Instructor’s

Resource Manual

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**Pharmacology for Nurses**

**A Pathophysiological Approach**

Second Canadian Edition

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**Chapter 1 Introduction to Pharmacology: Drug Regulation and Approval in Canada**

**Learning Outcomes:**

1. Define pharmacology.

Suggested Classroom Activity: Make a time line with students to demonstrate how the science of pharmacology has progressed in the past 200 years.

Suggested Clinical Activity: Discuss future developments in pharmacology with the pharmacist at a clinical site.

2. Discuss the interdisciplinary nature of pharmacology.

Suggested Classroom Activity: Using the examples of water, vitamin C, and natural hormones, discuss how a client may be confused about the difference between a substance for everyday use or one that naturally occurs in the body, and how these change when used in drug therapy.

Suggested Clinical Activity: Have students ask a nurse at a clinical site for an example of how pharmacotherapy made a difference in a client’s health.

3. Compare and contrast therapeutics and pharmacology.

Suggested Classroom Activity: Go to Health Canada website. Engage students in using the website to search for various drugs. Use the FAQ link to demonstrate how to stay updated on new drugs.

Suggested Clinical Activity: Have students compare and contrast medication therapy used for clients who have the same disease state, but are being treated with different drugs. Compare the drug’s pharmacologic and therapeutic classifications.

4. Compare and contrast conventional drugs, biologics, and natural health products. Suggested

Classroom Activity: Have students use the textbook to locate a prototype drug. Discuss how it is easily identifiable and what important nursing considerations are listed for each prototype.

Suggested Clinical Activity: Have students look at a medication administration record for an assigned client. Compare which drugs are prototypes and which are not. Students could also discuss how different or similar the drug is to the prototype.

5. Identify the advantages and disadvantages of prescription and over-the-counter (OTC) drugs.

Suggested Classroom Activity: Have students look at popular generics such as acetaminophen, aspirin, and ibuprofen. Have them identify possible trade names that are popular for these drugs. Then look at which products may represent a combination of drugs.

Suggested Clinical Activity: Have students take a drug history from a client. Discuss if the clients identify their medications by generic or trade names. Have students discuss how this could lead to possible medication errors.

6. Identify key Canadian drug regulations that help to ensure the safety and efficacy of medications.

Suggested Classroom Activity: Using Internet pharmacy sites, compare and contrast the differences between prices for trade and generic drugs.

Suggest Clinical Activity: Have students interview a pharmacist regarding the changes that occur when a pharmaceutical company’s period of exclusivity for the manufacture of a drug expires.

7. Discuss the role of Health Canada and the Health Products and Food Branch (HPFB) of Health Canada and its Therapeutic Products Directorate in the drug approval process.

Suggested Classroom Activity: Give examples of drugs that may be available to the client in both trade and generic names. Suggestions include ibuprofen, loratadine, and pseudoephedrine. Discuss what could change the bioavailability of the drug.

Suggested Classroom Activity: Have the student role-play a scene in which a client asks a nurse if generic substitutions are safe, and how the nurse would respond. Role-play another scene where the client asks the nurse about using an overseas Internet pharmacy.

Suggested Clinical Activity: Have students interview a hospital pharmacist to find out what the law in their state is regarding substitution of generic drugs. Ask how the pharmacist discusses the use of generic drugs with the prescriber.

Suggested Clinical Activity: Have students interview a neighborhood pharmacist about insurance reimbursement for generic drugs.

8. Describe the stages of approval for therapeutic and biologic drugs in Canada.

Suggested Classroom Activity: Go to Health Canada website. Engage students in using the website to explore the stages of approval for therapeutic and biologic drugs in Canada. Ask students to compare it with the process of approving none therapeutic products

Suggested Clinical Activity: Have students explore if any clinical trials are being conducted on the facility where they are assigned. Have students investigate when the drugs used in clinical trials will be available for use

**Key Concepts**

1. Pharmacology, now a key aspect of nursing care, started with early man using plants and herbs to relieve disease symptoms. Many early remedies were accidental discoveries.
2. The first “prescriptions” were written in the year 3000 BC by the Babylonians. The Chinese have the first recorded volume of plant remedies in the year 2700 BC.
3. Pharmacology was probably viewed as magic and superstition during the Dark Ages. There is very little recorded data from the Dark Ages.
4. Pharmacology first began to be practiced as a science in the 17th century, and the first text with the word *pharmacology* was published in 1693.
5. During the 19th century, chemists were able to make remarkable progress in separating specific substances and the first active agents such as morphine, colchicines, curare, cocaine, and other early drugs were discovered from their natural plant products.
6. The 20th century saw great progress and development of new drugs. We are now able to synthesize drugs from “scratch” in the laboratory.
7. A drug is any substance that is taken to prevent, cure, or reduce symptoms of a medical condition.
8. The word *pharmacology* came from the Greek *pharmakon,* which means “medicine” or “drugs,” and *logos,* which means “study.”
9. The subject of pharmacology is expansive and involves understanding what a drug is given for, how it is administered, where it travels in the body, the actual response it produces, and how it is eliminated.
10. Pharmacotherapy or pharmacotherapeutics is the application of drugs for the purpose of disease prevention and treatment.
11. Over 11,000 brand, generic, and combination agents are available, each with its own application, interactions, side effects, and actions.
12. Many drugs have more than one use. They may be prescribed for more than one disease and many produce multiple effects in the body.
13. Client factors that can cause drugs to elicit a different response are age, gender, race, body mass, health status, and genetics.
14. Staying current and up to date with new drugs is critical for the client and health care provider. Proper application of a drug can improve quality of life, whereas an improperly applied drug can cause disability or even death.
15. Many people believe that there are perfect drugs and that the perfect drug should and can always be selected for the client.
16. The perfect or ideal drug is effective, can be given at low doses, works quickly, has no adverse effects, can be taken conveniently, can be taken infrequently, is inexpensive, is quickly eliminated from the body, and does not interact with other medications or food.
17. There is no such thing as a perfect drug. Drugs that are used most often are ones that are close to the perfect drug profile. Drugs that have a profile that strays furthest from the perfect drug profile are used infrequently.
18. Conditions for which drugs are approved are called *indications*. All prescription drugs have at least one indication and some have multiple indications.
19. Some drugs are used for conditions for which they do not have an approved indication; this is called an *unlabeled* or *off-label use*.
20. Drugs are categorized in two ways: a therapeutic classification and a pharmacologic classification.
21. The therapeutic classification is how the drug is used in treating a specific disease.
22. The pharmacologic classification is the mechanism of drug action or how the drug produces its effects in the body.
23. Drugs may also have multiple therapeutic and pharmacologic classifications that are dependent on the clinical use of the drug.
24. The prototype drug is usually the first and best understood drug in its class, but sometimes the prototype may be a new or clinically more useful drug.
25. By learning about the prototype drug, nurses can understand the depth, actions, and adverse effects of other drugs in the same class.
26. Drugs are identified by multiple names, which can be confusing to both the client and health care provider.
27. Chemical names are assigned by using standard nomenclature established by the International Union of Pure and Applied Chemistry (IUPAC). Each drug has only one chemical name. Drugs can be named and classified by a portion of their chemical structure, known as the chemical group name.
28. Generic names are assigned by Health Canada. Generic names are usually less complicated and are easier to remember than chemical names. Each drug has only one generic name.
29. Trade names are also called *proprietary*, *product*, or *brand names*. The trade name is assigned by the pharmaceutical company and is usually short and easy to remember.
30. Health Canada grants pharmaceutical companies exclusive rights for naming and marketing a drug for a fixed number of years after the new drug application is approved, allowing the company to recoup the cost of research and development.
31. When this exclusivity expires, competing companies may sell a generic equivalent drug. They may give it a different trade name, which the Health Canada must approve.
32. Combination drugs are drugs with more than one active generic ingredient.
33. Because of the potential confusion with trade names, it is important for the nurse to identify drugs by their generic names.
34. Pharmaceutical companies often lobby aggressively against laws that might restrict the routine use of certain brand-name drugs. They claim that there is a difference between a trade-name drug and its generic equivalent and that switching to a generic may be harmful to the client.
35. Consumer advocates argue that generic substitutions should always be permitted because they provide cost savings to the client.
36. Bioavailability is defined by the Federal Food, Drug, and Cosmetic Act as the rate and extent to which the active ingredient is absorbed from the drug product and then becomes available at the site of the drug action to produce the desired effects.
37. Bioavailability may be affected by formulation, inert ingredients, and tablet compression. All of these factors can affect the absorption and/or distribution of the drug.
38. Bioavailability is measured by the time it takes for the drug to exert its effect; it is also known as onset time. Bioavailability may differ between trade and generic drugs.
39. Internet sites may allow clients to purchase drugs at substantial savings. However, the danger of doing so is that the drugs may be sold from other countries and these countries may not have the same quality control standards as the United States. These drugs may be harmful or not effective. The nurse must help clients understand the differences and the potential dangers.

**Chapter 2 Drug Classes and Schedules in Canada**

**Learning Outcomes:**

1. Explain what characterizes an ideal drug and how drugs are classified.

Suggested Classroom Activity: Discuss with students how patent medicines have “survived” over a long period of time. Use examples given in the textbook such as Smith Cough Drops, Fletcher’s Castoria, Doan’s Pills, Vick’s Vapo Rub, and Phillip’s Milk of Magnesia. Why are these products still popular and widely used? What could be some of the reasons that they survived regulations?

Suggested Clinical Activity: Have students discuss the use of patent medicines in the hospital setting. Is an order necessary? If so, why?

2. Explain the basis for placing drugs into therapeutic and pharmacological classes.

Suggested Classroom Activity: Using the time line in Table 2.1, have students add any future regulations they believe are needed or forthcoming.

Suggested Clinical Activity: Have students teach assigned clients in the clinical setting what Health Canada regulations ensure the safety and effectiveness of their drug therapy.

3. Discuss the prototype approach to drug classification.

Suggested Classroom Activity: Have students explore the Compendium of Pharmaceuticals and Specialties (CPS) website. Have them look at what type of information is available such as reference standards, health care quality and information, seminars, workshops, and drug safety reviews. Discuss how they could use this information in clinical practice.

Suggested Clinical Activity: Have students ask a pharmacist how Compendium of Pharmaceuticals and Specialties (CPS) information is accessed in their organization.

4. Describe what is meant by a drug’s mechanism of action.

Suggested Classroom Activity: Have students log onto Health Canad website. Then, have them explore the consumer links and resources. Assign a different link or resource to each student; have each student give a brief summary about whether they thought their source would be helpful to the general client population.

Have students choose a Health Canada industry link to explore. Break students into groups and assign one of the following to each group: CDER, CBER, CFSAN, MedWatch, Health Care Professional, Food Nutrition Industry, and Cosmetic Industry. Have students report back to the group what information is available.

Suggested Clinical Activity: Have students explain to their assigned clients how the health Canada oversees drug products in Canada. If Internet access is available, the student can demonstrate the consumer links on the Health Canada website.

5. Distinguish between a drug’s chemical name, generic name, and trade name.

Suggested Classroom Activity: Break the students into groups and give each group one of the three phases of the clinical drug trial. Have them develop a client teaching tool to provide teaching to the client involved in that phase of the trial. How would they explain safety, adverse effects, and client variables?

Suggested Clinical Activity: If possible in your clinical setting, have students interview either a health care professional or client involved in a clinical drug trial. They should ask questions about stages and phases of the trial, preclinical investigation, goal of the trial, possible adverse effects, and client consents and compensations. Have them report back to their clinical group what they learned in their interview. Did it change their thoughts about clinical drug trials? Why or why not?

6. Explain why the use of generic names is preferred to trade names when referring to drugs.

Suggested Classroom Activity: Build off the activity for Learning Outcome 5 and continue to discuss clinical drug trials. Why do some clients receive a placebo? Is there a risk with placebos? How would the client feel about getting the placebo if the drug turned out to be very effective? Discuss the moral issues regarding controlled drug trials.

Suggested Clinical Activity: If possible in your clinical setting, have students discuss the use of a clinical trial placebo with a nurse or pharmacist. Has either professional experienced concern that a client was not responding to treatment and might be receiving a placebo? If so, how did the professional cope with this concern?

7. Discuss why drugs are sometimes placed on a restrictive list and the controversy surrounding this issue.

Suggested Classroom Activity: Discuss with the class which disease states could require priority drug approval. Make a list on the classroom blackboard. Then ask the students to prioritize their list. Discuss how difficult it is to decide which disease is “more important.” Discuss if the list would be different in another part of the country or world.

Suggested Clinical Activity: Have students interview a nurse about using newly released drugs. What special concerns does the nurse have and are any special interventions used?

8. Explain the meaning of a controlled substance.

Suggested Classroom Activity: Discuss some of the recent drugs that have been reclassified from prescription to over the counter, such as loratadine (Claritin), cetirizine (Zyrtec), Omeprazole (Prilosec), famotidine (Pepcid), naproxen sodium (Aleve), and cromolyn sodium nasal spray (NasalCrom). Discuss the potential for use and misuse by the consumer. Why are these drugs safer than other drugs in the same category that are still prescription drugs? Does their classification help or harm the consumer?

Suggested Clinical Activity: Assign the students to a client who is prescribed a drug that is available over the counter. Have students develop a client teaching plan that will teach the client how to use the drug safely and how to follow the guidelines.

9. Explain the Controlled Drugs and Substances Act (CDSA) of 1997 and the role of the Drug Strategy and Controlled Substances Programme (DSCSP) in controlling drug abuse and misuse.

Suggested Classroom Activity: Refer to the Office of Controlled Substances (OCS) website for information about the Controlled Drugs and Substances Act. Suggested Classroom Activity: Refer to the Office of Controlled Substances (OCS) website for a list of controlled substances.

Suggested Clinical Activity: Have students shadow a nurse or pharmacist who prepares controlled substance medications. Have the student note the regulations in that clinical setting for recording and dispensing the drugs. Have students report if they think the regulations are appropriate or not. What would they change, if anything?

Suggested Clinical Activity: Have students list controlled substance medications they have seen administered in their clinical site. Have the student pick one drug and investigate its use and safety.

10. Explain how drugs are scheduled according to Canada’s Food and Drugs Act, the CDSA, and the Narcotic Control Regulations (NCR).

Suggested Classroom Activity: Have students discuss the requirements for prescriptive powers in your state. What education is required? Is continuing education required? How many nurses in your state have prescriptive powers?

Suggested Clinical Activity: Have students interview a CRNA or other hospital nurse who has prescriptive powers. Discuss which drugs they may prescribe and other laws regulating their ability to prescribe.

**Key Concepts**

1. Consumers expect that the drug they are taking is safe and effective and that the label is clear and accurate.
2. It is only since the 20th century that standards and regulations have existed to protect the consumer.
3. Historically, patent medicine was widely used and available.
4. There were no laws to regulate these medicines and products could make any claim to health or cure.
5. Many patent medicines contain addictive and at times dangerous additives, such as morphine and cocaine. Such addictive additives guaranteed repeat sales.
6. Several early patent medicines have gone through drug regulation and change and are still available today.
7. Prescription drugs are considered to be potentially addictive or too harmful for self-administration. Prescription drugs may require skill to administer correctly.
8. Requiring a prescription for drugs allows the client to be examined and diagnosed and allows for client teaching and disease monitoring.
9. OTC drugs do not require a prescription from a health care provider.
10. OTC drugs are safe if the client carefully follows the instructions and are easier to obtain than prescription drugs. Choosing the correct OTC drug can be a problem for the client, because clients may not be aware of food, drug, and herbal interactions with OTC drugs; hence, self-treatment with OTC drugs can be ineffective.
11. Prescription drugs can undergo a review process by the Health Canada which can reclassify a prescription drug to be an OTC drug. In order for a prescription drug to be reclassified as an OTC drug, a high margin of safety must exist.
12. Herbal and dietary supplements are not considered drugs and are available over the counter. They are not subjected to the same regulatory process as prescription drugs.
13. Health Canada does not test herbal and dietary supplements for safety. These products can cause side effects and interact with medications.
14. Some drugs have a high potential for dependence and/or are frequently abused, so the sale and distribution of these drugs are highly restricted.
15. These drugs are placed into one of five categories called schedules.
16. Complete records must be maintained of qualities purchased and sold.
17. Drugs with the highest abuse potential have additional restrictions, which may include special order forms, no telephone orders, and no refills. There are strict penalties for not following the laws.
18. Historically, prescribing drugs was the responsibility of the physician or dentist.
19. Advanced practice registered nurses (APRNs) are those who have completed graduate-level education that includes advanced pharmacology content and certification by exams.
20. Each state has different requirements for prescriptive authority for APRNs.
21. Work on a consensus model to define APRN practice and education requirements is continuing between a task force of APRNs and members of the National Council of State Boards of Nursing.
22. It is thought that passage of the Client Protection and Affordable Care Act (ACA) in 2010 will increase the need for practitioners to provide the best and most cost-effective care possible.

**Chapter 3 Pharmacokinetics**

**Learning Outcomes:**

1. Explain the applications of pharmacokinetics to clinical practice.

Suggested Classroom Activity: Divide students into several groups and assign each one a different drug. Have them look up the pharmacokinetics of the drug and the briefly present their findings to the class.

Suggested Clinical Activity: Choose a drug that two different clients are receiving, such as a beta blocker or proton pump inhibitor, and have students discuss how the pharmacokinetics of this drug may differ with each client.

Suggested Clinical Activity: Have each student pick one of the medications that an assigned client has received during the clinical day. Have them discuss the pharmacokinetics of the drug in relationship to the specific client. Have them identify any factors (diet, liver function, renal function, etc.) in the ­client that would impact any of the phases.

2. Identify the four components of pharmacokinetics.

Suggested Classroom Activity: Discuss the factors involved in the different mechanisms of drug movement across cell membranes.

Suggested Clinical Activity: Choose a client and review the medications he or she is receiving, exploring how the prescribed drugs for that client will move across plasma membranes.

3. Explain how substances travel across plasma membranes.

Suggested Classroom Activity: Divide students into a few groups and assign each group a different drug, choosing some oral and parenteral drugs. Have them research what factors will affect absorption of the drug.

Suggested Clinical Activity: Have each student choose one of the drugs an assigned client is receiving and discuss what factors in that client will most affect absorption of the drug.

4. Discuss factors affecting drug absorption.

Suggested Classroom Activity: Divide students into groups and have each group discuss one of the primary ways drugs cross plasma membranes. Have them identify a few drugs that use each method of distribution. Discuss findings in the large group.

Suggested Clinical Activity: Have students pick one of the drugs being taken by an assigned client and discuss what barriers the client has, if any, to the distribution of the drug.

