nurse is not busy

24. Every new resident of an extended care facility should be provided a copy of which of the following publications?
   - A. The Rights of the State Agency
   - B. The Rules and Regulations for Residents
   - C. The Patient's Bill of Rights
   - D. The Resident's Bill of Rights
25. The MA-C is responsible for knowing the medical information of whom?
   ○ A. All residents at the MA-C's place of employment
   ○ B. Each of the residents he/she is assigned to
   ○ C. All residents on his/her unit or floor
   ○ D. All residents assigned to his/her supervising nurse

26. The MA-C is administering guaifenesin to a resident as part of the resident's treatment for the flu. Which of the following responses would the MA-C see that would demonstrate the effectiveness of the treatment?
   ○ A. The resident becomes afebrile.
   ○ B. The resident sleeps through the night.
   ○ C. The resident's cough is looser and productive.
   ○ D. The resident experiences a decrease in coughing.

27. The MA-C knows the correct method for preparing to administer a metered-dose inhaled respiratory medication is which of the following?
   ○ A. Shake the medication container
   ○ B. Do not shake but roll the medication container in the palms of the hands until well mixed
   ○ C. Set the medication out at room temperature until it reaches body temperature
   ○ D. Do not shake or roll the medication container before administering

28. Which statement is a benefit of an oral decongestant?
   ○ A. Less chance of rebound congestion
   ○ B. Higher potency
   ○ C. Longer acting
   ○ D. Taste better

29. Which of the following medications is given for a bacterial infection?
   ○ A. Proscar
   ○ B. Flagyl
   ○ C. Cardizem
   ○ D. Tetracycline
30. The MA-C knows that it is not appropriate to do which of the following when taking an antibiotic?

- A. Stop the medication when symptoms clear
- B. Take the medication until the medication is gone
- C. Drink plenty of fluids
- D. Follow standard precautions

31. A resident who is taking a Klor-Con (potassium replacement) should avoid which of the following foods?

- A. Apples
- B. Grapefruit
- C. Tomatoes
- D. Bananas

32. Many older individuals have used baking soda as a home remedy for indigestion. Baking soda should not be taken if the resident has which of the following conditions?

- A. Congestive heart failure
- B. Renal disease
- C. Osteoporosis
- D. Hypertension

33. Residents who are taking PPI should only take them for which of the following durations?

- A. Until symptoms subside
- B. For as long as they are affordable
- C. After they have eaten a bland diet for two weeks
- D. Until discontinued by their healthcare provider

34. When should Carafate be administered?

- A. At least 1 hour before meals on an empty stomach
- B. At least 1 hour after meals on a full stomach
- C. With meals when food is in the stomach
- D. With fluids just before the meal
35. The maximum dose of Tylenol in 24 hours is which of the following?
   ○ A. 3 grams
   ○ B. 6 grams
   ○ C. 1 gram
   ○ D. 2 grams

36. Tramadol is a non-narcotic centrally acting analgesic. Which of the following is the most serious adverse effect listed that may occur when taken?
   ○ A. Excessive hunger
   ○ B. GI bleeding
   ○ C. Seizures
   ○ D. nervousness

37. Which of following forms of medication can be cut in half?
   ○ A. Nonscored tablet
   ○ B. Caplet
   ○ C. Capsule
   ○ D. Scored tablet

38. Fall precaution is important for residents taking anticonvulsant medications. Which of the medications is an anticonvulsant?
   ○ A. Sudafed
   ○ B. Neurontin
   ○ C. Toprol-XL
   ○ D. Naloxone

39. The most common bacteria that causes most UTIs is which of the following?
   ○ A. Staphylococcus aureus
   ○ B. Pseudomonas aeruginosa
   ○ C. Escherichia coli
   ○ D. Enterococcus faecalis
40. When instilling eye drops, you should hold the eye dropper where?
   - A. Close enough to touch the cornea
   - B. .5 to .75 inches from the lid surface
   - C. 3 to 4 inches away from conjunctiva
   - D. 1 inch to 1.5 inches from the lid surface

41. When administering several medications at the same time, they must be given in a particular order. Which of the following is the correct order?
   - A. Tablets, liquids, syrups, and lozenges
   - B. Liquids, syrups, tablets, and lozenges
   - C. Lozenges, tablets, liquids, and syrups
   - D. Syrups, liquids, tablets, and lozenges

42. A medical emergency can also arise due to a sudden life-threatening drug reaction, known as an anaphylaxis. Which of the following is a sign of anaphylaxis?
   - A. Dry hives
   - B. Shortness of breath
   - C. Nausea
   - D. Headache

43. One pint equals how many milliliters?
   - A. 100mL
   - B. 200mL
   - C. 500mL
   - D. 300mL

44. Which of the following is an example of a steroid medication?
   - A. Clindamycin
   - B. Metropolol
   - C. Hydrocodone
   - D. Prednisone
45. A pulse rate that stays below 60 is considered an indication of which of the following?
   ○ A. Hypertension
   ○ B. Bradycardia
   ○ C. Hypotension
   ○ D. Tachycardia

46. A provider may exchange a brand-name drug for a less-expensive form of the drug known as a what?
   ○ A. Trade name
   ○ B. Chemical name
   ○ C. Generic name
   ○ D. Popular name

47. Which medication is administered for anxiety?
   ○ A. Diazepam
   ○ B. Antivert
   ○ C. Morphine
   ○ D. Nitroglycerin

48. Which medication is an anticoagulant?
   ○ A. Vitamin K
   ○ B. Warfarin
   ○ C. Ferrous sulfate
   ○ D. Melatonin

49. What is the generic name for Motrin?
   ○ A. Acetylsalicylic acid
   ○ B. Ecotrin
   ○ C. Ibuprofen
   ○ D. Naproxen

50. The best way for an MA-C to avoid spreading infection is to do what?
   ○ A. Wash hands
   ○ B. Wear gloves while performing all procedures
   ○ C. Apply lotion to hands frequently
   ○ D. Wear a gown when entering residents’ rooms

From the Library of Scott Kruse
Practice Exam I Rationales

Answers at a Glance

1. C  18. D  35. A
6. A  23. C  40. B
7. D  24. D  41. A
8. A  25. B  42. B
10. D  27. A  44. D
13. C  30. A  47. A
15. A  32. C  49. C
16. A  33. D  50. A
17. B  34. A
Answer Rationales

1. The correct answer is C. Any time an order is illegible, you need to verify it with the one who wrote it and no one else. Guessing can lead to serious complications if the wrong medication is administered.

2. The correct answer is C. Residents who cannot swallow need a change to the route by which the medication is administered. The other choices are incorrect because the right medication, time, and dose are indicated.

3. The correct answer is B. Medications work by enhancing or blocking some functions or chemical reactions in the body. As for choices A, C, and D, creating new cells and changing functions are not how medications work in the body.

4. The correct answer is A. A resident who is competent and alert is using autonomy in making his/her decision. The Medication Aide is to alert the nurse so that the provider can be notified. The incorrect choices include using coercion and other inappropriate tactics to talk the resident into taking the medication.

5. The correct answer is C. A resident's nutrition and diet is important to the absorption, transportation, and delivery of medications. When a person is malnourished, his/her protein levels may be low and thus hinder these processes.

6. The correct answer is A. The definition of polypharmacy is several different medications for various disorders.

7. The correct answer is D. Choice D is the only open-ended question. Choices A, B, and C require yes or no answers.

8. The correct answer is A. When green leafy vegetables are consumed by persons who are taking Coumadin, it can decrease the effects of the medication. This interaction is considered a food interaction. Choice B, bioavailability, refers to the amount of a drug that is unchanged when it reaches the circulatory system after it is administered. Choice C, additive, is incorrect because the interaction causes a blocking of the effect of the medication. Choice D, polymorphism, refers to a change into some other chemical, which does not occur in this instance.

9. The correct answer is C. An adverse reaction to aspirin is ringing in the ears. Choices B, C, and D are possible side effects of medications other than aspirin.

10. The correct answer is D. Gastrointestinal upset is a common side effect of many medications. Choice A is a sign of a serious adverse reaction, and the nurse needs to be notified immediately. Choices B and C are considered adverse reactions.

11. The correct answer is C. Giving orange juice with ferrous sulfate can increase the absorption of iron. Choice A can decrease absorption. Choice B is incorrect because the medication should be given with food to decrease gastric upset. Choice D can cause significant reactions to thyroid medications and antibiotics.

12. The correct answer is A. Choice B gives the adverse effects of nitrates. Choices C and D are side effects of beta blockers.
13. The correct answer is **C**. A serious adverse effect of statins is muscle aches, which can be a sign of kidney failure. Choice A and B are incorrect because no cardiovascular adverse effects occur. Choice D is a side effect, such as GI upset, of statins.

14. The correct answer is **B**. Metoprolol is a beta-blocking agent that affects what are known as the beta 1 and beta 2 receptors. Beta 2 affects the bronchial tubes of the lungs. Metoprolol may cause dizziness and fatigue, but not headaches. This medication does not cause angina or constipation.

15. The correct answer is **A**. Synthroid is a medication that is prescribed for hypothyroidism.

16. The correct answer is **A**. Tachycardia is a serious adverse effect of synthroid. Choice B is incorrect because the medication can cause a slight increase in temperature, but not malignant hyperthermia. Choice C, fatigue, is a sign of hypothyroidism, not an adverse effect. Choice D is a side effect of some cardiovascular medications.

17. The correct answer is **B**. Metformin increases the utilization of glucose. Choice A, diabetes mellitus type 1, requires insulin to increase utilization of glucose. Choice C, diabetes insipidus, is a condition in which the kidneys are unable to conserve water, not a problem with glucose. Choice D, hypothyroidism, is a problem with the thyroid and pituitary glands, not glucose.

18. The correct answer is **D**. Metformin belongs in the class known as biguanides. If the patient becomes hypoglycemic from not eating, he/she can develop lactic acidosis, which is a serious problem that can cause an increase in mortality. Choice A is a meglitinide. Choice B is an alpha-glucosidase inhibitor; and Choice C is a thiazolidinedione. These are not prone to cause lactic acidosis.

19. The correct answer is **D**. Astringent therapy with medications such as benzoyl peroxide inhibits the growth of the microorganism that is responsible for acne. Choices A and C are parts of treatments to decrease the severity of acne. Choice B is the treatment for warts, not acne.

20. The correct answer is **C**. Proventil is a fast-acting bronchodilator. Choice A requires the medication to peak before it becomes effective. Choice B, Azmacort, is not used for rapid relief. Choice D is Spiriva, which takes a longer time to begin acting.

21. The correct answer is **B**. Azithromycin is a brand of Zithromax.

22. The correct answer is **A**. The only side effect of acyclovir listed is choice A.

23. The correct answer is **C**. A Medication Aide can refuse assignments when the delegated task is unclear, when the Medication Aide is unfamiliar with the task, when the delegated task could harm the client, or when the task is illegal or unethical.

24. The correct answer is **D**. By law, all nursing homes must have written policies describing residents’ rights and must make them available to all residents.

25. The correct answer is **B**. HIPPA law states that all healthcare personnel should access health information only if it is necessary for them to perform their jobs.

26. The correct answer is **C**. Expectorants like guaifenesin help to loosen secretions and the residents are able to them up easier. Choice A is not an action of the medication. Choices B and D are signs that the flu is progressing.
27. The correct answer is A. Metered dose inhalers require mixing before administration. Choices B, C, and D are incorrect techniques and may lead to incorrect dosing of the resident.

28. The correct answer is A. When an oral decongestant is given instead of a nasal one, there is less chance of rebound congestion when the medication is discontinued. Choice B and C are incorrect because the potency and length of action depends on medication and not the route. Choice D is according to the resident's taste buds.

29. The correct answer is D. Tetracycline is an antibiotic used to fight bacterial infection. Choice A is indicated for enlarged prostate treatment. Choice B Flagyl is used to treat fungal infections, and choice C, Cardizem, is used for hypertension.

30. The correct answer is A. Antibiotics should not be discontinued when symptoms disappear. It allows the bacteria to strengthen and it becomes harder to fight the infection. Choices B, C, and D are appropriate actions for someone who taking antibiotics.

31. The correct answer is D. Residents who are taking potassium supplement should avoid foods high in potassium (for example, bananas, melons, orange juice, and salt substitutes). The other food choices (choices A, B, and C) do not contain larger amounts of potassium.

32. The correct answer is C. Osteoporosis is not affected by the ingestions of baking soda. However, the other conditions (choices A, B, and D) have restrictions to sodium in the diet, and therefore baking soda would be contraindicated.

33. The correct answer is D. PPI are to be administered for short periods of time if taken over the counter. Long-term use outs the resident at risk for osteoporosis. Choice A is incorrect because stopping the PPI suddenly can cause rebound reflux. Choices B and C are not indications for use of a PPI.

34. The correct answer is A. Carafate is activated by the acid in stomach to form a thick protective paste; therefore, it must be given one hour before meals on an empty stomach. Choices B, C, and D are incorrect because they would not allow the medication to be effective.

35. The correct answer is A. The maximum daily dose is 3g. That is six extra-strength tablets a day. For persons with liver problems, the dose needs to be reconsidered. Choices A, C, and D are either two low or too high of a dose.

36. The correct answer is C. When Tramadol is given in high doses or along with medications to reduce muscle spasms, the seizure threshold is lowered.

37. The correct answer is D. Only scored tablets should be cut in half. Scored tablets mark where the medication would be half the dose.

38. The correct answer is B. Neurontin is an antiseizure and can cause drowsiness or sleepiness. Choice A, Sudafed, can cause drowsiness, but it is an antihistamine and not an anticonvulsant. Choice C, Toprolol XL, is for blood pressure; and choice D, Naloxone, is used to reverse the effect of opioids.

39. The correct answer is C. E. coli is the most common bacteria that can cause a UTI, especially in females.
40. The correct answer is **B**. The correct distance to hold an eye dropper when administering medication is 1/2 to 3/4 of an inch and not to touch any part of the eye.

41. The correct answer is **A**. When administering several forms of medication at the same time, the correct order is tablets, liquids, syrups, and then lozenges.

42. The correct answer is **B**. The signs of anaphylaxis include difficulty breathing, low blood pressure, irregular pulse, sweating, and swelling of the larynx/bronchi. Choices A, C, and D are possible side effects of some medications.

43. The correct answer is **C**. One pint equals 500 mL or 1/2 liter.

44. The correct answer is **D**. Prednisone is frequently used for upper respiratory infections and allergic reactions. Choice A, clindamycin, is an antibiotic. Choice B, metropolol, is a beta blocker used for cardiac disorders and hypertension. Choice C, hydrocodone, is a controlled analgesic used for pain control.

45. The correct answer is **B**. Choice A, hypertension, is the term used to describe a blood pressure greater than 140/90. Choice C, hypotension, is the term used to describe a blood pressure less than 90/60. Choice D, tachycardia, is the term used to describe a pulse rate greater than 100.

46. The correct answer is **C**. Generally the least expensive form of a medication is the generic.

47. The correct answer is **A**. Diazepam, the generic name for Valium, is an antianxiety medication and may not be given by the Medication Aide. Choice B, antiver, is used for syncope. Choice C, morphine, is used for severe pain. Choice D, nitroglycerin, is a vasodilator, and its primary indication is for chest pain.

48. The correct answer is **B**. Warfarin is the generic name for Coumadin, an anticoagulant that is ordered frequently. Choices A and C increase clotting time. Choice D is a natural herb used to induce sleep. It can interact with anticoagulants.

49. The correct answer is **C**. The generic name for Motrin is ibuprofen. Choice A is generic for aspirin. Choice B is the brand name for a form of aspirin. Choice D, naproxen, is the generic name for Aleve.

50. The correct answer is **A**. The best way for anyone to avoid spreading infection is to wash his/her hands. Choices B and D are necessary when the possibility of encountering a contact or a respiratory disease exists. Choice C is good to prevent hand chapping, but does not reduce the spread of infection.
Practice Exam II

1. The Resident's Bill of Rights includes all of the following except for what?
   - A. Access to privacy
   - B. Freedom from abuse
   - C. Grievance without retribution
   - D. Ability of the facility to discharge the resident without reason

2. A resident has received a change of order from PO Lasix to IV push Lasix. The Medication Aide realizes that according to the job description for medication administration aides
   - A. IV medication can be administered by the MA–C as long as a registered nurse is present.
   - B. The Medication Aide cannot administer IV medication under any conditions.
   - C. The Medication Aide can administer the Lasix after the initial dose is given by the RN.
   - D. The Medication Aide can administer the Lasix so long as the medication does not need to be titrated to effect.

3. When the RN delegates duties that are outside of the Medication Aide's job description
   - A. The Medication Aide is accountable for the RN's actions.
   - B. The RN is accountable for the Medication Aide's actions.
   - C. The RN is accountable for everyone's actions.
   - D. The RN and the Medication Aide are responsible for the delegated actions.

4. Is the following statement true or false? Failure to report a performance error could result in problems with the facility or with an accreditation agency.
5. After administering a medication to a resident, what is the next step?
   ○ A. Record the administration on the MAR
   ○ B. Give the resident a bath
   ○ C. Communicate to the nurse that the resident’s medication has been administered
   ○ D. Check the resident’s identification

6. Which of the following conditions puts the resident at risk when receiving Inderal?
   ○ A. Heart attack
   ○ B. Hypertension
   ○ C. COPD
   ○ D. Irregular heart beat

7. The most common side effect of alpha-1 adrenergic blockers is what?
   ○ A. Lightheadedness and syncope upon standing
   ○ B. Inability to urinate
   ○ C. Dry mouth
   ○ D. Priapism

8. Which of the following is a side effect of metformin?
   ○ A. Weight gain
   ○ B. Diarrhea
   ○ C. Dry skin
   ○ D. Elevated blood sugar

9. A resident is receiving an antithyroid drug. Which of the following elements found in food should the resident avoid?
   ○ A. Sodium
   ○ B. Potassium
   ○ C. Iodine
   ○ D. Magnesium
10. A resident who is taking antibiotics experiences a rash. What is this resident experiencing?
   ✗ A. Adverse effect
   ✗ B. Anaphylactic
   ✗ C. Side effect
   ✗ D. Allergic reaction

11. Potassium liquid should never be given without first being
   ✗ A. Diluted.
   ✗ B. Iced.
   ✗ C. Tested.
   ✗ D. Sweetened.

12. Which of the following medications belong in the classification of an antiparkinson medication?
   ✗ A. Synthroid
   ✗ B. Inderal
   ✗ C. Metformin
   ✗ D. Sinemet

13. When a resident is taking an expectorant, it is important for them to also increase what?
   ✗ A. Fluid intake
   ✗ B. Food intake
   ✗ C. Fiber intake
   ✗ D. Activity

14. Which of the following H2-receptor blockers can interfere with the effect of many classifications of medications?
   ✗ A. Cimetidine
   ✗ B. Famotidine
   ✗ C. Nizatidine
   ✗ D. Ranitidine
15. Which of the following medications is prescribed for hypothyroidism?
   ○ A. Synthroid
   ○ B. Inderal
   ○ C. Metformin
   ○ D. Sinemet

16. Bronchodilators work in which of the following ways?
   ○ A. Open airways by constricting smooth muscles in the bronchial tree
   ○ B. Decreases rhinorrhea
   ○ C. Decreases cough and clears airway
   ○ D. Open airways by dilating smooth muscles in the bronchial tree

17. Verapamil belongs to which class of medication?
   ○ A. Calcium channel blocker
   ○ B. Beta blocker
   ○ C. ACE-inhibitor
   ○ D. ARBs

18. The Medication Aide's responsibilities include all of the following except what?
   ○ A. Carries out delegated nursing tasks
   ○ B. Performs direct care to residents without supervision
   ○ C. Recognizes and performs tasks according to level of education and training
   ○ D. Accepts responsibility and accountability for own performance according to state laws and regulations regarding Medication Aides

19. Furosemide is a ______ for a commonly prescribed diuretic.
   ○ A. Trade name
   ○ B. Chemical name
   ○ C. Generic name
   ○ D. Popular name
20. It is necessary to wash hands in all of the following situations except when?
   ○ A. When the hands become visibly soiled
   ○ B. Before administering medications
   ○ C. After removing gloves
   ○ D. When arriving at work

21. Gloves should be worn when
   ○ A. Giving oral medication.
   ○ B. Coming into contact with body fluids.
   ○ C. Entering a resident’s room.
   ○ D. Collecting the trash.

22. After the resident has inhaled his/her dose of Proventil, the next step is to have him/her
   ○ A. Rinse out his/her mouth with water.
   ○ B. Hold in the medication for as long as possible.
   ○ C. Breath out as hard and fast as he/she can.
   ○ D. None of the above.

23. Which of the following medications belongs in the classification of an antibiotic?
   ○ A. 5 FU
   ○ B. Chlorpromazine
   ○ C. Valium
   ○ D. Bactrim DS

24. Requiring more of a medication to feel good or to be able to carry out daily activities is called what?
   ○ A. Tolerance
   ○ B. Dependence
   ○ C. Cumulative effect
   ○ D. A drug interaction
25. When checking for drug information, the best source for the Medication Aide is what?
   - A. Newspaper
   - B. A fellow Medication Aide
   - C. A pharmacist
   - D. The patient

26. The fastest absorption of medication is through which of the following?
   - A. Skin
   - B. Muscle
   - C. Veins
   - D. Stomach

27. Some medications to treat cancer are classified as antineoplastic. Which of the following medications is an antineoplastic medication?
   - A. Prilosec
   - B. 5 FU
   - C. Ampicillin
   - D. Cardizem

28. When administering ear drops, which of the following is an appropriate action?
   - A. Keep the medication in the refrigerator until just before administering it.
   - B. Have the person lie on his or her side for 15 to 20 minutes.
   - C. Place an ear wick in the affected ear for greater absorption.
   - D. Administer the medication only to the ear it is prescribed.

29. For which of the following patients would you withhold oral medications?
   - A. A patient who has had a stroke and needs to have liquids thickened
   - B. A patient who is unconscious
   - C. A patient who is blind
   - D. A patient who is awake and alert and has no deficits
30. Which of the following medications would be prescribed for anxiety?
   - A. Inderal
   - B. Lasix
   - C. Valium
   - D. Celebrex

31. Which of the following medications is used as an antihypertensive medications?
   - A. ACE inhibitor
   - B. NSAIDS
   - C. Xanax
   - D. Calcium

32. The Medication Aide should wear what when administering transdermal nitroglycerin patches?
   - A. Eye protection
   - B. Gloves
   - C. Gown and gloves
   - D. Eye protection, gown, and gloves

33. Which of the following are side effects of nitroglycerin?
   - A. Headache
   - B. Vertigo
   - C. Vomiting
   - D. Anorexia

34. Which of the following is an expectorant?
   - A. Spiriva
   - B. Benadryl
   - C. Loratadine
   - D. Guaifenesin
35. Patients who have reflux disease should avoid all of the following foods except for what?
   ☐ A. Peanuts
   ☐ B. Spicy foods
   ☐ C. Tomatoes, citrus, and onions
   ☐ D. High-fat foods

36. Which of the following medications could be used for hypertension?
   ☐ A. Inderal
   ☐ B. Sinemet
   ☐ C. Synthroid
   ☐ D. Glipizide

37. Which of the following is not a diuretic?
   ☐ A. Spironolactone
   ☐ B. Hydrochlorothiazide
   ☐ C. Triameterene
   ☐ D. Hydrocodone

38. What is the minimum number of patient identifiers that should be used to make sure the right patient is getting the medication?
   ☐ A. Three
   ☐ B. One
   ☐ C. Four
   ☐ D. Two

39. Which of the following medications is classified as an antihyperglycemic?
   ☐ A. Inderal
   ☐ B. Sinemet
   ☐ C. Synthroid
   ☐ D. Glipizide
40. Considering the list of medications below, which one would be prescribed for psychoses?

- A. 5 FU
- B. Chlorpromazine
- C. Valium
- D. Bactrim DS

41. When approaching a combative patient, all of the following are correct except what?

- A. Stand over a combative client to show you are able to control him/her if necessary
- B. Approach in a calm reassuring manner
- C. Speak slowly and clearly
- D. Ask for assistance as needed to maintain a safe distance as you approach the client

42. To prevent the spread of infection while administering medications, what is the single most important step for the Medication Aide to perform?

- A. Wash his or her hands frequently
- B. Wear protective eye wear
- C. Wear gloves
- D. Wash patient hands frequently

43. True or false: If you have worn gloves while administering medications, it is not necessary for you to wash your hands.

44. Which of the following medications is not a nasal decongestant?

- A. Pseudoephedrine
- B. Loratadine
- C. Epinephrine
- D. Phenylephrine

45. All of the following are important actions for the Medication Aide to prevent a lawsuit except what?

- A. Perform your duties according to your position description
- B. Flirt with family members and the patient
- C. Communicate effectively and efficiently
- D. Maintaining a positive attitude
46. Which of following is one of the six rights of medication administration?
   - A. Right to refuse care
   - B. Right dose
   - C. Right to choose
   - D. Right to request change in medication

47. Which of the following is the definition of ethics?
   - A. The study of euthanasia
   - B. The science of doing good for others
   - C. A set of principles that professionals can use to help them make decisions
   - D. Speaking the truth consistently and dependably

48. For the treatment of GERD, providers sometimes prescribe drugs that help move food faster through the esophagus and stomach. Those drugs are classified as what?
   - A. Probiotics
   - B. Antibiotics
   - C. Prokinetics
   - D. Hyperkinesias

49. Cycloplegic eye drops work on which part of the eye?
   - A. Lashes
   - B. Muscles that control the lens
   - C. Sclera
   - D. Iris

50. Which of the following medications are prescribed for the symptoms of asthma?
   - A. Inderal
   - B. Spiriva
   - C. Tussionex
   - D. Propranolol
Practice Exam II Rationales

Answers at a Glance

1. D  18. B  35. A
6. C  23. D  40. B
7. A  24. B  41. A
8. B  25. C  42. A
10. D  27. B  44. B
17. A  34. D
Answer Rationales

1. Answer D is correct. Residents can be discharged from a facility for specific reasons and are to be given a 30-day notice. Choices A, B, and C are rights of residents who reside in long-term care facilities.

2. Answer B is correct. The scope of practice for an Medication Aide does not include intravenous medications for any reason.

3. Answer D is correct. If a Medication Aide accepts a task that falls outside his/her position description, both he/she and the delegating nurse are medically liable (legally responsible) for any of the Medication Aide’s actions, or lack of actions, that may result in harm to the client.

4. The statement is true. Failure to report an error could result in termination from the agency and/or discipline by the accrediting agency of the state in which the Medication Aide works.

5. Answer A is correct. The steps to medication administration require that the patient be identified before the medication is given. Immediately after a medication is administered, it is to be documented on the medication administration record.

6. Answer C is correct. Inderal is a beta-2 blocker and can cause bronchospasms. The other conditions listed as choices A, B, and D are strong indications for the use of Inderal.

7. Answer A is correct. Syncope and light-headedness are especially a problem with the first dose of the alpha-1 adrenergic blockers. Choice B, the medication, actually helps the person urinate. Choices C and D are not common side effects.

8. Answer B is correct. Metformin is an antihyperglycemic agent that befits the resident by lowering blood sugar (choice A) and weight (choice C). The most common side effect of metformin is diarrhea (choice B). Metformin does not affect the skin (choice D).

9. Answer C is correct. An antithyroid medication is used to block the thyroid, and its effects are lowered when iodine is taken. Choices A, B, and D are electrolytes and do not affect the action of antithyroid medications.

10. Answer D is correct. An allergic reaction of antibiotics can be hives or a rash. When this occurs, the medication needs to be stopped and the provider notified.

11. Answer A is correct. Potassium liquid is never to be administered without first being diluted. Choice B, C, and D are incorrect ways to administer potassium.

12. Answer D is correct. Sinemet is commonly prescribed for Parkinson symptoms.

13. Answer A is correct. When a resident is taking an expectorant, the medication will have a greater effect if fluids are given to help thin the secretions.

14. Answer A is correct. Cimetidine can interfere with blood thinners and seizure medications.

15. Answer A is correct. The medication prescribed for hypothyroidism is synthroid.

17. Answer A is correct. The correct classification for Verapamil is a calcium channel blocker.

18. Answer B is correct. The Medication Aide performs duties under supervision of a nurse.

19. Answer C is correct. Furosemide is the generic name for Lasix, which is a loop diuretic. The chemical name is 4-chloro-N-furfuryl-5-sulfamoylanthranilic acid.

20. Answer D is correct. Hands do not necessarily need to be washed when first arriving at work. Hands are to be washed with soap and water instead of by using the hand sanitizer when they become visibly soiled (choice A), before administering any medications (choice B), and after removing gloves (choice C).

21. Answer B is correct. Gloves are to be worn whenever the Medication Aide may come into contact with any body fluids. They do not need to be worn when giving oral medication (choice A) entering a resident’s room (choice C), or emptying everyday trash (choice D).

22. Answer B is correct. After the resident has inhaled his/her dose of Proventil, the next step is to have him/her hold in the medication for as long as possible and then slowly release it. This technique allows for greater absorption of the medication. Choice A, rinsing out the mouth with water, should be done if the medication includes a steroid. Rinsing occurs after the medication is exhaled. Choice C, breathing out as hard and fast as he/she can, is the action necessary when the respiratory therapist or RN is testing the resident’s breathing force. Choice D is obviously incorrect because choice B is correct.

23. Answer D is correct. Bactrim DS is an antibiotic. Choice A is an antineoplastic. Choice B is medication used for psychoses. Choice C is an anti-anxiety medication.

24. Answer B is correct. Drug dependence can create a sense of not being able to function without a certain medication.

25. Answer C is correct. When checking for drug information, the best choice from those provided is the pharmacist at the institution where the Medication Aide is employed.

26. Answer C is correct. The fastest absorption of medication is through the veins (although the Medication Aide is not permitted to administer intravenous medication).

27. Answer B is correct. 5-FU is prescribed to fight some cancers.

28. Answer D is correct. It is best to give ear medications at room temperature because cold drops may cause vertigo. As for choice B, patients are not required to lie flat for 20 minutes after receiving ear medications. As for choice C, placing an ear wick is a procedure completed by the provider and not the Medication Aide.

29. Answer B is correct. A patient who is unconscious has a very high risk for choking and should not receive medication by mouth. Choices C and D do not hinder swallowing oral medications. Choice A may require the Medication Aide to test swallowing before giving medications but does not necessarily preclude the patient from swallowing oral medications.
30. Answer C is correct. The medication known as Valium is prescribed for anxiety symptoms.

31. Answer A is correct. An ace inhibitor is an antihypertensive medication that works at lowering the blood pressure by assisting the blood flow in the kidney. Choice B is an analgesic. Choice C is a benzodiazepine for anxiety. Choice D is the mineral calcium administered to increase calcium in the body when it is low.

32. Answer B is correct. Gloves should be worn to prevent the Medication Aide from coming into contact with the nitroglycerin paste and it being absorbed through the skin. Choices A, C, and D are unnecessary precautions.

33. Answer A is correct. Nitroglycerin works by dilating blood vessels, and when administered, this can cause the common side effect of a headache. Choices B, C, and D are not listed side effects of nitroglycerin.

34. Answer D is correct. Guaifenesin is an expectorant. Choice A is a leukotriene inhibitor and is administered to improve breathing in respiratory disease. Choice B and C are antihistamines.

35. Answer A is correct. Peanuts are not prohibited in the diet of a patient diagnosed with GERD. Spicy foods (choice B) have the potential to irritate the lining of the esophagus leading to heartburn. Tomatoes, citrus fruits, and onions (choice C) can often trigger heartburn because of their acidity. Choice D, high-fat foods, may relax the lower esophageal sphincter muscle and allow gastric acid to escape the stomach into the esophagus.

36. Answer A is correct. Inderal is a beta blocker and is commonly used for hypertension.


38. Answer D is correct. Before administering a medication to patients, they should be identified by at least two means. The most common is by name and date of birth.

39. Answer D is correct. Glipizide is a sulfonylurea medication that is used commonly in type 2 diabetes mellitus.

40. Answer B is correct. Chlorpromazine (Thorazine) is a medication used to treat disorders and the symptoms of schizophrenia.

41. Answer A is correct. You should never stand over combative clients because they may misunderstand it as aggressiveness. Choices B, C, and D are correct actions to use when approaching a combative patient.

42. Answer A is correct. Hand washing cannot be overemphasized in the healthcare setting; it is the single most important step in preventing infection. Wash your hands just before preparing medications for each client and before leaving the room. Choices B, C, and D are related to standard precautions. If the patient is in contact isolation, the Medication Aide may need to wear gloves.

43. The correct answer is false. Wearing gloves may be necessary for certain medications, like applying topicals or when you must touch the client’s mouth, but do not rely on them alone or to take the place of proper hand washing (because gloves can have small tears that allow contamination).
44. Answer B is correct. Loratadine is Claritin and is an oral antihistamine. Choices A, C, and D are nasal decongestants.

45. Answer B is correct. The Medication Aide should maintain professional boundaries in line with choices A, C, and D.

46. Answer is B is correct. The six rights of medication administration are the right patient, medication, dose, route, time, and documentation.

47. Answer C is correct. Ethics is a branch of philosophy dealing with the good, bad, right, and wrong thing to do in human interactions and the principles that help guide professionals in terms of what ought to be done in certain situations. Choice A, euthanasia, is commonly referred to as mercy killing. Choice B, doing good for others, is beneficence. Choice D, speaking the truth consistently and dependably, is veracity.

48. Answer C is correct. A prokinetics is a drug that increases gastrointestinal peristalsis. Probiotics (choice A) are recommended for gastrointestinal health. Antibiotics (choice B) are used to fight infections, and choice D is the term for increased activity of muscles.

49. Answer B is correct. Cycloplegic agents relax the eye muscles that accommodate the lens of the eye (dilates the eye) for diagnostic tests.

50. Answer B is correct. Choice A, Inderal, is contraindicated in asthma. Choice C, Tussionex (hydrocodone and chlorpheniramine), is used to suppress a cough in adults. Choice D is the generic name for Inderal.
This page intentionally left blank
# Medication Administration Skills Performance Checklist

## Administering Oral Medication

**Delegation Guidelines:** At no time is it appropriate to delegate medication administration to another MA-C.

<table>
<thead>
<tr>
<th>Task</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bold type = Critical step (must be performed with 100% accuracy)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Follow pre-administration procedures per agency protocol:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Confirm prescriber’s order</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Gather equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Confirm client's identify</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Explain procedure to client</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Arrange work area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. Perform hand hygiene</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Provide for privacy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. Check medication expiration dates on all containers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Check client to verify that the oral route is appropriate. Notify the nurse if you find contraindications for giving medications by this route.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Confirm the medication order sheet against the original prescriber's orders.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Determine any procedures needed (that is, vital signs) before the dose can be given.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Dispense medications one at a time, for one client at a time.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Unlock the medication drawer or storage area.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Task Rating (Check one.)

<table>
<thead>
<tr>
<th>Task</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Select the correct medication and compare its label with the order sheet.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Calculate the dose needed and where allowed in job description.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Recheck the dose to be sure it is correct.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Place a solid medication into a soufflé cup.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Crush medications if needed and add to a small amount of liquid.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. To remove the dose from a bottle, pour the correct number of tablets or capsules into the upturned bottle cap, and then into a soufflé cup.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Return any excess, unused tablets or capsules to the bottle.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Leave unit-dose medications in their original packaging and place together in one cup. Keep medications requiring special measurements in a separate cup.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. To give a liquid medication, pour it into a calibrated, disposable medication cup.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Hold the bottle so that the label is against the palm.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Pour the desired dose at eye level.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Wipe the lip of the bottle dry with a paper towel before replacing the lid.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Unless a partial dose is required from a unit-dose liquid medication, bring it unopened to the bedside.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. For all forms of oral medication, recheck the medicine and the dose after it is poured but before it is given to the client.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Lock the medication cart of storage area and bring the medications to the client.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Identify the client using at least three means of identification.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Perform final measurements, notifying nurse of the data; upon her recommendation, hold medications if pulse is lower than 60bpm.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Task 24
Give the medications to the client according to the client's wishes whenever possible.

<table>
<thead>
<tr>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Task 25
Recheck the accuracy of any medication the client questions.

<table>
<thead>
<tr>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Task 26
For unit-dose medications, remove them from their containers and give to client by placing them in the client's hand or per her instructions.

<table>
<thead>
<tr>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Task 27
Offer a full glass of water or other allowable liquid.

<table>
<thead>
<tr>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Task 28
Give liquids, chewable medications, lozenges, and sublingual or buccal medications separately from oral tablets, capsules, or pills. Do not follow with water.

<table>
<thead>
<tr>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Task 29
Ensure that the client has swallowed all medications before leaving the bedside.

<table>
<thead>
<tr>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Task 30
Follow post-administration procedures per agency protocol including the following:

<table>
<thead>
<tr>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A. Making the client comfortable

<table>
<thead>
<tr>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Performing hand hygiene

<table>
<thead>
<tr>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C. Documenting the procedure

<table>
<thead>
<tr>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Task 31
Recheck the client after the medication has had sufficient time to take effect to note client response to the medication.

<table>
<thead>
<tr>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Task 32
Report any untoward client responses to the nurse immediately.

<table>
<thead>
<tr>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Date:

### Student name:

### Student signature:

### Evaluator:

### Signature:

### Final rating (circle one):

Pass  Fail
This page intentionally left blank
# Arithmetic Review: Weights and Measures

## Household Measure and Metric System Equivalents

<table>
<thead>
<tr>
<th>Weights and Measures</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Volume</strong></td>
<td></td>
</tr>
<tr>
<td>1 teaspoon</td>
<td>Approximately 5mL</td>
</tr>
<tr>
<td>1 tablespoon (3 teaspoons)</td>
<td>15mL</td>
</tr>
<tr>
<td>1 cup (8 ounces)</td>
<td>240mL</td>
</tr>
<tr>
<td>1 pint (4 cups)</td>
<td>500mL</td>
</tr>
<tr>
<td>1 quart (2 pints)</td>
<td>1000mL or 1 liter</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td></td>
</tr>
<tr>
<td>1 ounce</td>
<td>30 grams</td>
</tr>
<tr>
<td>1 pound</td>
<td>500 grams</td>
</tr>
<tr>
<td>2.2 pounds</td>
<td>1 kilogram</td>
</tr>
</tbody>
</table>

## Decimal Fractions

Remember that decimals indicate the number is *less* than a whole number, or less than one. This is important to remember when selecting the correct dose of a drug to prevent overdosing the client.

For example, 0.5mg is *less* than, or 1/2 of, 1.0 milligrams.

Remember, when reading decimals, the number to the left of the decimal point is a whole number; the number to the right of the decimal point is a percentage of a whole number.

**Example 1.1**

Number to the left of the decimal point = 1 (whole number or 100%)
Number to the right of the decimal point = 1/10, or part of a whole number
Changing Common Fractions to Decimal Fractions

Divide the numerator of the fraction by the denominator:

1/2 means $1 \div 2 = 0.50$
3/4 means $3 \div 4 = 0.75$

Conversions in the Metric System

From milligrams to grams
Divide mgs by 1000 (conversion factor)
Example: $500\text{mg} = \underline{\underline{\underline{}}} \text{grams (g)}$
Divide 500mg by 1000mg (1 gram) by moving the decimal point three places to the left:
500 (decimal at end 500.0mg) = 0.500g = 0.5g
Answer: 0.5g

From grams to milligrams
Multiply mgs by 1000 (conversion factor)
Example: $0.5\text{g} = \underline{\underline{\underline{}}} \text{milligrams (mg)}$
Multiply by 1000mg (1g) by moving the decimal point three places to the right:
0.5g (decimal at front of 0.5g) = 500mg
Answer: 500mg
Multiplying Decimals by Decimals

Remove the decimals in both measures and consider the number as a whole number.

Calculating Doses

Remember, divide the dose desired by the dose that is on hand:

Dose desired = Correct dose
Desire
Have (500mg) = 2 capsules

Dose on Hand

Example

Dose desired (in capsule): 1g of a drug
Dose on hand (in capsule): 500mg of the drug

1g/500mg = 2
So, give two capsules.
# Herbals, Vitamins, and Minerals

## Herbals

<table>
<thead>
<tr>
<th>Substance</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>Healing ointment; relieves gas, assists with arthritic pain and muscle cramps</td>
</tr>
<tr>
<td>Aloe leaves</td>
<td>Topical: treats burns, heals wounds Orally: used to treat constipation</td>
</tr>
<tr>
<td>Arnica gel</td>
<td>Topical: muscle pain</td>
</tr>
<tr>
<td>Bayberry</td>
<td>Topical: promotes wound healing Orally: antidiarrheal</td>
</tr>
<tr>
<td>Black cohosh</td>
<td>Relieves PMS, menopausal symptoms</td>
</tr>
<tr>
<td>Chamomile</td>
<td>Topical: treats wounds, ulcer, conjunctivitis Orally: treats migraines, gastric cramps, relieves anxiety</td>
</tr>
<tr>
<td>Coriander</td>
<td>Aids in weight loss and lowers blood pressure</td>
</tr>
<tr>
<td>Echinacea (cone flow)</td>
<td>PO: treats colds/flu, stimulates the immune system, causes immunosuppression</td>
</tr>
<tr>
<td>Feverfew</td>
<td>PO: treats arthritis, fever, migraines</td>
</tr>
<tr>
<td>Fish oil</td>
<td>PO: treats arthritis, coronary disease, colitis, depression, attention deficit disorder</td>
</tr>
<tr>
<td>Garlic</td>
<td>PO: reduces blood pressure</td>
</tr>
<tr>
<td>Ginkgo</td>
<td>PO: increases blood flow to the brain</td>
</tr>
<tr>
<td>Glucosamine</td>
<td>Treats arthritis and joint diseases</td>
</tr>
<tr>
<td>Peppermint leaves</td>
<td>Treats dizziness, insomnia, nervousness, gastric distress</td>
</tr>
<tr>
<td>Rose hips</td>
<td>Laxative</td>
</tr>
<tr>
<td>Saw palmetto</td>
<td>Treats benign prostatic hypertrophy (BPH)</td>
</tr>
<tr>
<td>St. John’s wart</td>
<td>Treats depression, PMS; antiviral</td>
</tr>
<tr>
<td>Valerian</td>
<td>Lowers cholesterol and tryglycerides, sleep aid</td>
</tr>
<tr>
<td>Yohimbe</td>
<td>Treats erectile dysfunction</td>
</tr>
</tbody>
</table>

* Use cautiously with drugs; effectiveness not well established for some herbals.
Vitamins and Minerals

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>*Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (Aquasol A, Palmitate-A5000)</td>
<td>Vitamin A deficiency</td>
</tr>
<tr>
<td>Ascorbic acid (Vita-C, Cecon)</td>
<td>Wound healing, burns, common cold</td>
</tr>
<tr>
<td>Calcified D (Calderol)</td>
<td>Metabolic bone disease, hypocalcemia, deficiency</td>
</tr>
<tr>
<td>Cyanocobalamin (B12)</td>
<td>Anemias</td>
</tr>
<tr>
<td>E (Vita-Plus E)</td>
<td>Deficiency, skin disorders, cardiac disorders</td>
</tr>
<tr>
<td>Niacin (B3)</td>
<td>Niacin deficiency, hyperlipidemia</td>
</tr>
<tr>
<td>Pyridoxine HCL (B6)</td>
<td>Deficiency</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>Deficiency</td>
</tr>
<tr>
<td>Thiamine</td>
<td>Same</td>
</tr>
</tbody>
</table>

* Overdose or accumulation of vitamin source can be toxic.
Health care in the United States is not as safe as it should be—and can be. At least 44,000 people, and perhaps as many as 98,000 people, die in hospitals each year as a result of medical errors that could have been prevented, according to estimates from two major studies. Even using the lower estimate, preventable medical errors in hospitals exceed attributable deaths to such feared threats as motor-vehicle wrecks, breast cancer, and AIDS. Medical errors can be defined as the failure of a planned action to be completed as intended or the use of a wrong plan to achieve an aim. Among the problems that commonly occur during the course of providing health care are adverse drug events and improper transfusions, surgical injuries and wrong-site surgery, suicides, restraint-related injuries or death, falls, burns, pressure ulcers, and mistaken patient identities. High error rates with serious consequences are most likely to occur in intensive care units, operating rooms, and emergency departments.

Beyond their cost in human lives, preventable medical errors exact other significant tolls. They have been estimated to result in total costs (including the expense of additional care necessitated by the errors, lost income and household productivity, and disability) of between $17 billion and $29 billion per year in hospitals nationwide. Errors also are costly in terms of loss of trust in the health care system by patients and diminished satisfaction by both patients and health professionals. Patients who experience a long hospital stay or disability as a result of errors pay with physical and psychological discomfort. Health professionals pay with loss of morale and frustration at not being able to provide the best care possible. Society bears the cost of errors as well, in terms of lost worker productivity, reduced school attendance by children, and lower levels of population health status.

A variety of factors have contributed to the nation’s epidemic of medical errors. One oft-cited problem arises from the decentralized and fragmented nature of the health care delivery system—or “nonsystem,” to some observers. When patients see multiple providers in different settings, none of whom has access to
complete information, it becomes easier for things to go wrong. In addition, the processes by which health professionals are licensed and accredited have focused only limited attention on the prevention of medical errors, and even these minimal efforts have confronted resistance from some health care organizations and providers. Many providers also perceive the medical liability system as a serious impediment to systematic efforts to uncover and learn from errors. Exacerbating these problems, most third-party purchasers of health care provide little financial incentive for health care organizations and providers to improve safety and quality.

**Errors are costly in terms of loss of trust in the health care system by patients and diminished satisfaction by both patients and health professionals.**

**Types of Errors**

**Diagnostic**
- Error or delay in diagnosis
- Failure to employ indicated tests
- Use of outmoded tests or therapy
- Failure to act on results of monitoring or testing

**Treatment**
- Error in the performance of an operation, procedure, or test
- Error in administering the treatment
- Error in the dose or method of using a drug
- Avoidable delay in treatment or in responding to an abnormal test
- Inappropriate (not indicated) care

**Preventive**
- Failure to provide prophylactic treatment
- Inadequate monitoring or follow-up of treatment

**Other**
- Failure of communication
- Equipment failure
- Other system failure


**Health Care System at Odds with Itself**

The Quality of Health Care in America Committee of the Institute of Medicine (IOM) concluded that it is not acceptable for patients to be harmed by the health care system that is supposed to offer healing and comfort—a system that promotes, “First, do no harm.” Helping to remedy this problem is the goal of *To Err is Human: Building a Safer Health System*, the IOM Committee’s first report.
More commonly, errors are caused by faulty systems, processes, and conditions that lead people to make mistakes or fail to prevent them.

In this report, issued in September 1999, the committee lays out a comprehensive strategy by which government, health care providers, industry, and consumers can reduce preventable medical errors. Concluding that the know-how already exists to prevent many of these mistakes, the report sets as a minimum goal a 50 percent reduction in errors over the next five years. In its recommendations for reaching this goal, the committee strikes a balance between regulatory and market-based initiatives, and between the roles of professionals and organizations.

One of the report’s main conclusions is that the majority of medical errors do not result from individual recklessness or the actions of a particular group—this is not a “bad apple” problem. More commonly, errors are caused by faulty systems, processes, and conditions that lead people to make mistakes or fail to prevent them. For example, stocking patient-care units in hospitals with certain full-strength drugs, even though they are toxic unless diluted, has resulted in deadly mistakes.

Thus, mistakes can best be prevented by designing the health system at all levels to make it safer—to make it harder for people to do something wrong and easier for them to do it right. Of course, this does not mean that individuals can be careless. People still must be vigilant and held responsible for their actions. But when an error occurs, blaming an individual does little to make the system safer and prevent someone else from committing the same error.