5. Explain the metabolism of drugs and its applications to pharmacotherapy.

Suggested Classroom Activity: Divide class into sections and assign each a different drug, choosing ones that have a different protein-binding percentage, such as digoxin, gentamicin, and phenytoin. Discuss how these different percentages affect blood levels of the circulating drug and how the addition of another drug can displace the drug.

Suggested Clinical Activity: Have students check the albumin level of an assigned client and discuss how this will affect drug availability of the medications that are prescribed.

6. Discuss how drugs are distributed throughout the body.

Suggested Classroom Activity: Compare the differences in oral and intravenous doses of meperidine (Demerol) and/or morphine sulfate to explain the first-pass effect.

Suggested Classroom Activity: Explain that some drugs, such as methylphenidate (Ritalin), are available in short-acting as well as extended release ­formulas. Discuss how this relates to the half-life of the drug. Discuss what some of the advantages and disadvantages of the different doses might be. When might the short-acting formula be chosen over the long-acting one?

Suggested Clinical Activity: Have the students choose one client who is receiving at least three to four drugs and have them check if any of the drugs are CYP substrates. Have them cross-check all the drugs to determine if any of the other drugs are inducers or inhibitors of the same isoenzyme system and discuss the implications it could have for the client.

7. Describe how plasma proteins affect drug distribution.

Suggested Classroom Activity: Discuss the implications of drugs that are ­excreted in breast milk for the woman who is breast-feeding.

Suggested Classroom Activity: Discuss drugs that are excreted by routes other than the kidney.

Suggested Clinical Activity: Have students review the assessment data (I&O, urinary function, etc.) and laboratory values that reflect renal function (creatinine and BUN levels) on an assigned client and discuss the impact on excretion of medications they are receiving.

8. Identify major processes by which drugs are excreted.

Suggested Classroom Activity: Discuss the effects of enterohepatic recirculation on drugs with a long half-life, such as amiodarone.

Suggested Clinical Activity: Have students examine the role enterohepatic recycling will have on the drugs being taken by one client.

9. Explain how enterohepatic recirculation might affect drug activity.

Suggested Classroom Activity: Divide students into a few groups and assign each of them a drug level to monitor, such as lithium, digoxin, or vancomycin levels. Discuss when these levels should be taken and what is done when levels indicate subtherapeutic or toxic levels.

Suggested Classroom Activity: Choose one or two drugs, such as digoxin or vancomycin, and discuss why plasma drug ­levels might be monitored and how the lab ­results are used to adjust doses.

Suggested Clinical Activity: Show students how blood levels are monitored in the clinical setting. If possible, find a drug on which peak and trough level tests are being done and discuss the implications and responsibilities associated with this.

10. Explain the applications of a drug’s plasma half-life (t1/2) to pharmacotherapy.

Suggested Classroom Activity: Have students look up the half-life of any drug. Choose a few different ones and correlate the implications of half-life to drug dosing schedules.

Suggested Clinical Activity: Have students examine the half-life of drugs prescribed for their assigned client(s) and correlate this to the schedule of times for administration.

11. Explain how a drug reaches and maintains its therapeutic range in the plasma.

Suggested Classroom Activity: Assign students in groups and ask them to study the effects of the drug’s half- life on the therapeutic range. Ask students to identify the number of half- life a typical drug will take to reach a steady-state

Suggested Clinical Activity: As students to go to the hospital pharmacy to ask how therapeutic range is monitored in the hospital, provide some examples of drugs that need to be monitored. Ask students to articulate the significance of monitoring the therapeutic levels of these drugs

12. Differentiate between loading and maintenance doses.

Suggested Classroom Activity: Discuss the purpose and practical application of drugs that are sometimes prescribed with an initial loading dose, such as azithromycin (the Z pack) and digoxin.

Suggested Clinical Activity: Illustrate an example of a loading dose if one is found in the clinical setting.

**Key Concepts**

1. Pharmacokinetics is what the body does to drugs. *Pharmaco* means “medicines,” and *kinetics* means “movement.”
2. Drugs face numerous obstacles in reaching their target cells, the greatest of which is crossing the many membranes that separate the drug from its target cells.
3. The four phases of pharmacokinetics are absorption, distribution, metabolism, and excretion.
4. Various mechanisms are used by drugs to reach target tissues. These can involve simple diffusion (passive transport), facilitated diffusion, and active transport.
5. Simple diffusion involves movement from an area of high concentration to one of low concentration.
6. Facilitated diffusion involves utilization of a carrier protein.
7. Active transport involves movement against a concentration gradient, which requires energy.
8. The first phase of pharmacokinetics, absorption, is the process of moving a drug from the site of administration to the bloodstream. Absorption is affected by many different factors.
9. The route of administration is one of the most important variables affecting drug absorption.
10. Enteral drugs are delivered to the GI tract, either orally (PO) or through nasogastric or gastrostomy tubes.
11. Tablets and capsules are the most common forms of oral medication and must dissolve before the drug becomes available to the body for absorption.
12. Enteric-coated tablets are designed to dissolve in the alkaline environment of the small intestine.
13. Extended release tablets or capsules are designed to dissolve slowly, resulting in a longer duration of action.
14. Drugs absorbed from the stomach and small intestine first travel to the liver, where they may be inactivated in a process called the *first-pass effect*.
15. Sublingual and buccal administrations are enteral routes in which the medications are not swallowed but instead are kept in the mouth.
16. Topical drugs are applied to the skin or mucous membranes. Some drugs are applied topically to produce a local effect, while others are so administered to provide for slow release and absorption to the general circulation.
17. Parenteral drugs are administered by routes other than enteral or topical.
18. Intradermal and subcutaneous drugs are administered into the layers of the skin.
19. Intramuscular drugs are administered directly into large muscles.
20. Intravenous drugs are delivered directly into the bloodstream
21. For almost all drugs, higher doses produce a faster and greater response.
22. The physical and chemical condition of the GI tract plays a significant role in absorption for drugs administered by mouth.
23. For a drug to be absorbed, there must be adequate blood flow to the site of administration.
24. Ionization of the drug affects its ability to cross plasma membranes and to be excreted by the body.
25. Drug–drug and food–drug interactions have the potential to affect absorption.
26. Other factors being equal, drugs will be absorbed faster when applied to regions of the body having a larger surface area.
27. Drug distribution is the second phase of pharmacokinetics. It involves the transportation of the drug through the body.
28. Distribution is affected by drug solubility, tissue storage, amount of blood flow to tissue, and protein binding.
29. Drugs compete for protein-binding sites.
30. Only unbound drugs will reach their target site.
31. The percentage of drug bound to plasma proteins is found in most drug guides.
32. Special barriers to drug distribution include the blood–brain barrier and the fetal–placental barrier.
33. The drug metabolism process is also called *biotransformation*. In this process, the body chemically changes a drug molecule, which results in functional changes to the drug.
34. Prodrugs are medication that require metabolism to produce their therapeutic actions.
35. For many drugs, metabolism is accomplished by the hepatic microsomal enzyme system in the liver by the CYP, or cytochrome P450, enzyme system
36. Drugs metabolized by CYP are substrates for the enzyme.
37. Some drugs act to inhibit the action of CYP and are called enzyme inhibitors. Some drugs have the ability to cause enzyme induction and are called enzyme inducers.
38. Some drugs have the ability to increase metabolic activity in the liver, a process called enzyme induction.
39. The first-pass effect occurs with many oral drugs. Much of the drug is rendered inactive on the first trip through the liver and does not reach general circulation. Because of this effect, oral doses of drugs often differ from a parenteral dose of the same drug.
40. Infants do not develop a mature microsomal enzyme system until at least 1 year of age and this activity is generally reduced in older adults.
41. CYP activity can be genetically determined.
42. CYP activity is also affected by lifestyle factors such as tobacco use and chronic alcohol consumption.
43. The rate at which a drug is excreted determines the drug concentration’s in the blood.
44. Drugs are excreted primarily via the kidney, but may also be eliminated via pulmonary, fecal, and glandular routes.
45. The renal excretion of drugs is influenced by the pH of the filtrate in the renal tubule.
46. The lungs excrete most drugs in their original unmetabolized form.
47. Drugs may also be excreted by glands into saliva, sweat, or breast milk.
48. Drugs cleared through biliary excretion can be recirculated many times with bile, extending the length of time in the body.
49. Time response relationships illustrate drug plasma levels following administration of a specified dose.
50. These levels reflect a *minimum effective dose,* the *therapeutic range,* and *toxic concentration.*
51. The plasma half-life (t1/2) is the time required for a drug’s plasma concentration to be reduced by one half after being administered.
52. It takes four half-lives for a drug to be considered eliminated from the body.
53. Repeated dosing of a drug allows for the drug to reach a plateau level, which is often desired in order to provide a therapeutic response.
54. Administration of a loading dose of medication may be given to increase the plasma level of the drug and induce a therapeutic response sooner.
55. A maintenance dose is given to keep the drug level in a therapeutic range.

**Chapter 4 Pharmacodynamics**

**Learning Outcomes:**

1. Apply principles of pharmacodynamics to clinical practice.

Suggested Classroom Activity: Ask students to find five different families of medications and to create a table to compare the pharmacodynamics effect of these drugs. Suggested Clinical Activity: Ask students to identify a link between clinical practice and pharmacodynamics. Ask them to give examples so as to operationalize the link.

2. Discuss how frequency response curves may be used to explain how clients respond differently to medications.

Suggested Classroom Activity: Provide a graphic outline on the board or other media and involve students in identifying the average dose response versus the minimal response.

Suggested Clinical Activity: Using an example of a drug being taken by an actual client, discuss how the response to this medication may differ if it is taken by another client.

3. Explain the importance of the median effective dose (ED50) to clinical practice.

Suggested Classroom Activity: Divide students into groups and assign each one a different drug, such as ampicillin, digoxin, pantoprazole, or acetaminophen. Have them research the average median dose for their drug and discuss how this dose was chosen. Discuss when and why the dose may need to be decreased or increased.

Suggested Clinical Activity: Have students look at the medication profile of their assigned clients and examine whether the clients are receiving an average dose of the medication; if they are not, discuss why.

4. Compare and contrast median lethal dose (LD50) and median toxicity dose (TD50).

Suggested Classroom Activity: Have students identify four commonly administered drugs with a low margin of safety and discuss nursing assessments required when administering these drugs.

Suggested Clinical Activity: Have students examine the drugs their assigned client is receiving and determine if he or she is receiving a safe dose.

5. Correlate a drug’s therapeutic index to its margin of safety.

Suggested Classroom Activity: Have students calculate the therapeutic index for drugs within the same classification, such as beta blockers or diuretics, and discuss how safe the drug will be.

Suggested Clinical Activity: Assist students to determine the therapeutic index of one or two drugs that an assigned client is receiving.

6. Identify the significance of the graded dose-response relationship to clinical practice.

Suggested Classroom Activity: Have students break into groups and assign each a different analgesic drug, including both narcotic and nonnarcotic drugs. Have them discuss how increasing the dose or frequency of the drug will affect the therapeutic effect and adverse effects on a client.

Suggested Clinical Activity: Have students identify a drug that has reached a plateau level in an assigned client and discuss why they feel the plateau effect has been reached. Some suggestions for them to explore are blood pressure control with antihypertensives, pain control with analgesics, and control of gastric symptoms with proton pump inhibitors.

7. Compare and contrast the terms potency and efficacy.

Suggested Classroom Activity: Divide students into small groups and assign two drugs within the same class (such as a loop diuretic or ACE inhibitor). Have the students identify which is more potent and why. Discuss the concept of efficacy; is one drug more efficacious than the other?

Suggested Clinical Activity: Have students choose a client who has two different classes of drugs ordered for pain, such as a narcotic and a nonnarcotic. Discuss why the narcotic is more potent, but may not necessarily be the more efficacious drug, depending on the origin of the pain.

8. Distinguish between an agonist, partial agonist, and antagonist.

Suggested Classroom Activity: Assign different groups of students a specific drug, such as metoprolol, albuterol, or epinephrine. Have each group identify whether the drug is an agonist, partial agonist, or antagonist and why.

Suggested Classroom Activity: Explore how drug–food interactions have agonist and antagonist properties, using warfarin (Coumadin) as an example.

Suggested Clinical Activity: Have each student choose two different drugs an assigned client is receiving. Identify which action the drug has on the receptor site.

Suggested Clinical Activity: Have students identify any drug–drug or food–drug interactions that could act as agonists or antagonists.

9. Explain the relationship between receptors and drug action.

Suggested Classroom Activity: Assign different groups of students a specific drug, such as metoprolol, albuterol, or epinephrine. Have them discuss which receptor is being affected and whether it is stimulating or inhibiting the receptor site.

Suggested Clinical Activity: Have each student choose two different drugs an assigned client is receiving. Have them identify which receptor is being affected and how.

10. Explain possible future developments in the field of pharmacogenetics.

Suggested Classroom Activity: Discuss the goals of the Human Genome Project and provide examples of how drugs can be used in the treatment of disorders that are detected genetically in a client, such as Alzheimer’s disease.

Suggested Clinical Activity: Have each student explore the possibility of how drugs could be used to the advantage of a client if any genetic markers were found on the client.

**Key Concepts**

1. Pharmacodynamics is what the drug does to the body. *Pharmaco* means “medicines,” and *dynamics* means “change.”
2. Pharmacodynamics involves a drug’s mechanism of action and the effect of drug concentration on body responses.
3. The frequency distribution curve provides a graphic representation of how a specific number of clients respond to different doses of the same drug.
4. The horizontal axis shows range of doses.
5. The peak of the curve indicates the largest number of clients responding to the drug.
6. The dose in the middle of the frequency distribution curve represents the drug’s median effective dose.
7. The median effective dose is the average dose of drug that will provide a therapeutic response in 50% of clients; represented as ED50.
8. The nurse needs to recognize that not all clients will experience the desired effect of a drug at the average dose, but may need adjustments in dosage.
9. The median lethal dose (LD50) is determined by the dose at which 50% of laboratory animals die during clinical studies.
10. The therapeutic index is the ratio of a drug’s LD50 to its ED50. The higher this value, the safer the medication.
11. In comparison, the median toxicity dose (TD50) is the dose at which 50% of clients will experience toxic effects of the drugs. This dose has more practical clinical application than the lethal dose.
12. The margin of safety (MOS) is calculated as the amount of drug that is lethal to 1% of animals (LD1) divided by the amount of drug that produces a therapeutic effect in 99% of the animals (ED99). This is another index of safety.
13. The dose–response relationship describes how the actions of a drug change with increasing dose.
14. The dose–response curve provides a graphical representation of client response to varying drug doses.
15. The three distinct phases of the dose-response curve are: phase 1 which indicates a subtherapeutic effect; phase 2 which reflects the most desirable range; and phase 3 which represents the point at which a plateau has been reached.
16. When drug dosing hits a plateau, additional dose increases will not provide further therapeutic responses and may cause adverse effects.
17. Potency is the amount of drug needed to produce a specified effect.
18. Efficacy is the drug’s ability to produce the greatest maximal response. It compares the desired therapeutic effect of two drugs.
19. Drugs within the same class or in different classes can be compared in terms of their potency and efficacy. Of the two, efficacy is more important in terms of pharmacotherapeutic effects.
20. Receptor theory states that the majority of drugs produce therapeutic effects by stimulating or inhibiting receptor sites.
21. The response of a drug is proportional to the concentration of receptors that are bound or occupied by the drug.
22. Drugs that have the ability to bind to a receptor and produce a strong action are said to have high intrinsic activity.
23. Drug receptor binding is like a lock and key.
24. Once occupied, receptor triggers second messenger events, biochemical events occur, and the drug stimulates or inhibits the normal activity of the cell.
25. The discovery of receptor subtypes (two basic types are alpha and beta) paved the way for the development of more specific drug therapies.
26. Some drug actions result in nonspecific cellular responses and are independent of cellular receptors.
27. Agonists activate or bind to receptors and produce the same action of the endogenous chemical triggered by that receptor. The response may be greater than that of the endogenous activity.
28. Partial agonists produce a lesser endogenous effect.
29. Antagonists prevent the endogenous activity of the receptor. They may compete with the agonist or block excess endogenous activity.
30. Antagonists do not have intrinsic activity
31. Functional antagonists inhibit the effects by changing pharmacokinetic factors.
32. Many drug–drug and drug–food interactions can be explained by the relationships that occur between agonists and antagonists.
33. It is hoped that future drugs can be customized for clients using data from the Human Genome Project and other advances in medicine.
34. Pharmacogenetics is the branch of pharmacology that studies the role of genetic variation in drug responses.
35. It is hoped that the use of pharmacogenetic information may someday allow for drug therapy that is customized to a client’s individual molecules.

**Chapter 5 The Nursing Process in Pharmacology**

**Learning Outcomes:**

1. Explain the steps of the nursing process in relation to pharmacotherapeutics.

Suggested Classroom Activity: Have students discuss various ways of finding up-to-date drug therapy information. Suggestions include reference books, evidence-based Internet sites, ongoing clinical education, and pharmacists.

Suggested Clinical Activity: Have students ask a nurse at a clinical site how he or she learns about new drugs and their indications, side effects, and common dosages.

2. Identify assessment data to be gathered to ensure safe medication administration.

Suggested Classroom Activity: Have students review the core responsibilities for safe drug administration and discuss how each concept can prevent medication errors.

Suggested Classroom Activity: Have students work in small groups and interview each other. Have them identify differences in their own demographics that would influence safe drug therapy.

Suggested Clinical Activity: Have students shadow a nurse in a hospital or clinic setting who is assigned to administer medications. Have students observe how the nurse checks to make sure the medications are correct for that client, if the drugs are dispensed in trade or generic names, what checks the nurse completes before dispensing the medication, and what teaching the nurse offers the client about the medication.

3. Develop appropriate nursing diagnoses for clients receiving medications.

Suggested Classroom Activity: Have students develop a priority list of nursing responsibilities for the drug they selected.

Suggested Clinical Activity: Have students create an assessment strategy inclusive of the systems that the drug they selected will affect

Suggested Clinical Activity: Have students develop a priority of nursing responsibilities for the drug their assigned client is receiving

4. Set realistic goals and outcomes during the planning stage for clients receiving medications.

Suggested Classroom Activity: Assign students in small group and get each group to list advantages and disadvantages (if any) of using the nursing process

Suggested Clinical Activity: Ask students to ask the primary nurses on the unit about their utilization of the nursing process while administering medications. Ask to give example if possible where the nursing process saved a client’s life

5. Discuss key intervention strategies to be carried out for clients receiving medications.

Suggested Classroom Activity: Ask students to identify system specific nursing intervention focusing on assessment of the system before and after administering medications

Suggested Clinical Activity: Ask students to list all the possible routes of administering medications and to identify the nursing interventions associated with each

6. Evaluate the outcomes of medication administration.

Suggested Classroom Activity: Ask students to identify 5 different medications and to articulate the expected outcomes for each medication. Then ask students to articulate how they are going to assess or measure the efficacy of the outcome

Suggested Clinical Activity: Ask students to list the medications their respective clients are receiving then to create a chart delineating the process of evaluation the therapeutic outcome of each medication

7. Apply the nursing process when giving medications, using the Nursing Process Focus flowcharts found in Chapters 13 through 63.