Strategy for Improvement

To achieve a better safety record, the report recommends a four-tiered approach:

Establishing a national focus to create leadership, research, tools, and protocols to enhance the knowledge base about safety.

Health care is a decade or more behind many other high-risk industries in its attention to ensuring basic safety. This is due, in part, to the lack of a single designated government agency devoted to improving and monitoring safety throughout the health care delivery system. Therefore, Congress should create a Center for Patient Safety that would set national safety goals and track progress in meeting them; develop a research agenda; define prototype safety systems; develop, disseminate, and evaluate tools for identifying and analyzing errors; develop methods for educating consumers about patient safety; and recommend additional improvements as needed.

Funding for the center should be adequate and secure, starting with $30 million to $35 million per year and growing over time to at least $100 million annually—modest investments relative to the consequences of errors and to the resources devoted to other public safety issues. The center should be housed within the Agency for Healthcare Research and Quality (AHRQ), which already is involved in a broad range of quality and safety issues, and has established the infrastructure and experience to fund research, education, and coordinating activities.

Identifying and learning from errors by developing a nationwide public mandatory reporting system and by encouraging health care organizations and practitioners to develop and participate in voluntary reporting systems.
Under the mandatory reporting system, state governments will be required to collect standardized information about adverse medical events that result in death and serious harm. Hospitals should be required to begin reporting first, and eventually reporting should be required by all health care organizations. This system will ensure a response to specific reports of serious injury, hold health care organizations and providers accountable for maintaining safety, provide incentives to organizations to implement internal safety systems that reduce the likelihood of errors occurring, and respond to the public’s right to know about patient safety. Currently, about a third of the states have mandatory reporting requirements.

Voluntary reporting systems will provide an important complement to the mandatory system. Such systems can focus on a much broader set of errors, mainly those that do no or minimal harm, and help detect system weaknesses that can be fixed before the occurrence of serious harm, thereby providing rich information to health care organizations in support of their quality improvement efforts. To foster participation in voluntary systems, Congress should enact laws to protect the confidentiality of certain information collected. Without such legislation, health care organizations and providers may be discouraged from participating in voluntary reporting systems out of worry that the information they provide might ultimately be subpoenaed and used in lawsuits.

Health care is a decade or more behind many other high-risk industries in its attention to ensuring basic safety.

Voluntary reporting systems will provide an important complement to the mandatory system.

The process of developing and adopting standards also helps to form expectations for safety among providers and consumers.

Medication errors now occur frequently in hospitals, yet many hospitals are not making use of known systems for improving safety.

Raising performance standards and expectations for improvements in safety through the actions of oversight organizations, professional groups, and group purchasers of health care.

Setting and enforcing explicit performance standards for patient safety through regulatory and related mechanisms, such as licensing, certification, and accreditation, can define minimum performance levels for health professionals, the organizations in which they work, and the tools (drugs and devices) they use to care for patients. The process of developing and adopting standards also helps to form expectations for safety among providers and consumers.

Standards and expectations are not only set through regulations, however. The values and norms set by the health professions influence the practice, training, and education for providers. Thus, professional societies should become leaders in encouraging and demanding improvements in patient safety, by such actions as setting their own performance standards, convening and communicating with members about safety, incorporating attention to patient safety in training programs, and collaborating across disciplines.
The actions of large purchasers of health care and health care insurance, as well as actions by individual consumers, also can affect the behaviors of health care organizations. Public and private purchasers, such as businesses buying insurance for their employees, must make safety a prime concern in their contracting decisions. Doing so will create financial incentives for health care organizations and providers to make needed changes to ensure patient safety.

**Implementing safety systems in health care organizations to ensure safe practices at the delivery level.**

Health care organizations must develop a “culture of safety” such that their workforce and processes are focused on improving the reliability and safety of care for patients. Safety should be an explicit organizational goal that is demonstrated by strong leadership on the part of clinicians, executives, and governing bodies. This will mean incorporating a variety of well-understood safety principles, such as designing jobs and working conditions for safety; standardizing and simplifying equipment, supplies, and processes; and enabling care providers to avoid reliance on memory. Systems for continuously monitoring patient safety also must be created and adequately funded.

The medication process provides an example where implementing better systems will yield better human performance. Medication errors now occur frequently in hospitals, yet many hospitals are not making use of known systems for improving safety, such as automated medication order entry systems, nor are they actively exploring new safety systems. Patients themselves also could provide a major safety check in most hospitals, clinics, and practice. They should know which medications they are taking, their appearance, and their side effects, and they should notify their doctors of medication discrepancies and the occurrence of side effects.

**Progress Under Way**

The response to the IOM report was swift and positive, within both government and the private sector.

Almost immediately, the Clinton administration issued an executive order instructing government agencies that conduct or oversee health-care programs to implement proven techniques for reducing medical errors, and creating a task force to find new strategies for reducing errors. Congress soon launched a series of hearings on patient safety, and in December 2000 it appropriated $50 million to the Agency for Healthcare Research and Quality to support a variety of efforts targeted at reducing medical errors.

The AHRQ already has made major progress in developing and implementing an action plan. Efforts underway include the following:

- Developing and testing new technologies to reduce medical errors.
- Conducting large-scale demonstration projects to test safety interventions and error-reporting strategies.
Supporting new and established multidisciplinary teams of researchers and health-care facilities and organizations, located in geographically diverse locations, that will further determine the causes of medical errors and develop new knowledge that will aid the work of the demonstration projects.

Supporting projects aimed at achieving a better understanding of how the environment in which care is provided affects the ability of providers to improve safety.

Funding researchers and organizations to develop, demonstrate, and evaluate new approaches to improving provider education in order to reduce errors.

Casting its net even more broadly, the AHRQ has produced a booklet of practical tips on what individual consumers can do to improve the quality of health-care services they receive. The booklet focuses on key choices that individuals and their families face, such as choosing doctors, hospitals, and treatments, and it stresses the importance of individuals taking an active role in selecting and evaluating their care. (The booklet is available on the organization's Web site at www.ahrq.gov.)

In efforts focused at the state level, during the past year the National Academy for State Health Policy (NASHP) convened leaders from both the executive and legislative branches of the states to discuss approaches to improving patient safety. The NASHP also helped lead an initiative to better understand how states with mandatory hospital error-reporting requirements administer and enforce their programs. (A report on this initiative is available on the organization’s Web site at www.nashp.org.) In addition, the Agency for Healthcare Research and Quality has contracted with the National Quality Forum to produce a list of so-called “never events” that states might use as the basis of a mandatory reporting system.

Among activities in the private sector, the Leapfrog Group, an association of private and public sector group purchasers, unveiled a market-based strategy to improve safety and quality, including encouraging the use of computerized physician-order entry, evidence-based hospital referrals, and the use of ICUs staffed by physicians credentialed in critical care medicine.

With adequate leadership, attention, and resources, improvements can be made.

Professional groups within the health-care community also have been active. As but one example, the Council on Graduate Medical Education (COGME) and the National Advisory Council on Nurse Education and Practice (NACNEP) held a joint meeting on “Collaborative Education Models to Ensure Patient Safety.” Participants addressed such issues as the effect of the relationships between physicians and nurses on patient safety, the impact of physician-nurse collaboration on systems designed to protect patient safety, and educational programs to ensure interdisciplinary collaboration to further patient safety. (A report on the meeting is available on the COGME’s Web site at www.cogme.org.)
Pulling Together

Although no single activity can offer a total solution for dealing with medical errors, the combination of activities proposed in *To Err is Human* offers a roadmap toward a safer health system. With adequate leadership, attention, and resources, improvements can be made. It may be part of human nature to err, but it is also part of human nature to create solutions, find better alternatives, and meet the challenges ahead.

For More Information

Copies of *To Err is Human: Building a Safer Health System* are available for sale from the National Academy Press; call (800) 624-6242 or (202) 334-3313 (in the Washington metropolitan area), or visit the NAP home page at www.nap.edu. The full text of this report is available at http://www.nap.edu/books/0309068371/html/.

Support for this project was provided by The National Research Council and The Commonwealth Fund. The views presented in this report are those of the Institute of Medicine Committee on the Quality of Health Care in America and are not necessarily those of the funding agencies.

The Institute of Medicine is a private, nonprofit organization that provides health policy advice under a congressional charter granted to the National Academy of Sciences. For more information about the Institute of Medicine, visit the IOM home page at www.iom.edu.

Copyright ©2000 by the National Academy of Sciences. All rights reserved.

*Permission is granted to reproduce this document in its entirety, with no additions or alterations.*

COMMITTEE ON QUALITY OF HEALTH CARE IN AMERICA

WILLIAM C. RICHARDSON (Chair), President and CEO, W.K. Kellogg Foundation, Battle Creek, MI

DONALD M. BERWICK, President and CEO, Institute for Healthcare Improvement, Boston

J. CRIS BISGARD, Director, Health Services, Delta Air Lines, Inc., Atlanta

LONNIE R. BRISTOW, Past President, American Medical Association, Walnut Creek, CA

CHARLES R. BUCK, Program Leader, Health Care Quality and Strategy Initiatives, General Electric Company, Fairfield, CT

CHRISTINE K. CASSEL, Professor and Chairman, Department of Geriatrics and Adult Development, Mount Sinai Medical Center, New York City

MARK R. CHASSIN, Professor and Chairman, Department of Health Policy, The Mount Sinai Medical Center, New York City

MOLLY JOEL COYE, Vice President and Director, West Coast Office, The Lewin Group, San Francisco
DON E. DETMER, Dennis Gillings Professor of Health Management, University of Cambridge, UK

JEROME H. GROSSMAN, Chairman and CEO, Lion Gate Management, LLC, Boston

BRENT JAMES, Executive Director, Intermountain Health Care, Institute for Health Care Delivery Research, Salt Lake City, UT

DAVID McK. LAWRENCE, Chairman and CEO, Kaiser Foundation Health Plan, Inc., Oakland, CA

LUCIAN LEAPE, Adjunct Professor, Harvard School of Public Health

ARTHUR LEVIN, Director, Center for Medical Consumers, New York City

RHONDA ROBINSON-BEALE, Executive Medical Director, Managed Care Management and Clinical Programs, Blue Cross Blue Shield of Michigan, Southfield

JOSEPH E. SCHERGER, Associate Dean for Clinical Affairs, University of California at Irvine College of Medicine

ARTHUR SOUTHAM, Partner, 2C Solutions, Northridge, CA

MARY WAKEFIELD, Director, Center for Health Policy and Ethics, George Mason University

GAIL L. WARDEN, President and CEO, Henry Ford Health System, Detroit, MI

Study Staff

JANET M. CORRIGAN, Director, Division of Health Care Services, Director, Quality of Health Care in America Project

MOLLA S. DONALDSON, Project Codirector

LINDA T. KOHN, Project Codirector

TRACY McKAY, Research Assistant

KELLY C. PIKE, Senior Project Assistant

Auxiliary Staff

MIKE EDINGTON, Managing Editor

KAY HARRIS, Financial Advisor

SUZANNE MILLER, Senior Project Assistant

Copy Editor

FLORENCE POILLON
Glossary

**Aa**: Of each.

**ABGs**: See arterial blood gases.

**ACE**: See angiotensin-converting inhibitor.

**ACTH**: See adrenocorticotropic hormone.

**Abduction**: Movement away from the mid-line of the body.

**Abductor muscles**: Muscles that move muscles away from the body.

**AC**: *(ante cibum)* Before mealtime.

**AD**: See Alzheimer’s disease.

**ADA**: See American with Disabilities Act.

**ADH**: See antidiuretic hormone.

**ADH**: See activities of daily living.

**ADR/ADE**: See adverse drug reaction/adverse drug effect.

**AIDS**: See acquired immunodeficiency syndrome.

**ALF**: See assisted-living facility.

**Accountability**: Accepting responsibility for one’s actions.

**Angiotensin-converting enzyme inhibitor**: Agent that inhibits conversion of angiotensin I to angiotensin II.

**Acetylcholine**: Neurotransmitter at somatic neuromuscular junctions.

**Acquired healthcare-associated infection**: Infection contracted through receipt of care in a healthcare facility; also known as nosocomial infection.
Acquired immunity: Protection from future disease from microorganism by contracting the disease or by receiving vaccine for the disease.

Acquired immunodeficiency syndrome: Late-stage infection with the human immunodeficiency virus.

Activities of daily living: Client daily activities, including toileting, grooming, bathing, and dressing.

Adrenocorticotropic hormone: Hormone that produces steroids in the body.

Active immunity: Protection from a disease by either exposure to an antigen for it, vaccine, or actual disease.

Acute: Episode (for example, disease) that happens suddenly and resolves (goes away) within days, weeks, or months.

American with Disabilities Act: Legislative act to ensure the rights of persons with disabilities and to prohibit discrimination of person on the basis of disability in employment, public accommodation, transportation, and public services.

Adduction: Movement toward the midline of the body.

Adolescence: Youth; puberty.

Adrenergic blocking agent: Agent that blocks transmission of sympathetic nerve stimuli.

Adrenergic fiber: Nerve fiber that releases norepinephrine or epinephrine at synapses.

Aerobe: Microbe that is able to live in reproduce in the presence of oxygen.

Agonist: An agent that binds to the receptor and stimulates the receptor's function; drug mimics the body's own regulatory function.

Akinesia: \((a, \) not; \(kinesis, \) movement) Loss of muscle movement.

Aldosterone: Hormone secreted by the adrenal cortex that helps regulate fluid absorption in the body.

Antidiuretic hormone: Hormone that holds fluid in the body.

Assisted-living facility: Facility that provides assistance with ADLs for ambulatory clients.

Alkalosis: Metabolic condition in which the chemical levels in the bloodstream is base in nature.

Allergen: Substance/source that causes an allergic reaction in the body.

Allergen-antibody response: Chemical, hormonal body systems response to a source that causes an allergic reaction.

Allergic drug reaction/effect: Adverse drug reaction; negative, unintended response of various degrees to a drug.

Alveoli: Air sacs in the lungs where oxygen and carbon dioxide exchange.

Anaerobe: Microorganism that must have an oxygen-free environment to live and produce.

Analgesc: Without pain; drug given to relieve pain.

Anaphylaxis: Severe, life-threatening reaction to a source.

Anemia: Blood condition in which the blood does not contain sufficient amounts of hemoglobin.

Aneurysm: Weakened wall of an artery.

Angina: Chest pain.
**Apex of heart:** Tapered end/tip of the heart located to the left of the median line of the body.

**Angiogram:** Internal viewing of the blood vessels.

**Angiography:** Process of viewing the blood vessels internally.

**Angiotensin II receptor blockers:** Special receptors that block angiotensin from elevating blood pressure.

**Anorexia:** Loss of appetite.

**Antacid:** Drug that lessens gastric acid secretion.

**Antagonist:** Drug that acts against another drug.

**Antibiotic:** Drug that destroys bacteria.

**Anticholinergic agent:** An agent that blocks parasympathetic nerve impulses.

**Anticoagulant:** Drug or agent that prevents the blood from coagulating.

**Antidiabetic agents:** Drugs that act on the pancreas or liver to control glucose (blood sugar) levels.

**Antidiarrheals:** Drugs or agents that control diarrhea.

**Antidiuretic hormone:** Hormone that prevents diuresis.

**Antidysrhythmics:** Drug that prevents abnormal heart rhythms (dysrhythmias).

**Antiemetic:** Drug or agent that prevents vomiting.

**Antiflatulent:** Drug that prevents gas-formation (flatus).

**Antifungal agent:** Agent that kills or inhibits fungi.

**Antihistamines:** Drug that prevents release of histamine.

**Antihypertensive agent:** Drug or agent that lowers blood pressure.

**Anti-infective agents:** Agent that prevents or treats infection.

**Anti-inflammatory agent:** Agent that prevents or treats inflammation/swelling.

**Antilipemic agent:** Agent that prevents lipid (fats) buildup in the blood.

**Antimicrobial agents:** Drugs that destroy pathogenic microorganisms.

**Antiplatelet agents:** Agent that keeps platelets from clumping together to form a thrombus (clot).

**Antipsychotics:** Drug or agent that prevents psychosis (losing touch with reality).

**Antipyretics:** Drug or agent that reduces fever.

**Antispasmodic:** Drug or agent that prevents muscle spasms.

**Antithyroid agent:** Agent that inhibits action of the thyroid.

**Antitoxin:** Drug or agent that neutralizes, acts contrary to, a toxin, or poison.

**Antitussives:** Drug or agent that prevents coughing.

**Anus:** Distal end of the colon; opening for expelling feces.

**Aorta:** Largest artery in the body; artery leading from the heart that delivers oxygenated blood to the body.

**Aortic valve:** Soft flap that prevents blood from flowing back from the aorta.
**Aphasia**: Inability to speak.

**Apical pulse (AP)**: Heartbeat heard or felt at the apex of the heart.

**Appendicular skeleton**: Movable body frame.

**APRN**: Advanced Practice Registered Nurse.

**Arrhythmia**: Abnormal heart rhythm; dysrhythmia.

**Arterial blood gases**: Gases in the blood like oxygen and carbon dioxide.

**Arterial carbon dioxide**: Amount (expressed in percentage) of carbon dioxide in the blood.

**Arterial oxygen**: Oxygen in the blood.

**Arteries**: Muscle-lined blood vessels that carry blood away from the heart.

**Arteriosclerosis**: Stiffening/hardening of the arteries.

**Articulated**: Ability to be moved.

**Asbestosis**: Chronic respiratory condition caused by exposure to asbestos.

**Ascites**: Accumulation of fluid in the peritoneal (abdominal) cavity of the abdomen.

**Aseptic**: Without germs.

**Aspiration**: To draw out by suction.

**Assault**: Physical attack.

**Assign**: When a nurse directs an individual to do something the individual is authorized to do.

**Asthma**: Respiratory condition in which the air passages become narrowed and inflamed, causing dyspnea.

**Atelectasis**: Reduced or absent air in all or part of a lung and may be due to pulmonary collapse.

**Atherosclerosis**: Arteriosclerotic condition in which fatty substances (lipids) accumulate in the arteries, which stiffens them.

**Atria**: Upper chambers of the heart that fill with de-oxygenated blood; connect to other chambers (ventricles in the heart) by passageways, or valves. The right atrium fills with deoxygenated blood. The left atrium fills with oxygenated blood.

**Atrioventricular node (AV)**: Small node of connective fibers in the heart; gives rise to the atrioventricular bundle of the conduction system of the heart.

**Atrophy**: Wasting of tissues, organs, or the entire body.

**Attenuated virus**: Virus whose potency has been reduced.

**Auscultation**: Listening with a medical instrument/device to the various sounds made by body structures and functions; for example, listening to bowel sounds with a stethoscope.

**Autonomic**: Automatic control by the nervous system.

**Axial skeleton**: Articulated (movable) bones of head and vertebral column.

**Axons**: Part of nerve cells that conducts impulses away from the cell body.

**BM**: See bowel movement.

**BP**: See blood pressure.

**BPH**: See benign prostatic hyperplasia.

**Bacteremia**: Bacteria in the blood.
**Bacteria**: One-cell microorganism that may be free-living, parasitic, or pathogenic.

**Bactericide**: An agent that kills bacteria.

**Bacteriostatic**: Having an inhibiting or retarding effect on the growth of bacteria.

**Barbiturate**: Organic compound made from barbituric acid that treats and prevents convulsions, relieves anxiety, or treats sleep disorders.

**Barrel chest**: Condition in which the anterior-posterior (front-to-back) diameter of the chest is greater than normal; occurs in emphysema.

**Basal ganglia**: Masses in the cerebral hemispheres that play an important role in the formation of habits and unconscious motor functions.

**Battery**: Unlawful touching of another person.

**Beneficence**: Habit, intention, or act of doing good for others.

**Benign prostatic hyperplasia**: Condition in which the prostate gland is progressively enlarged.

**Beta-adrenergic blocking agent**: Agent that prevents beta cells in the heart from responding, which helps to treat cardiovascular diseases and related conditions.

**Blood pressure**: The pressure or tension applied to the walls of the arteries when the heart beats.

**Blood-borne pathogen**: Disease-causing organism that is carried by blood, tissue, and body fluid that contains blood.

**Bone resorption inhibitor**: Agent that prevents bone cells from being reabsorbed.

**Bone**: Hard connective tissue made up of cells embedded in a metric (system) of mineralized ground substance and collagen fibers; osseous tissue of definite shape and size, forming a part of the skeleton.

**Bony joints**: Area where bone ends meet.

**Bowel movement**: Expulsion/movement of solid wastes (feces) from the colon to the outside of the body.

**Brachial pulse**: Pulse (rhythmic expansion) of the brachial artery felt at the antecubital space (bend of the arm).

**Bradycardia**: Slow heart rate, usually lower than 60bpm.

**Brain stem**: Stem-like portion of the brain that connects the cerebral hemispheres with the spinal cord; contains the medulla oblongata, the pons, and the midbrain.

**Broad-spectrum antibiotics**: Antibiotic that is effecting in destroying a wide variety and number of bacteria.

**Bronchi**: Subdivisions of the trachea, which convey air to and from the lungs.

**Bronchiectasis**: Condition in which the bronchi or bronchioles are chronically dilated as result of inflammatory disease or obstruction.

**Bronchioles**: Small air passages, branching from the bronchi within the lungs.

**Bronchitis**: Acute or chronic inflammation of the mucous membrane of the bronchial tubes.

**Bronchodilator**: Drug or agent that help open/dilate the bronchi.

**Bronchospasm**: Spasms (sudden contractions) of the bronchi or bronchioles, causing narrowing of the bronchial passages that obstructs breathing.
**Buccal**: Cheek.

**Bursae**: Closed sac lines with synovial membrane and contains synovial fluid; usually located or formed in areas where friction occurs—for example, over an exposed or prominent part or where a tendon passes over a bone.

**CAD**: See coronary artery disease.

**Cap**: See capsule.

**CEs**: See cardiac enzymes.

**CNA**: See certified nursing assistant.

**CHF**: See congestive heart failure.

**CNS**: See central nervous system.

**CO**: See cardiac output.

**COPD**: See chronic obstructive pulmonary disease.

**CVA**: See cardiovascular accident.

**Calcium channel blocker**: Class of cardiovascular drugs that prevents calcium ions from passing through membranes in cardiac muscles and blood vessels; used to treat angina, cardiac dysrhythmias.

**Capillaries**: Tiny blood vessels where oxygen and waste products are exchanged in the blood.

**Carbon dioxide**: A waste product produced in the body by combining carbon with air; a respiratory stimulant.

**Cardiac**: Pertaining to the heart.

**Cardiac arrest**: Sudden condition in which the heart stops beating.

**Cardiac catheterization**: Procedure in which a small catheter is introduced into blood vessels to view the coronary vessels.

**Cardiac enzymes**: Proteins that act to start chemical changes in the heart; elevated levels reveal evidence of cardiac muscle damage.

**Cardiac muscle**: Specialized muscle of the heart responsible for its contracting.

**Cardiac Output**: Amount of blood pumped from the heart in one minute.

**Cardiology**: Medical specialty concerned with the diagnosis and treatment of heart disease.

**Cardiomegaly**: Enlarged heart (*cardio*, heart; *megas*, large).

**Cardiomyopathy**: Diseased heart muscle (*cardio*, heart; *mys*, muscle; *pathos*, disease).

**Cardiopulmonary resuscitation (CPR)**: Process of restoring breathing and heart rhythm/heartbeat in client suffering cardiac arrest.

**Cardiotonic agent**: Agent that improves the muscle tone and contracting ability of the heart.

**Caring characteristics**: Desirable personal characteristics of the caregiver (for example, empathy, respect, honesty, commitment to others, advocacy).

**Carotid pulse**: Pulse felt in the neck.

**Carpals**: Bones of the hand.

**Cartilage**: Soft, fibrous connective tissue that connects bones.

**Central nervous system (CNS)**: The brain and spinal cord.

**Cerebellum**: Portion of the brain responsible for coordination of balance, posture, and voluntary movements.
Cerebral cortex: Thin, convoluted surface layer of gray matter of the cerebrum.

Cerebral edema: Swelling in the brain.

Cerebral vascular accident (CVA): Acute event in which blood flow is blocked to the brain tissue by a thrombus in an artery or a bleeding artery, which causes damage to the brain; brain attack.

Cerebrospinal fluid: Tissue fluid of the brain and spinal cord; watery cushion that protects the central nervous system from mechanical shocks.

Certified Nursing Assistant: Healthcare provider educated by an approved program of study, certified by national testing, and approved by a licensing or credentialing agency to provide personal care and assistance to clients in healthcare settings (NCSBN).

Cerumen: Earwax.

Cheyne-Stokes respiration: Abnormal breathing pattern in which respirations progressively become faster and deeper, and then stop for periods or time.

Cholesterol: Steroid in animal protein that is essential structural component of the cells of mammals; responsible for fat buildup in the arteries.

Cholinergic fiber: Fibers that release acetylcholine.

Chorea: Involuntary writhing of the limbs or facial muscles.

Chronic illness: Long-term/protracted illness lasting months or years.

Chronic obstructive pulmonary disease: General term used for those diseases with temporary or permanent narrowing of small bronchi, in which forced outflow of air is diminished.

Cilia: Hair-like projections that propel air or food through the body.

Circulation: Blood flow, distribution of blood to and from the heart.

Circumduction: Movement in a circular motion.

Clonus: Rhythmic contraction and relaxation of a muscle in rapid succession; linked to spasticity and some seizure illnesses.

Coating agent: Drug or agent that forms a protective coating over an area.

Code of ethics: Set of principles, or ethics that guides professional behavior.

Colon: Segment of the large intestine that begins at the cecum and ends at the rectum.

Compensate: Make up for a deficiency.

Competence: Quality of being skilled; knowledge and ability to safely perform skills necessary for a certain job function.

Conductivity: Power of transmission or conveyance of certain of energy; in cardiology, the movement of electrical impulses through the heart muscle.

Confidentiality: Duty of health professionals not to disclose client information unless information communicated reveals potential harm to the individual and therefore needs to be reported.

Congestion: Overcrowding; jamming; clogging; obstruction.
Congestive heart failure: Condition in which the heart fails to pump efficiently.

Conjunctival surface: Mucous membrane in the anterior surface of the eyeball and the posterior surface of the eyelid.

Constipation: Condition in which bowel movements are infrequent or incomplete.

Coronary artery disease (CAD): Condition in which one or more of the arteries supplying blood to the heart muscle are narrowed, most often by atherosclerosis.

Coronary: Pertaining to the heart (corona, crown); often used as a term for heart attack.

Corticosteroids: Hormone secreted by the suprarenal gland; a corticoid containing a steroid.

Cough reflex: Reflex that controls coughing in response to irritation of the larynx or tracheobronchial tree.

Cough suppressants: Agents that prevent coughing.

CPR: See cardiopulmonary resuscitation.

Cretin: Person born with congenital hypothyroidism.

Culture and sensitivity: Laboratory development of an organism to detect which drug or agent will kill it.

Cushingoid: Resembling signs and symptoms of Cushing disease/syndrome buffalo hump, obesity, adiposity, HTN, diabetes, and osteoporosis, usually due to consuming corticosteroids.

Cyanotic: Blue state; condition in which the skin appears bluish in color due to low oxygen levels in the blood or skin may darken as seen in African Americans.

Cystitis: Inflammation of the urinary bladder.

DNR: See do not resuscitate.

DVT: See deep vein thrombosis.

Debilitated: A state of being weak.

Decongestant: Agent that helps relieve lung congestion.

Deep vein thrombus (DVT): A thrombus, blood clot, usually in the deep veins of the lower extremities.

Defecation: The act of expelling solid wastes from the body.

Defibrillation: To stop the fibrillation of the cardiac muscle (atrial or ventricular) that restores normal rhythm.

Dehydration: Deprived of water.

Delegation: Act of assigning a task to another.

Deoxygenated: Lack of oxygen.

Diaphragm: The muscle membrane that separates the abdominal and thoracic cavities.

Diarrhea: Abnormally frequent discharge of semisolid or liquid fecal matter from the bowel.

Diastole: Period after systole, or mainly contraction of the ventricles of the heart in which the atria fill with blood.

Diffusion: The process of spreading.

Digitalization: Administration of digitalis until desired therapeutic.
**Disease**: Dysfunction or disorder of body functions, systems, or organs; illness; sickness.

**Disease carrier**: Person who harbors a specific pathogen, does not become ill because of it but can infect others.

**Disinfectant**: Substance that prevents infection by killing bacteria.

**Distal**: Away from the center of the body, or from the point of origin.

**Diuresis**: Excretion of urine.

**Diuretic**: Drug or agent that promotes excretion of urine; agent that increases the amount of excreted urine.

**Diversion**: Taking a drug for sale or own use that is intended for use by a client.

**Do not resuscitate (DNR)**: Written client directive that prohibits healthcare staff from restoring the heartbeat and/or respirations of a client in the event of a cardiac or respiratory arrest.

**Dopaminergic**: Caused by dopamine.

**Dormant**: Quiet or latent state.

**Dorsal**: Pertaining to the dorsum, or back.

**Drug absorption**: Process by which a therapeutic agent/drug is taken into the body’s tissues.

**Drug abuse**: Habitual misuse of a drug not intended for therapeutic purposes, (for example, a drug taken solely to alter mood).

**Drug capsule**: Solid dosage form in which a drug is enclosed in either a hard of soft shell or soluble material.

**Drug dose**: Amount of drug or therapeutic agent ordered.

**Drug interaction**: The pharmaceutical result, intended or accidental, of drugs interacting/reacting with other drugs, other chemicals in the body, elements of the diet and with chemicals used in diagnostic tests.

**Drug order**: Expression by physician or other licensed healthcare professional, verbal or written, to give a certain drug, its dosage, frequency, time, form, client, and other client identification.

**Drug overdose**: Ingestion, intentional or accidental, of sufficient amount of drug or drugs to cause injury or harm.

**Drug reaction**: Adverse and undesired response to a substance taken for its pharmacological effects.

**Drug route**: Mode of delivering a drug to a client; for example, by mouth, under the tongue, on the skin, and so on.

**Drug solution**: Drug mixed with another substance, most often in liquid form.

**Drug suspension**: Oral drug solution in which particles of drug are mixed with but not dissolved in a liquid.

**Drug toxicity**: The poisonous effect of taking a particular drug; often seen with accumulation of a drug in the body system.

**Drug trade name**: Manufacturer’s brand name for a drug.

**Drug**: Therapeutic agent; any substance, other than food, used to prevent, treat, alleviate, or cure a disease; synonymous with medication, although a medication is the drug once it enters the body to begin desired action.

**Duodenum**: Portion of the small intestine closest to the stomach.
**Dysarthria**: Difficult or painful movement.

**Dysphagia**: Inability to swallow or difficulty in swallowing.

**Dyspnea**: Air hunger resulting in labored or difficult breathing (dys, difficult; pnea, breathing); breathlessness.

**Dyspneic**: Client who has difficulty breathing.

**Dysuria**: Difficult or painful urination.

**EC**: See enteric-coated.

**ECG**: See electrocardiogram.

**E-R**: See extended-release.

**Echocardiogram**: Graphic electrical recording of the heart transmitted by electrodes attached to the skin.

**Echocardiography**: Noninvasive diagnostic method in which ultrasound is used to visualize cardiac structures.

**Edema**: Swelling; local or generalized condition in which excessive amount of fluid is found in the spaces between body tissues.

**Electrocardiogram**: Record of the electrical activity of the heart.

**Electrocardiograph**: A device for recording changes in the electrical energy produced by the action of the heart muscles.

**Electrolytes**: Solution that conducts electricity, (for example, acids, bases, and salts such as sodium, potassium, and chlorine).

**Embolus**: A mass of undissolved matter present in a blood or lymphatic vessel delivered to a site by the blood or lymph from another location.

**Emesis**: Vomiting (emein, to vomit).

-**emia**: Suffix meaning blood condition.

**Empathy**: Awareness, insight into the feelings, emotions, and behavior of another person and their meaning and significance.

**Emphysema**: See chronic obstructive pulmonary disease.

**Emulsion**: Mixture of two liquids not mutually soluble; once shaken, one substance becomes mixed with the other.

**Enhance**: Advance; support.

**Enteric-coated**: A protective coating for tablets or capsules that does not dissolve until the pill is exposed to the fluids in the small intestine; special coating of tablets or capsules that helps prevent irritation to the mucous membranes of the esophagus and stomach.

**Enuresis**: Involuntary voiding.

**Enzyme**: Organic catalyst produced by living cells, most likely proteins that change the rate of chemical reactions without needing an external energy source or by being changed themselves.

**Epiglottis**: Uppermost cartilage of the larynx.

**Equilibrium**: Steady state; balance.

**Eructation**: Belching.

**Erythrocytes**: Mature red blood cells (RBCs).

**Erythropoiesis**: Process of forming red blood cells.

**Erythropoietin**: Substance produced by the kidneys that supports red blood cell production.

**Escheria coli (E. coli)**: Gram-negative bacillus microbe present in the colon.
**Esophagus**: Hollow tube that propels food into the stomach from the mouth.

**Estrogen**: Female sex hormone.

**Ethics**: System of moral principles or standards that guides conduct.

**Etiology**: The cause of disease.

**Euphoria**: Exaggerated feeling of well-being or extreme elation.

**Eversion**: Being turned inside out.

**Exacerbation**: Aggravation of symptoms or increased severity of a disease.

**Exophthalmos**: Abnormal anterior protrusion of the eyeball.

**Expectorant**: Agent that aids in the removal of thick secretions from the bronchi.

**Extended-release capsule**: Capsule that releases drug contents over time.

**Extension**: Movement that separates each end of a part.

**External rotation**: Moving a limb in a circular motion away from the body.

**Extrinsic**: Coming from the outside.

**Exudate**: Body fluid released that contains a high concentration of proteins, cells, or solid debris.

**False imprisonment**: Unlawful confinement of another person within fixed boundaries so the confined person cannot leave the boundaries.

**Feces**: Solid body wastes; bowel movement (BM).

**Femoral pulse**: Rhythmic contractions of the artery felt at the junction of the top of the thigh and the abdomen.

**Femur**: Thighbone.

**Fibrillation**: Quivering, spontaneous contraction of individual muscle fibers.

**Fibula**: The smallest of the two bones of the lower leg bone from the ankle to the knee.

**Filtration**: The act of solid particles passing through a membrane to separate them from the liquid portion of a solution.

**Flatulence**: Excessive gas in the stomach and small intestines.

**Flexion**: To decrease the angle of a joint.

**Flexor muscles**: Muscles that bring two bones closer together to produce flexion.

**Flutter**: Tremulous movement.

**Fracture**: A break.

**Fraud**: Deception.

**Fungi**: Single-cell organisms, as in yeast, molds, and mushrooms.

**Fungicide**: Agent that inhibits or kills fungi.

**GERD**: See gastroesophageal reflux disease.

**GU**: See genitourinary.

**Gastric**: Pertaining to the stomach.

**Gastroenteritis**: Inflammation of the stomach and intestinal tract.

**Gastroesophageal reflux disease**: Condition in which stomach acids (gastric juices) flow back into the esophagus, causing discomfort and, in some cases, damage to the esophagus.

**Gastrointestinal tract (GI tract)**: Stomach and intestines.

**Generic drug name**: Chemical name of a drug.
Genitourinary: Of the genital and urinary structure and functions.

Germs: Microorganism, especially one that causes disease.

Glaucoma: Group of eye diseases involving increased intraocular pressure (IOP).

Glomerulus: Capillary network in the nephron of the kidney.

Gouty arthritis: Arthritis caused by accumulation of crystals in joints.

Granule: Outgrowth of new capillaries that is part of new tissue growth.

Gray matter: Specialized brain tissue.

Gynecomastia: Enlargement of breast tissue in the male client.

HAI: See healthcare-associated infection.

HBV: See Hepatitis B virus.

HDL: See high-density lipoprotein.

HIPAA: See Health Insurance Portability and Accountability Act.

HPV: See human papilloma virus.

Halitosis: Bad breath.

Hand hygiene: Individual practices to keep hands as clean and germ free as possible.

Healthcare-associated infection: Infection contracted by receiving care in a healthcare facility; associated with medical or surgical instrumentation or spread of microorganisms by contacted with infected personnel or clients.

Heart valve: One-way membranous tissue through which blood passes through the heart.

Heart valve prolapse: Failure of heart valve to close sufficiently to avoid backflow of blood to a heart chamber.

Heartburn: Burning sensation in the mid-epigastrium.

Hematemesis: Bloody vomitus.

Hematopoiesis: Process of blood building.

Hemoptysis: Bloody sputum.

Hepatitis B virus: Strain of a microorganism responsible for hepatitis B.

Hepatotoxic: Poisonous to the liver.

Herpes simplex type I: Type of herpes virus.

Herpes simplex type II (genital herpes): Sexually transmitted disease; type of herpes virus responsible for recurrent lesions appearing in the genital area of males and females.

Hiatal hernia: Protrusion of the upper end of the stomach upward through the diaphragm.

High-density lipoprotein: Plasma lipids bound to albumin; with cholesterol, called the “good lipoprotein.”

Histamine-receptor antagonist: Agent that inhibits histamine from attaching to special receptors.

Homeostasis: State of dynamic equilibrium (balance) between inside processes with outside influences on the body.

Hormone: Stimulating substance produced by an organ, gland, or body part.

Hormone replacement therapy (HRT): Estrogen and progestin supplement to treat hormone deficiencies.
Host: The organism from which a parasite gets its food.

Human immunodeficiency virus (HIV): Retrovirus that causes acquired immunodeficiency syndrome.

Human papilloma virus: Papillomavirus, specific to humans, that causes a common viral sexually transmitted disease.

Humerus: Upper arm bone.

Hyper: Prefix meaning above, excessive, beyond.

Hyperacidity: Excessive acidity; referred to in gastric disorders.

Hyperextending: Extreme extension.

Hyperglycemia: Excessive glucose in the circulating blood.

Hyperlipidemia: Excessive amount of fats circulating in the blood.

Hyperreflexia: Increased action of the reflexes.

Hypersensitivity: Being overly sensitive.

Hypertension: High blood pressure.

Hyperthyroidism: Disease that results from an excessive amount of thyroid hormone in the blood.

Hypertonia: Excessive tone.

Hypertrophy: Increased size of an organ or structure.

Hypnotic: Pertaining to sleep or hypnosis.

Hypocalcemia: Decreased amount of calcium in the blood.

Hypocalcemic agent: Agent that lowers circulating calcium in the blood.

Hypoglycemia: Decreased amount of glucose in the blood.

Hypokalemia: Decreased amount of potassium in the blood.

Hyponatremia: Decreased amount of sodium in the blood.

Hypotension: Decreased tension; low blood pressure.

Hypothyroidism: Decreased amount of thyroid hormone in the blood.

ICD: See implantable cardiac defibrillator.

ICS: See intercostal space.

ID: See intradermal.

IM: See intramuscular.

I & O: See intake and output.

IOP: See intraocular pressure.

IV: See intravenous.

Immunity: Protection from disease, especially from infectious disease.

Immunization: Protecting a person from specific diseases by vaccination or injection (inoculation) with immune globulins.

Immunocompromised: Impaired immune system as a result of disease or drug therapy with agents that inhibit parts of the normal immune system.

Implantable cardiac defibrillator: Device implanted in the client’s body to treat potentially deadly dysrhythmias.

Infection: A disease caused by microorganisms that release toxins or invade body tissues.
**Inferior vena cava**: Large vein that receives deoxygenated blood from the lower body and returns it to the heart.

**Inhalation**: Drawing air into the lungs.

**Inhibitor**: A substance that prevents or slows a process.

**Injection**: Forcing a fluid into a vessel, tissue, or cavity.

**Inoculation**: Injection or introduction of an antigen or microbe into a client; vaccination.

**Inotropic agents**: Agent that changes the force of muscular contractions.

**Insomnia**: Inability to sleep.

**Instillation**: Pouring or dropping a liquid into a cavity.

**Insulin**: Hormone responsible for the use of blood sugar (glucose) by the body.

**Intake and output**: Foods and fluids taken into and removed from the body.

**Intercostal space**: Space between ribs.

**Intermittent claudication**: Sporadic pain in the lower extremities upon walking.

**Internal rotation**: Circular movement of a limb toward the body; can also be accomplished with movement of the eye.

**Intestinal motility**: Ability of the intestine to contract to propel food.

**Intra**: Prefix meaning within; inside.

**Intraarterial**: Within an artery.

**Intraarticular**: Within a joint.

**Intracardiac**: Within the heart.

**Intradermal**: Within the skin.

**Intramuscular**: Within the muscle.

**Intraocular**: Within the eye.

**Intraocular pressure**: Pressure within the eyeball.

**Intraosseous**: Within the bone.

**Intrathecal**: Within the spinal canal.

**Intravenous**: Within the vein.

**Inversion**: To turn inward.

**Iodine**: Hormone that enables the thyroid to function normally.

**Ischemia**: Temporary deficiency of blood flow to an organ or tissue.

**Isolation**: To be kept separate; apart.

**Jaundice**: Condition in which the skin and mucous membranes have a yellowish hue due to excess bilirubin in the blood.

**Joint**: Area where two bones come together.

**Joint degeneration**: Tearing down, erosion of a joint.

**Kidney tubule**: Vessel within the kidney for transport and absorption of metabolic liquid wastes and water.

**LDL**: See low-density lipoprotein.

**LPN**: See Licensed Practical Nurse.

**LVH**: See left ventricular hypertrophy.

**Lacrimal**: Pertaining to tears.

**Lactic acid**: Organic acid formed in muscles after strenuous exercise or when anaerobic cellular activity cannot change glucose into pyruvic acid.

**Lactic acidosis**: Accumulation of lactic acid in the blood.
Lavage: Washing out of a cavity.

Laxative: Agent that stimulates the bowel to evacuate solid wastes.

Left ventricular hypertrophy: Enlargement of the left ventricle of the heart.

Legal-ethical practice: Practice standard or guideline that honors the law and moral principles by which a society lives.

Lethargy: Extreme tiredness, lack of energy.

Leukocytes: White blood cells.

Libel: False statements in writing about another person.

Licensed Practical/Vocational Nurse: Healthcare provider who has completed an approved program of study and certified as competent to perform nursing according to the standards approved by the state or territory under which job occurs and is under the supervision of the registered nurse (settings where nursing care is provided).

Ligaments: Band or sheet of strong fibrous connective tissue connecting the movable ends of bones.

Liniment: Topical product containing medication mixed with a liquid designed to be gently rubbed in or applied to the skin; warmth to the area occurs.

Lipid: Fat or fat-like substance that cannot be broken down (insoluble) in water.

Lithotomy position: Position in which a client lies on the back, thighs flexed on the abdomen, legs on thighs, thighs abducted.

Local infection: Infection confined to an area of the body.

Lotion: Medicinal preparation for local application.

Low-density lipoprotein: Majority of lipids that carry most of the cholesterol in plasma.

Lozenge: Dry, solid medicine designed to be held in the mouth until it dissolves.

Lumen: Inside diameter of a hollow tube.

Lymphatic system: System that includes all the lymph vessels that collect tissue fluid and return it to the blood.

Lyse: To kill; dissolve; to destroy or fragment.

MAR: See Medication Administration Record.

Mcg: See microgram.

mEq: Symbol for milliequivalent.

MDS: See myelodysplastic disease.

Mg: Milligram.

MI: See myocardial infarction.

mL: Milliliter.

mm Hg: Measurement compared to the same amount (millimeters) of mercury.

MRSA: See methicillin-resistant staphylococcus aureus.

Malaise: Subjective feeling of being run-down; fatigued.

Mandible: Lower jawbone.

Maxilla: Upper jawbone.

Medical asepsis: Observing clean technique to keep the environment and healthcare providers as free from germs as possible without being sterile.

Medical liability: Being responsible for actions as a healthcare provider.
**Medication**: Medicinal preparation; drug.

**Medication Administration Record (MAR)**: Written record of administration of a client’s medications.

**Medication Assistant-Certified**: An individual who receives training preparing for a role in administering medications (with the exception of parenteral routes and enteral routes through nasogastric, gastrostomy, or jejunostomy tubes) and who works under the supervision of a licensed nurse.

**Medicine cup**: Small container that holds medication.

**Medicine dropper**: Glass or plastic tube with a rubber bulb on one end and is tapered on the other end; designed to instill liquid medication.

**Menopause**: Period marking the end of menstrual activity, normally occurring between age 40 and 58.

**Methcillin-resistant staphylococcus aureus (MRSA)**: Resistant strain of staph bacteria.

**Microbe**: One-cell microorganism, only visible under the microscope; in medicine, a disease-causing microbe or germ.

**Micturition**: The act of voiding/urinating.

**Mitral valve**: Valve that closes the opening between the left atrium and the left ventricle of the heart.

**Mnemonic**: Memory aid.

**Murmur**: Abnormal sound of blood flowing through blood vessels; heard when listening to the heart or neighboring large blood vessels.

**Muscle spasticity**: Motor disorder with exaggerated tension in muscle and tendon jerks, and clonus.

**Myelodysplastic syndrome**: Condition in which the bone marrow produces abnormal blood cells such as white blood cells (leukocytes) or platelets.

**Myocardial infarction**: Death of living heart muscle due to an occlusion of a cardiac artery by a fat plaque; heart attack.

**Myocardium**: Muscle of the heart.

**Myxedema**: Abnormal, waxy, and coarse skin seen in hypothyroid clients.

**N & V**: Nausea and vomiting.

**NCSBN**: National Council of State Boards of Nursing.

**NSAID**: See nonsteroidal anti-inflammatory agent.

**Narcotic**: A drug that depresses the central nervous system, which relieves pain and produces sleep.

**Narcotic antagonist**: Drug that blocks or reverses the effects of a narcotic.

**National Council of State Boards of Nursing**: National board that established national guidelines for nursing practice and oversees the competency examinations of licensed nurses and certain unlicensed assistive healthcare personnel.

**Nausea**: Unpleasant, queasy, wavelike feeling in the back of the throat, epigastrium, or abdomen.

**Necrosis**: Tissue death.

**Neglect**: Inattentiveness to one’s responsibilities, especially to those in one’s care.

**Negligence**: Failure of healthcare professional to meet own responsibilities for care of clients that results in harm to the client.
Nephron: Working unit of the kidney.

Nephrosclerosis: Hardening of the connective tissues of the kidney.

Nephrotoxic: Poisoning of the kidney.

Neurologic: Concerning the nerves.

Neuron: Nerve cell; the structural and functional unit of the nervous system.

Neurotransmitter: A chemical released when the axon of a presynaptic neuron is excited.

Neutrophil: A granular white blood cell.

Nitrate: A salt of nitric acid.

Nocturia: Excessive or frequent voiding after bedtime.

Nodes: A knot, knob, swelling, or protuberance.

Noncommunicative: Unable to communicate in any way.

Nonpathogen: Microbe that does not cause disease.

Nonsteroidal anti-inflammatory agent/drug (NSAID): An agent/drug that relieves inflammation but does not contain a steroid.

Norepinephrine: Adrenal hormone similar to epinephrine; a vasoconstrictor that has little effect on cardiac output.

Normal flora: Normal microbe living in a particular environment; for example, intestinal flora.

Nurse Assistant/Aide: Specially trained and competent healthcare provider who has completed an approved program of study as well as a certification examination; the NA works under the supervision of the licensed nurse, physician, or other licensed healthcare professional.

Nurse Practice Act: Law of a state or jurisdiction that describes the licensed nurse and the scope of practice, allowable duties, practice limitations, and licensing requirements.

Nursing assistive personnel: Healthcare staff who assist licensed nurses in providing client care within various settings where nursing care is provided.

Nursing process: Organized, scientific process of assessing, planning, implementing, and evaluating a plan for care of clients.

OBRA: See Omnibus Budget Reconciliation Act.