Suggested Classroom Activity: Ask students to use the nursing process focus flowcharts on 5 medications working on different body systems

Suggested Clinical Activity: Ask students to use the nursing process focus flowcharts while administering medications to their assigned clients

**Key Concepts**

1. The nurse is expected to understand the pharmacotherapeutic principles for all medications received by each client.
2. The nurse’s responsibilities include knowledge and understanding of what drug is ordered; name (generic and trade) and drug classification; intended or proposed use; effects on the body; contraindications; special considerations, such as how age, gender, weight, body fat distribution, genetic factors, and pathophysiologic states affect pharmacotherapeutic response; and expected and potential adverse events.
3. The nurse must also know why the drug has been prescribed for this particular client. how the drug is supplied by the pharmacy, how the drug is to be administered, including dose ranges, and what nursing process considerations related to the drug apply to this client
4. A major goal in studying pharmacology is to eliminate medication errors and to limit the number and severity of adverse drug events.
5. Knowledge of pharmacology is an ongoing, lifelong process that builds as a nurse is in practice and chooses specific clinical areas.
6. Learning prototypes, recognizing key similarities in generic names, and always looking up unknown or new drugs will help build this knowledge base.
7. Describe major considerations in drug therapy for children, adults, and clients with impaired renal or hepatic function or critical illness.
8. Discuss application of the nursing process in home care settings.
9. Apply evidence-based data about clients and therapeutic drugs in all steps of the nursing process.

**Chapter 6 Life Span Considerations in Pharmacotherapy**

**Learning Outcomes:**

1. Discuss the basic concepts of human growth and development in relation to pharmacotherapeutics

Suggested Classroom Activity: Have students research one of the conditions that require pharmacotherapy during pregnancy/lactation and write a short paper for the justification of this action.

Suggested Clinical Activity: Have students care for a mother with a preexisting condition and write a formal care plan.

1. Explain how physical, cognitive, and psychomotor development influence pharmacotherapeutics

Suggested Classroom Activity: Have students draw a diagram of the absorption, distribution, metabolism, and excretion process of a drug in a pregnant woman and compare them to the same processes in a nonpregnant woman.

Suggested Clinical Activity: Have students use their diagram as part of a teaching plan for a pregnant woman in the clinical setting.

1. Match the six pregnancy categories with their definitions.

Suggested Classroom Activity: Have students diagram the route a drug would take from ingestion by the mother to the fetus.

Suggested Clinical Activity: Have students write a simple explanation of placental transfer of drugs from mother to infant. Have them include this information in a teaching plan for a mother who is ingesting some form of drug. Alcohol, or nicotine.

1. Describe physiological changes during pregnancy that may affect the absorption, distribution, metabolism, and excretion of drugs. .

Suggested Classroom Activity: Have students present a report in class on the effects of a certain medication from one of the pregnancy categories.

Suggested Clinical Activity: Have each student review his or her pregnant client’s chart and determine if the medication she was taking was beneficial or harmful to the fetus/newborn. Present a report in postconference.

1. Identify factors that influence the transfer of drugs into breast milk.

Suggested Classroom Activity: Have students discuss as a group the potential adverse effects of teratogens during each period of development from preimplantation to birth.

Suggested Clinical Activity: Have students care for a new mother who was exposed to a teratogen.

1. Outline important points in client and family education regarding drug use during pregnancy and lactation.

Suggested Classroom Activity: Have students diagram the route a drug would take from ingestion by the mother to breast milk.

Suggested Clinical Activity: Have students include this diagram in a care plan for a mother who is breast-feeding.

1. Identify the importance of teaching the breastfeeding mother about prescription and over-the-counter (OTC) drugs, as well as the use of herbal products.

Suggested Classroom Activity: Assign each student group a drug that is found in breast milk. Have the groups investigate the effects on the infant and report to the total group.

Suggested Clinical Activity: Have students write a teaching plan for a new mother who is breast-feeding for the first time. Have students focus on the potential for adverse side effects from maternal drug ingestion.

1. Describe physiological and biochemical changes that occur in the older adult, and how these affect pharmacotherapy

Suggested Classroom Activity: Have students use a skit to explain the adverse effects to the fetus/neonate from a mother who is abusing drugs.

Suggested Clinical Activity: Have students care for a mother who is ingesting some form of drug, alcohol, or nicotine.

1. Discuss the nursing and pharmacological implications associated with each of the following developmental age groups: prenatal, infancy, toddlerhood, preschool, school age, adolescence, young adulthood, middle adulthood, and older adulthood.

Suggested Classroom Activity: Ask students simulate how they would use the nursing process to administer a drug to a family member

Suggested Clinical Activity: Ask students to high light the specific nursing interventions that were considered due to the clients age group

**Key Concepts**

1. The nurse must be aware of the physiological changes and developmental stages that occur during pregnancy to the pregnant woman and the developing fetus.
2. The nurse must also be able to identify potential adverse drug events in both mother and fetus.
3. The nurse must also understand that most drugs cross the placental barrier and are also present in breast milk.
4. Pharmacotherapy is postponed until after pregnancy and lactation when possible and safer alternatives are used during pregnancy.
5. Certain preexisting illnesses, complications related to pregnancy, and some conditions unrelated to pregnancy must be treated.
6. The goal is to treat the mother without harming the fetus and the therapeutic value of the drug must be balanced against the potential adverse effects.
7. Most body systems undergo predictable changes during pregnancy with some processes speeding up and other slowing down.
8. Hormone changes and the pressures exerted by a growing fetus may change gastric emptying times.
9. Due to nausea and vomiting, some pregnant women may be unable to take oral medications early in the pregnancy.
10. Pulmonary blood flow changes in response to hormones so respiratory agents are absorbed in higher quantities.
11. Increased total body water dilutes plasma proteins, resulting in fewer plasma proteins to bind with drugs, which causes a higher concentration of “free” drug in the plasma.
12. Unbound free drugs are more available to cross the placental boundary and to pass into breast milk and to the infant.
13. Highly lipophilic drugs are distributed into lipid-rich breast milk.
14. Metabolism is significantly altered throughout pregnancy.
15. The fetal liver is still developing and lacks the ability to metabolize most drugs taken by the mother.
16. Excretion is enhanced during pregnancy by increases in renal plasma flow, glomerular filtration rate, creatinine clearance, and renal tubular reabsorption.
17. The placenta is a temporary organ that allows for nutrition and gas exchange between mother and fetus.
18. Maternal blood does not circulate through the fetus, but capillary-like structures in the placenta allow for an exchange of substances.
19. The placenta offers a degree of protective filtration of the maternal blood, preventing certain harmful substances from reaching the fetus, but vitamins, fatty acids, glucose, and electrolytes freely pass from mother to fetus.
20. Most drugs cross the placenta by simple diffusion and a few drugs cross by way of active transport.
21. Drugs do not have to cross the placenta or enter fetal blood to cause fetal abnormalities.
22. Maternal factors impacting drug transfer across the placenta include plasma drug level in the mother, solubility of the drug, molecular size, protein binding, drug ionization, and blood flow to the placenta.
23. Health Canada pregnancy risk categories are used as guides when prescribing medications during pregnancy.
24. Drugs are tested on pregnant laboratory animals to determine their ability to cause birth anomalies so little human data is available.
25. The human placenta is unique among mammals; therefore, the animal data extrapolated from animal data may be only crude approximations of actual risk to a human fetus.
26. No prescription drug, OTC medication, or herbal product should be taken during pregnancy unless prescribed by a health care provider who has weighed the benefits and risks.
27. Category A drugs are considered safe during pregnancy; they include multivitamins, iron, and folic acid.
28. Category B drugs are also considered safe; they include penicillin and macrolide used to treat infections during pregnancy.
29. The primary reason for category C designation is insufficient data to determine if the drug is safe or if it may cause birth defects. These drugs should be avoided since they may cause fetal abnormalities.
30. All category D and X drugs should be avoided due to their potential for causing serious birth defects. Examples are angiotensin converting enzyme (ACE) inhibitors, tetracyclines, isotretinoin (Accutane), misoprostol (Cytotec), and thalidomide (Thalomid).
31. Alcohol, nicotine, and illicit drugs may also negatively affect the fetus.
32. Problems with the current classification system include no specific clinical information to guide health care providers and no information on dose adjustment.
33. All pregnant women taking medications are being encouraged to join a pregnancy registry to survey drug effects on both the client and the fetus or newborn.
34. Lack of scientific information on the effects of drugs does not mean they are safe.
35. A teratogen is a substance, organism, or physical agent that causes a permanent abnormality in structure or function, growth retardation, or death to the embryo or fetus.
36. The teratogenic effect depends on multiple, complex factors such as dose, timing of therapy, and the stage of fetal development.
37. During the preimplantation period (weeks 1 and 2), the developing embryo has not established a blood supply with the mother and exposure to a teratogen will either cause death to the embryo or have no effect.
38. During the embryonic period (weeks 3 through 8), internal structures develop rapidly. This is a period of maximum sensitivity to teratogens, which can lead to structural malformation and spontaneous abortion during this period.
39. During the fetal period (9 weeks until birth), organ systems continue to grow and mature. This period is when the maximum transfer of substances from maternal circulation to fetal blood occurs.
40. During this period exposure to teratogens is more likely to result in slowed growth or impaired organ function than gross structural malformations.
41. Nurses caring for the woman must be able to differentiate between adverse drug effects and the normal symptoms of pregnancy.
42. The transfer of drugs from mother to infants may occur through breast milk.
43. For the few drugs that are absolutely contraindicated during lactation, equally effective, safer alternatives are usually available.
44. The amount of drug that passes to the infant during lactation depends on multiple factors such as the mother’s plasma drug level, the drug’s solubility, molecular size and protein binding, drug ionization, and drug half-life.
45. The infant’s stomach content is quite acidic and some drugs are destroyed, some drugs are inactivated when ingested with calcium- and protein-rich foods, and some drugs are removed by first-pass metabolism.
46. The infant’s organs that are responsible for metabolizing and eliminating drugs are immature.
47. Considering all the variables, it is impossible to accurately predict the amount of maternal drug that enters the breast milk. Estimates are from 1% to 3%.
48. Nonspecific drug effects seen in breast-feeding infants include diarrhea, constipation, sedation, and irritability.
49. The nurse’s responsibility is to monitor infants for adverse drug effects and educate new mothers to do the same.
50. The nurse must inform the mother that all drugs of abuse are contraindicated during both pregnancy and lactation. The infant may experience withdrawal symptoms and test positive for the drug for several weeks to months after exposure.
51. Usually topical medications that are applied to the mother’s skin have no adverse effect on the breast-feeding infant.
52. Creams that are applied to the nipples such as vitamin E, A, or D creams may be ingested by the breast-feeding infant.
53. Hale’s lactation risk categories serve as guidelines for the health care provider to identify safe and contraindicated drugs during lactation.
54. Pediatric clients receive large amounts of nearly all the same drugs that are prescribed for adults; however, the distribution of the drug classes is different in children.
55. Before the 1990s, there was very little drug information targeted for the pediatric population. Drug trials for pediatric clients were virtually unheard of and data regarding the pharmacokinetics and adverse effects was not well documented.
56. Among the flaws noted in this plan were that many medications were chosen to extend their exclusivity and generate higher profits, not for their potential value to children and that the act gave no incentives for studying generic drugs or those with a smaller market.
57. The increased emphasis on pediatric drugs has led to labeling changes. Today, vaccines and antibiotics have adequate pediatric labeling, but steroids and drugs for treating HIV, gastrointestinal (GI) disorders, pain, and hypertension still have very little information related to their use in pediatric clients.
58. Normal physiological changes of growth and development markedly affect pharmacokinetics and pharmacodynamics.
59. Increased gastric pH and delayed gastric emptying have the potential to influence oral absorption in pediatric clients. These absorption characteristics are especially true for premature infants and neonates.
60. Slow gastric motility in very young children will keep the drug in the stomach longer. This will also increase the absorption of drugs across the stomach lining, and slow the rate of absorption of drugs that rely on the intestine.
61. The infant’s low blood flow to skeletal muscles leads to slow and erratic absorption of drugs administrated by the intramuscular (IM) and subcutaneous routes.
62. The infant’s thin, highly permeable skin allows lotions and topical dugs to be absorbed at a more rapid rate than in adults.
63. The three main factors that affect drug distribution in children are the proportion of water to fat, immaturity of liver function, and an underdeveloped blood–brain barrier
64. The higher proportion of water dilutes water-soluble drugs such as furosemide (Lasix). Where water concentration is high, water-soluble drugs will move out of the serum to other areas of the infant’s body. The overall effect is lower serum drug levels; this may require an increase in dosages to maintain adequate serum levels of the drug.
65. In infants under 6 months of age, the liver is immature and produces very small amounts of plasma proteins. Drugs that bind to plasma proteins present as “free” drug in the serum while drugs and endogenous substances (such as bilirubin) compete for the protein-binding sites.
66. The child’s blood–brain barrier is not fully developed at birth, allowing easy penetration of drugs and chemicals to the CNS. This results in heightened responses.
67. The rate of metabolism in children is impacted by the immaturity of the hepatic cytochrome P450 (CYP450) enzyme system. Metabolism is significantly slower in children, which leads to reduced clearance rates and extended half-lives for drugs extensively metabolized by the liver.
68. The enzyme alcohol dehydrogenase, which is responsible for detoxifying benzyl alcohol, is markedly reduced at birth, leaving the newborn at risk for the development of “gasping syndrome,” which can lead to respiratory and cardiovascular failure.
69. Young children have immature renal systems with slower renal clearance so drugs primarily excreted by the kidneys may accumulate and cause nephrotoxicity.
70. Age, weight, and developmental level of the child must be taken into consideration when administering medications to pediatric clients.
71. Pediatric clients are defined as being any age from birth to 16 years of age and weighing less than 50 kg.
72. Growth is the progressive increase in physical size, whereas development is the functional evolution of the physical, psychomotor, and cognitive capabilities.
73. Growth and developmental stages usually go together in a predictable sequence but psychomotor and cognitive development is more variable.
74. The infancy period is from birth to 12 months of age and includes the neonatal period (the first 28 days of life). Nursing care and pharmacotherapy are directed toward the safety of the infant, proper dosing of prescribed drugs, and educating the parents on how to administer medications properly.
75. Toddlers (ages 1 to 3) display a tremendous sense of curiosity; they begin to explore, try new things, and tend to place everything in their mouth. There is a major concern for medication and household product safety because toddlers can swallow liquids and chew solid medications. Poisoning is extremely common at this age.
76. Administering medications to toddlers is a challenge related to increased motor ability, and learning to assert independence and limited ability to reason or understand the relationship of medicines to health.
77. In general, principles of medication administration that pertain to the toddler also apply to preschoolers (ages 3 to 5 years) with some changes in sites of IM injections.
78. When the child plays the role of the nurse or doctor, it makes them feel more in control of the situation.
79. Rapid mental, physical, and social development as well as early ethical-moral development occurs during school age (between 6 and 12 years). During this time frame, most children remain healthy with GI upsets and respiratory infections being the most common complaints.
80. School-age children are usually more cooperative with medication administration.
81. Their strong sense of independence leads adolescents (ages 13 to 16) to self-medicate, with or without parental knowledge.
82. Skin problems, headaches, menstrual symptoms, sex-related concerns, eating disorders, contraception, alcohol and tobacco use, and sports-related injuries are the most common pharmacotherapy needs for adolescents.
83. Adolescents have a need for privacy, control, and explanations concerning their treatment. Nurses should communicate with adolescents more in the manner they would with an adult and give the adolescent time to ask questions.
84. The principles of safe medication practice for pediatric clients are identical to those of adult clients.
85. Nurses must remember to follow the five rights when administering medications.
86. Nurses must question drug orders that are outside the normal range, because some drugs can be lethal to pediatric clients.
87. The nurse must be accurate in calculating drug dosages of pediatric clients and consistently update his or her skills since errors may have serious consequences.
88. All critical care medications should be double-checked by the pharmacist and another nurse prior to administration.
89. Body weight method: Involves the calculation of the number of milligrams of drug based on the child’s weight in kilograms; a unit of time is usually included. Serum concentrations are not proportional to body weight, and body weight does not take into consideration variables such as metabolism and elimination rates.
90. Body surface area (BSA): This method is considered the most valid basis for dosage and accounts for pharmacokinetic differences. It also better estimates blood volume, metabolism, and the effects of drugs.
91. Using the BSA method, a child’s height and weight are plotted on a nomogram and a line is drawn between the two points. The point at which the line intersects the surface area line is the child’s BSA. BSA divided by 1.73 times adult dose = pediatric dose.
92. Pediatric clients are more susceptible to adverse drug reactions than adults because of their smaller size and immature or developing organ systems.
93. Identifying adverse drug reactions (ADRs) will depend on the skill and the ability of the nurse in assessing subtle changes. Infants and young children do not have the maturity or verbal skills to accurately describe feelings resulting from the medication ingestion.
94. Knowing specific drugs and their predictable adverse reactions in the adult population will help the nurse quickly identify the signs and symptoms in pediatric clients.
95. Few types of ADRs are specific to children. Often, ADRs are the result of immature or developing organs and tissues.
96. Children may experience drug interactions just like adults.
97. Parents often use home remedies, OTC drugs, and herbal treatments as the first response to their child’s illness. Research suggests that this is on the rise.
98. If not taken properly, a drug will fail to achieve optimum therapeutic outcomes.
99. It is essential to assess the client and family’s ability to assist the child with the medication regimen, and develop strategies that will enhance medication adherence.
100. In long-term drug therapy, arrangements may be made for follow-up appointments to assess drug responses.
101. Directly observed therapy (DOT) is a technique in which the health care provider administers the oral drug(s) to the child and observes the drug being swallowed.
102. Polypharmacy is defined as the use of multiple medications to treat a client. Elderly adults often have comorbidities that require the use of several medications. The probability for drug interactions and adverse effects directly correlates with the number of medications a client is required to take.
103. Clients may also routinely take OTC drugs such as dietary supplements and herbal products that may interact with prescription medications. It is important to ask clients at each visit if they take any of these types of medications, because these can also interact with prescription medications.
104. Polypharmacy may also occur when clients see multiple prescribers or fill their prescriptions at different pharmacies. Clients may receive duplicative therapy, or be prescribed drugs that interact with medications ordered by another prescriber.
105. Giving an “average dose” may result in markedly different effects in older clients than in younger clients even if the two clients are of similar body size.
106. Gastrointestinal (GI) motility decreases and blood flow to this system is decreased. A decrease in liver size also results in decreased drug metabolism. Serum albumin production decreases as does total body water.
107. The contractility and cardiac output of the heart decrease. Also, an increase in peripheral resistance or blood pressure occurs.
108. Cognitive ability and sensory function progressively decline. This is due to a decrease in brain mass, neuron loss, and a slower conduction velocity. The effectiveness of the blood–brain barrier declines, which causes some medications to penetrate the brain more easily.
109. Blood flow to the kidneys becomes reduced and the number of nephrons within the kidneys declines. Therefore, the capability of the kidneys to filter substances is reduced, which results in prolonged exposure to drugs and other substances.
110. Normal aging processes can change the older adult’s response to drug therapy.
111. Absorption of medications is typically slower, yet still complete, in the elderly. Since the gastric pH is higher, drugs that require an acidic environment to dissolve require more time for absorption. Local GI adverse effects can be more pronounced because drugs can remain in the GI tract longer.
112. Elderly clients have more body fat than younger clients, so fat-soluble drugs (e.g., diazepam, phenobarbital, and haloperidol) distribute into fat tissues and remain in the body for longer periods of time. Water-soluble drugs (e.g., gentamicin, hydrochlorothiazide) can have higher serum concentrations because total body water decreases with age.
113. Decreased liver function can result in delayed metabolism and a decrease in plasma proteins. Because only free drug is pharmacologically active, a decrease in protein binding can result in toxicity for drugs that are highly protein bound (e.g., phenytoin, warfarin).
114. The greater permeability of the blood–brain barrier can result in more pronounced CNS adverse effects from drugs such as benzodiazepines, antipsychotics, or antiepileptics. Medications may need to be prescribed at lower dosages or dosed less frequently.
115. Changes in liver function may result in extended duration of action for some drugs such as digoxin and acetaminophen.
116. Decreased renal function can result in the decreased clearance of medications. Monitor serum creatinine to estimate the renal function, or collect urinary output to determine renal function directly.
117. Elderly adults may have a decreased response to beta agonists and antagonists, and an increased response to anticholinergics, CNS depressants, and warfarin. These altered responses are due to changes in pharmacodynamics, not pharmacokinetics.
118. Assess any barriers that exist with the client such as a visual or hearing impairment, and any functional or cognitive dysfunction that may contribute to nonadherence. Encourage the client to report any signs of adverse effects of medications.
119. Assess whether the client understands the benefit of the medication, can afford it, and is willing to make lifestyle changes if necessary. Provide the client with social support services to obtain medications if necessary.
120. Drug misuse is common among elderly clients and includes overuse, underuse, and erratic use. Misuse may be accidental or deliberate. Drug misuse is rarely reported to health care providers and may have serious consequences. Prevention includes client education and encouraging the reporting of how drugs are actually being taken.
121. Adverse drug reactions (ADRs) are common in the elderly primarily due to the number of medications they take. Review the regimen regularly to ensure that each medication is still necessary.
122. Hepatic and renal impairment can result in an increased risk for ADRs. Assess laboratory values and adjust dosages or dosing frequency to account for hepatic and renal impairment.
123. Medications are a possible cause of sudden changes in mental status, weight loss, dehydration, restlessness, anorexia, fluid retention, change in bowel habits, or major changes in organ function.
124. Due to age-related changes in pharmacokinetics and/or pharmacodynamics, some commonly used medications should be used with caution in the elderly. A multidisciplinary group has developed a list of drugs that should be used with extreme caution in the elderly. The list is known as the Beers Criteria.
125. The Beers Criteria has three categories of drugs: drugs or classes to avoid, potentially inappropriate drugs or classes to avoid in older adults with certain diseases that the drugs may exacerbate, and drugs to be used with caution.
126. Factors that predispose elderly clients to ADRs include the number of drugs taken, age-related physiological and anatomic changes, and difficulty in distinguishing ADRs from normal aging processes.
127. The nurse plays a key role in optimizing pharmacotherapy outcomes in older adults. Key factors are assessing level of comprehension, cultural beliefs, dietary practices, and physiological conditions of the client and family.