OCD: See obsessive-compulsive disorder.

OSHA: See Occupational Safety and Health Administration.

OTC: See over the counter.

OZ: See ounce.

Obsessive-compulsive disorder: Type of anxiety disorder in which the client's repetitive and persistent ideas, thoughts, impulses, and behaviors are ritualistic, intrusive, disruptive to normal routines, and cause the client distress.

Occupational Safety and Health Administration (OSHA): U.S. governmental regulatory agency concerned with the health and safety of workers.

Omnibus Budget Reconciliation Act (OBRA): Legislation providing for the protection of the aging by regulating nursing homes.

Oculogyric crises: Acute condition in which the eyeballs rotate constantly.

Ointment: A semisolid drug form used for topical administration of medicine.
Opiate: Any drug derived from opium.

Opportunistic infection: Infection caused by decreased immunity.

Ophthalmic: Pertaining to the eye.

Organ: Specialized group of tissues organized for a particular purpose in the body; for example, heart.

Orifice: The entrance or outlet of any anatomical structure.

Orthostatic hypotension: Sudden decrease in blood pressure when standing.

Osteoporosis: Condition in which bones become porous and brittle.

Ototoxic: Poisonous to the ears.

Over-active bladder: State in which the bladder receives excessive nerve signals to evacuate urine.

Over the counter (OTC): Term referring to the availability of drugs without a prescription.

Ounce (OZ): Household measure; equal to 30mL.

Oxygenated: Supplied with oxygen.

P: See pulse.

PAC: See premature atrial contractions.

PAT: See paroxysmal atrial tachycardia.

PDR: See Physician’s Desk Reference.

PPE: See personal protective equipment.

PPI: See proton pump inhibitor.

PRN: As needed.

PTCA: See percutaneous transluminal coronary angioplasty.

PUD: See peptic ulcer disease.

PVC: See premature ventricular contraction.

PVD: See peripheral vascular disease.

Pacemaker: Another name for sinoatrial node of heart; product that provides pacing action for the heart.

Pain: Subjective feeling of discomfort, ache, or soreness in the body.

Palpitations: Sensation of rapid, irregular beating of the heart.

Pancreatitis: Inflammation of the pancreas.

Paradoxical: Conflicting with expectation.

Paranasal sinuses: Air-filled cavities near the nose.

Parasympathetic: Pertaining to the craniosacral division of the autonomic nervous system.

Parenteral: Any medication route other than rectal; for example, subq, IM, or IV.

Paroxysmal atrial tachycardia (PAT): Increased heart rate occurring suddenly and without warning.

Passive immunity: Introducing preformed antibodies into a client who is not already immune to a disease.

Paste: Solid form of topical medication meant to be applied to the skin.

Patella: Kneecap.

Patent: Open.

Pathogen: Disease-causing organism.

Pathophysiology: Study of how disease alters normal physiological processes.

Peptic: Concerning digestion; areas of the
body that contain acid (namely, the stomach and duodenum).

**Peptic ulcer**: Erosion of the mucosa of the stomach or duodenum.

**Percutaneous transluminal coronary angioplasty**: Insertion of a catheter into a coronary artery to open and repair it.

**Perfusion**: Supplying a tissue or organ with nutrients.

**Peripheral nervous system (PNS)**: Portion of the nervous system outside the central nervous system (brain and spinal cord).

**Peripheral Vascular Disease (PVD)**: Disease that blocks normal blood flow to or from the arteries or veins outside the chest.

**Peristalsis**: Wavelike involuntary movement occurring in hollow tubes of the body (that is, the alimentary tract).

**Personal Protective Equipment (PPE)**: Equipment worn by healthcare personnel to protect themselves and others from contamination by pathogens.

**Phantom pain**: Subjective sensation of pain in a limb that is no longer there.

**Pharmacology**: Study of origins, nature, properties, and effects of drugs.

**Pharmacotherapeutics**: Medicines used in disease.

**Pharynx**: Medical term for throat.

**Phlebitis**: Inflammation of a vein.

**Photosensitivity**: Skin reaction to ultraviolet rays from sunlight.

**Physician's Desk Reference (PDR)**: Publication that serves as a reference for desk products.

**Placebo**: Inactive, harmless substance intended to satisfy a client’s desire for medication.

**Plaque**: Fatty deposit in an artery.

**Platelet aggregation inhibitor**: Substance that prohibits coagulation (clumping) of platelets.

**Platelets**: Blood fragments responsible for blood clotting.

**Pledget**: Small, flat cotton or gauze compress used for topical application of medicines.

**Pleural effusion**: Accumulation of fluid in the space between the lung and the chest wall.

**Pleurisy**: Inflammation of the lining surrounding the lung and the thoracic cavity.

**Pneumonia**: Inflammatory condition of the lung.

**Pneumothorax**: Air in the chest cavity outside the lung.

**PO/p.o.**: Per os; by mouth.

**Position description**: Written description for a particular job title.

**Powder**: Fine particles alone or in combination with other particles; form of medication preparation.

**Precipitating factors**: Reasons that support the development of a medical condition or illness.

**Preinfarct**: Time coming before death of a muscle.

**Premature atrial contraction**: Premature beating of the atria.
Premature ventricular contraction: Premature, nonreassuring contraction of the left ventricle of the heart.

Preoperatively: Before an operation.

Prescription: Written order by a physician or other approved healthcare professional (for example, ARNP or PA).

Primary disease: Original disease.

PRN order: Physician order for a treatment or medication to be given as needed.

Productive cough: Cough that brings up sputum.

Professional boundaries: Limits for professional relationship with clients.

Prokinetic agent: Agent that promotes movement.

Pronation: Turning downward.

Prophylactic: Agent or regimen that contributes to preventing disease.

Prostate gland: Gland in the male reproductive system that produces fluid to protect sperm and is located/goes around the neck of the bladder.

Prostatitis: Inflammation of the prostate gland.

Proton pump inhibitor: Agent that prevents secretion of gastric acid in the stomach.

Protration: Moving forward.

Pulmonary: Pertaining to the lung.

Pulmonary capillaries: Tiny blood vessels in the lung.

Pulmonary circulation: Circulation of blood through the lungs.

Pulmonary edema: Abnormal fluid accumulation in the lungs.

Pulmonary lobes: Segments of the lungs.

Pulse: Rhythmic beats of the blood being pumped by the heart through the arteries and is felt at various points in the body (wrist, posterior knee, and so on).

Pyelonephritis: Inflammation of the renal pelvis and kidney.

Red blood cell: Component of the blood that carries oxygen to the cell.

Registered Nurse: Healthcare provider educated through an approved course of study and licensed to practice nursing in a state or jurisdiction where nursing care is performed.

Radial pulse: Pulse felt at the inside, radial aspect, of the wrist.

Raynaud's phenomenon: Vasospastic disease of small arteries and arterioles.

Reabsorption: Process of absorbing again.

Rectal sphincter: Specialized muscular tissue responsible for opening or closing the rectum.

Rectum: Lower part of the large intestine.

Regurgitation: To flow in a backward direction.

Renal: Pertaining to the kidney.

Renin: Enzyme produced by the kidney.

Resident's Bill of Rights: Proscribed rights of clients residing in a nursing home or long-term care facility.

Resistance: To pull against.
Respiration: Process of breathing in (inspiration) and breathing out (expiration) (inspiration and expiration equals one breath).

Respiratory arrest: Cessation of respirations.

Respiratory distress: Difficult respirations.

Retching: Involuntary attempt to vomit.

Retraction: Moving backward.

Rhinitis: Inflammation or irritation of the nasal passages.

Rhinorrhea: Thin, watery discharge from the nose.

Risk factor: Consideration placing a client in danger.

Role: Purposeful function.

SOB: See shortness of breath.

SSRI: See selective serotonin reuptake inhibitor.

STAT: Immediately.

STD: See sexually transmitted disease.

Saliva: Fluid secreted from the salivary glands in the mouth.

Scapula: Shoulder blade.

Sclerosed: Stiffened.

Scope of practice: Description of professional practice duties as well as limits of practice.

Scored tablet: Solid drug-infused disc that is marked with a line allowing even dividing of the tablet.

Secondary disease: Disease occurring because of another earlier disease.

Secretion: Making and releasing substances by glands.

Sedation: State of calmness.

Sedative: Agent that calms a client.

Sedative/hypnotics: Agent that is tranquilizing and causes sleep.

Sedentary lifestyle: Lifestyle requiring little physical exercise.

Semisynthetic: Chemical change to a part of a natural substance.

Sensitization: Process of making a substance or client susceptible to an antigen by exposing them to it repeatedly.

Sepsis: Systemic inflammatory response to infection.

Septum: Wall dividing two cavities.

Serotonin: Neurotransmitter and vasoconstrictor.

Selective serotonin reuptake inhibitor: Drug that prevents reabsorption of serotonin.

Sexual harassment: Unsolicited and unwelcome verbal or physical sexually oriented conduct or innuendos.

Sexually transmitted disease (STD): Disease transmitted through sexual activity.

Shortness of breath: Breathlessness.


Single order: One-time order for treatment.

Sinusitis: Inflammation of a sinus cavity.

Small intestine: Portion of the GI tract that begins at the end of the stomach and ends with the cecum.

Solution: Liquid containing a dissolved substance.
Soufflé cup: Small pleated paper cup used for medication administration.

Spasm: Sudden, quick muscle contraction.

Spasmolytic agent: Agent that prevents spasm.

Sputum: Semiliquid substance produced by the lung.

Standard of care: Statement by professionals of minimum safe professional conduct under specific circumstances.

Standard precautions: Precautions to help prevent the risk of spread of infection in hospitals or other healthcare settings.

Standing order: Written orders for procedure, protocol, or therapy.

Staphylococcus aureus: Bacteria normally present on the skin, nasal, and oral cavities.

Stasis: Stopping the flow of fluids such as blood or urine.

Statins: Agents that lower cholesterol levels in the blood.

Stent: Mechanism to keep an object in place; in cardiology, to maintain open blood vessels or support a graft while healing is taking place.

Sternal: Beneath the breastbone (sternum).

Superinfection: Infection contracted from another infection.

Supination: Turning a limb with the hand (palm) upward.

Suppository: Semisolid medication designed to be inserted into a body cavity to be dissolved.

Surfactant: Substance to keep surfaces from adhering to each other.

Suspension: Solid particles suspended but not dissolved in a liquid or other solid; requires shaking before administering it.

Sympathetic: In sympathy; in biology, something that affects one of a paired organ influencing the other.

Sympathomimetic: Substance that mimics effects or supports them.

Synapse: Point of contact between a nerve and another cell or nerve.

Syncope: Fainting.

Synovial fluid: Fluid that covers movable joints.

Synthetic: Manufactured.

Syrup: Concentrated solution of sugar in water.

Systemic circulation: Circulation through the body.

Systemic effect: Effect on a system.

Systemic infection: Infection that affects an entire system.

Systole: Contraction phase of the heart chambers.
**Systolic pressure**: Pressure exerted against the arteries by the pumping of blood from the heart.

**TB**: See tuberculosis.

**TIA**: See transient ischemic attack.

**TPN**: See total parenteral nutrition.

**TSH**: See thyroid-stimulating hormone.

**Tablet**: Solid disc of medicinal powder.

**Tachycardia**: Rapid heartbeat; over 100bpm.

**Tachypnea**: Rapid breathing.

**Tarsals**: Bones of the feet.

**Telephone order**: Order for treatment by a prescriber via the telephone.

**Temporal pulse**: Pulse felt at the temple.

**Tendons**: Fibrous connective tissue that attaches muscles to bones.

**Theft**: Stealing.

**Therapeutic effect**: Effect that has healing properties.

**Therapeutic relationship**: Helpful relationship.

**Thrombolytic**: Agent that breaks up a thrombus (clot).

**Thrombophlebitis**: Blood clot with inflammation to a vein.

**Thrombus**: Clot of blood (stationary).

**Thyroid replacement hormones**: Hormones that act in place of natural hormones in the body.

**Thyroid-stimulating hormone (TSH)**: Hormone that stimulates the thyroid gland.

**Thyroxine**: Hormone secreted by the thyroid gland.

**Tibia**: The largest of two bones in the lower leg from the knee to the ankle.

**Tinnitus**: Ringing in the ears.

**Total parenteral nutrition (TPN)**: Combination of essential nutrients delivered parenterally.

**Tophi**: Nodules of sodium near a joint in the ear, or elsewhere in clients with gouts.

**Topical**: Pertaining to the surface of the skin.

**Toxic**: Poisonous effect.

**Trachea**: Windpipe.

**Tracheobronchial tree**: The trachea and windpipe.

**Transdermal**: Across the skin.

**Transient ischemic attack (TIA)**: Sudden, short-term episode in which part of the brain suffers from lack of blood.

**Triglycerides**: Glycerol and fatty acids.

**Trophic**: Concerned with nourishment of a part.

**Tuberculin skin test (TST)**: Diagnostic procedure in which a tiny amount of tuberculin bacterium is inserted into the skin to assess a local reaction to it.

**Tuberculosis**: Infectious disease caused by the tuberle bacillus bacterium.

**Tubule**: Small tube or canal.

**URI**: See upper respiratory infection.

**UTI**: See urinary tract infection.

**Ulcer**: Erosion of mucus membrane.
Ulna: One of two long bones extending from the elbow to the wrist.

Universal precautions: Guidelines developed to protect workers from blood-borne pathogens.

Upper respiratory infection (URI): Infection affecting the upper respiratory tract.

Urate: Salt of uric acid.

Ureter: Tube that carries urine from the kidney to the bladder.

Urethra: Tube allowing for the discharge of urine from the bladder to the outside of the body.

Urethritis: Inflammation of the urethra.

Urgency: Urge to void.

Uricemia: Uric acid in the blood.

Urinary frequency: Urge to void frequently.

Urinary meatus: Opening of the urethra.

Urinary tract infection (UTI): Infection involving the urinary tract.

Urination: Act of voiding.

Urine: Liquid metabolic waste.

Urticaria: Allergic reaction consisting of discrete swelling on the skin causing intense itching.

VF: Ventricular flutter.

VT: Ventricular tachycardia.

Vaccination: Process of inoculating a client with a weak form of a microbe to protect them from active disease.

Vagina: Tube that forms the passageway between the cervix and the vulva.

Vaginitis: Inflammation of the vagina.

Vasodilator: Agent that dilates a vessel.

Vasospasm: Spasm of a blood vessel.

Vein: Tube-like vessel that carries blood to the heart.

Venous: Pertaining to a vein or blood passing through it.

Ventilation: Moving air into and out of the lungs.

Ventral: Pertaining to the belly, or underside; opposite of dorsal.

Ventricle: Small cavity.

Ventricular tachycardia: Rapid beating of the ventricle.

Vesicle: Tiny vein.

Verbal order (VO): Order from a prescriber given orally may also be referred to as a vocal order.

Virus: Pathogen that grows only on a host cell.

Void: To pass urine.

Voluntary muscles: Those muscles under conscious control.

Vomiting: Act of sudden expulsion of gastric contents (emesis) through the mouth.

Vomitus: Gastric contents expelled suddenly from the stomach.

WBC: See white blood cell.

Wheeze: Noisy breaths of air passing through narrowed air passages.

White blood cell (WBC): Component of the blood responsible for fighting infection.

Wong-Baker Faces Pain Rating Scale: Pain rating scale composed of a series of facial expressions that represent levels of pain.
**Index**

**A**
- abductor muscles, role in musculoskeletal system, 210-212
- abuse (ethical/legal issues), 41
  - libel, 44
  - mental abuse, 44
  - physical abuse, 44
  - reporting, 45
  - sexual abuse, 45
  - sexual harassment, 45
  - signs of, 45
  - slander, 44
- accessory muscles, emphysema and, 149
- accountability of Medication Aides
  - characteristics of Medication Aides, 40
  - delegated tasks, 36
- ACE (Angiotensin-Converting-Enzyme) inhibitors, hypertension, 125
- Acetaminophen, liver damage and, 244
- acetylcholine, 226
- acquired immunity, 196
- acrochordons, 264
- active immunity, infections and, 177
- acute infections, 146
- acute pain, 237
- acute ulcers (stress ulcers), 160

**AD (Alzheimer’s disease), 244-245**

- additive effect (drugs), defining, 54
- adduction, 213
- adenocarcinomas, 277
- ADH (Antidiuretic Hormone), role in urinary system, 194
- administering medication
  - accuracy of medications, assuring, 78
  - age and, 108
  - aphasis clients, 110
  - blood-borne pathogens, 81
  - CDC, 81
  - client identification, 94
  - clients with physical limitations, 109-110
  - cognitive limitations, 82
  - ears, 104
  - errors, causes and reporting of, 87-88
  - eyes, 102-103
  - gloves, 95
  - hand hygiene, 80
  - hand washing, 94
  - HBV, 81
  - hemiparalysis, 110
  - medical asepsis, 80-81
  - medicine cups, 80
  - mental preparation, 79-80
  - noncommunicative clients, 111

- nose
  - nasal inhalation, 102
  - nasal instillation, 101-102
- oral
  - liquids, 98-99
  - lozenges/troches, 99-100
  - powders, 99
  - solids, 96-98
  - sublinguals/buccals, 100
- order of, 82
- OSHA, 81
- physical impairments, 82
- physical preparation, 79-80
- positioning clients, 95
- post-administrative procedures
  - client comfort, 112
  - client environment, 112
  - right documentation, 113
- PPE, 80
- procedures, explaining to clients, 95
- rectal application, 107-109
- refusal to take medication, 110
- rights of medication administration
  - right documentation, 86-87
  - right dose, 85
  - right drug, 83
  - right resident, 84

From the Library of Scott Kruse
right route, 84
right time, 85-86
safety checks, 82
souffle cups, 79-80
swallowing difficulties, 81-82
therapeutic relationships, 111
topicals and transdermal installations, 71, 104-105, 184-185
vaginal application, 106-107
workstation preparation, 79
administration (medication)
communication
verbal, 38-39
written, 39
policies, 36-37
six rights (principles) of administering medications, 37
ADR (Adverse Drug Reactions), 55
adrenergic agents, ANS and, 226-227
adrenergic catecholamine, 225
aerobic microbes, 176
age
eyes, aging's effects on, 264-265
medication administration and, 108
pain and, 236
AHA (American Hospital Association), Resident's Bill of Rights, 42-44
AHRQ (Agency for Healthcare Research and Quality), building safer healthcare systems, 347
aiding and abetting (ethical/legal issues), 41
AIDS (Acquired Immunodeficiency Syndrome), 182
air conduction, ears and, 268
akinesia, 245
Aldactone (Spironolactone), 204
aldosterone, 125, 194
alimentary canal, role in digestive system, 158
alkalosis, 161
alkylating agents, cancer and, 279-280
allergen-antibody responses, role in respiratory system, 146
allergic reactions, 55
alopecia, cancer and, 279
alpha adrenergic blocking agents, ANS and, 227-230
alpha-1 adrenergic blocking agents, hypertension, 126
alveoli, 133, 145
amino acids, role in digestive system, 158
aminoglycosides, 183
anaerobic microbes, 176
analgesics, 52
ANS and, 235
NSAID, 241
opioid analgesics, 238-241
opiates and opiate-like drugs, 243
salicylates, 242
eyes, 265
anaphylaxis, 55-56
androgen (male hormones), cancer and, 282
anaemia, 195
angina, 123, 128-130
anorexia, statin drugs and, 124
ANS (Autonomic Nervous System)
adrenergic agents, 226-227
alpha adrenergic blocking agents, 227-230
analgesics, 235
NSAID, 241
opiotes and opiate-like drugs, 238-243
salicylates, 242
anticholinergics, 231-232
barbiturates, 232-233
benzodiazepines, 233-234
beta adrenergic blocking agents, 227-230
cholinergics, 226, 230-231
dopaminergic agents, 227
heartbeat and, 121
nonbarbiturates, 234-235
nonbenzodiazepines, 234-235
parasympathetic nervous system, 226
sedative-hypnotic drugs, 232-235
SNS, 225
answers
practice exam I, 311-315
practice exam II, 327-331
testing strategies
face value, 15
focusing on key words, 15
opposite options, 15
option C, 15
process of elimination, 15
rethinking the question in your own words, 14
safety concerns, 15
taking time, 14
umbrella terms, 14
antacids, 160-161
antagonist effect (drugs), defining, 54
anti-infectives, 52, 186
cancer and, 279
eyes and, 265
anti-inflammatory agents, treating upper respiratory tract illnesses, 151
antibiotics, 52
allergies and, 184
aminoglycosides, 183
anti-infective agents, 186
antitubercular agents, 187
antiviral agents, 186
cephalosporins, 187-188
infection process
AIDS, 182
bacteremia, 187
clostridium perfringens, 176
From the Library of Scott Kruse
arteries

disease carriers, 180
dormant viruses, 181
E.coli, 176
environmental conditions for, 176
germs, 176, 183
HAI, 180
Hepatitis B, 180
Hepatitis C, 181
herpes, 181
hosts, 176
immunity's role in, 176-177
immunization process, 177
immunocompromised clients, 179
local infections, 178
meningitis, 183
microbes, 176
normal flora, 176
older clients and, 179
osteomyelitis, 187
pancreatitis, 186
pathogens, 176
recovering from, 179
resistance, 183
septicemia, 183
signs/symptoms of, 178
staph infections, 180
superinfections, 183
systemic infections, 178
TB (tuberculosis), 181, 187
urinary tract infections, 183
wound infections, 183
macrolides, 189
pneumonia treatments, 148
quinolones, 189
safety considerations, 184
sulfonamides, 189
systemic antifungal agents, 186
tetracyclines, 189
topical antifungal (fungicidal) agents, 71, 104-105, 184-185
UTI treatment, 196
Furandantin, 201
Macrodantin, 201
Mandelamine, 201
penicillins, 197-198
quinolones, 200-201
sulfa drugs, 198-199
tetracyclines, 199-200
antibodies, immunity from infection and, 177
anticholinergics, 167
ANS and, 231-232
Parkinson's disease, treatment of, 247
anticoagulating, 242
antidepressants, 292-293
antidiabetic agents, 52
antidiarrheals, 52, 167-168
antiemetics, 52, 166-167, 279
antifungal (fungicidal) agents, 184-186
antigens, 196
antihistamines, 52, 150-151, 167
antihyperlipidemic drugs, 123
antihypertensive drugs, 126-128
antipalipidemics, 53, 124
antimetabolites, cancer and, 280-281
antimicrobial agents
allergies and, 184
aminoglycosides, 183
antibiotics, 183
safety considerations, 184
UTI, 196
antineoplastic drugs, 278-282
antiepileptic agents (anticonvulsants), 160-161
antiplatelet agents, 136-137
antipsychotics, 53, 295-296
antipyretics, 53
antiseptic effect, UTI, 196
antispasmodics, 165, 202
antitubercular agents, 187
antitussives, 53
lower respiratory tract illness, treating, 152
pneumonia treatments, 148
antiviral agents, 186
anuria, 196
anxiety
anxiolytics, 290
benzodiazepines, 289
signs/symptoms of, 288-289
tranquilizers, 289
aortic arteries, 121
aortic bodies, role in respiratory system, 145
aortic valves (heart), 120
aphasic clients and medication administration, 110
apical pulse, 120
appendicular skeleton, 211
arachnoid (CNS), 224
ARR (Angiotensin II Receptor Blockers), hypertension, 125
arcus senilis, 264
ARDS (Acute Respiratory Distress Syndrome), 147
arithmetic review
decimals, 337
changing fractions to decimals, 338
multiplying decimals by decimals, 339
doses, calculating, 339
fractions, 337-338
metrics
conversions, 338
weights and measures table, 337
arrhythmia, 131-133
arteries
aortic arteries, 121
arterioles, 121
cardiovascular system, role in, 119
coronary arteries, 121