**Chapter 7 Individual, psychosocial and cultural influences in drug responses**

**Learning outcomes**

1. Describe fundamental concepts underlying a holistic approach to pharmacotherapy.

Suggested Classroom Activity: Have students research and write a report on the development of holistic nursing. The report should be from three to five pages long and presented in class.

Suggested Clinical Activity: Have students write a care plan for their assigned client using the holistic approach to client care.

2. Describe the components of the human integration pyramid model

Suggested Classroom Activity: Ask students to apply the human integration model on a client they care for in the hospital setting. Ask them to identify all the levels on the pyramid pertaining to the client and discuss how these may affect the process of drug administration

Suggested Clinical Activity: Ask students to identify the main variables on the pyramid that will impact the clients’ reaction to medications.

3. Identify psychosocial and spiritual factors that can affect pharmacotherapeutics.

Suggested Classroom Activity: Have students research and write a report about how spirituality influences health.

Suggested Clinical Activity: Have students assess an assigned client from the psychosocial aspect of care.

4. Explain how ethnicity can affect pharmacotherapeutic outcomes.

Suggested Classroom Activity: Have students discuss how ethnicity is determined and how it differs from culture.

Suggested Clinical Activity: Have students incorporate the aspects of ethnicity and cultural impact into their assigned client’s care plan.

5. Identify examples of how cultural values, beliefs, and practices can influence pharmacotherapeutic outcomes.

Suggested Classroom Activity: Have students discuss the use of cultural values and beliefs in health care as groups. Each group should study a different culture to discuss in class.

Suggested Clinical Activity: Have students incorporate the use of alternative therapies in their assigned client’s care plan.

6. Explain how community and environmental factors can affect pharmacotherapeutic outcomes.

Suggested Classroom Activity: Ask students to explore environmental variable that have a direct impact on intake of medications

Suggested Clinical Activity: Ask students to interview a community nurse to investigate the community resources available or clients with chronic disease who need long-term pharmacological therapy

7. Convey how genetic polymorphisms can influence pharmacotherapy.

Suggested Classroom Activity: Have students write a three- to four-page report on the effect a polymorphism has on a certain ethnic group.

Suggested Clinical Activity: Have students incorporate the effects of polymorphism into their assigned client’s care plan.

8. Relate the implications of gender to the actions of certain drugs.

Suggested Classroom Activity: Have students write a three- to four-page report to be presented to the class on a medication in which gender affects the outcome of this drug’s use in a client.

Suggested Clinical Activity: Have students incorporate the effects of gender differences into their assigned client’s care plan.

9. Explain how pharmacogenomics may lead to customized drug therapy.

Suggested Classroom Activity: Have students research current literature regarding pharmacogenomics and present findings to the class.

Suggested Clinical Activity: Have students interview a pharmacist about how pharmacogenomics may one day change the delivery of medications.

**Key Concepts**

1. *Psychosocial* is the term used in health care to describe psychological development in the context of the social environment.
2. The close relationship between the psychological, social, and spiritual nature of individuals strongly influences a client’s illness.
3. The psychosocial history of a client is critical to effective pharmacotherapy.
4. A well-performed psychosocial assessment reveals the relationship between the client and his or her physical and social environment.
5. Ethnicity implies that people have biologic and genetic similarities, whereas culture is a set of beliefs, values, and norms that provide meaning for an individual or group.
6. Cultural and ethnic variables are important aspects of a client’s pharmacotherapy.
7. Modern clinical pharmacology is largely based on research and clinical experiences with Caucasians.
8. Protocols for many clinical trials now include as diverse a population as possible.
9. Researchers have discovered a biologic basis for differences in metabolic response to drugs among various ethnic groups.
10. Nurses should strive to understand the significance of a client’s cultural traditions and their potential impact on the client’s pharmacotherapy regimen.
11. Important ethnic and cultural variables include diet, use of alternative therapies, and beliefs about health and disease.
12. Genetic polymorphisms can affect drug action.
13. Human DNA is 99.8% alike, but the remaining 0.2% may result in significant differences in a client’s ability to handle certain medications.
14. Differences in ability to handle medications may arise when a mutation occurs in the DNA.
15. Mutation creates a genetic polymorphism, which is two or more versions of the same protein.
16. Genetic polymorphisms have been discovered in enzymes that metabolize drugs and in proteins that serve as receptors for drugs.
17. Since the altered or mutated form of the enzyme has a changed structure, it does not function the same as the unmutated enzyme.
18. Polymorphism has been discovered in the enzyme acetyl transferase, which metabolizes isoniazid (INH), the drug prescribed for tuberculosis.
19. Other enzyme polymorphisms also have been discovered.
20. A second type of genetic polymorphism affects protein receptors, resulting in simple changes in structure such that the body can no longer accept the drug.
21. Genetic polymorphisms occur in specific ethnic groups that settled the same geographic area and married within the same ethnic group for hundreds of generations. This results in amplified genetic polymorphisms that are expressed within that group.
22. Pharmacogenetics is the study of genetic variations that cause differences in the way clients respond to medications.
23. There are well-established differences in the patterns of disease between males and females; therefore, they may respond differently to drugs.
24. Adherence to certain prescribed medications may also be gender based since negative responses may only apply to one gender.
25. Recent studies have shown that although men and women have identical genes, expression of the genes greatly differs.
26. Gender differences in drug response may be explained by differences in body composition such as the fat-to-muscle ratio, cerebral blood flow variance, and differences in rate of elimination.
27. In the past, the majority of the drug research studies were conducted using only male subjects because the assumption was made that there were no differences in genders and that study conclusions applied to both genders.
28. Gender consideration is necessary in the analyses of clinical data and assessment of potential pharmacokinetic and pharmacodynamic differences.

**Chapter 8 Drug effects, adverse reactions and interactions**

**Learning Outcomes:**

1. Differentiate between adverse effects and side effects.

Suggested Classroom Activity: Divide students into three to four groups. Assign each group a different drug (e.g., ciprofloxacin, atenolol, pantoprazole, lisinopril). Have them present some predictable side effects of the drug and then discuss what would be considered adverse effects.

Suggested Classroom Activity: Compare and contrast the different side effects and adverse effects for furosemide (Lasix).

Suggested Clinical Activity: Have each student evaluate the medications of an assigned client and determine if the client is experiencing any side effects or adverse effects of any of the medications.

2. Create a plan to minimize or prevent adverse drug events in clients.

Suggested Classroom Activity: Using the same groups and drugs as in Learning Outcome 1, have students identify what they can do to reduce or prevent the side effects of the drugs.

Suggested Clinical Activity: Select a client who is experiencing side effects of a drug and discuss what the nurse can do to minimize the effect. Discuss if anything could be done to prevent the side effect from occurring in the future.

3. Describe the incidence and characteristics of drug allergies.

Suggested Classroom Activity: Present a scenario where a client states, “I am allergic to sulfa. It makes me so sick to my stomach and I get diarrhea.” Discuss why this may not be a true allergy. Explore what questions should be asked to determine if a true allergy exists.

Suggested Classroom Activity: Present a scenario where a client develops an anaphylactic reaction. Outline steps the nurse would take to treat the reaction.

Suggested Clinical Activity: Check the chart of clients assigned to the students and identify one or two who have a reported allergy. Have students assess clients to determine what occurs when the client takes the medication. Discuss if the symptoms reflect a true allergic response.

4. Explain how idiosyncratic reactions differ from other types of adverse effects.

Suggested Classroom Activity: Discuss how to differentiate a side effect from an idiosyncratic effect.

Suggested Clinical Activity: Review drug therapies with staff at the clinical site to identify if any clients are experiencing, or have recently experienced, any idiosyncratic reactions and share these with the students.

5. Explain why certain drugs with carcinogenic or teratogenic potential are used in pharmacotherapy.

Suggested Classroom Activity: Divide students into four to five groups, assigning each group a different drug to check the pregnancy risk category. Be sure to include drugs from a safe category (such as acetaminophen) as well as those with known teratogenic effects (isotretinoin and finasteride).

Suggested Classroom Activity: Illustrate how the drugs with known carcinogen effects can provide therapeutic benefits (e.g., doxorubicin [Adriamycin] and methotrexate).

Suggested Clinical Activity: Check clients to determine if any are receiving a medication with a known carcinogenic or teratogenic effect. (If not on an oncology unit, look for immunosuppressant drugs or hormones and hormone antagonists.) Discuss why the client is receiving the drug and why the benefits may outweigh the risks.

6. Report the characteristic signs, symptoms, and treatment for each of the following organ-specific adverse events: nephrotoxicity, neurotoxicity, hepatotoxicity, dermatologic toxicity, bone marrow toxicity, cardiotoxicity, and skeletal muscle toxicity.

Suggested Classroom Activity: Divide students into six groups and assign each a drug class with a known toxicity for each system. Have each group present what specific toxic effect can occur with the drug classification assigned to them. Suggestions for classifications are:

* Renal toxicity: aminoglycosides
* Hepatotoxicity: antifungals
* Muscle toxicity: HmG co-reductase inhibitors (statins)
* Bone marrow toxicity: folic acid antagonists
* Neurotoxicity: anticonvulsants
* Dermatologic toxicity: sulfonamides

Suggested Classroom Activity: Discuss the relevance of doing peak and trough levels for drugs with potential toxicities, such as vancomycin.

Suggested Clinical Activity: Have students review all medications their assigned clients are receiving and identify any that have potential for toxicities. Discuss what parameters should be closely monitored in the client.

7. Use examples to explain the importance of drug interactions to pharmacology.

Suggested Classroom Activity: Select a common drug and examine the various types of interactions that can potentially occur with this drug. Involve students by using a drug guide and having them follow which are food–drug interactions and which are drug–drug interactions.

Suggested Clinical Activity: Have each student choose one drug an assigned client is receiving. Have them identify what drug or food interactions are possible with that drug. Have them assess whether the client is at risk for any of the interactions.

Suggested Clinical Activity: Develop a teaching plan that addresses the food–drug interactions of warfarin (Coumadin).

8. Describe the mechanisms of drug interactions that alter absorption, distribution, metabolism, or excretion.

Suggested Classroom Activity: Divide students into four to five groups and assign each group a different drug. Have students look up interactions for that given drug and identify which phase of pharmacokinetics is affected.

Suggested Clinical Activity: Have each student choose the drugs an assigned client is receiving and identify if the drugs have any interactions and what phase of pharmacokinetics is affected by the interaction.

9. Differentiate among additive, synergistic, and antagonistic drug interactions.

Suggested Classroom Activity: Discuss the implications of administering drugs with each of these effects. Are there instances when these effects are undesirable? Are there instances in which a drug is given for a specific additive, synergistic, or antagonistic effect, but giving the drug has other undesired effects?

Suggested Clinical Activity: Identify a drug with each of these implications among those being taken by assigned clients. What is the specific reason this drug was chosen for this client?

10. Identify examples of drug–food interactions that may impact pharmacotherapeutic outcomes.

Suggested Classroom Activity: Divide students into four to five groups and assign each group a different drug. Have students look up interactions for that given drug and identify which ones are drug–food interactions. Have them explain if the drug should be given with or without food and why.

Suggested Clinical Activity: Have students identify any food–drug interactions that are indicated with the medications being taken by their assigned clients. Discuss if this posed any problems with administration of the medications (for example, ciprofloxacin may be ordered along with an antacid and several other a.m. medications; it is sometimes inconvenient to hold one medication and administer it 2 hours later).

**Key Concepts**

1. Adverse events, also called adverse effects, are undesirable and possibly harmful actions that occur secondary to a medication.
2. All drugs have a potential to produce adverse events, including OTC drugs, herbals, and dietary supplements.
3. Side effects are predictable and can occur at therapeutic doses.
4. The distinction between adverse effects and side effects is in the severity of the symptoms.
5. According to the Health Canada, serious drug effects are those that can result in death, can cause congenital abnormalities, can cause life-threatening events, and/or require interventions to prevent serious consequences.
6. Adverse events may be an extension of a drug’s pharmacologic action. Knowing the drug’s expected therapeutic action enables the nurse to predict potential adverse effects.
7. Nurses play a critical role in minimizing the severity and occurrence of adverse drug events. Adverse effects cannot always be predicted or prevented, but nurses should take measures to minimize or prevent them.
8. A thorough health history/assessment of the client provides valuable information that can identify potential drug interactions. It alerts the nurse to allergies and to metabolic and excretion problems that may impact drug effects.
9. Giving medications accurately helps to reduce unnecessary adverse effects.
10. A thorough knowledge of drug doses, actions, and potential adverse effects is necessary for early recognition of harmful drug effects.
11. Nurses must anticipate unusual and unexpected drug effects.
12. The nurse should question unusual orders.
13. The nurse should teach the client about adverse effects.
14. Health Canada has initiated MedEffect Canada which is a voluntary program that encourages health care providers and consumers to report suspected adverse effects to Health Canada (https://hpr-rps.hres.ca/static/content/form-formule.php?lang=en).
15. Data from MedEffect are analyzed by clinical reviewers. If a potential safety concern is identified, Health Canada may conduct additional studies to determine the validity or extent of safety concerns, require changes to a product’s labeling, require a black box warning that warns prescribers the drug carries a risk of serious or even fatal adverse effects, restrict use of the drug in specific populations, communicate safety information to health care providers and consumers, or recall or remove the product from the market.
16. Some clients experience a placebo effect. Thus when examining drug information, the nurse should always examine the incidence of adverse effects that occur over and above that caused by a placebo.
17. Clients exhibit many different types of symptoms with allergies, but they are all caused by a hyper-response of the immune system.
18. Allergy symptoms are unrelated to the pharmacologic action of a drug.
19. Anaphylactic reactions have the same symptoms regardless of the drug.
20. Drug classes more likely to cause allergic reactions include penicillin and related antibiotics, radiologic contrast dyes, insulin, NSAIDs, sulfonamides, cancer chemotherapy agents, preservatives, and certain antiseizure drugs.
21. Idiosyncratic responses are rare drug events but are not considered to be expected side effects or allergic responses. They are unrelated to pharmacologic action of the drug.
22. Idiosyncratic responses are often attributed to genetic differences that affect drug metabolism.
23. Some drugs are approved for use in humans even though they were shown to produce cancer in laboratory animals. The risk–benefit ratio of these drugs demonstrates that the benefits of the drug outweigh its long-term risks.
24. Many of the drugs with a risk–benefit ratio are those used to treat cancer. Treatment with such drugs often prolongs life.
25. Immunosuppressants may cause cancer.
26. Hormone or hormone antagonists may cause cancer.
27. Drugs known to cause birth defects are called teratogens. These drugs are only dangerous to pregnant women.
28. When drugs with known teratogenic effects are used in women of childbearing years, the nurse must be diligent in educating clients to avoid pregnancy.
29. Drugs are not tested in pregnant humans.
30. No woman should take a drug, herbal product, or dietary supplement during pregnancy unless approved by the client’s health care provider.
31. Since the majority of drugs are excreted by the kidneys, the renal tubule is exposed to high drug concentrations.
32. It is important to identify drugs that have nephrotoxicity potential and recognize risk factors for impaired renal function in the client, which include dehydration, abnormal urinary lab values, and history of renal impairment.
33. Drugs with the ability to cross the blood–brain barrier (BBB) can cause neurotoxicity, so clients need to be assessed for CNS effects. Clients receiving these drugs need to be taught safety precautions.
34. A common adverse effect is hepatotoxicity, since the majority of drugs are detoxified in the liver. Liver function tests must be monitored when known hepatotoxic drugs are being administered.
35. Some of the most common drug adverse events include skin reactions, such as rashes with pruritus. More serious, and even fatal, skin reactions include urticaria, which may lead to anaphylaxis; angioedema; and Stevens–Johnson syndrome. Photosensitivity can also occur.
36. Since the bone marrow is the source of RBC, WBC, and platelet production, toxicity can result in serious and life-threatening conditions, including pancytopenia, aplastic anemia, agranulocytosis, and neutropenia. Such conditions are often associated with antineoplastic treatment.
37. Some drugs damage the muscle cells of the heart, reducing cardiac output. The nurse must monitor for excessive fatigue, cough, shortness of breath, weight gain, and peripheral edema, which may be associated with heart failure.
38. Although muscle tissue is quite resistant to drug effects, skeletal muscle myopathy and toxicity to cardiac muscle can occur. Abnormal muscle pain should always be evaluated, and CK levels should be monitored.
39. Drugs can interact with other substances such as foods, dietary supplements, herbal products, or another drug, affecting the drug’s action.
40. Drug interactions are ongoing and can often go unnoticed because therapy is not affected.
41. Drug interactions can inhibit, enhance, or change the therapeutic effect of a drug.
42. Absorption of drugs can be affected by stomach pH, peristalsis, and concurrent administration with other drugs or foods.
43. Interactions can occur when a drug is displaced from protein-binding sites or an altered plasma pH affects the ability of drugs to cross membranes.
44. Drugs that are inhibitors, inducers, and substrates of CYP enzymes have potential to cause drug interactions. Inducers can increase drug metabolism; inhibitors can decrease drug metabolism.
45. Most drugs are excreted via the kidneys. Interactions can be influenced by cardiac output, glomerular filtration rate (GFR), competition for reabsorption or excretion in the tubule, biliary drug excretion, effects on aging, and urinary pH.
46. When pharmacodynamic drug interactions occur, the drug action is enhanced or inhibited. In addition, the drug interactions are either desirable—with increased therapeutic response or decreased adverse effects—or undesirable—with decreased therapeutic responses or increased adverse effects.
47. When two drugs are given to produce a therapeutic response that is greater than that of each drug given separately, it is called an additive effect.
48. When the effect of two drugs given together is greater than the effect expected from simply adding the two drugs’ responses, it is called a synergistic effect.
49. When one drug diminishes the pharmacologic response of another drug, it is called an antagonistic effect.
50. Pharmacologic interactions can also be indirect. In this situation, one drug does not directly affect the pharmacologic action of another drug, but produces adverse effects that indirectly impact the second drug.
51. Many drug–food and drug–herb interactions can impact pharmacotherapeutic outcomes.
52. Grapefruit juice inhibits the CYP3A4 enzyme, which can increase blood levels of benzodiazepines, calcium channel blockers, and statins.
53. Absorption and bioavailability of drugs can be increased or decreased.
54. To avoid interactions, separate drugs and food. Some drugs are better absorbed if given with food.

**Chapter 9 Principles of Drug Administration**

**Learning Outcomes**

1. Discuss drug administration as a component of safe, effective nursing care, using the nursing process

Suggested Classroom Activity: Ask students to List requirements of a complete drug order or prescription and to accurately interpret drug orders containing common abbreviations.

Suggested Classroom Activity: Assign students to work on groups to differentiate drug dosage forms for various routes and purposes of administration and to discuss advantages and disadvantages of oral, parenteral, and topical routes of drug administration

Suggested Clinical Activity: On their assigned clients ask students to identify supplies, techniques, and observations needed for safe and accurate administration of drugs by different routes and to assess clients for conditions and factors that are likely to influence drug effects, including age, weight, health status, and lifestyle.

2. Describe the roles and responsibilities of the nurse regarding drug administration.

Suggested classroom activity: Ask students to identify nondrug interventions to prevent or decrease the need for drug therapy, and to discuss interventions to increase therapeutic effects and decrease adverse effects of drug therapy. Obtain a medication history about the client’s use of prescription, over-the-counter (OTC), and social drugs as well as herbal and dietary supplements.

Suggested clinical activity: As students to discuss guidelines for rational choices of drugs, dosages, routes, and times of administration on their assigned clients. Also ask them to observe clients for therapeutic and adverse responses to drug therapy.

3. Explain how the 10 rights of drug administration affect client safety.

Suggested Classroom Activity: Ask students to list the “rights” of drug administration and discuss knowledge and skills needed to implement the “rights” of drug administration.

Suggested Clinical Activity: Ask students to identify how the 10 rights play a role in minimizing the incidence of medication errors.

4. Give specific examples of how the nurse can increase client adherence in taking medications

Suggested Class room Activity: Ask students to list factors that will enhance adherence to drug therapy

Suggested Clinical Activity: Ask students to identify adherence specific barriers on a clients they cared for in the hospital and to discuss the measures taken to enhance adherence on that client.

5. Interpret drug orders that contain abbreviations.

Suggested Classroom Activity: Ask students to identify the most commonly used abbreviations and to discuss the advantages and disadvantages of using them

Suggested Clinical Activity: Ask students to gather the approved abbreviations used in the hospital. Discuss in a post conference how abbreviations can sometimes be misinterpreted and the consequences of this misinterpretation on clients.

6. Compare and contrast the three systems of measurement used in pharmacology.

Suggested Classroom Activity: Ask students to create a table comparing the systems of measurement used in Canada and in the US

Suggested Clinical Activity: Ask students to ask a pharmacist in the hospital about the advantages and disadvantages of using different measurement system.

7. Explain the proper methods to administer enteral, topical, and parenteral drugs.

Suggested Classroom Activity: Assign students to work in groups and ask them to draw tables showing the advantages and disadvantages of each route

Suggested Clinical Activity: Ask students to justify the routes of administration for the drugs received by their clients

8. Compare and contrast the advantages and disadvantages of each route of drug administration.

Suggested Classroom Activity: Assign students to explore new routes of administration such as orally disintegrating tablet or orally dissolving tablet (ODT). Ask students to discuss the advantages and disadvantages of this route

Suggested Clinical Activity: Ask students to visit the pharmacy to explore none traditional routes of administration.

Suggested classroom activity: Ask students to discuss the use of herbal and dietary supplements, provide—or assist them in obtaining—reliable information.

Suggested clinical activity: Ask students to teach clients and family members how to use prescription and OTC drugs safely and effectively. Also ask students to teach clients about the potential effects of herbal and dietary supplements.

**Key concepts**

1. Medication history is an essential part of a thorough assessment.
2. Planning minimizes factors such as ambiguous abbreviations that contribute to medication errors.
3. Implementation: Be aware that stress, noise, and interruptions increase the chance of a nurse making a medication error. Careful attention to the task of medication administration and following agency policy can reduce medication errors.
4. Evaluating the effects of medication and monitoring for adverse effects are essential activities to prevent medication errors.
5. Nurses must stay up to date on medications and must never administer any medication with which they are unfamiliar with the normal dose, purpose, or effects.
6. There are many resources for the nurse to access for drug information and updates. However, such resources may occasionally be wrong. It is the nurse’s duty to contact the publisher of any published resource and report any inaccurate information.
7. Medication reconciliation is a way of “keeping track” of a client’s medications as they process from one provider to another. Reconciliation accurately lists all medications a client is taking in an attempt to reduce duplication, omissions, dosing errors, or drug interactions.
8. Polypharmacy, although it can impact any age group, is usually associated with older adults. It is the result of multiple chronic disorders, and therefore, multiple medications, that interact. The medications are frequently from more than one health care provider and also from more than one pharmacy.
9. Joint Commission recommendations for medication reconciliation include implementing a process for obtaining and documenting a complete list of the client’s current medications on admission, communicating a complete list of the client’s medications when the client is transferred to another provider, and on discharge, providing the client with a complete list of all medications and instructions on how to properly take them.
10. Proper client education is essential for safe medication usage.
11. Adherence, or taking medications as directed, is a major factor affecting pharmacotherapy.
12. Many factors affect adherence such as forgetfulness and the expense of medications.
13. The nurse should not only ask what medications are prescribed for a client, but should also investigate the client’s adherence to directions for administration.
14. Clients should be encouraged to become active partners in their own health care by becoming knowledgeable about the medications they take.
15. Health care agencies are actively involved in reducing medication errors.
16. The trend is toward computerized, locked, and automated cabinets for medication storage. The nurse has a code to access the medication storage cabinet.
17. Larger agencies have risk management departments to examine risks and minimize the number of medication errors.
18. Examples for policies and procedures within an institution include those associated with storage of medication, identification of expired medication, handling of medications, stocking levels, abbreviations, and a method for removing outdated reference books.
19. Health care agencies use analytical tools to assess for the likelihood of errors and to analyze errors once they have occurred.
20. Health care failure mode and effect analysis (HFMEA) identifies processes where errors may occur related to prescription, dispensing, and administration.
21. Root cause analysis (RCA) attempts to focus attention on the causes of an error, rather than on the person responsible for the error.
22. The nurse should be aware of potential areas that may increase medication errors and should employ strategies to mitigate risk.

**Chapter 10 Medication errors and risk reduction**

1. Explain how the ethical principles contained in the Code of Ethics for Registered Nurses by the Canadian Nurses Association (CNA) are used to guide nurses in their practice.”

Suggested Classroom Activity: Have students critique three research articles on this learning objective and submit a one-page paper on each article.

Suggested Clinical Activity: Discuss the clinical facility’s medication administration process. List the pros and cons of its system in postconference.

2 Apply general moral principles to the effective administration of medications

Suggested Classroom Activity: Use a case study in the classroom as a skit and let the students portray the people involved in the incident. Use a mock jury to decide the outcome.

Suggested Clinical Activity: Have students describe the clinical facility’s process with regard to its medication error procedure in postconference.

3. Discuss the standards of care in the application of the nursing process

Suggested Classroom Activity: Have students critique research articles on two of the major types of medication errors and summit a one-page paper on each article. Let the students choose their area(s) of interest.

Suggested Clinical Activity: Have students discuss what factors would have put their client at risk for a medication error in postconference.

4. Explain the importance of documentation in the administration of medications. .

Suggested Classroom Activity: Have students complete the medication error reporting process.

Suggested Clinical Activity: Have students review the policies and procedures that risk management has in place for medication errors at their clinical site. This should be done with permission from the agency. Have students then present the process in postconference.

5. Discuss factors that contribute to medication incidents. .

Suggested Classroom Activity: Have students critique two research articles related to policies and procedures in relation to medication errors and summit a one-page paper on each article.

Suggested Clinical Activity: Have students review the facility’s policy and procedure manual for the medication administration process.

6. Identify the process in reporting and managing medication incidents. .

Suggested Classroom Activity: Brainstorm ideas for reducing medication errors.

Suggested Clinical Activity: Have students interview nurses at the clinical site to gain ideas on how nurses implement medication error reduction strategies.

7. Describe strategies that the nurse may implement to prevent medication incidents

Suggested Classroom Activity: Have students write one paragraph on why they think that medication reconciliation is, or is not, a benefit to reducing medication errors.

Suggested Clinical Activity: Have students follow the medication reconciliation process for their clients.

8. Describe the role of the nurse in reporting adverse drug reactions (ADRs).

Suggested Classroom Activity: Design a teaching plan for an elderly person who is being discharged to home and is now responsible for taking his or her medications.

Suggested Clinical Activity: Incorporate the teaching plan into the client’s discharge instructions.

9. Discuss client education that is important for safe medication usage. .

Suggested Classroom Activity: Have students compare the different methods of medication storage and present their findings in class.

Suggested Clinical Activity: Have students discuss the pros and cons of the system used at their clinical site in postconference.

**Key Concepts**

1. Medication error definition, per the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP): “Any preventable event that may cause or lead to inappropriate medication use or client harm while the medication is in the control of the health care professional, client or consumer.”

1. NCC MERP has developed a “medication error index” that categorizes medication errors by evaluating the extent of harm an error can cause.
2. Anti-infectives, hematologic drugs, and cardiovascular drugs are common classifications of drugs that resulted in drug errors.
3. The Joint Commission disseminates information about sentinel events, which are unexpected deaths of injury or the risk of such a death or injury. This information is meant to trigger review of policies, procedures, or processes to prevent future errors.
4. Medication errors may result in extended lengths of hospitalization, legal challenges, risk to accreditation status, loss of reimbursement, and harm to the reputation of the facility.
5. There is no acceptable incidence rate for medication errors, and the goal of every health care organization should be to improve medication administration systems to prevent medication errors.
6. All medication errors should be investigated in a nonpunitive manner to identify procedures that may improve the medication administration process to prevent future errors.
7. Medication errors that occur repeatedly should alert the facility that new policies and procedures for medication administration are needed.
8. Medication errors may be caused by human factors, inadequate communication, or confusing labels, packaging, or drug names.
9. Frequent categories of medication errors include errors in client assessment, inaccurate prescribing, and errors in administration.
10. Failure to adhere to the “five rights” of medication administration is the most common cause of medication error.
11. Health Canada works with health care agencies to reduce confusion of packaging or drug names that are too similar.
12. The Institute for Safe Medication Practices (ISMP) was founded in 1994 to help standardize medication error reporting.
13. Some types of areas are independent of the drug itself; for example, the failure to perform a system check, forgetting to give a medication, or administering a medication to the wrong client can occur with any medication.
14. Drugs with familiar sounding names are at greater risk for medication errors. Sound-alike drugs are the reason verbal drug orders should be confirmed in writing before being administered.
15. Drugs that have a narrow therapeutic index are more likely to cause serious consequences. They are not necessarily more “error prone” than others, but due to their toxicity alerts, double checking is an additional safeguard.
16. *High-alert medications* are drugs with a high risk of causing significant client harm should an error occur. The nurse must be very vigilant when administering these agents.
17. It is a nurse’s legal and ethical responsibility to document all occurrences of medication errors and incidents.
18. Health Canada coordinates the reporting of medication errors on the federal level.
19. Medications errors may be reported anonymously directly to Health Canada.
20. Numerous agencies are involved in the tracking and reporting of medication errors on all levels.
21. All medical facilities have policies and procedures that provide guidance for reporting medication errors.
22. Documentation should be done in a factual manner and include all the interventions implemented for the client’s safety following the error. Failure to document nursing actions could be interpreted as negligence or failure to acknowledge the incident.
23. The medication administration record (MAR) should contain the information on what drug was given or omitted.
24. The nurse should follow agency policy and procedure concerning the completion of an occurrence report regarding a medication error.
25. Accurate documentation is essential for legal reasons. Documentation verifies the interventions used to ensure the client’s safety.
26. Adhering to the steps of the nursing process promotes safe drug administration.

**Chapter 11 Complementary and alternative therapies and their roles in pharmacotherapy in Canada**

**Learning Outcomes**

1. Explain the role of complementary and alternative medicine in client wellness.

Suggested Classroom Activity: Have students share any personal experiences they have had with the use of CAM.

Suggested Clinical Activity: Have students interview their assigned clients to determine if any are using any CAM. Share with all students in a postconference setting.

2. Discuss reasons why herbal and dietary supplements have increased in popularity.

Suggested Classroom Activity: Assign students to interview family members and close friends to determine if they use any forms of CAM. Discuss in class some of the reasons why CAM was chosen by the people who use it.

Suggested Clinical Activity: Have students ask clients who use CAM why they have chosen this type of therapy.

Suggested ClassroomActivity: Have students research the cost of a selected herbal preparation or supplement.

3. Identify the parts of an herb that may contain active ingredients and the types of formulations made from these parts.

Suggested Classroom Activity: Divide students into several groups and assign a different herb to each group. Have students research what formulations the herb is available in (for example, echinacea comes in a tincture, capsules, tea, etc.).

Suggested Clinical Activity: Have students identify the particular type of herbal preparation used by any of their assigned clients.

4. Discuss the regulatory process for natural health products licensed for sale in Canada.

Suggested Classroom Activity: Have students visit a health food store and read the labels of five different supplements. Have them analyze the data on the label and share this in the classroom setting.

Suggested Clinical Activity: Have students evaluate their clients’ knowledge of any herbal products or supplements used by them. Discover who recommended the product.

5. Describe some adverse effects that may be caused by herbal preparations.

Suggested Classroom Activity: Divide students into four to five groups and assign each group a supplement to research. Have students present a brief review of the supplement’s action and potential for side effects.

Suggested Clinical Activity: Have students assess clients taking any herbal products or supplements for the presence of adverse effects.

6. Discuss the role of the nurse in teaching clients about complementary and alternative therapies.

Suggested Classroom Activity: Discuss why clients may be reluctant to divulge use of CAM therapy.

Suggested Clinical Activity: Have students develop a teaching plan for assigned clients who using a CAM therapy.

7. Identify common herb-drug interactions

Suggested Classroom Activity: Divide students into several groups and assign specific specialty supplements. Have each group report on nursing responsibilities unique to the type of therapy.

Suggested Clinical Activity: Have students review the medication histories of assigned clients to look for the use of specialty supplements.