How can we make this index more useful? Email us at indexes@quepublishing.com

From the Library of Scott Kruse
<table>
<thead>
<tr>
<th>Term</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>arteries</td>
<td>378</td>
</tr>
<tr>
<td>intra-arterially administering</td>
<td></td>
</tr>
<tr>
<td>drugs, 72</td>
<td></td>
</tr>
<tr>
<td>lumen, 122</td>
<td></td>
</tr>
<tr>
<td>respiratory system, role in, 145</td>
<td></td>
</tr>
<tr>
<td>stenosis, 125</td>
<td></td>
</tr>
<tr>
<td>arterioles, 121</td>
<td></td>
</tr>
<tr>
<td>arteriosclerosis obliterans, 135</td>
<td></td>
</tr>
<tr>
<td>arthritis (gouty), 219</td>
<td></td>
</tr>
<tr>
<td>ascites, urinary retention, 203</td>
<td></td>
</tr>
<tr>
<td>aspiration, 81, 147</td>
<td></td>
</tr>
<tr>
<td>aspirin, 242</td>
<td></td>
</tr>
<tr>
<td>assault (ethical/legal issues), 41</td>
<td></td>
</tr>
<tr>
<td>asthma, 148</td>
<td></td>
</tr>
<tr>
<td>atelectasis, 147</td>
<td></td>
</tr>
<tr>
<td>atherosclerosis, 122-123</td>
<td></td>
</tr>
<tr>
<td>atria (heart), 120</td>
<td></td>
</tr>
<tr>
<td>attenuated viruses, 186</td>
<td></td>
</tr>
<tr>
<td>auricle (pinna), ears and, 268</td>
<td></td>
</tr>
<tr>
<td>auscultate, 121</td>
<td></td>
</tr>
<tr>
<td>axial skeleton, 210</td>
<td></td>
</tr>
<tr>
<td>axons (white matter), cerebrum</td>
<td></td>
</tr>
<tr>
<td>and, 224</td>
<td></td>
</tr>
<tr>
<td><strong>blepharitis</strong>, 266</td>
<td></td>
</tr>
<tr>
<td><strong>blood</strong></td>
<td></td>
</tr>
<tr>
<td>anticoagulating, 242</td>
<td></td>
</tr>
<tr>
<td>bacteremia, 187</td>
<td></td>
</tr>
<tr>
<td>blood-borne pathogens, medication</td>
<td></td>
</tr>
<tr>
<td>administration, 81</td>
<td></td>
</tr>
<tr>
<td>BP, 121</td>
<td></td>
</tr>
<tr>
<td>de-oxygenated blood, cardiovascular system, 119</td>
<td></td>
</tr>
<tr>
<td>oxygenated blood, cardiovascular system, 119</td>
<td></td>
</tr>
<tr>
<td>stagnation, 147</td>
<td></td>
</tr>
<tr>
<td><strong>blood clots (thrombus)</strong>, 123</td>
<td></td>
</tr>
<tr>
<td><strong>blood vessels</strong></td>
<td></td>
</tr>
<tr>
<td>capillaries, 121</td>
<td></td>
</tr>
<tr>
<td>cardiovascular system, role in, 119</td>
<td></td>
</tr>
<tr>
<td>hypoxia, 149</td>
<td></td>
</tr>
<tr>
<td>PVD, 134</td>
<td></td>
</tr>
<tr>
<td>antiplatelet agents, 136-137</td>
<td></td>
</tr>
<tr>
<td>arteriosclerosis obliterans, 135</td>
<td></td>
</tr>
<tr>
<td>DVT, 135-136</td>
<td></td>
</tr>
<tr>
<td>Reinaud's disease, 135</td>
<td></td>
</tr>
<tr>
<td>thromboembolic diseases, 136</td>
<td></td>
</tr>
<tr>
<td>vasoconstriction, 228</td>
<td></td>
</tr>
<tr>
<td>vasospasms, 135</td>
<td></td>
</tr>
<tr>
<td><strong>bones</strong></td>
<td></td>
</tr>
<tr>
<td>axial skeleton, 210-211</td>
<td></td>
</tr>
<tr>
<td>bone resorption inhibitors, 215</td>
<td></td>
</tr>
<tr>
<td>carpals, 210</td>
<td></td>
</tr>
<tr>
<td>cartilage, 211-212</td>
<td></td>
</tr>
<tr>
<td>estrogen and calcium storage, 212</td>
<td></td>
</tr>
<tr>
<td>femurs, 210</td>
<td></td>
</tr>
<tr>
<td>fibulas, 210</td>
<td></td>
</tr>
<tr>
<td>flat bones, 210</td>
<td></td>
</tr>
<tr>
<td>fractures, 215</td>
<td></td>
</tr>
<tr>
<td>hematopoiesis, 211</td>
<td></td>
</tr>
<tr>
<td>humerus, 210</td>
<td></td>
</tr>
<tr>
<td>intraosseously administering drugs, 72</td>
<td></td>
</tr>
<tr>
<td>irregular bones, 210</td>
<td></td>
</tr>
<tr>
<td>long bones, 210</td>
<td></td>
</tr>
<tr>
<td>mandible, 210</td>
<td></td>
</tr>
<tr>
<td>maxilla, 210</td>
<td></td>
</tr>
<tr>
<td>musculoskeletal system, role in, 210-211</td>
<td></td>
</tr>
<tr>
<td>osteomyelitis, 187</td>
<td></td>
</tr>
<tr>
<td>osteoporosis, 215</td>
<td></td>
</tr>
<tr>
<td>patellas, 210</td>
<td></td>
</tr>
<tr>
<td>radius, 210</td>
<td></td>
</tr>
<tr>
<td>RBC, 211</td>
<td></td>
</tr>
<tr>
<td>scapulas, 210</td>
<td></td>
</tr>
<tr>
<td>sesamoids, 210</td>
<td></td>
</tr>
<tr>
<td>short bones, 210</td>
<td></td>
</tr>
<tr>
<td>skeletal density, 212</td>
<td></td>
</tr>
<tr>
<td>tarsals, 210</td>
<td></td>
</tr>
<tr>
<td>tibias, 210</td>
<td></td>
</tr>
<tr>
<td>ulna, 210</td>
<td></td>
</tr>
<tr>
<td>vertebrae, 210</td>
<td></td>
</tr>
<tr>
<td><strong>boundaries (professional), ethics and</strong>, 46</td>
<td></td>
</tr>
<tr>
<td><strong>bowels</strong></td>
<td></td>
</tr>
<tr>
<td>antidiarrheals, 167-168</td>
<td></td>
</tr>
<tr>
<td>laxatives, 168-169</td>
<td></td>
</tr>
<tr>
<td>BP (Blood Pressure), 121</td>
<td></td>
</tr>
<tr>
<td>BPH (Benign Prostatic Hypertrophy), 195</td>
<td></td>
</tr>
<tr>
<td>brachial pulse, 120</td>
<td></td>
</tr>
<tr>
<td>bradycardia, 120, 131</td>
<td></td>
</tr>
<tr>
<td>bradykinesia, antipsychotic agents and, 295</td>
<td></td>
</tr>
<tr>
<td>brain, 224-225</td>
<td></td>
</tr>
<tr>
<td>bronchi, role in respiratory system, 145</td>
<td></td>
</tr>
<tr>
<td>bronchioles, role in respiratory system, 145</td>
<td></td>
</tr>
<tr>
<td>bronchitis, 148</td>
<td></td>
</tr>
<tr>
<td>bronchodilators, 53, 153-154</td>
<td></td>
</tr>
<tr>
<td>buccally administering drugs, 70</td>
<td></td>
</tr>
<tr>
<td>buccals/sublinguals, oral medication administration, 100</td>
<td></td>
</tr>
<tr>
<td>bursae, role in musculoskeletal system, 212</td>
<td></td>
</tr>
</tbody>
</table>
C
C (option), answering questions, 15
CAD (Coronary Artery Disease), 122
calcium
calcium ion antagonists, hypertension and, 125
estrogen and calcium storage, 212
hypertension, 126
Cancer
adenocarcinomas, 277
age and, 279
alopecia, 279
carcinogenesis, 276-277
carcinoma in situ, 282
carcinomas, 277
common sites for, 277
drug therapy
age and, 279
alkylating agents, 279-280
anti-infectives, 279
antiemetics, 279
antimetabolites, 280-281
antineoplastic drugs, 278-282
chemotherapeutic agents, 279
cytoprotective agents, 279
mitotic inhibitors, 281
erthroleukemia, 277
gliomas, 277
hormones and, 282-283
leukemia, 277, 281
leukopenia, 279
lung cancer, 149
lymphomas, 277
malignancy, defining, 276
melanomas, 277
metastasis, 276
myelomas, 277
myeloblastic disease, 279
respiratory system, upper respiratory tract, 149
risks for developing, 276
sarcomas, 277, 282
signs/symptoms of, 278
stomatitis, 279
thrombocytopenia, 279
tumors (malignant neoplasms), 276
carcinoma in situ, 282
drug therapy, 281
sarcomas, 282
capillaries, 121
caplets, 68
capsules, 68
carbon dioxide
cardiovascular system, role in, 119
respiratory system, role in, 145
carcinogenesis, 276-277
carcinomas, 277, 282
cardiac arrest, 56, 123
cardiac/heart muscle, role in cardiovascular system, 120
cardiologists, 121
cardiomegaly, 133
cardiotoxic drugs, 134
cardiovascular system, 138
disorders
angina, 123, 128-130
arrhythmia, 131-133
arteriosclerosis
obliterans, 135
atherosclerosis, 122-123
bradycardia, 131
CAD, 122
cardiac arrest, 123
cardiomegaly, 133
congestive heart failure, 133-134
controllable factors, 122
DVT, 135-136
dysrhythmia, 131
embolus, 123
heart attacks, 123
heart murmur, 134
hyperlipidemia, 123-124
hypertension, 124-128
hypotension, 126
hypoxia, 133
infarct, 123
ischemia, 123
left-sided heart failure, 133
MI, 123
peripheral edema, 134
pitting edema, 134
pulmonary edema, 133
PVD, 134-137
Raynaud’s disease, 135
right-sided heart failure, 134
tachycardia, 131
thrombus, 123
uncontrollable factors, 122
valvular heart disease, 133
function of, 119-121
structure of, 119-121
caring, characteristics of Medication Aides, 39
carotid bodies, role in respiratory system, 145
carotid pulse, 120
carpals and tarsals, 210
cartilage, 211-212
cataracts, 264
catatonia, schizophrenia and, 295
CDC (Center for Disease Control), medication administration, 81
central hearing loss, 268
cephalosporins, 187-188
cerebellum, 224
cerebral cortex, 224
cerebral edema, urinary retention, 203
cerebrum, 224
cerumen (wax), ears and, 268-270
chalzion, 266

How can we make this index more useful? Email us at indexes@quepublishing.com

From the Library of Scott Kruse
checklists (performance), medication administration skills, 333-335
chemical name (drugs), 52
chemotherapeutic agents, 279
chicken pox (varicella), 196
cholesterol, 123
cholinergics, ANS and, 226, 230-231
chorea, 247
choriocarcinomas, 281
chronic bronchitis, 148
chronic pain, 238
chronic sinusitis, 146
chime, role in digestive system, 158
circulatory system. See cardiovascular system
circumduction, 212
cirrhosis, 281
civil lawsuits, 44
classifying drugs, 52-53
clearance (creatinine), role in urinary system, 194
civil lawsuits, 44
client identification, medication administration, 94
clostridium perfringens, 176
CNA (Certified Nursing Assistants/Nurse Aides), responsibilities of, 33
CNS (Central Nervous System), 224-225
CO (Cardiac Output), 123
cochleas (ears), 268
code of ethics, 46
COGME (Council on Graduate Medical Education), building safer healthcare systems, 348
cognitive limitations, medication administration and, 82
comfort (client), medication administration, 112
communication (medication administration)
noncommunicative clients, 111
  verbal communication, 38-39
  written communication, 39
competence, medical-error prevention, 37
conductive activity (heart), 121
conductive hearing loss, 268
confidentiality, Resident’s Bill of Rights, 43
congestion (stuffy nose), 146
congestive heart failure, 133-134
conjugata, 264
conjecturitis (pink eye), 266
conscientiousness, characteristics of Medication Aides, 40
constipation
  antacids and, 161
  laxatives, 168-169
constructive criticism, handling, 41
contraindications, 56
Controlled Substance Act (1970), diversion, 42
COPD (Chronic Obstructive Pulmonary Disease), bronchodilators and, 154
corneas, 264
coronary arteries, 121
corticosteroids, 53
gout treatment, 216-217
intranasal corticosteroids, 151-152
cough reflex, role in respiratory system, 146
CPR (Cardiopulmonary Resuscitation), 123
creams, drugs as, 71
creatinine clearance, role in urinary system, 194
cretins, symptoms/signs of, 253-254
criticism/feedback, handling, 41
CSF (Cerebrospinal Fluid), 224
cycloplegic agents, 265
cystitis, 196
cytoprotective agents, cancer and, 279
deoxygenated blood, role in cardiovascular system, 119
decimals, arithmetic review, 337
changing fractions to decimals, 338
multiplying decimals by decimals, 339
decongestants, 53, 150-151
defibrillation, 123
dehydration, 126
degraded tasks, Medication Aides and accountability, 36
degraded, RN as, 35
delusions, 294
dependability, characteristics of Medication Aides, 40
depression, 290
  age and, 291
drug therapy
  antidepressants, 292-293
  MAOI, 291-293
  SSRI, 291-293
  TCA, 291-293
  signs/symptoms of, 291
  suicidal ideation, 291
diabetes
  antidiabetic agents, 52
  complications from, 256-257
  DKA, 256
  drug therapy, 257-258
  HHSN, 256
  sulfonylureas agents, 258
  symptoms/signs of, 256
  TZD antibiotic agents, 258
diagnostic errors, the healthcare system and, 344
diaphragm, role in respiratory system, 145
diarrhea
  antacids and, 161
  antidiarrheals, 167-168
diastolic phase (heart), 120
diastolic pressure (heart), 121
diffusion, role in respiratory system, 145

From the Library of Scott Kruse
digestive enzymes, role in digestive system, 158
digestive system
  alimentary canal, 158
  bowels
    antidiarrheals, 167-168
    laxatives, 168-169
  function of, 158
  GI tract disorders
    antacids, 160-161
    antispasmodics, 165
    eructation (belching), 158
    flatulence (passing gas), 159
    GERD, 159
    H pylori, 160
    heartburn, 158
    PUD, 158-160
    reflux, 158
    stress ulcers (acute ulcers), 160
  histamine-2 antagonists, 161-162
  large intestine, 158
  peristalsis, 158
  rectum, 158
  small intestine, 158
  stomach
    amino acids, 158
    antiemetics, 166-167
    chyme, 158
    digestive enzymes, 158
    gastric juices, 158
    hyperemesis, 166
    lavage (gastric), 166
    PPI, 163-164
    prostaglandins, 163
    structure of, 158
  diplopia (double vision), 265
disease carriers and infections, 180
disposing of drugs, 67
distal end (large intestine), 158
diuretics, 53
  hypertension, 125
  Lasix, 203
  loop diuretics, 203
  potassium-sparing diuretics, 204
  thiazide diuretics, 203-204
  urinary retention, 203-204
diversion (theft), ethical/legal issues, 41-42
DKA (Diabetic Ketoacidosis), 256
DM (Diabetes Mellitus), 254-255
  complications from, 256-257
  DKA, 256
  drug therapy, 257-258
  HHSN, 256
  sulfonylurea agents, 258
  symptoms/signs of, 256
  TZD antihyperglycemic agents, 258
documentation, medication administration, 113
dopamine agonists, treatment of Parkinson’s disease, 247
dopaminergic agents, ANS and, 227
dormant viruses and infections, 181
dorsal root (PNS), 225
doses
  calculating, 339
  defining, 53
double vision (diplopia), 265
drugs
  absorption/distribution of, 55
  actions of, 53
  additive effect, defining, 54
  administering
    buccally, 70
    ear drops, 71
    eye drops, 71
    inhaling, 71
    intra-arterially, 72
    intracardially, 72
    intradermally, 71
    intramuscularly, 72
    intranasally, 72
    intravenously, 72
  nose drops, 71
  orally, 70
  parenterally, 71
  subcutaneously, 72
  sublingually, 70
  topically, 71, 104-105, 184-185
  transdermally, 71
ADR, 55
allergic reactions, 55
antagonist effect, defining, 54
classifying, 52-53
contraindications, 56
defining, 52
disposing of, 67
doses, defining, 53
drug order, defining, 53
effectiveness of, 54
food and, 55
forms of
  caplets, 68
  capsules, 68
  creams, 71
  elixirs, 69
  liniments, 71
  liquids, 69
  lotions, 69-71
  lozenges/troches, 69
  ointments, 69-71
  pastes, 69
  powders/granules, 68
  solutions, 69
  suppositories, 69
  suspensions, 70
  syrups, 70
  tablets, 68
  tinctures, 69
  idiosyncratic effect, defining, 54
  implications of, 53
  indications, defining, 53
  information sources, 57
  interactions, 55
  labels, 65-66
measurements, metric system equivalents table, 67
metabolism and, 54
naming, 52
narcotics sheets, 67
ordering clarifying orders, 63
components of an order, 62
confusion and, 63
dangerous terms/abbreviations table, 64-65
key terms/abbreviations table, 63-64
one-time drug orders, 62
PRN drug orders, 62
STAT drug orders, 62
TO, 62
VO, 62
overdoses, 55
packaging, 66
paradoxical effect, defining, 54
pharmacology, defining, 52
pharmacotherapeutics, defining, 52
placebo effect, defining, 54
potentiate effects, defining, 54
precautions, 56
receptor sites, multiple drugs using the same sites, 55
Schedule II drugs, diversion of, 42
side effects, 55-56
storing, 66-67
therapeutic effects, defining, 52-53
tolerance, defining, 54
toxicity, 55
duodenum, role in digestive system, 158
dura mater, 224
duties of Medication Aides, 34
DVT (Deep Vein Thrombosis), 135-136
dysphagia, GERD and, 159
dyspnea, 146-148
dysrhythmia, 131
dysuria, 196, 201
dysuria, 196-201
edema, 146
cerebral edema, urinary retention, 203
peripheral edema, 134
pitting edema, 134
pulmonary edema, 133, 203
EKG (Electrocardiograms), 121, 131
elastic cartilage, 212
electrocardiographs, 121
elimination, process of (answering questions), 15
elixirs, 69
embolus, 123
emesis (vomit), GI bleeding, 242
emotions and the nervous system
mental disorders
antipsychotic agents, 295-296
anxiety, 288-290
bipolar disorder, 294
delusions, 294
depression, 290-293
hallucinations, 294
mood disorders, 290-294
paranoia, 290, 294
psychoses, 294-296
schizophrenia, 295-296
mental illness, defining, 288
neurohormonal agents, 288
serotonin, 288, 292
empathy, characteristics of Medication Aides, 40
emphysema, 149
endocardium (heart), 120
endochondral ossification, cartilage and, 211
endocrine system
function of, 252
structure of, 252
thyroid diseases
DM, 254-258
Grave's disease, 253
hyperthyroidism, 252-253
From the Library of Scott Kruse
myxedema, 253-254
thyroid-replacement hormones, 254

enzyme blockers,
hypertension, 125
enzymes (digestive), role in digestive system, 158
epicardium (heart), 120
epiglottis, role in respiratory system, 144
EPS (Extrapyramidal Side Effects), antipsychotic agents and, 295
equilibrium
  brain and, 224
ears and, 268
errors (medical)
  contributing factors of, 343
  costs of, 343
  diagnostic errors, 344
  error prevention policies (medical), 37
  systems, processes and conditions, 345
eructation (belching), 158
erythroleukemia, 277
erythropoiesis, 195
erythropoietin, 195
Escherichia coli. See E.coli (Escherichia coli)
esophagitis, GERD and, 159
estrogen, 212

ethical/legal issues, 35
  abuse, 41
    libel, 44
    mental abuse, 44
    physical abuse, 44
    reporting, 45
    sexual abuse, 45
    sexual harassment, 45
  signs of, 45
  slander, 44
  aiding and abetting, 41
  assault, 41
  battery, 41
  diversion (theft), 41
  false imprisonment, 41
  invasion of privacy, 41-43
  involuntary seclusion, 41
  lawsuits, 46
  malpractice, 46
  medical liability, 36
  negligence, 41, 46
  offensive language, 46
  profanity, 46
  romantic language, 46
  suggestive language, 46
  theft (diversion), 41
  torts, 44
  values, 46
  veracity, 45
euphoria, bipolar disorder, 294
Eustachian tubes (ears), 268
euthanasia, ethics and, 46

examination, 213

exams
  practice exams
    answers, 311-315,
      327-331
    questions, 301-310,
      317-325
  testing strategies
    answering questions, 14-15
    Cram Sheet, 13
    Exam Alerts, 13
    last-minute crises, 16
    positive attitude, 15
    practice questions, 13
    relaxation, 15
    reviewing materials, 13
    self-assessments, 16
exophthalmos, 253

expectorants
  lower respiratory tract illness, treating, 152
  pneumonia treatments, 148
  respiratory system, role in, 144
expiration, role in respiratory system, 144

extension, 212
external auditory meatus, ears and, 268
external otitis (Swimmer’s ear), 269
external rotation, 212
exudating fluid, respiratory system, 147

eyes
  acrochordons, 264
  aging’s effects on, 264-265
  analgesics, 265
  anti-infectives, 265
  arcus senilis, 264
  cataracts, 264
  chalazion, 266
  choroid, 264
  conjunctiva, 264
  corneas, 264
  cycloplegic agents, 265
  diplopia (double vision), 265
  double vision (diplopia), 265
  exophthalmos, 253
  eye drops, 71
  farsightedness (presbyopia), 264
  floaters, 265
  function of, 264
  glaucoma, 265
  infections
    blepharitis, 266
    conjunctivitis (pink eye), 266
    hordeolum, 266
    medications for treatment, 266-267
    stys, 266
    IOP, 265
    irises, 264
    lacrimal ducts, 264
    medication administration, 102-103
    miotic drugs, 265
    mydriatics, 265
    oculogyric crises, Parkinson’s disease and, 246

How can we make this index more useful? Email us at indexes@quepublishing.com
ophthalmic drugs, 265
optic nerves, 264
photophobia, 266
presbyopia
(farsightedness), 264
refraction, 265
retinas, 264
retinopathy, 256
sclera, 264
sebaceous (oil) glands, 266
structure of, 264
vitreous humor, 264-265

F

function of
CNA, 33
LPN, 33
Medication Aides, 32

treatment
legal limitations, 35
medical liability, 36
PCA, 33
PCT, 33
RN, 33
state regulatory agencies, 32
UAP, 33
fungicidal (antifungal) agents,
184-186
Furandantin, UTI treatments, 201

gas, passing (flatulence), 159
gastric juices, role in digestive
system, 158
generic name (drugs), 52
GERD (Gastroesophageal Reflux Disease), 159
germs, 176, 183
GI (Gastrointestinal) tract
antispasmodics, 165
bleeding, 242
digestive system, role in, 158
EC tablets, 68
eructation (belching), 158
flatulence (passing gas), 159
GERD, 159
H pylori, 160
heartburn, 158
PUD, 158-160
reflux, 158
stress ulcers (acute ulcers), 160
ulcers, antacids, 160-161
glaucoma, 203, 265
gliomas, 277
gloves, medication
administration, 95
glycosuria, 195
gout, 282
gouty arthritis, 219
joint degeneration, 216
kidney stones, 216
purines, 215
tophi, 216
treatment
corticosteroids, 216-217
NSAID, 218-219
uric acid, 215
uricemia, 216
grandeur, delusions of, 294
granules/powders, 68
Grave’s disease, 253
grey matter (cerebrum), 224
grouping drugs. See classifying
drugs
gualefensin (Robitussin), treating
lower respiratory tract
illness, 152
guides (usage)
herbals, 341
minerals, 342
vitamins, 342