**Key Concepts**

1. Complementary and alternative medicine (CAM) is growing in popularity with both health care providers and clients. CAM focuses on treating each person as an individual, considering the health of the whole person and emphasizing the integration of mind and body. Additional characteristics of CAM are promotion of disease prevention, self-care, and self-healing as well as recognizing the spirituality in health and healing.
2. There is insufficient research on CAM therapies to definitively determine their effectiveness or lack of effectiveness.
3. The nurse should be sensitive to the client’s beliefs about alternative treatments.
4. CAM includes biologically based therapies, alternate health care systems, manual healing, mind–body interventions, spiritual methods, and other therapies such as bioelectromagnetics, detoxifying therapy, and animal-assisted therapy.
5. An herb is a botanical or plant product that is used for a purpose, most commonly a food enhancer or medicine.
6. When the pharmaceutical industry began in the late 1800s, interest in herbal medicine began to diminish.
7. CAM has increased in popularity in part due to increased ease of availability of the product.
8. Other factors contributing to the rise in the use of herbal and dietary supplements include aggressive marketing, increased attention to natural alternatives and preventive medicine, and a widespread impression that natural substances are safer than synthetic pharmaceuticals.
9. Research and surveys reveal that the use of alternative therapy in the United States is widespread and progressively increasing. Women and those with higher education levels are more likely to use CAM. Most people use CAM in addition to conventional medicine.
10. The active ingredients in herbs may be present in only one specific part of the plant, such as the root or leaves, or in all parts. It is important for the client using herbs to be familiar with which part of the plant contains the active ingredient.
11. Herbs may contain dozens of active chemicals rather than only one active chemical as is present in most prescription drugs.
12. The strength of an herbal preparation can vary depending on its preparation, where it was grown, and how it was collected, stored, and preserved.
13. Standardization of strength or dose is based either on the amount of biologically active substance in the herb or on a common substance in the whole herb that may not be the active ingredient.
14. The two basic formulations of herbs are solid (pills, tablets, capsules, salves, and ointments) and liquid (teas, infusions, decoctions, tinctures, and extracts are forms of liquid herbal preparations).
15. The Dietary Supplement Health and Education Act of 1994 (DSHEA) regulates herbal products and specialty supplements and is far less rigorous than the Food, Drug, and Cosmetic Act of 1936.
16. Dietary supplements are defined as products intended to enhance or supplement the diet that are not already approved as a drug by the Health Canada.
17. A key concept with alternative therapy is that “natural” does not always mean “safer.” Some of the active chemicals are the same strength as those in currently approved prescription and OTC medications.
18. Herbal products have ingredients that have additive, synergistic, or antagonistic interactions with prescriptions and OTC drugs. Some herbs can also have organ-specific toxicity, such as comfrey with liver toxicity.
19. The true extent of herb–drug interactions is unknown.
20. Allergic reactions can occur with use of natural products since herbal products contain several different chemicals from one plant. It is better if the client initially takes the smallest dose to determine if an allergy exists.
21. Nurses are responsible for maintaining information on CAM therapies since many clients utilize these therapies today.
22. Nurses should not be judgmental of clients who utilize CAM therapies. Determine the clients’ goals in using the therapy. Ensure that clients do not have false hopes about the therapy being used.
23. Specialty supplements, such as chondroitin and glucosamine, are substances that occur naturally in the body. Taking additional amounts may or may not be beneficial and in general are not harmful unless taken in excess amounts.
24. The health care provider should advise clients to be skeptical about any health claims associated with herbal products or specialty supplements.

**Chapter 12 Brief review of the autonomic nervous system and neurotransmitters**

**Learning Outcomes**

1. Distinguish between the functions of the central and peripheral nervous systems.

Suggested Classroom Activity: Discuss with students the importance of studying neuropharmacology.

Suggested Clinical Activity: Identify clients seen in the clinical setting who have been prescribed neuropharmacologic agents

2. Discuss how drugs are classified according to their effects on each of the two fundamental divisions of the nervous system.

Suggested Classroom Activity: Have students differentiate between the somatic nervous system and the autonomic nervous system structures.

Suggested Clinical Activity: Have students identify clients in the clinical setting who have been prescribed somatic or autonomic drugs.

3. Compare and contrast the actions of the sympathetic and parasympathetic nervous systems.

Suggested Classroom Activity: Use the bear versus couch analogy:

Sympathetic: What will the SNS (organs/glands) do when chased by a bear?

Parasympathetic: What will the PNS (organs/glands) do when sitting on a couch?

Suggested Clinical Activity: Have students identify clients who have demonstrated effects of autonomic nervous system drugs, either SNS or PNS effects.

4. Explain the process of synaptic transmission and the neurotransmitters that are important to the autonomic nervous system.

Suggested Classroom Activity: Have students trace the pathway of the activation of neurotransmitters: NE and Ach.

Suggested Clinical Activity: Have students identify clients that might benefit from each ANS neurotransmitter, NE and Ach.

5. Discuss how drugs are used to modify functions of the autonomic nervous system.

Suggested Classroom Activity: Have students identify drugs in each of the five categories along the multiple locations of the two neuron chains and on which site the drugs exert their action.

Suggested Clinical Activity: Have students identify clients who are taking ANS drugs and the drug’s effect, whether on organs or glands.

6. Describe the actions of acetylcholine and cholinergic synapses.

Suggested Classroom Activity: Have students identify muscarinic and nicotinic effects on the body.

Suggested Clinical Activity: Have students identify clients who are affected by cholinergic drugs.

7. Describe the actions of norepinephrine at adrenergic synapses.

Suggested Classroom Activity: Have students provide a list of medications with specific adrenergic properties.

Suggested Clinical Activity: Have students identify adrenergic drugs being administered to assigned clients. Are these drugs being used for their alpha or beta effects.

8. Compare and contrast the types of responses that occur when a drug activates alpha1-, alpha2-, beta1-, or beta2-adrenergic receptors.

Suggested Classroom Activity: Have students discuss how stress activates the adrenal medulla and subsequent release of catecholamines.

Suggested Clinical Activity: Have students identify conditions of their clinical clients that may be stress related.

9. Compare the actions of the adrenal medulla with those of other sympathetic effector organs.

Suggested Classroom Activity: Have students discuss how emotions and sensory stimulation activate the ANS through the integration of the hypothalamus.

Suggested Clinical Activity: Have students identify clients who have experienced emotional or sensory stimuli and what effect the stimulation has had on their physical or psychological condition.

10. Explain how higher centers in the brain can influence autonomic functions

Suggested Classroom Activity: Make a list of identifying terms and medications for each ANS classification, scramble the items, and have students identify the class to which each term belongs.

Suggested Clinical Activity: Have students identify clients who have been prescribed the various classifications of ANS drugs.

**Key Concepts**

1. The two major subdivisions of the nervous system are the central nervous system and the peripheral nervous system. The nervous system is considered the master controller of most activities occurring within the body.
2. The brain, spinal cord, and peripheral nerves act as a smoothly integrated whole to accomplish minute-to-minute changes in essential functions such as heart rate, blood pressure, pupil size, and intestinal movement.
3. The nervous system has two major divisions: the central nervous system (CNS) and the peripheral nervous system. The CNS is comprised of the brain and spinal cord, while the peripheral division consists primarily of nerves that carry messages to and from the CNS.
4. The peripheral nervous system is divided into somatic and autonomic components. The peripheral nervous system provides the brain the means to communicate with and receive sensory messages from the outside world.
5. Neurons in the peripheral nervous system either recognize changes to the environment (sensory division) or respond to those changes by moving muscles or secreting chemicals (motor division). The motor division is divided into two components. The somatic nervous system consists of nerves that provide voluntary control over skeletal muscle. The nerves of the autonomic nervous system (ANS) give involuntary control over vital functions of the cardiovascular, digestive, respiratory, and genitourinary systems.
6. The ANS has two distinct divisions, the sympathetic nervous system and the parasympathetic nervous system. Most organs and glands receive nerves from both branches, and the two divisions have opposing actions.
7. The sympathetic nervous system is activated under emergency conditions or stress, and produces a set of actions called the fight-or-flight response. Activation of this branch prepares the body for heightened activity and for an immediate response to a threat.
8. The parasympathetic nervous system is activated under nonstressful conditions and produces a set of symptoms known as the rest-and-digest response. These nerves promote relaxation and body maintenance activities.
9. There is always some degree of autonomic activity, even in the absence of stimuli. This background level of activity is known as autonomic tone.
10. The basic unit of the ANS is a two-neuron chain. The first neuron, called the preganglionic neuron, originates in the CNS. The preganglionic neuron connects with the second nerve outside the CNS in structures called ganglia. A ganglion (singular of ganglia) contains the neuron cell body of the postganglionic neuron, which is waiting to receive the action potential.
11. The communication of the message from one cell to another, or synaptic transmission, utilizes special chemicals called neurotransmitters.
12. The movement of the nerve impulse from the CNS to the ganglia to the neuroeffector junction occurs in several steps: synthesis of neurotransmitter, storage of neurotransmitter, release of neurotransmitter, binding to the receptor, and termination of neurotransmitter action.
13. The two primary neurotransmitters of the autonomic nervous system are norepinephrine (NE) and acetylcholine (Ach).
14. The two-neuron anatomic structure of the ANS allows multiple locations at which drugs can act.
15. Drugs can affect the outflow of impulses traveling along the preganglionic neuron at their source: the CNS; at a second site in ganglia, at the synapse where the preganglionic and postganglionic neurons meet; and at a third site at the end of the chain, at the target tissues of the postganglionic neuron.
16. The ANS actions of drugs affecting this system can be grouped into the following categories: medications that affect the synthesis of the neurotransmitter in the preganglionic nerve; medications that prevent the storage of the neurotransmitter in vesicles within the preganglionic nerve; medications that influence the release of the neurotransmitter from the preganglionic nerve; medications that bind to the neurotransmitter receptor site on the postganglionic cell; and medications that prevent the normal destruction or reuptake of the neurotransmitter.
17. When an “autonomic drug” is administered, the goal is not to treat an autonomic disease; it is to correct disorders of target organs and other organ systems through its effects on autonomic nerves.
18. Acetylcholine was the first neurotransmitter to be identified. Neurons releasing acetylcholine are called *cholinergic nerves*.
19. Two types of cholinergic receptors bind Ach. They are named after certain chemicals that bind to them: nicotinic receptors and muscarinic receptors.
20. When acetylcholine binds to nicotinic receptors, the action is always stimulatory. Acetylcholine action at muscarinic receptors, however, may be stimulatory or inhibitory, depending on the target tissue.
21. The goal of nerve transmission is to produce an immediate, though transient, response.
22. The enzyme that resides in the synaptic cleft and catalyzes the destruction of Ach is called acetylcholinesterase (AchE). Following the breakdown of Ach, choline is re-formed and is taken up by the preganglionic neuron, where it is used to synthesize more Ach.
23. Norepinephrine is the neurotransmitter that belongs to a class of endogenous hormones called catecholamines and is released at almost all postganglionic sympathetic nerves.
24. The receptors at the ends of postganglionic sympathetic neurons are called adrenergic, which is derived from the word *adrenaline*.
25. Adrenergic receptors are of two basic types, alpha (α) and beta (β). These receptors are further divided into the subtypes beta1, beta2, alpha1, and alpha2.
26. In alpha1 receptors, intracellular calcium stores are released, causing excitatory effects such as smooth muscle contraction or sphincter closure.
27. Activation of the alpha2 receptor will inhibit norepinephrine release from sympathetic nerve endings.
28. Beta receptors act by increasing the second messenger cAMP in target cells.
29. The primary tissues served by beta1 receptors are the heart and coronary vessels.
30. Beta2 receptors are more widely distributed than beta1 receptors, with locations in the smooth muscle in blood vessels, the GI tract, and the lung.
31. Fifty to eighty percent of the NE is taken back into the preganglionic nerve, a process known as reuptake. After reuptake, NE in the nerve terminal is repackaged in vesicles for future use, or destroyed enzymatically by monoamine oxidase (MAO). Norepinephrine entering the circulation, such as that secreted by the adrenal glands or given as medication, is destroyed by the enzyme catechol-O-methyltransferase (COMT) in kidney and liver cells.
32. The adrenal medulla is closely associated with the sympathetic nervous system. Preganglionic neurons from the spinal cord terminate in the adrenal medulla, and release the neurotransmitter epinephrine and norepinephrine directly into the blood.
33. When released into the systemic circulation, the effects of epinephrine and norepinephrine are more diffuse and longer lasting than those produced by activation of postganglionic sympathetic neurons in the ANS.
34. The ANS is influenced by higher levels of control in the cerebral cortex and hypothalamus. The hypothalamus is thought to be the main integration center of the ANS. This tissue receives signals from the cerebrum, and sensory input such as emotions from the limbic system of the brain. The hypothalamus interprets the information and responds by sending messages to the various portions of the ANS.
35. Autonomic drugs are classified by which receptors they stimulate or block and are classified in four ways:
    1. Stimulation of the sympathetic nervous system. These drugs are called sympathomimetics or adrenergic agonists and they produce the classic symptoms of the fight-or-flight response.
    2. Stimulation of the parasympathetic nervous system. These drugs are called parasympathomimetics or muscarinic agonists and they produce the characteristic symptoms of the rest-and-digest response.
    3. Inhibition of the sympathetic nervous system. These drugs are called adrenergic antagonists or adrenergic blockers and they produce actions opposite to those of the sympathomimetics.
    4. Inhibition of the parasympathetic nervous system. These drugs are called anticholinergics, parasympatholytics, or muscarinic blockers and they produce actions opposite to those of the parasympathomimetics.

**Chapter 13 Pharmacotherapy with cholinergic agonists and antagonists**

1. Compare and contrast the mechanisms of action for direct- and indirect-acting cholinergic agonists.

Suggested Classroom Activity: Have students differentiate the physical responses that would be stimulated from the autonomic nervous system versus the somatic system.

Suggested Clinical Activity: Ask students to monitor pulse rates on each other before and after exercise and document the response.

2. Identify the actions of muscarinic agonists and their pharmacological uses.

Suggested Classroom Activity: Have students describe the adverse effects of muscarinic agonists by body system.

Suggested Clinical Activity: Have students evaluate the medical records for assigned clients to discover if any are prescribed a muscarinic agonist medication.

3. Describe the pharmacotherapy of myasthenia gravis.

Suggested Classroom Activity: Have students describe the process and findings associated with the anti-acetylcholine receptor (AChR) antibody test used for diagnosis of myasthenia gravis.

Suggested Clinical Activity: Have students compare/contrast neuromuscular strength in a myasthenia gravis client before and after medication administration.

4. Explain the actions and pharmacological applications of nicotine.

Suggested Classroom Activity: Divide students into groups and assign each group a different form of delivery of nicotine (in tobacco smoke, as a liquid, in gum, or in patch form). Have the groups research the dangers inherent in each form of delivery and present findings to the class.

Suggested Clinical Activity: Have students investigate the use of smoking cessation drugs in the clinical site. How are they ordered? Who initiates the order? Do the nurses find the drugs are successful for their clients?

5. For each of the drug classes listed in Protoype Drugs, identify the prototype and representative drugs and explain the mechanism(s) of drug action, primary indications, contraindications, significant drug interactions, pregnancy category, and important adverse effects.

Suggested Classroom Activity: Have students compare and contrast expected side effects in the client from each class of drugs.

Suggested Clinical Activity: Review preoperative and postoperative reports on a surgical unit to observe which medications are given to induce anesthesia and which are used to reverse anesthesia.

6. Apply the nursing process to care for clients who are receiving pharmacotherapy with cholinergic agonists and antagonists.

Suggested Classroom Activity: Have students develop a priority list of nursing responsibilities for a postoperative client.

Suggested Clinical Activity: Have students assess vital signs, respiratory efforts, and swallowing capabilities on clients in the clinical unit.

**Key Concepts**

1. The two basic types of cholinergic receptors are muscarinic and nicotinic. They are classified as direct acting or indirect acting.
2. Direct-acting agents work by producing the rest-and-digest response. They activate the cholinergic synapses by entering the synaptic space and binding to cholinergic receptors.
3. Indirect-acting agents stimulate release of Ach from nerve terminals, allowing more Ach to reach receptors.
4. Muscarinic agonists used as medication are relatively resistant to destruction by AchE and exhibit a longer duration of action than Ach.
5. These agents increase the degree of smooth muscle tone and contractions of the GI tract and are contraindicated in clients with suspected GI or GU obstruction.
6. Since muscarinic agonists stimulate lacrimal, sweat, digestive, and salivary secretions they may be used to advantage in treating clients with xerostomia or Sjogren’s syndrome.
7. Muscarinic agonists contract bronchial smooth muscle, causing the airways to constrict and are contraindicated in clients with asthma.
8. These agents work by reducing heart rate and blood pressure; they may, however, induce reflex tachycardia.
9. They may be used as prophylaxis for poisoning and to treat muscarinic mushroom overdoses.
10. Prototype drug is bethanechol (Duvoid), which is used to treat urinary retention.
11. Potential uses for AchE medications include treatment of Alzheimer’s disease, glaucoma, and prophylaxis of nerve gas poisoning.
12. Cholinergic crisis can be caused by an overdose of medications or by poisoning. It causes intense miosis, nausea and vomiting, urinary incontinence, and abdominal cramping. It can also cause tachycardia, hyperglycemia, and muscle weakness when severe.
13. It must be treated quickly with atropine to reverse the muscarinic effects.
14. Myasthenia gravis appears when antibodies in the body attack nicotinic synapses in the skeletal muscles, leading to “grave muscular weakness.” Symptoms include extreme fatigue, double vision, speech impairment, and difficulty chewing or wallowing. Ptosis may appear.
15. MG is diagnosed clinically and by positive antibodies to acetylcholinesterase and can be confirmed with an edrophonium test.
16. It is crucial to assess the client’s baseline status prior to medication administration.
17. MG is primarily treated with AchE inhibitors and corticosteroids.
18. A myasthenia gravis crisis may occur with sudden withdrawal of medications. Prompt diagnosis and treatment are essential.
19. It should be clearly understood that MG is a disease of skeletal muscle, not a disorder of the ANS.
20. Prototype drug is pyridostigmine which reversibly inhibits the action of AchE at cholinergic synapses.
21. Other AchE inhibitors include ambenonium, edrophonium, and neostigmine.
22. Nicotine acts by activating Ach receptors at the ganglia and is the only drug in widespread use with this effect.
23. Nicotine is extremely dangerous and overdose can be fatal.
24. As a drug nicotine is used as nicotine replacement therapy for tobacco cessation programs.
25. Nursing diagnoses useful for clients receiving pharmacotherapy with cholinergic agonists may include *Ineffective Airway Clearance, Impaired Physical Mobility, Urinary Retention, Impaired Urinary Elimination, Incontinence, Deficient Knowledge,* and *Risk for Injury.*
26. It may be helpful for the client or family to keep a diary of variations in muscle strength.
27. Teach client to immediately report tremors, palpitations, changes in blood pressure, dizziness, urinary retention, abdominal pain, or changes in behavior.
28. Instruct client to report any severe muscle weakness that occurs 1 hour after taking drug or if it occurs 3 or more hours after taking the drug.
29. Cholinergic antagonists (or anticholinergics) are drugs that inhibit the action of acetylcholine (Ach) at cholinergic synapses. Cholinergic synapses may be muscarinic or nicotinic.
30. Muscarinic antagonists are drugs that block receptors at cholinergic synapses in the parasympathetic nervous system and at a few target organs in the sympathetic nervous system.
31. Nicotinic antagonists block receptors at cholinergic synapses in the ganglia or in the somatic nervous system at the neuromuscular junction.
32. Ganglionic blockers inhibit transmission at the ganglia in the sympathetic and parasympathetic nervous systems, thus affecting both autonomic divisions.
33. Neuromuscular blockers do not act on the autonomic nervous system at all but instead inhibit transmission at the neuromuscular junctions on skeletal muscles in the somatic nervous system.
34. Muscarinic antagonists are very old drugs and are rarely the drugs of choice due to adverse effects.
35. Muscarinic antagonists exhibit a relatively high incidence of adverse effects, most of which are predictable because they are associated with inhibition of the parasympathetic nervous system.
36. Overdose with anticholinergic substances produces a set of symptoms known as anticholinergic syndrome, symptoms of which include dry mouth, blurred vision, photophobia, visual changes, difficulty swallowing, agitation, and hallucinations.
37. The prototype drug for muscarinic antagonists is atropine, which is used in the treatment of bradycardia and as an antidote for cholinergic agonist overdose.
38. Drugs similar to atropine include benztropine, cyclopentolate, dicyclomine, glycopyrrolate, ipratropium, oxybutynin, propantheline, and scopolamine
39. When ganglionic blockers block parasympathetic tone, symptoms characteristic of anticholinergic drugs occur, such as urinary retention, constipation, blurred vision, increased heart rate, and dry mouth.
40. Although ganglionic blockers affect all autonomic organs, their only action that has therapeutic usefulness is vasodilation.
41. By reducing sympathetic vasomotor tone at arterioles, ganglionic blockers are capable of causing profound hypotension.
42. Only one ganglionic blocker, mecamylamine is approved for use.
43. Muscle contraction occurs when the motor end plate is depolarized. Motor end plates on skeletal muscle are cholinergic synapses that release Ach.
44. When depolarized by an action potential, the muscle cell releases intracellular calcium stores and contracts.
45. Multiple action potentials can produce a state of continuous contraction, followed by muscle paralysis.
46. Depolarizing neuromuscular blockers are given to produce muscle paralysis during short medical–surgical procedures.
47. The prototype drug for depolarizing-type neuromuscular blockers is succinylcholine .
48. Malignant hyperthermia may occur is certain clients.
49. Succinylcholine carries a black box warning regarding use in children, especially those with certain congenital musculoskeletal diseases.
50. Nondepolarizing neuromuscular blockers are given to produce muscle paralysis during longer surgical procedures.
51. There are six nondepolarizing neuromuscular blockers (NDNBs) that have similar uses, actions, and adverse effects.
52. While these drugs are similar, they do differ in durations of action.
53. The most serious concern when using NDNBs is paralysis of respiratory muscles.
54. Hypotension is another serious concern.
55. Nursing diagnoses useful in the care of clients receiving pharmacotherapy with cholinergic (muscarinic) antagonists include *Decreased Cardiac Output, Urinary Retention, Constipation, Impaired Oral Mucous Membranes, Deficient Knowledge, Risk for Imbalanced Body Temperature,* and *Risk for Injury.*
56. The client should report palpitations shortness of breath, dizziness, dysphagia, or syncope immediately.
57. Urinary retention and constipation may occur.
58. Teach the client that heat intolerance may occur, resulting in dizziness, change in mental status, pale skin, muscle cramping, nausea, and other signs of impending heat exhaustion or stroke.
59. Photosensitivity may occur.

**Chapter 14 Pharmacotherapy with adrenergic agonists and antagonists**

**Learning Outcomes**

1. Identify the physiological responses produced when a drug activates adrenergic receptors.

Suggested Classroom Activity: Have a physiologist visit the class to talk about the sympathomimetics and the fight-or-flight response.

Suggested Clinical Activity: Assess for findings associate with activation of adrenergic receptors in assigned clients.

2. Explain the direct and indirect mechanisms by which adrenergic agonists act.

Suggested Classroom Activity: Have students investigate the drug ephedrine and describe its direct and indirect mechanisms.

Suggested Clinical Activity: Have students evaluate assigned client medication history for the use of a MAO inhibitor. What drugs are found?

3. Compare and contrast the characteristics of catecholamines and noncatecholamines.

Suggested Classroom Activity: Have students list the important characteristics of catecholamines and noncatecholamines and their clinical applications.

Suggested Clinical Activity: Have students evaluate assigned client medication history for the use of a noncatecholamine drug.

4. Identify indications for pharmacotherapy with adrenergic agonists.

Suggested Classroom Activity: Have students identify adrenergic agonist drugs and their indications for use.

Suggested Clinical Activity: Obtain an EpiPen autoinjector and teach the students the correct way to use it.

5. Apply the nursing process to care for clients who are receiving pharmacotherapy with adrenergic agonists

Suggested Classroom Activity: Have students make a chart of drugs from this class.

Suggested Clinical Activity: Using the above chart, have students evaluate the medication history of assigned clients for these drugs. Why are they being used in these clients?

6. Identify the physiological responses produced when a drug blocks adrenergic receptors.

Suggested Classroom Activity: Have students prepare drug cards for a prototype of each class of adrenergic agonist.

Suggested Clinical Activity: Have students interview a client with chronic asthma regarding his or her symptoms, the medications being taken, and any side effects of these medications.

7. Identify indications for pharmacotherapy with adrenergic antagonists.

Suggested Classroom Activity: Divide students into small groups. Assign a specific nursing diagnosis to each group and have the group develop a care plan for that nursing diagnosis.

Suggested Clinical Activity: Have students complete a care plan for an assigned client who is on an adrenergic agonist.

1. Describe the first-dose phenomenon and how it may be prevented.

Suggested Classroom Activity: Ask students to define first-dose phenomenon and to illustrate its pathophysiology

Suggested Clinical Activity: Ask students to locate a client who is about to be started on antihypertensive and to create a teaching plan for this client to avoid the first –dose phenomenon

1. Explain the advantages of selective beta antagonists versus nonselective beta antagonists.

Suggested Classroom activity: Ask students to discuss the effects of blocking Beta receptors in the heart and the lungs and to explore the potential therapeutic and adverse effects of blocking these receptors

Suggested Clinical Activity: Ask students to interview a client on beta blockers and to teach the client about what to expect while on these medications and how to mitigate their side effects

1. Explain why beta-adrenergic antagonists should never be abruptly discontinued.

Suggested Class room activity: Ask students identify the most commonly prescribed beta blockers and to discuss the effects of these blockers on different body organs

Suggested Clinical Activity: Ask students to create a teaching plan for a clients receiving beta blockers for his hypertension

1. Apply the nursing process to care for clients who are receiving pharmacotherapy with adrenergic antagonists.

Suggested Classroom Activity: Have students make a chart of drugs from this class.

Suggested Clinical Activity: Using the above chart, have students evaluate the medication history of assigned clients for these drugs. Why are they being used in these clients?

**Key Concepts**

1. Adrenergic agonists activate the sympathetic nervous system and induce symptoms of the fight-or-flight response.
2. The pharmacology of adrenergic drugs is more complex than that of their cholinergic counterparts, due to the existence of the two receptor subtypes alpha and beta.
3. Drugs in this class are norepinephrine, epinephrine, and dopamine.
4. The most important action of adrenergic agonists is on the cardiovascular system: They increase the heart rate and cardiac output.
5. They also impact the respiratory system by relaxing the bronchi and causing bronchodilation. They impact the gastrointestinal system by slowing peristalsis and causing constipation. They also cause urinary retention.
6. The therapeutic effect of these drugs may become an adverse effect if taken to the extreme: They may raise blood pressure too much or excessively dry out the mucosa.
7. Adrenergic agonists may act directly by binding to adrenergic receptors (e.g., epinephrine, norepinephrine [NE], and dopamine).
8. Some adrenergic agonists act indirectly by increasing the amount of NE available at adrenergic synapses by three means (e.g., ephedrine, amphetamine, imipramine, cocaine, and phenelzine .
9. Adrenergic agonists may be classified as catecholamines or noncatecholamines.
10. Catecholamines contain a catechol and an amino group (e.g., norepinephrine, dopamine, isoproterenol, and dobutamine).
11. Noncatecholamines include phenylephrine, terbutaline, and ephedrine. They are rapidly destroyed by the enzymes MAO and COMT. Therefore, they have a short duration of action.
12. Catecholamines cannot be given orally but parenterally or by inhalation. They also cannot cross the blood–brain barrier. They are not as rapidly destroyed by MAO and COMT; therefore, they have a longer duration of action.
13. Noncatecholamines can be given orally. They do cross the blood– brain barrier. They are rapidly destroyed by MAO and COMT; therefore, they have a shorter duration of action.
14. The nonselective adrenergic agonists activate both alpha and beta receptors. The specific effects of each drug are dependent on which receptor subtypes are stimulated.
15. The first subtype is the alpha1-receptor agonists. They are used for the treatment of nasal congestion, hypotension, and ophthalmic examination. They may also be used to produce mydriasis during ophthalmic examinations.
16. The second subtype is the alpha2-receptor agonists. They are used for the treatment of hypertension.
17. The third subtype is the beta1-receptor agonists. They are used for the treatment of cardiac arrest, heart failure, and shock.
18. The fourth subtype is the beta2-receptor agonists. They are used for the treatment of asthma and to reduce preterm labor.
19. Some sympathomimetics are nonselective, stimulating two or more adrenergic-receptor subtypes (e.g., epinephrine and ephedrine). The nonselective adrenergic agonists generally cause more autonomic-related side effects than the selective agents.
20. One of the most important applications of the nonselective adrenergic agonists is for the pharmacotherapy of shock and other life-threatening cardiac disorders.
21. Epinephrine, norepinephrine, and dopamine are nonselective agents for shock and anaphylaxis when blood pressure and heart rate need to be quickly restored to normal levels.
22. Epinephrine is the prototype drug for nonselective adrenergic agonists. It is used to treat shock and anaphylaxis and as a bronchodilator.
23. Drugs similar to epinephrine include dopamine, ephedrine, and NE.
24. Activation of alpha1-adrenergic receptors causes a number of important physiological responses, most of which relate to contraction of vascular smooth muscle.
25. Alpha1-adrenergic agonists are used for treatment of hypotension associated with shock, and for treatment of orthostatic hypotension.
26. Another major action of alpha1-adrenergic agonists is vasoconstriction of vessels in the nasal mucosa. These agents are used for upper respiratory tract infection or allergic rhinitis. An intranasal agent is phenylephrine. An oral agent is ephedrine.
27. A third action of alpha1-adrenergic agonists is vasoconstriction of arterioles in the eye, and mydriasis. These agents are topically instilled into the eye, and relieve conjunctival congestion and redness. They are also used for ophthalmic examination, but are not the drug of choice for this purpose.
28. Activation of alpha2 receptors produces important responses in the brain rather than the peripheral nervous system.
29. The prototype alpha-adrenergic agonist is phenylephrine (Neo-Synephrine).
30. Drugs similar to phenylephrine are classified as intranasal decongestants or ocular decongestants.
31. Activation of beta1 receptors results in cardiac actions typical of the fight-or-flight response: Heart rate, force of contraction, and velocity of impulse conduction through the myocardium all increase.
32. Drugs with significant beta1 activity may be called cardiotonic or inotropic drugs.
33. Beta2-adrenergic receptors are more widely distributed than beta1 receptors. Pharmacologically, the most important site is in the lung.
34. Activation of beta2 receptors leads to relaxation of bronchial smooth muscle. Beta2-adrenergic agonists are commonly referred to as bronchodilators and are used for treatment of bronchial asthma and other pulmonary disorders.
35. Beta2-adrenergic agonists are also used for the treatment of preterm labor contractions. These drugs are called tocolytics.
36. Isoproterenol is the prototype nonselective beta-adrenergic agonist and is used as a bronchodilator and as a cardiac stimulator.
37. Drugs similar to isoproterenol are grouped into two primary subclasses: bronchodilators and tocolytics.
38. Nursing diagnoses useful for clients receiving adrenergic agonists include *Decreased Cardiac Output, Impaired Gas Exchange. Ineffective Airway Clearance, Disturbed Sleep Pattern, Deficient Knowledge,* and *Risk for Injury.*
39. Caffeine intake should be limited or eliminated to reduce nervousness, insomnia, and tremors.
40. IV adrenergic drips may cause intense vasoconstriction if extravasated.
41. Clients who have diabetes may experience increased blood glucose.
42. Photosensitivity may occur.
43. Adrenergic antagonists act by blocking the effects of norepinephrine (NE) at adrenergic receptors.
44. Adrenergic antagonists are drugs that compete with NE for adrenergic receptors.
45. Adrenergic antagonists and cholinergic agonists produce many of the same symptoms.
46. The presence of the alpha- and beta-adrenergic receptor subtypes in the sympathetic nervous system allows for more specific pharmacologic responses.
47. Actions of these agents are specific to either alpha blockade or beta blockade. Beta blockade is further divided into those drugs that inhibit both beta1 and beta2 receptors, and those that selectively inhibit only beta1 receptors.
48. Adrenergic antagonists have wide therapeutic application: They are the most frequently prescribed class of autonomic drugs. With few exceptions, these applications relate to the cardiovascular system, such as managing hypertension. They also have a limited role in treating benign prostatic hypertrophy (BPH).
49. Alpha1-adrenergic antagonists impact receptors located on smooth muscle of the heart, genitourinary system, gastrointestinal system, and brain. Blockade of alpha receptors dilates blood vessels, which causes lowering of blood pressure.
50. Drugs selective for alpha1 receptors have greater therapeutic value. Example drugs include doxazosin, prazosin, and terazosin.
51. Nonselective alpha antagonists activate alpha1 and alpha2 receptors. Examples include phentolamine and phenoxybenzamine. The high incidence of side effects like hypotension, tachycardia, nausea, vomiting, and diarrhea limits these agents’ usefulness.
52. Alpha1 blocker action on the urinary bladder and prostate produces effects by relaxing the smooth muscle of the bladder and prostate, which increases urine flow and voiding and decreases residual urine. The selective agent used in BPH is doxazosin (Cardura). Alpha1 blockers do not cure the condition; surgery is required to correct the restriction.
53. Alpha1 antagonists are occasionally used to treat pheochromocytoma and Raynaud’s disease.
54. Most of the adverse effects of alpha blockers are predictable based on their mechanism of action, which increases parasympathetic activity.
55. The *first-dose phenomenon* occurs when the sympathetic nervous system is blocked, and the parasympathetic system dominates. It creates hypotension and orthostatic hypotension due to reduced blood flow to the brain and syncope. These effects can be decreased by beginning therapy with low doses administered at bedtime.
56. The fall in blood pressure during alpha1-antagonist therapy may be accompanied by reflex tachycardia. Nasal congestion is an annoying adverse effect.
57. Noncardiovascular adverse effects include inability to ejaculate during intercourse, nausea, vomiting, abdominal cramping, incontinence, depression, lethargy, and vivid dreams.
58. Prazosin (Minipress) is the prototype selective alpha1-adrenergic antagonist. It is used as an antihypertensive.
59. Drugs similar to prazosin are doxazosin (Cardura) and phentolamine
60. Because their mechanism of action is to antagonize the effects of endogenous catecholamines, all beta-adrenergic antagonists (beta blockers) have the potential to slow the heart rate, decrease the force of myocardial contraction, and slow conduction velocity through the atrioventricular node.
61. The primary use of beta-adrenergic antagonists is the treatment of hypertension (HTN). They decrease cardiac output due to a decrease in myocardial contractions and antagonize the release of renin by the kidney. Nonselective beta blockers like carvedilol block alpha1-adrenergic receptors to relieve hypertension.
62. Beta blockers can ease the acute chest pain characteristic of angina pectoris, and because they slow cardiac conduction, beta blockers are used in the pharmacotherapy of certain types of dysrhythmias.
63. Some nonselective beta blockers have the ability to reduce intraocular pressure when given as ophthalmic solutions in the pharmacotherapy of glaucoma.
64. Other therapeutic uses include the treatment of heart failure, myocardial infarction (MI), and migraine prophylaxis.
65. Due to the presence of beta-adrenergic receptors throughout the body, pharmacotherapy with nonselective beta antagonists usually produces more side effects than treatment with selective beta1 antagonists.
66. One of the more serious side effects with the nonselective beta blockers is that inhibition of beta2 receptors in the lung can cause bronchoconstriction, which may be particularly acute in clients with chronic obstructive pulmonary disease (COPD) or asthma.
67. Beta blockers should be withdrawn gradually, over several weeks. If withdrawn abruptly, the heart displays hypersensitivity to catecholamines. Rebound cardiac excitation may produce sweating, headache, palpitation, and tremulousness. Angina and MI may also occur.
68. Propranolol (Inderal) is the prototype nonselective beta-adrenergic blocker and is used to treat hypertension and dysrhythmias.
69. Drugs similar to propranolol include carvedilol (Coreg), nadolol (Corgard), sotalol , and timolol.
70. Beta1-adrengeric antagonists are selective for beta1 receptors in the myocardium and are used to treat hypertension and other cardiovascular disorders.
71. The major advantage of beta1-adrenergic antagonists is that they have little effect on beta2 receptors in bronchial smooth muscle, allowing them to be administered to clients with asthma or COPD with lower risk of inducing bronchospasm.
72. Beta blockers must be used with caution in clients with history of heart failure because they depress the speed of impulse conduction across the myocardium.
73. The prototype selective beta1-adrenergic antagonist is metoprolol (Lopressor).
74. Drugs similar to metoprolol include acebutolol (Sectral), and atenolol (Tenormin)
75. Potential nursing diagnoses include *Decreased Cardiac Output, Impaired Gas Exchange, Ineffective Airway Clearance, Impaired Urinary Elimination, Activity Intolerance, Sexual Dysfunction, Disturbed Sleep Pattern, Deficient Knowledge, Risk for Falls,* and *Risk for Injury.*
76. The client is at risk for orthostatic hypotension and should be taught to arise from lying or sitting to the standing position slowly.
77. The client should know the safety parameters of individual blood pressure and should hold the medication and contact the prescriber if blood pressure is below these parameters.
78. The client should report any palpitations, chest pain, or dyspnea.
79. The client should report urinary hesitancy, feelings of bladder fullness, or difficulty starting the urinary stream.
80. The client should take the first dose immediately before going to bed and should not drive for 12 to 24 hours after initiation of therapy or if dosage is increased.
81. Clients with diabetes should closely monitor blood glucose.
82. Unusual feelings of sadness, despondency, apathy, or depression should be reported.
83. Hand or feet pain, pallor, coldness, numbness, or cyanosis should be reported.
84. The client and caregivers should be taught that the medication should not be stopped abruptly.