H

H pylori (Helicobacter
pylori), 160
HAI (Healthcare-Associated
Infections), 180, 195
halitosis, GERD and, 159
hallucinations, 87, 294
hand washing, medication
administration, 80, 94
harassment (sexual),
ethical/legal issues, 45
HBV (Hepatitis B Virus), medica-
tion administration, 81
HDL (High-Density
Lipoproteins), 123
healthcare system
building safer systems, 343
AHRQ action plan, 347
COGME, 348
homeostasis

enforcing performance standards, 346
improvement strategies, 345
IOM findings, 344-347
Leapfrog Group, 348
NACNEP, 348
NASHP, 348
nationwide reporting systems, 346
safety systems, 347
To Err is Human: Building a Safer Health System, 349
medical errors contributing factors of, 343
costs of, 343
diagnostic errors, 344
systems, processes and conditions, 345

hearing
hearing loss, 268
ototoxic drugs, 186

heart
angina, 128-130
ANS and, 121
aortic valves, 120
arrhythmia, 131-133
arteries
aortic arteries, 121
arterioles, 121
coronary arteries, 121
stenosis, 125
atherosclerosis, 123
atria, 120
bradycardia, 120, 131
cardiac arrest, 123
cardiac output, 123
cardiologists, 121
cardiomegaly, 133
cardiotonic drugs, 134
cardiovascular system, role in, 119-120
cholesterol, 123
conductive activity, 121
congestive heart failure, 133-134
CPR, 123
defibrillation, 123
diastolic phase, 120
diastolic pressure, 121
dysrhythmia, 131
ECG, 121, 131
EKG, 121, 131
electrocardiographs, 121
embolus, 123
endocardium, 120
epicardium, 120
HDL, 123
heart attacks, 123
heartburn, 158
hyperlipidemia
antihyperlipidemic drugs, 123
antilipidemic drugs, 124
statin drugs, 123
hypertension
antihypertensive drugs, 126-128
HTN (primary hypertension), 124-126
hypotension, 126
hypoxia, 133
intracardially administering drugs, 72
LDL, 123
left-sided heart failure, 133
lipids, 123
MI, 123
mitral valves, 120
murmur, 134
myocardium, 120
nodes, 121
pulmonic valves, 120
pulse, 120
PVD, 134
antiplatelet agents, 136-137
arteriosclerosis obliterans, 135
DVT, 135-136
Reynaud's disease, 135
thromboembolic diseases, 136
right-sided heart failure, 134
septa, 120
sphygmomanometer, 121
systolic phase, 120
systolic pressure, 121
tachycardia, 120, 131
thrombus, 123
tricuspid valves, 120
valvular heart disease, 133
ventricles, 120

help, testing strategies
answering questions, 14-15
Cram Sheet, 13
Exam Alerts, 13
last-minute crises, 16
positive attitude, 15
practice questions, 13
relaxation, 15
reviewing materials, 13
self-assessments, 16

hematopoiesis, 211
hemiparesis, medication administration, 110
hemophysis, lung cancer and, 149
Hepatitis B, 180
Hepatitis C, 181
hepatomegaly, 134
hepatotoxicity, 55, 186
herbals, 53, 341
herpes, 181
HHNS (Hyperosmolar Hyperglycemic Nonketotic Syndrome), 256
histamines
histamine-2 antagonists, 161-162
role in respiratory system, 146
HIV (Human Immunodeficiency Virus), 182
hives, 55
homeostasis, 120, 225

How can we make this index more useful? Email us at indexes@quepublishing.com

From the Library of Scott Kruse
honesty (truthfulness), characteristics of Medication Aides, 39
hordeolum, 266
hormones
  aldosterone, 125
  androgen (male hormones), 282
cancer and, 276, 282-283
endocrine system, function in, 252
estrogen, 212
gonadotropic hormones (sex hormones), 282
HRT, 276
insulin, DM, 254, 257
thyroid-replacement hormones, 254
trophic hormones, endocrine system and, 252
urinary system
  ADH, 194
  aldosterone, 194
erthropoietin, 195
hosts, role in infections, 176
HRT (Hormone Replacement Therapy), cancer and, 276
HTN (hypertension), urinary system, 194
humerus, 210
hyaline cartilage, 211
hygiene (hands), medication administration, 80
hyperemesis, 166
hyperglycemia, 195
defining, 55
symptoms/signs of, 255
hyperlipidemia
  antihyperlipidemic drugs, 123
antilipidemic drugs, 124
statin drugs, 123
hyperpnea, asthma and, 148
hypertension, 121
  antihypertensive drugs, 126-128
HTN (primary hypertension), 124-126
pulmonary hypertension, 149
hyperthyroidism, 252-253
hypertonia, 213
hypnotics/sedatives, 53
hypocalcemia, 195
hypoglycemia, 257
hypokalemia, 203
hypotension, 211, 126
hypothalamus (cerebrum), 224
hypoxia, 133, 149
idiosyncratic effect (drugs), defining, 54
ilium, role in digestive system, 158
illness, pain’s relationship to, 237
immunity and infections, 176
  active immunity, 177
  acquired immunity, 196
  immunization process, 177
  inoculation, 177
  passive immunity, 177, 196
immunocompromised clients and infections, 179
immunosuppressive therapy, pneumonia and, 147
imprisonment (false), ethical/legal issues, 41
incident reports, medical-error prevention, 37
incus bones (ears), 268
indications (drugs), defining, 53
infarct, 123
infections
  acute infections, 146
  AIDS, 182
  anti-infective agents, 52, 186
  antimicrobial agents, 183-184
  antitubercular agents, 187
  antiviral agents, 186
  bacteremia, 187
  cephalosporins, 187-188
  clostridium perfringens, 176
disease carriers, 180
dormant viruses, 181
E.coli, 176
environmental conditions for, 176
germs, 176, 183
HAI, 180, 195
Hepatitis B, 180
Hepatitis C, 181
herpes, 181
hosts, 176
immunity, 176-177
immunocompromised clients, 179
local infections, 178
macrolides, 189
meningitis, 183
microbes, 176
normal flora, 176
older clients and, 179
osteomyelitis, 187
pancreatitis, 186
pathogens, 176
quinolones, 189
recovering from, 179
resistance, 183
septicemia, 183
signs/symptoms of, 178
staph infections, 180
sulfonamides, 189
superinfections, 183
systemic antifungal agents, 186
systemic infections, 178
TB (tuberculosis), 181, 187
tetracyclines, 189
topical antifungal (fungicidal) agents, 71, 104-105, 184-185
urinary tract infection (UTI), 183
  antibiotics, 196-201
  antimicrobial agents, 196
  antiseptic effect, 196
anuria, 196
BPH, 195
cystitis, 196
drug therapy, 196-201
dysuria, 196, 201
E. coli, 196
Furandantin, 201
Macrodantin, 201
Mandelamine, 201
oliguria, 196
pathogens, 196
penicillins, 197-198
prostatitis, 195
pyelonephritis, 196
pyuria, 196
quinoles, 200-201
signs/symptoms of, 196
sulfa drugs, 198-199
tetracyclines, 199-200
urethritis, 196
urosepsis/uricemia, 196
wound infections, 183
information sources, drugs, 57
inhaling, administering drugs via, 71
inoculation and infections, 177
inspiration, role in respiratory system, 144
insulin, DM, 254, 257
intercostal muscles, role in respiratory system, 145
intercostal nerves, role in respiratory system, 145
intermittent pain, 236
internal rotation, 212
intestines, 158
intra-arterially administering drugs, 72
intradurally administering drugs, 72
intradermally administering drugs, 72
intramuscularly administering drugs, 72
intranasal corticosteroids, treating upper respiratory tract illness, 151-152
intraosseously administering drugs, 72
intrathecally administering drugs, 72
intravascularly administering drugs, 72
invasion of privacy (ethical/legal issues), 41-43
inversion, 213
involuntary seclusion (ethical/legal issues), 41
IOM (Institute of Medicine), building safer healthcare systems, 344-347
IOP (Intraocular Pressure), 265
irises, 264
irregular bones, 210
ischemia, 123
IV (Intravenous) therapy, 72
labels (drugs), 65-66
labyrinthitis, 268
lacrimal ducts, 264
lactic acid, muscle spasms, 213
language (ethical/legal issues), 46
large intestine, role in digestive system, 158
larynx (voice box), role in respiratory system, 144
Lasix, 203
last-minute crises, avoiding (testing strategies), 16
lavage (gastric), 166
lawsuits, 44-46
laxatives, 53, 168-169
LDL (Low-Density Lipoproteins), 123
Leapfrog Group, building safer healthcare systems, 348
left-sided heart failure, 133
legal/ethical issues, 35
abuse, 41
libel, 44
mental abuse, 44
physical abuse, 44
reporting, 45
sexual abuse, 45
sexual harassment, 45
signs of, 45
slander, 44
aiding and abetting, 41
assault, 41
battery, 41
diversion (theft), 41
false imprisonment, 41
invasion of privacy, 41-43
involuntary seclusion, 41
lawsuits, 46
malpractice, 46
medical liability, 36
negligence, 41, 46
offensive language, 46
profanity, 46
romantic language, 46
suggestive language, 46

How can we make this index more useful? Email us at indexes@quepublishing.com

From the Library of Scott Kruse
theft (diversion), 41
torts, 44
values, 46
veracity, 45

leukemia, 277, 281
leukocytes and immunity from infection, 177
leukopenia, cancer and, 279
liability (medical), 36
libel (ethical/legal issues), 44
ligaments, role in musculoskeletal system, 212
liniments, drugs as, 71
lipids, 123
liquids
drugs as, 69
oral medication administration, 98-99

liver
acetaminophen and liver damage, 244
hepatom注algy, 134
lobes (lungs), role in respiratory system, 145
local infections, 178
long bones, 210
loop diuretics, 203
lotions, drugs as, 69-71
lower respiratory tract
COPD, 154
drug therapy
antitussives, 152
bronchodilators, 153-154
expectorants, 152
guaifenesin (Robitussin), 152
SSKI (potassium iodide), 152
lozenges/troches, 69, 99-100
LPN (Licensed Practical Nurses), role/responsibilities of, 33
lumen (arteries), 122

lungs
asthma, 148
atelectasis, 147
bronchitis, 148
cancer, 149
emphysema, 149
peripheral edema, 134
pitting edema, 134
pneumonia, 146
antibiotics, 148
antitussives, 148
aspiration pneumonia, 147
classifications of, 147
effects of, 147
expectorants, 148
immunosuppressive therapy, 147
mucolytic agents, 148
pneumococcal pneumonia, 147
primary pneumonia, 147
secondary pneumonia, 147
symptoms of, 148
treatment of, 148
viral pneumonia, 147
vomitus, 147
pulmonary circulation, 119
pulmonary edema, 133
respiratory system expiration, 144
inspiration, 144
lobes, 145
perfusion, 145
ventilation, 145
lymphatic system, role in cardiovascular system, 12
lymphomas, 277
lyse, 213

M
MA-C (Medication Assistant-Certified), 32
MACE (Medication Aide Certification Exam), testing strategies
answering questions, 14-15
Cram Sheet, 13
Exam Alerts, 13
last-minute crises, 16
positive attitude, 15
practice questions, 13
relaxation, 15
reviewing materials, 13
self-assessments, 16
Macrodantin, UTI treatments, 201
macrolides, 189
main stem bronchi, role in respiratory system, 145
male hormones (androgen), 282
malignancy, cancer as, 276
malignant neoplasms (tumors), 276
carcinoma in situ, 282
drug therapy, 281
sarcomas, 282
malleus bones (ears), 268
malpractice, 46
Mandelamine, UTI treatments, 201
mandible, 210
MAOI (Monoamine Oxidase Inhibitors), 291-293
MAR (Medication Administration Record), 39

math review
decimals, 337
changing fractions to decimals, 338
multiplying decimals by decimals, 339
doses, calculating, 339
fractions, 337-338
metrics
conversions, 338
weights and measures table, 337
maxilla, 210
medical asepsis, medication administration, 80-81
medical errors
contributing factors of, 343
costs of, 343
diagnostic errors, 344
systems, processes and conditions, 345

From the Library of Scott Kruse
**medical liability, 36**

**medical-error prevention policies, 37**

**medication administration**
- accuracy of medications, assuring, 78
- age and, 108
- aphasic clients, 110
- blood-borne pathogens, 81
- CDC, 81

**clients**
- identification, 94
- physical limitations, 109-110
- cognitive limitations, 82

**communication**
- verbal, 38-39
- written, 39

**ears**, 104

**errors, causes and reporting of**, 87-88

**eyes**, 102-103

**gloves**, 95

**hand hygiene**, 80

**hand washing**, 94

**HBV**, 81

**hemiparalysis**, 110

**medical asepsis**, 80-81

**medication skills performance checklist**, 333-335

**medicine cups**, 80

**mental preparation**, 79-80

**noncommunicative clients**, 111

**nose**
- nasal inhalation, 102
- nasal instillation, 101-102

**oral**, 333-335
- liquids, 98-99
- lozenges/troches, 99-100
- powders, 99
- solids, 96-98
- sublinguals/buccals, 100

**order of**, 82

**OSHA**, 81

**physical impairments**, 82

**physical preparation**, 79-80

**positioning clients**, 95

**post-administrative procedures**
- client comfort, 112
- client environment, 112
- right documentation, 113

**PPE**, 80

**procedures, explaining to clients**, 95

**rectal application**, 107-109

**refusal to take medication**, 110

**rights of medication administration**, 37
- right documentation, 86-87
- right dose, 85
- right drug, 83
- right resident, 84
- right route, 84
- right time, 85-86

**safety checks**, 82

**souffle cups**, 79-80

**swallowing difficulties**, 81-82

**therapeutic relationships**, 111

**topicals, transdermal installations**, 71, 104-105, 184-185

**vaginal application**, 106-107

**workstation preparation**, 79

**Medication Aides**

**characteristics of**
- accountability, 36, 40
- being a team player, 41
- caring, 39
- conscientiousness, 40
- dependability, 40
- empathy, 40
- flexibility, 40
- honesty (truthfulness), 39
- respect, 40

**self-responsibility**, 40

**working well with others**, 41

**criticism/feedback, handling**, 41

**delegated tasks**, 36

**duties of**, 34

**job description per NCSBN**, 33-34

**MA-Cn designation**, 32

**Medication administration**, 36-37
- verbal communication, 38-39
- written communication, 39

**medication-error prevention policies**, 37

**responsibilities of**, 35-36

**role of**, 35-36

**medicine cups, medication administration**, 80

**medulla oblongata**, 225

**melanomas**, 277

**meningitis**, 183

**menopause, estrogen and**, 212

**mental abuse (ethical/legal issues)**, 44

**mental health**
- antidepressants, 292-293
- antipsychotic agents, 295-296

**anxiety**
- anxiolytics, 290
- benzodiazepines, 289
- paranoia, 290
- signs/symptoms of, 288-289
- tranquilizers, 289
- bipolar disorder, 294
- delusions, 294
- depression, 290
- age and, 291
- drug therapy, 291-293
- signs/symptoms of, 291
- suicidal ideation, 291
- drug therapy
- anxiolytics, 290

*How can we make this index more useful? Email us at indexes@quepublishing.com*

From the Library of Scott Kruse
mental health

- benzodiazepines, 289
- bipolar disorder, 294
- mood disorders, 291-293
- schizophrenia, 295-296
- tranquilizers, 289
- hallucinations, 294
- MAOI, 291-293
- mental illness, defining, 288
- mood disorders, 290-294
- nervous system and emotions, 288, 292
- neurohormonal agents, 288
- paranoia, 294
- psychoses, 294-296
- schizophrenia, 295-296
- serotonin and, 288, 292
- SSRI, 291-293
- TCA, 291-293
- metabolic diseases. See gout
- metabolism, factors influencing drug effectiveness, 54
- metastasis, cancer and, 276
- metric system
  - conversions, arithmetic review, 338
  - drug measurements table, 67
  - weights and measures table, 337
- MI (Myocardial Infarction), 123
- microbes
  - aerobic microbes, 176
  - anaerobic microbes, 176
  - antimicrobial agents, 183-184
- micturition, role in urinary system, 194
- midbrain, 225
- middle ear infection (otitis media), 146
- minerals, usage guide, 342
- miotic drugs, 265
- mitotic inhibitors, cancer and, 281
- mitral valves (heart), 120
- Model Nurse Practice Act, 32
- mood disorders
  - bipolar disorder, 294
  - depression, 290
  - age and, 291
  - drug therapy, 291-293
  - signs/symptoms of, 291
  - suicidal ideation, 291
- mucolytic agents, pneumonia treatments, 148
- mucus, role in respiratory system, 145
- multiplying decimals by decimals (arithmetic review), 339
- murmur (heart), 134
- muscles
  - abduction, 212
  - abductor muscles, role in musculoskeletal system, 210
  - accessory muscles and emphysema, 149
  - adduction, 213
  - akinesia, 245
  - cardiac/heart muscle, role in cardiovascular system, 120
  - circumduction, 212
  - eversion, 213
  - extension, 212
  - external rotation, 212
  - flexion, 212
  - flexor muscles, role in musculoskeletal system, 210
  - hypertension, 213
  - intercostal muscles, role in respiratory system, 145
  - internal rotation, 212
  - inversion, 213
  - pronation, 213
  - protraction, 213
  - relaxants, 214
  - retraction, 213
  - skeletal muscles, role in musculoskeletal system, 210
  - spasms, 213-214
  - spasticity, 213
  - striations, 210
  - supination, 213
  - voluntary muscles, role in musculoskeletal system, 210
- musculoskeletal system
  - abductor muscles, 210
  - bones
    - bone resorption inhibitors, 215
    - classifying, 210-211
    - estrogen and calcium storage, 212
    - fractures, 215
    - osteoporosis, 215
    - skeletal density, 212
    - bursae, 212
    - cartilage, 211-212
    - corticosteroids and, 216-217
  - disorders of
    - gout, 215-219
    - muscle spasms, 213
    - muscle spasticity, 213
    - osteoporosis, 215
  - flexion, 210
  - flexor muscles, 210
  - function of, 210-213
  - joints, 210-212
  - ligaments, 212
  - muscles
    - abduction, 212
    - adduction, 213
    - circumduction, 212
    - eversion, 213
    - extension, 212
    - external rotation, 212
    - flexion, 212
    - internal rotation, 212
    - inversion, 213
    - pronation, 213
    - protraction, 213
    - relaxants, 214
    - retraction, 213
    - supination, 213
  - NSAID and, 218-219
  - skeletal muscles, 210
  - striations, 210
  - structure of, 210-213
  - tendons, 212
  - voluntary muscles, 210
mydriatics, 265
myelomas, 277
myeloblastic disease, cancer and, 279
myocardium (heart), 120
myxedema, 253-254

N
N & V (nausea and vomiting), 55
NACNEP (National Advisory Council on Nurse Education and Practice), building safer healthcare system, 348
naming drugs, 52
narcotic sheets and drug storage, 67
nasal inhalation (medication administration), 102
nasal instillation (medication administration), 101-102
Nasalcrom, treating upper respiratory tract illness, 151
NASHP (National Academy for State Health Policy), building safer healthcare systems, 348
nausea
antiemetics, 166-167
N & V, 55
NCSBN (National Council of State Boards of Nursing), 32-34
negligence (ethical/legal issues), 41, 46
neoplasms
benign neoplasms, 276
malignant neoplasms (tumors), 276
carcinoma in situ, 282
drug therapy, 281
sarcomas, 282
nephrons (kidneys), role in urinary system, 194
nephrotoxicity, 55, 186
nerves
intercostal nerves, role in respiratory system, 145
optic nerves, 264
nervous system
acetylcholine, 226
adrenergic agents and ANS, 226-227
adrenergic catecholamine, 225
alpha adrenergic blocking agents and ANS, 227-230
Alzheimer's disease, drug therapy, 244-245
analgesics and ANS, 235

NSAID, 241
opiates and opiate-like drugs, 243
salicylates, 242
ANS
adrenergic agents, 226-227
alpha adrenergic blocking agents, 227-230
analgesics, 235, 238-243
anticholinergics, 231-232
barbiturates, 232-233
benzodiazepines, 233-234
beta adrenergic blocking agents, 227-230
cholinergics, 226, 230-231
dopaminergic agents, 227
nonbarbiturates, 234-235
nonbenzodiazepines, 234-235
parasympathetic nervous system, 226
sedative-hypnotic drugs, 232-235
SNS, 225
anticholinergics and ANS, 231-232
barbiturates and ANS, 232-233
benzodiazepines and ANS, 233-234
beta adrenergic blocking agents and ANS, 227-230
cholinergics and ANS, 226, 230-231
CNS, 224-225
dopaminergic agents and ANS, 227
emotions and mental disorders
antipsychotic agents, 295-296
anxiety, 288-290
bipolar disorder, 294
delusions, 294
depression, 290-293
hallucinations, 294
mental illness, 288
mood disorders, 290-294
neurohormonal agents, 288
paranoia, 290, 294
psychoses, 294-296
schizophrenia, 295-296
serotonin, 288, 292
function of, 224-226
homeostasis, 225
neuropathy, 257
nonbarbiturates and ANS, 234-235
nonbenzodiazepines and ANS, 234-235
norepinephrine, 225
parasympathetic nervous system, 226
Parkinson's disease, 245-247
PNS, 225-230
sedative-hypnotic drugs and ANS, 232-235
SNS, 225
structure of, 224-226
sympathomimetics, 225
neurohormonal agents, nervous system and emotions, 288
neuron cell bodies (cerebrum), 224
neuropathy, 257
neutrophils and immunity from infection, 177
nitrates, 129-130
nitroglycerin, angina and, 129
Nocturia, 134

How can we make this index more useful? Email us at indexes@quepublishing.com

From the Library of Scott Kruse
nodes (heart), 121
nonbarbiturates, ANS and, 234-235
nonbenzodiazepines, ANS and, 234-235
noncommunicative clients, medication administration, 111
nonmaleficence, 45
norepinephrine, 126, 225
normal flora, role in infections, 176
nose
  congestion (stuffy nose), 146
  edema, 146
nasal inhalation, medication administration, 102
nasal instillation, medication administration, 101-102
nose drops, 71
rhinitis, 146
rhinorrhea, 146
septum, 146
sinusitis, 146
turbines, 146, 150
NSAID (Nonsteroidal Anti-Inflammatory Agents), 53, 218-219, 241
Nurse Practice Act, 32
nursing process, RN and, 35

O
OAB (Overactive Bladder), 202
obese clients, GERD and, 159
ocular/ophthalmic (eyes) instillation (medication administration), 102-103
oculogyric crises, Parkinson’s disease and, 246
offensive language (ethical/legal issues), 46
oil (sebaceous) glands, eyes and, 266
ointments, drugs as, 69-71
oliguria, 196
ombudsmen committees, 45
one-time drug orders, 62
ophthalmic drugs, 265
ophthalmic/ocular (eyes) instillation (medication administration), 102-103
opiate analgesics, 238-243
opposite options (answering questions), 15
optic nerves, 264
option C (answering questions), 15
oral medication administration, 70, 333-335
  liquids, 98-99
  lozenges/troches, 99-100
  powders, 99
  solids, 96-98
  sublinguals/buccals, 100
ordering drugs
  clarifying orders, 63
  components of an order, 62
  confusion and, 63
  dangerous terms/abbreviations table, 64-65
  key terms/abbreviations table, 63-64
  one-time drug orders, 62
  PRN drug orders, 62
  STAT drug orders, 62
  TO, 62
  VO, 62
orthopnea, 134
orthostatic hypotension, 126
OSHA (Occupational and Safety Health Administration), medication administration, 81
ossification (endochondral), cartilage and, 211
osteomyelitis, 187
osteoporosis, 215
otic (ear) drugs, 269-270
otic (ear) instillation (medication administration), 104
otitis media (middle ear infection), 146
ototoxicity
  defining, 55
  ototoxic drugs, 186
overdoses, drug toxicity and, 55
oxygen
  cardiovascular system, role in, 119
  hypoxia, 149
  respiratory system, role in, 145
oxygenated blood, cardiovascular system, 119

P
packaging drugs, 66
pain
  acute pain, 237
  age and, 236
  character of, 237
  chronic pain, 238
  duration of, 237
  exacerbation of, 238
  illness and, 237
  intermittent pain, 236
  location of, 238
  meaning of, 237
  onset of, 237
  phantom pain, 238
  precipitating factors of, 238
  previous experiences with, 237
  radiating, 238
  rating, 237
  relief of, 238
  signs/symptoms of, 235-236
  value of, 237
  Wong-Baker Faces Pain Rating Scale, 237
pancreas
  endocrine system, function in, 252
  hyperglycemia, 255
  hypoglycemia, 257
  pancreatitis, 186
paradoxical effect (drugs), defining, 54
paranoia, 290, 294
parasympathetic nervous system, 226

From the Library of Scott Kruse
parasympathomimetic drugs.  
See cholinergics
parenteral vaccinations, 71, 177
Parkinson’s disease, 245-247
passing gas (flatulence), 159
passive immunity, 177, 196
pastes, drugs as, 69
patellas, 210
pathogens, 176, 196
pathophysiology, 119
PCA (Patient Care Assistants), 33
PCT (Patient Care Technicians), 33
PDR (Physician’s Drug Reference), 57
penicillin, UTI treatments, 197-198
performance checklists, medication administration skills, 333-335
perfusion, role in respiratory system, 145
peripheral edema, 134
peristalsis, role in digestive system, 158
personal finances, Resident’s Bill of Rights, 43
phantom pain, 238
pharmacology, defining, 52
pharmacotherapeutics, defining, 52
pharynx (throat), role in respiratory system, 144
phlegm, role in respiratory system, 144
photophobia, 266
physical abuse (ethical/legal issues), 44
physical limitations, clients with (medication administration), 82, 109-110
pia mater, 224
pink eye (conjunctivitis), 266
pinna (auricle), ears and, 268
pitting edema, 134
placebo effect, defining, 54
placebo
plaque  cardiovascular system, 122
embolus, 123
thrombus, 123
pneumococcal pneumonia, 147
pneumonia, 146
antibiotics, 148
antitussives, 148
classifications of, 147
effects of, 147
eceptorants, 148
immunosuppressive therapy, 147
mucolytic agents, 148
pneumococcal pneumonia, 147
primary pneumonia, 147
secondary pneumonia, 147
symptoms of, 148
treatment of, 148
viral pneumonia, 147
vomitus, 147

PNS (Peripheral Nervous System)

ANS
adrenergic agents, 226-227
alpha adrenergic blocking agents, 227-230
analgesics, 235, 238-243
anticholinergics, 231-232
barbiturates, 232-233
benzodiazepines, 233-234
beta adrenergic blocking agents, 227-230
dopaminergics, 226, 230-231
nonbarbiturates, 234-235
nonbenzodiazepines, 234-235
parasympathetic nervous system, 226
sedative-hypnotic drugs, 232-235
SNS, 225
dorsal root, 225
receptors, 225
ventral route, 225

policies
medical-error prevention policies, 37
medication administration policies, 36-37
pons, 225
positioning clients, medication administration, 95
positive attitude, testing strategies, 15
potassium iodide (SSKI), treating lower respiratory tract illnesses, 152
potassium-sparing diuretics, 204
potentiate effects (drugs), defining, 54
powders/granules, 68, 99
PPE (Personal Protective Equipment), medication administration, 80
PPI (Proton Pump Inhibitors), 163-164

practice exams
answers
practice exam I, 311-315
practice exam II, 327-331
questions
practice exam I, 301, 303-310
practice exam II, 317-325

practice questions, testing strategies, 13

precautions (drugs), 56
presbycusis, 268
presbyopia (farsightedness), 264
primary pneumonia, 147
privacy (invasion of), ethical/legal issues, 41-43
PRN drug orders, 62

procedures, explaining to clients (medication administration), 95

process of elimination (answering questions), 15

How can we make this index more useful? Email us at indexes@quepublishing.com
profanity (ethical/legal issues), 46
professional boundaries, ethics and, 46
prokinetics, GERD and, 159
pronation, 213
prostaglandins, 163
prostatitis, 195
protraction, 213
psychoses
  antipsychotic agents, 295-296
delusions, 294
delusions of grandeur, 294
hallucinations, 294
paranoia, 294
schizophrenia, 295-296
PUD (Peptic Ulcer Disease), 158-160
pulmonary (lung) circulation, cardiovascular system, 119
pulmonary edema, 133, 203
pulmonary hypertension, 149
pulmonic valves (heart), 120
pulse, role in cardiovascular system, 120
purines, gout and, 215
PVD (Peripheral Vascular Disease), 134
  antiplatelet agents, 136-137
  arteriosclerosis obliterans, 135
  DVT, 135-136
  Reynaud's disease, 135
  thromboembolic diseases, 136
pyelonephritis, 196
pyuria, 196

Q
questions
  answering
    face value, 15
    focusing on key words, 15
    opposite options, 15
    option C, 15

process of elimination, 15
resident's feelings, 15
rethinking the question in your own words, 14
safety concerns, 15
taking time, 14
umbrella terms, 14
practice exam I, 301-310
practice exam II, 317-325
practice questions, testing strategies, 13
quinolones, 189, 200-201

R
radial pulse, 120
radiating pain, 238
radius and ulna, 210
RBC (Red Blood Cells), 211
reaction to drugs (side effects), 55-56
receptor sites (drugs), multiple drugs using the same receptor sites, 55
receptors, 225
rectal application, medication administration, 107-109
rectum, role in digestive system, 158
reflux (GI tract disorder), 158
refraction, 265
refusal to take medication, medication administration, 110
regulatory agencies (state), role of, 32
regurgitation, 121, 159
relaxants (muscle), 214
relaxation, testing strategies, 15
renal calculi (kidney stones), gout and, 216
renin, 125
renin-angiotensin-aldosterone, 125
reporting abuse (ethical/legal issues), 45

reports
  incident reports, medical-error prevention, 37
  MAR, 39
  Medication administration, 39
Resident's Bill of Rights, 42-44
resident's feelings (answering questions), 15
resistance and infections, 183
respect, characteristics of Medication Aides, 40
respiratory arrest, anaphylaxis, 56
respiratory system
  allergen-antibody responses, 146
  alveoli, 145
  aortic bodies, 145
  ARDS, 147
  arteries, 145
  asthma, 148
  bronchioles, 145
  bronchitis, 148
  cancer, 149
  carbon dioxide, 145
  carotid bodies, 145
  congestion (stuffy nose), 146
  COPD, 154
  cough reflex, 145
  diaphragm, 145
  diffusion, 145
  disorders, causes of, 145
  dyspnea, 146
  emphysema, 149
  epiglottis, 144
  expectorant, 144
  expiration, 144
  exudating fluid, 147
  function of, 144-146
  histamine, 146
  hypoxia, 149
  inspiration, 144
  intercostal muscles, 145
  intercostal nerves, 145
  larynx (voice box), 144

From the Library of Scott Kruse
seclusion (involuntary), ethical/legal issues

lower respiratory tract
antitussives, 152
bronchodilators, 153-154
COPD, 154
drug therapy, 152-154
expectorants, 152
guaifenesin
(Robitussin), 152
SSKI (potassium iodide), 152

lungs, 144
ateletasis, 147
cancer, 149
lobes, 145
perfusion, 145
ventilation, 145
main stem bronchi, 145
mucus, 145
nose, turbinates, 150
otitis media (middle ear infection), 146
oxygen, 145
pharynx (throat), 144
phlegm, 144
pneumonia, 146
antibiotics, 148
antitussives, 148
aspiration pneumonia, 147
classifications of, 147
effects of, 147
expectorants, 148
immunosuppressive therapy, 147
mucolytic agents, 148
pneumococcal pneumonia, 147
primary pneumonia, 147
secondary pneumonia, 147
symptoms of, 148
treatment of, 148
viral pneumonia, 147
vomitus, 147
pulmonary hypertension, 149
rhinitis, 146
rhinorrhea, 146
right ventricular hypertrophy, 149
secondary bronchi, 145
septum, 146
sinusitis, 146
sputum, 144
structure of, 144-146
trachea (windpipe), 144
trachea-bronchial tree, 145
upper respiratory tract
anti-inflammatory agents, 151
antihistamines, 150-151
cancer, 149
decongestants, 150-151
drug therapy, 150-152
intranasal corticosteroids, 151-152
Nasalcrom, 151

responsibilities of
CNA, 33
LPN, 33
Medication Aides, 32, 35-36, 40
PCA, 33
PCT, 33
RN, 33
UAP, 33

rethinking the question in your own words (answering questions), 14
reticular formation (brain), 225
retinas, 264
retinopathy, 256
retraction (muscles), 213
reviewing materials (testing strategies), 13
Reynaud’s disease, 135
rhinitis, 146
rhinorrhea, 146
right ventricular hypertrophy, 149
right-sided heart failure, 134
rights of medication administration
right documentation, 86-87
right dose, 85
right drug, 83
right resident, 84
right route, 84
right time, 85-86
RN (Registered Nurses)
delegates, RN as, 35
nursing process, 35
responsibilities of, 33
role of, 33
Robitussin (guaifenesin),
treating lower respiratory tract illnesses, 152
role of
CNA, 33
LPN, 33
Medication Aides, 32
legal limitations, 35
medical liability, 36
PCA, 33
PCT, 33
RN, 33
state regulatory agencies, 32
UAP, 33
romantic (ethical/legal issues), 46
rotation (muscles), 212

safety
concerns (answering questions), 15
medication administration and, 82
salicylates, 242
sarcomas, 277, 282
scapulas, 210
Schedule II drugs, diversion of, 42
schizophrenia, 295-296
sclera, 264
scope of practice. See Nurse Practice Act
scored tablets, 68
sebaceous (oil) glands, eyes, 266
seclusion (involuntary),
ethical/legal issues, 41

How can we make this index more useful? Email us at indexes@quepublishing.com
secondary bronchi, role in respiratory system

secondary pneumonia, 147
sedative-hypnotic drugs, ANS and, 232-235
sedatives/hypnotics, 53
self-assessments, testing strategies, 16
self-responsibility, characteristics of Medication Aides, 40
sensorineural hearing loss, 268
septa (heart), 120
septicemia, 183
septum (nose), 146
serotonin, nervous system and emotions, 288, 292
sesamoids, 210
severe dyspnea, 146
sex hormones (gonadotropic hormones), 282
sexual abuse (ethical/legal issues), 45
sexual harassment (ethical/legal issues), 45
short bones, 210
side effects (drugs), 55-56
signs/symptoms
  anxiety, 288-289
  cancer, 278
  depression, 291
  schizophrenia, 295
  UTI, 196
sinusitis, 146
six rights (principles) of administering medications, 37
skeletal muscles, role in musculoskeletal system, 210
slander (ethical/legal issues), 45
small intestine, role in digestive system, 158
SNS (Sympathetic Nervous System), 225
sulfonamides, 189
solids, oral medication administration, 96-98
solutions, drugs administered as, 69
souffle cups, medication administration, 79-80
spasms (muscles), 213
  lye, 213
  treatment by spasmolytic agents, 213-214
spasticity (muscles), 213
speech, noncommunicative clients and (medication administration), 111
sphygmomanometers, 121
spinal cord, CNS, 224-225
Spironolactone (Aldactone), 204
Sputum, role in respiratory system, 144
SR (sustained-release) capsules, 68
SSKI (potassium iodide), treating lower respiratory tract illness, 152
SSRI (Selective Serotonin Reuptake Inhibitors), 291-293
stagnation, 147
stapes (ears), 268
staph (staphylococcus aureus) infections, 180
STAT drug orders, 62
state regulatory agencies
  medication administration policies, 36
  role of, 32
statin drugs
  anorexia, 124
  hyperlipidemia, 123
stenosis (arteries), 125
steroids, treating upper respiratory tract illness, 151
stethoscopes, 121
stomach
  amino acids, 158
  antiemetics, 166-167
  chyme, 158
  digestive enzymes, 158
  digestive system, role in, 158
  gastric juices, 158
  hyperemesis, 166
  lavage (gastric), 166
  PPI, 163-164
  prostaglandins, 163
stomatitis, cancer and, 279
storing drugs, 66-67
stress ulcers (acute ulcers), 160
striations, 210
stuffy nose (congestion), 146
stys, 266
subcutaneously administering drugs, 72
sublinguals/buccals, oral medication administration, 70
suggestive language (ethical/legal issues), 46
suicidal ideation, depression and, 291
sulfa drugs, UTI treatments, 198-199
sulfonylureas agents, DM drug therapy, 258
superinfections, 183
supination, 213
suppositories, 69
surfactant, 147
suspensions, drugs administered as, 70
swallowing difficulties, medication administration and, 81-82
swimmer's ear (external otitis), 269
sympathomometics, 225
symptoms/signs
  anxiety, 288-289
  cancer, 278
  depression, 291
  schizophrenia, 295
  UTI, 196
syrups, drugs as, 70
systemic antifungal agents, 186
systemic circulation, role in cardiovascular system, 119
systemic infections, 178
systolic phase (heart), 120
systolic pressure (heart), 121
tablets, 68
tachycardia, 120, 131
tardive dyskinesia, antipsychotic agents and, 295
tarry (sticky) stools, GI bleeding, 242
tarsals and carpals, 210
TB (Tuberculosis), 181, 187
TCA (Tricyclic Antidepressants), 291-293
team player (being a), characteristics of Medication Aides, 41
temporal pulse, 120
tendons, role in musculoskeletal system, 212
testing strategies
answering questions
face value, 15
focusing in key words, 15
opposite options, 15
option C, 15
process of elimination, 15
resident's feelings, 15
rethinking the question in your own words, 14
safety concerns, 15
taking time, 14
umbrella terms, 14
Cram Sheet, 13
Exam Alerts, 13
last-minute crises, avoiding, 16
positive attitude, 15
practice questions, 13
relaxation, 15
reviewing materials, 13
self-assessments, 16
tests. See exams (practice exams)
tetracyclines, 189, 199-200
thalamus (cerebrum), 224
thieves (diversion), ethical/legal issues, 41-42
therapeutic effect (drugs), defining, 52-53
therapeutic relationships, medication administration, 111
thiazide diuretics, 203-204
throat (pharynx), role in respiratory system, 144
thromboembolic diseases, 136
thrombus (blood clots), 123
thyroid
cretins, symptoms/signs of, 253-254
DM, 254-255
complications from, 256-257
DKA, 256
drug therapy, 257-258
HHSN, 256
sulfonylureas agents, 258
symptoms/signs of, 256
TZD antibiotic agents, 258
endocrine system, function in, 252
exophthalmos, 253
goiters, 253
Grave's disease, 253
hyperthyroidism, 252-253
myxedema, 253-254
thyroid-replacement hormones, 254
thyroiditis, 253
toxic adenoma, 253
tibias and fibulas, 210
time, taking (answering questions), 14
time-release capsules, 68
tinctures, 69
tinnitus, 268
TO (telephone orders), 62
To Err is Human: Building a Safer Health System, 349
tolerance (drugs), defining, 54
tophi (gout), 216
topicals and transdermal drug installations, 71, 104-105, 184-185
torts, 44
toxic adenoma, 253
toxicity (drugs), 55
trachea (windpipe), role in respiratory system, 144
trachea-bronchial tree, role in respiratory system, 145
trade name (drugs), 52
tranquilizers, anxiety and, 289
transdermal and topical drug installations, 71, 104-105, 184-185
tricuspid valves (heart), 120
glycerides, 123
troches/lozenges, 69, 99-100
trophic hormones, function in endocrine system, 252
truthfulness (honesty), characteristics of Medication Aides, 39
TSH (Thyroid-Stimulating Hormone), endocrine system and, 252
thyroid
gifts, symptoms/signs of, 253-254
DM, 254-255
complications from, 256-257
HHSN, 256
sulfonylureas agents, 258
symptoms/signs of, 256
TZD antibiotic agents, 258
endocrine system, function in, 252
exophthalmos, 253
goiters, 253
Grave's disease, 253
hyperthyroidism, 252-253
myxedema, 253-254
thyroid-replacement hormones, 254
thyroiditis, 253
toxic adenoma, 253
tibias and fibulas, 210
time, taking (answering questions), 14
time-release capsules, 68
tinctures, 69
tinnitus, 268
TO (telephone orders), 62
To Err is Human: Building a Safer Health System, 349
tolerance (drugs), defining, 54
tophi (gout), 216
U
UAP (Unlicensed Assistant Personnel), role/ responsibilities of, 33
ulcers
antacids, 160-161
GERD and, 159
PUD, 158-160
stress ulcers (acute ulcers), 160
ulna and radius, 210

umbrella terms (answering questions), 14

upper respiratory tract
cancer, 149
drug therapy
  anti-inflammatory agents, 151
  antihistamines, 150-151
decongestants, 150-151
  intranasal corticosteroids, 151-152
  Nasalcrum, 151

ureters, role in urinary system, 194

urethra
  urethritis, 196
  urinary system, role in, 194

uric acid, gout and, 215

uricemia, gout and, 216

urinary retention, diuretics, 203-204

urinary system
  anemia, 195
  antigens, 196
  anuria, 196
  bladder, role of, 194
  BPH, 195
  clearance (creatinine), role of, 194
  cystitis, 196
dysuria, 196, 201

E.coli, 196
erythropoiesis, 195
function of, 194-195
glycosuria, 195
hormones
  ADH, 194
  aldosterone, 194
  erythropoietin, 195
  HTN, 194
  hyperglycemia, 195
  hypocalcemia, 195
  kidneys, role of, 194
  micturition, role of, 194
  nephrons, role of, 194

OAB, 202
oliguria, 196
prostatitis, 195
pyelonephritis, 196
pyuria, 196
structure of, 194-195
tubules, role of, 195
ureters, role of, 194
urethra, role of, 194
urethritis, 196

urinary retention, diuretics, 203-204

urinary tract infections, 183

urination, role of, 194

urine, role in, 194
urosepsis/uricemia, 196

UTI (Urinary Tract Infection)

  antibiotics, 196-201
  antimicrobial agents, 196
  antiseptic effect, 196
  anuria, 196
  BPH, 195
cystitis, 196
drug therapy, 196-201
dysuria, 196, 201
E.coli, 196

Furandantin, 201
Macrodantin, 201
Mandelamine, 201
penicillins, 197-198
quinolones, 200-201
sulfa drugs, 198-199
tetracyclines, 199-200
dysuria, 196, 201
E.coli, 196
oliguria, 196
pathogens, 196
prostatitis, 195
pyelonephritis, 196
pyuria, 196

signs/symptoms of, 196
urethritis, 196
urosepsis/uricemia, 196

urticaria, defining, 55

vaccination and infections, 177, 186
vaginal application, medication administration, 106-107
values (ethics), 46
valvular heart disease, 133
varicella (chicken pox), 196
vasoconstriction, 228
vasodilator drugs. See nitrates
vasospasms, 135

veins
  cardiovascular system, role in, 119
  venules, 121

ventilation, role in respiratory system, 145
ventral route (PNS), 225
ventricles (heart), 120

From the Library of Scott Kruse
venules, 121
veracity, 45
verbal communication, medication administration, 38-39
vertebrae, 210
vertigo, 269
viral pneumonia, 147
viruses
  antiviral agents, 186
  attenuated viruses, 186
  dormant viruses and infections, 181
  HIV, 182
  vaccines, 186
vitamins, 53, 342
vitreous humor, 264-265
VO (Verbal Orders), 62
voice box (larynx), role in respiratory system, 144
voluntary muscles, role in musculoskeletal system, 210
vomit
  antimetics, 166-167
  GI bleeding, 242
  hyperemesis, 166
  N & V, 55
  pneumonia, 147

W–X–Y–Z

washington hands, medication administration, 94
wax (cerumen), ears and, 268-270
WBC (White Blood Cells), 211
weights and measures table, 337
wheezing, asthma and, 148
white matter (axons), cerebrum and, 224
windpipe (trachea), role in respiratory system, 144
Wong-Baker Faces Pain Rating Scale, 237
working well with others, characteristics of Medication Aides, 41
wound infections, 183
written communication, medication administration, 39

How can we make this index more useful? Email us at indexes@quepublishing.com
Your purchase of *MACE Exam Cram* includes access to a free online edition for 45 days through the [Safari Books Online](https://www.safaribooksonline.com) subscription service. Nearly every Exam Cram book is available online through Safari Books Online, along with thousands of books and videos from publishers such as Addison-Wesley Professional, Cisco Press, IBM Press, O’Reilly Media, Prentice Hall, Que, Sams, and VMware Press.

*Safari Books Online* is a digital library providing searchable, on-demand access to thousands of technology, digital media, and professional development books and videos from leading publishers. With one monthly or yearly subscription price, you get unlimited access to learning tools and information on topics including mobile app and software development, tips and tricks on using your favorite gadgets, networking, project management, graphic design, and much more.

### Activate your FREE Online Edition at informit.com/safarifree

**STEP 1:** Enter the coupon code: RYVUHFH.

**STEP 2:** New Safari users, complete the brief registration form. Safari subscribers, just log in.

If you have difficulty registering on Safari or accessing the online edition, please e-mail customer-service@safaribooksonline.com

---

*From the Library of Scott Kruse*
MACE Cram Sheet

REMEMBER

- Do no harm.
- Exclusions in your role as a Medication Aide.

According to the NCSBN, you shall not delegate to the Medication Aide any of the following acts:

A. Give medications that require dosage conversions or calculations
B. Assess the client's need for, or response to, medications, including PRN (as needed) medications
C. Give medications via parenteral, nasogastric, gastrostomy, or jejunostomy routes

- Refuse a delegated assignment under the following circumstances:
  A. The delegated task is unclear.
  B. You are unfamiliar with the task.
  C. The client's condition is unstable.
  D. Performing the delegated task could harm the client.
  E. The task is illegal or unethical.
  F. You will not be supervised by the nurse.
  G. The nurse will not be available to monitor the client's response to the task.

- Equivalents

<table>
<thead>
<tr>
<th>Metric System</th>
<th>Household Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1mL</td>
<td>1/4 teaspoon (tsp)</td>
</tr>
<tr>
<td>5mL</td>
<td>1 teaspoon (tsp) or 1/4 ounce</td>
</tr>
<tr>
<td>15mL</td>
<td>1 tablespoon (Tbsp) or 1/2 ounce</td>
</tr>
<tr>
<td>30mL</td>
<td>2 tablespoons (Tbsp) or 1 ounce</td>
</tr>
<tr>
<td>500mL</td>
<td>1 pint (pt)</td>
</tr>
<tr>
<td>1000mL</td>
<td>1 quart (qt)</td>
</tr>
<tr>
<td>1 kilogram (kg)</td>
<td>2.2 pounds (lbs.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metric System Equivalents of Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 milligram (mg) = 0.001 or 1/1000 gram (g)</td>
</tr>
<tr>
<td>1 gram = 1000 milligrams</td>
</tr>
<tr>
<td>1 kilogram = 1000g</td>
</tr>
<tr>
<td>ROMAN NUMERALS</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>I = 1</td>
</tr>
<tr>
<td>X = 10</td>
</tr>
<tr>
<td>L = 50</td>
</tr>
<tr>
<td>C = 100</td>
</tr>
<tr>
<td>M = 1000</td>
</tr>
</tbody>
</table>

- Six rights of drug administration:
  A. Right client
  B. Right drug
  C. Right time
  D. Right dose
  E. Right route
  F. Right documentation

<table>
<thead>
<tr>
<th>*Pre-Administration Procedures</th>
<th>*Post-Administration Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirm prescriber’s order</td>
<td>Ensure client comfort</td>
</tr>
<tr>
<td>Gather equipment</td>
<td>Perform hand hygiene</td>
</tr>
<tr>
<td>Confirm client’s identity</td>
<td>Document care</td>
</tr>
<tr>
<td>Explain procedure to client</td>
<td></td>
</tr>
<tr>
<td>Arrange work area</td>
<td></td>
</tr>
<tr>
<td>Perform hand hygiene</td>
<td></td>
</tr>
<tr>
<td>Provide for privacy</td>
<td></td>
</tr>
</tbody>
</table>