**Chapter 15 Brief review of the central nervous system**

**Learning Outcomes**

1. Identify disorders for which central nervous system medications are prescribed.

Suggested Classroom Activity: Have students look in a nursing drug handbook for medications listed as CNS drugs. Find medications used, or prescribed, for each of the listed medical conditions.

Suggested Classroom Activity: Review the mechanism of action for each ­classification of CNS drug.

Suggested Clinical Activity: Have students investigate in their clinical ­setting what CNS drugs are most commonly prescribed for clients at that institution.

2. Illustrate the major components of a synapse within the central nervous system.

Suggested Classroom Activity: Divide the class into groups of four and have each group draw a diagram of a neuron communicating with another neuron across a synapse, using a neurotransmitter.

Suggested Clinical Activity: Have students interact with a client diagnosed with Parkinson’s disease. Discuss the effects of dopamine in this disease.

3. Identify the major neurotransmitters in the central nervous system and their functions.

Suggested Classroom Activity: Assign each student a CNS drug. Have the student research what neurotransmitter is affected, or used, by each drug and the outcome.

Suggested Clinical Activity: Have students check the medications ordered for their individual clients to see if any of their medications affect serotonin levels; use of glutamate; GABA receptors; or activation of dopamine, endorphins, Ach, or NE as neurotransmitters.

4. Describe the major structural regions of the brain and their primary functions.

Suggested Classroom Activity: Divide the class into two teams and have a contest to see which team can answer the most questions about the different structural regions of the brain and their functions.

Suggested Clinical Activity: During postconference, quiz the students by stating a dysfunction of the CNS system, such as facial drooping, and ask them to state what area of the brain has most likely been affected.

5. Explain the major functional systems of the brain and their primary functions.

Suggested Classroom Activity: Quiz the students by giving them specific symptoms of dysfunctions of the limbic, reticulating, basal ganglia, or extrapyramidal systems and have them state which system has been involved.

Suggested Clinical Activity: Have students use their list of client’s medications to research which medications may have extrapyramidal side effects, or that may affect neurotransmission through the basal ganglia, or may excite or inhibit the RAS. What symptoms would be exhibited?

**Key Concepts**

1. Of all divisions of pharmacology, CNS drug mechanisms are probably the least understood.
2. CNS drugs have two basic actions: They either stimulate (activate) or suppress (inhibit) the firing of neurons.
3. CNS drugs are used to reduce anxiety, improve sleep patterns, elevate mood, manage psychotic symptoms, slow progression of chronic debilitation disease of the brain, terminate or prevent seizures, reduce muscle spasms and spasticity, reduce hyperactivity and mania, reduce pain, and induce anesthesia.
4. Neurons in the central nervous system communicate with each other, and with body tissues, using neurotransmitters.
5. The neuron is the primary functional cell of the nervous system.
6. Synapses allow communication between neurons.
7. Similar to the autonomic nervous system, an electrical impulse releases a neurotransmitter that activates a neuron receptor on the opposite side (postsynaptic).
8. More than 30 substances have been identified as neurotransmitters in the CNS.
9. Adrenergic synapses utilize NE as a neurotransmitter, which activates areas to heighten alertness and wakefulness.
10. Cholinergic synapses utilize Ach as the neurotransmitter, which is usually stimulatory.
11. Dopaminergic synapses use dopamine as a neurotransmitter. It is a chemical precursor to norepinephrine and is classified as a catecholamine.
12. There are two major receptor subtypes: D1 is stimulatory and D2 is inhibitory.
13. Endorphins and enkephalins are involved in pain transmission through the opioid receptors.
14. Gamma aminobutyric acid (GABA) is used by GABA synapses, the second most common type of synapse in the CNS.
15. Glutamate is the most common neurotransmitter in the CNS and is always excitatory.
16. Serotonin is utilized by serotonergic synapses. Ninety-eight percent of these synapses are found outside the CNS in platelets, mast cells, and other peripheral cells.
17. Several structural regions of the brain have applications to neuropharmacology.
18. The cerebrum is responsible for perception, speech, conscious motor movement, movement of skeletal muscles, memory, and smell.
19. Focal abnormalities may affect a single function such as vision, hearing, or movement of a specific limb (common to CVAs), while generalized disorders affect multiple regions as in drowsiness, coma, hallucinations, depression, and anxiety.
20. The thalamus sends sensory information such as sounds, sights, pain, touch, and temperature to the cerebral cortex. Diverse mood disorders such as obsessive–compulsive, bipolar, anxiety, and panic disorders may occur as abnormalities of the thalamus.
21. The hypothalamus regulates visceral functions such as hunger, thirst, water balance, and body temperature.
22. The cerebellum is involved in fine motor skills and complex tasks such as walking, so cerebellar injury results in uncoordinated, jerky body movements.
23. The brainstem is a major relay center to and from the brain. It connects the spinal cord to the brain, and it consists of the medulla oblongata, pons, and midbrain.
24. The spinal cord is a conduction path to and from the brain. Disruptions to this conduction path result in loss of sensory (paresthesia) and/or motor (paralysis) function.
25. The blood–brain barrier protects the brain from destructive pathogens or toxins, while allowing a continuous supply of oxygen and glucose. CNS drugs must be designed to penetrate the blood–brain barrier to produce their effects.
26. Functional brain systems are clusters of neurons that are physically located far apart in the CNS, but work together as a coordinated unit.
27. The limbic system is a group of structures responsible for emotional expression, learning, and memory. It is connected to the hypothalamus; therefore it affects heart rate, blood pressure, or peptic ulcers.
28. The limbic system is connected with the cerebrum, which allows one to use logic to “override” inappropriate or harmful emotional reactions.
29. The reticular activating system (RAS) projects from the brainstem to the thalamus. Stimulation of the RAS causes heightened alertness and arousal. Inhibition of the RAS causes drowsiness and sleepiness.
30. Drugs that decrease activity in the RAS may cause drowsiness or sleep, such as alcohol and sedative–hypnotic drugs.
31. Basal ganglia help regulate the initiation and termination of skeletal muscle movement, as well as initiating and terminating some cognitive functions such as memory, learning, planning, and attention.
32. Psychoses, ADHD, and OCD are thought to be associated with connections between basal ganglia and the limbic system.
33. The two motor pathways from brain to brainstem to spinal cord are pyramidal and extrapyramidal. The pyramidal (direct) tracts control voluntary movement of skeletal muscles. The extrapyramidal (indirect) tracts control locomotion, complex movements, and posture.
34. Adverse extrapyramidal symptoms include jerking motions; muscular spasm of the head, face, and neck; and akathisia (an inability to rest). Some of these symptoms resemble Parkinson’s disease.

**Chapter 16 Pharmacotherapy of anxiety and sleep disorders**

1. Discuss factors contributing to anxiety and insomnia and explain some non-pharmacological therapies used to manage each of these disorders.

Suggested Classroom Activity: Have students research the Internet for ways of treating anxiety, such as nutrition, coping mechanisms, and different methods of disease management. Have the students break into groups and then report to the whole group what nonpharmacologic methods they discovered for treating anxiety and sleep disorders.

Suggested Clinical Activity: Ask a psychotherapist or psychological counselor at the clinical facility if he or she would share with the students different methods taught to the clients to deal with anxiety.

Suggested Classroom Activity: Have students research the different treatments recommended for different kinds of anxiety to show that proper diagnosis is necessary to determine treatment.

Suggested Clinical Activity: Have students check their client’s medical history for a diagnosis of anxiety. Try to discover diagnoses for different types of anxiety.

2. Identify drug classes used for treating anxiety and sleep disorders.

Suggested Classroom Activity: Divide students into five groups and assign each group a major anxiety disorder. Have students act out an example of the anxiety disorder assigned.

Suggested Clinical Activity: Have each student search their client’s chart for one or more of the five different major anxiety disorders and the symptoms leading to that diagnosis.

3. Explain the therapeutic action of drugs used to treat anxiety disorders and insomnia.

Suggested Classroom Activity: Provide students a drawing of the brain and have them label the hypothalamus, limbic system, amygdala, and RAS.

Suggested Clinical Activity: Have students interview a client who has a sleep disorder. Evaluate prescribed medications and identify the region of the brain they affect.

Suggested Classroom Activity: Have a sleep specialist come speak to the class about different sleep disorders and the medications most commonly prescribed.

Suggested Clinical Activity: Have students include an assessment for sleep disorders when performing a physical assessment on their assigned client(s) in clinicals. Report to the clinical group the students’ findings during postconference.

4. Describe the nurse’s role in the pharmacological management of clients with anxiety disorders and insomnia.

Suggested Classroom Activity: Give students a short pop quiz on the five stages of sleep, what occurs in each stage, and the effects of disrupted sleep in the NREM stage and REM stage.

Suggested Clinical Activity: Arrange a visit to a sleep center to find out how sleep studies are carried out.

5. For each of the drug classes listed in Prototype Drugs, identify a representative drug and explain its mechanism of action, therapeutic effects, and important adverse effects.

Suggested Classroom Activity: Assign each student two to three medications used for anxiety and/or sleep disorders. For each medication assigned, the student is to present the classification, action, usual dose, route and method given, pertinent side effects or interactions, and nursing interventions.

Suggested Clinical Activity: Have students in each clinical group share information regarding the medications taken by their clients for anxiety and/or sleep. If none are prescribed, then ask the unit nurses what medications are commonly prescribed to the clients admitted to the unit for anxiety or sleep. Have the students research information on each drug using a drug handbook.

6. Describe and explain, based on pharmacological principles, the rationale for nursing assessment, planning, and interventions for clients with anxiety disorders and insomnia.

Suggested Classroom Activity: Assign a major class of medications used to treat anxiety and sleep disorders to different groups of students and have them report to the class the following information about each class: actions, usual route, unusual side effects and/or interactions, and nursing implications.

Suggested Clinical Activity: Have students visit the clinical site pharmacy to find out which medications are most commonly prescribed for anxiety and sleep in that institution.

Suggested Classroom Activity: Have students go to the National Institute of Mental Health website to look for associations between anxiety disorders and sleep disorders.

Suggested Clinical Activity: Have students perform a survey on preoperative clients to see if the temporary anxiety that comes with the presurgical experience affected the clients’ ability to sleep. Report back to postconference to show how anxiety affects one’s ability to sleep.

7. Use the nursing process to care for clients who are receiving drug therapy for anxiety and insomnia.

Suggested Classroom Activity: Have students participate in writing a nursing care plan for a client with anxiety and then a client with a sleep disorder following the instructor’s prompting.

Suggested Clinical Activity: Assign each student a scenario regarding a client with either a sleep disorder and/or anxiety disorder and bring a nursing care plan to be discussed in postconference.

**Key Concepts**

1. In the clinical setting, most clients with anxiety will present with multiple symptoms such as apprehension, dread, fear, palpitations, shortness of breath, heartburn, pounding in the ears, excessive sweating, and dry mouth.
2. Anxiety responds well to complementary and alternative medicine, and the nurse is a key person to recommend and teach nonpharmacologic stress-reduction techniques.
3. Note any substances the client is taking that may worsen or cause anxiety symptoms.
4. Anxiety disorders may be divided into five major categories.
5. Situational anxiety is not a major anxiety disorder because it is not disabling or persistent.
6. Generalized anxiety disorder (GAD) is excessive anxiety that persists 6 months or longer. It is most prevalent in the 20- to 35-year-old age group and is the most common form of anxiety.
7. Panic disorder is characterized by intense feelings of immediate apprehension, fearfulness, terror, or impending doom. For diagnosis, the client must have at least 1 month of ongoing concern about experiencing another attack.
8. Agoraphobia is an avoidance of closed places where an attack may occur.
9. Social anxiety disorder (SAD) is an unreasonable fear of crowds or of being ridiculed or embarrassed in public, such as performing and speaking in public.
10. SAD is a type of phobia, including such things as fear of snakes, spiders, blood, etc.
11. Obsessive–compulsive disorder (OCD) involves recurrent, intrusive thoughts or repetitive behaviors. The most common onset is the teen years or early adulthood.
12. Post-traumatic stress disorder (PTSD) is an anxiety that occurs in response to re-experiencing a previous traumatic life event. The re-experience commonly takes the form of nightmares, hallucinations or flashbacks, and panic attacks.
13. Modulation of anxiety is accomplished in specific brain regions and by multiple neurotransmitter systems.
14. Neural systems in the brain associated with anxiety include the limbic system and the reticular activating system.
15. The limbic system is a cluster of structures in the midbrain that are responsible for emotions, behavior, and long-term memory.
16. The amygdala is a key component and once activated, it generates feelings of anxiety and fear, and stimulates several regions that begin the stress response.
17. Signals routed through the amygdala connect with the hypothalamus, which is responsible for the fight-or-flight response.
18. The hypothalamus may respond by secreting corticotropin-releasing factor, which causes the release of corticosteroids. The hypothalamus also regulates essential somatic functions such as sleep, appetite, and body temperature.
19. An area of the anterior hypothalamus, the suprachiasmatic nucleus, receives input from the retina regarding light and dark; therefore, it controls the production of melatonin.
20. An area known as the locus coeruleus, within the brainstem, is associated with fear responses and panic attacks.
21. The RAS is responsible for sleeping, wakefulness, and the ability to respond to stimuli. Drugs that stimulate the RAS cause heightened alertness and arousal; inhibitory drugs cause general drowsiness and induction of sleep.
22. Sleep occurs in two basic stages: rapid eye movement (REM) sleep and non–rapid eye movement (NREM) sleep.
23. NREM sleep is signaled by decreases in acetylcholine, norepinephrine, and serotonin. During this time, respirations slow, heart rate and blood pressure decrease, O2 consumption decreases, and urine formation decreases.
24. REM is an active dreaming stage of sleep. Eyes move during this stage. In REM sleep, muscle tone decreases, and heart rate and respirations become irregular. Penile erections and clitoral enlargement may occur.
25. A person alternates between REM and NREM about every 90 minutes.
26. Stage IV NREM sleep is linked to repair and restoration of the physical body, and deprivation causes depression, a feeling of apathy, and fatigue.
27. REM sleep is associated with learning, memory, and the ability to adjust to changes in the environment. Deprivation of REM sleep causes fright, irritability, paranoia, and emotional disturbances. Judgment is impaired, and reaction time is slowed.
28. Circadian rhythm refers to a synchronized pattern of sleeping and waking.
29. Traveling rapidly through several time zones causes circadian rhythm, also known as jet lag.
30. Sleep-onset insomnia is an inability to fall asleep within a reasonable time (i.e., 30 minutes).
31. Sleep-maintenance insomnia is frequent nighttime awakenings with or without the ability to fall back to sleep.
32. Sleep-offset insomnia is premature, early morning awakenings.
33. Nonrestorative sleep is persistent sleepiness during the day despite adequate sleep duration.
34. Chronic insomnia lasts 30 days or longer and interferes with activities of daily living.
35. Polysomnography testing records physiological changes during sleep and can determine the amount of REM and NREM sleep.
36. Actigraphy measures motor activity during waking and sleeping hours.
37. Narcolepsy is a sleep disorder characterized by not being able to stay awake during daytime. Narcolepsy may include four “classic” symptoms: cataplexy: the sudden loss of muscle strength as in slurred speech, sagging of the jaw, head nodding, or collapse of the body; hypnagogic hallucinations: vivid, fearful illusions at the onset of sleep or upon wakening; muscular paralysis: an inability to move or speak; and automatic behavior: talking or repetitive movements during sleep.
38. Treatment of narcolepsy includes amphetamines such as methylphenidate and modafinil (Provigil).
39. Treatment for cataplexy symptoms includes tricyclic antidepressants and SSRIs
40. There is a pathophysiologic link between sleep and anxiety, and many drugs used to treat anxiety are also effective for treating insomnia.
41. Three classes of drugs are used to treat anxiety and insomnia: benzodiazepines, nonbenzodiazepine antianxiety and miscellaneous agents, and antidepressants.
42. Long-term use of sleep medications may cause physical or psychological dependence.
43. Rebound insomnia occurs when a sedative drug is discontinued abruptly. Symptoms are sleeplessness, anxiety, and daytime drowsiness.
44. Nonpharmacologic coping strategies include cognitive–behavioral therapy, counseling, biofeedback techniques, yoga, and meditation.
45. Complementary and alternative treatments include such therapies as acupuncture, aromatherapy, massage, prayer, hypnosis, exercise, and nutrition.
46. Natural products and supplements may promote relaxation and sleep.
47. Melatonin is a natural hormone that promotes sleep. Too much can cause side effects such as headaches, mental impairment, and nightmares.
48. Valerian promotes sleep and relaxation.
49. Kava promotes sleep, but high doses can damage the liver so it should not be used unless recommended by a health care provider.
50. Their long duration of action causes a drowsy feeling the next day. Other side effects of these antihistamines include a dry mouth and nose, blurred vision, and dizziness. Antihistamines should not be taken for prolonged periods for insomnia, because clients become tolerant to the effects.
51. Prescription drugs are used to treat anxiety and/or insomnia when the sleep disorder is severe or the condition is unresponsive to nonpharmacologic therapies.
52. An anxiolytic is a drug that has the ability to relieve anxiety and usually includes the benzodiazepines and nonbenzodiazepines.
53. A sedative is a CNS depressant that produces relaxation, calmness, and a reduction in anxiety and excitement. A tranquilizer is another term for a sedative. A hypnotic is a drug that produces sleep.
54. A sedative–hypnotic is a drug with the ability to produce a calming effect at lower doses and sleep at higher doses.
55. All of these drugs (anxiolytics, tranquilizers, sedatives, and hypnotics) are considered CNS depressants.
56. Many CNS depressants have the potential to cause physical and psychological dependence and most are controlled substances.
57. Some behaviors that should be immediately reported to a health care provider include aggressiveness, hallucinations, suicidal thinking, and unusual extroversion or depersonalization.
58. Benzodiazepines are drugs of choice for generalized anxiety disorder and a short-term treatment for insomnia.
59. Benzodiazepines bind to the gamma-aminobutyric acid (GABA) receptor and intensify the effect of GABA.
60. These are schedule IV drugs with less physical dependence and less tolerance than the barbiturates.
61. Most are orally administered, but some, such as diazepam and lorazepam (Ativan), can be given parenterally and should be monitored carefully for CNS effects such as depressed respirations.
62. Benzodiazepines shorten the time it takes to fall asleep and reduce interrupted sleep.
63. Benzodiazepines are used for short-term therapy of insomnia, approximately 4 weeks, because dependence and tolerance may develop.
64. Benzodiazepines have a potential to cause sleep-related behaviors that the client does not remember (i.e., sleepwalking, making phone calls, or driving a car).
65. Flumazenil is an antidote for benzodiazepine overdose. It is given rapid IV and may need to be repeated every 30 to 45 minutes due to its short duration of action. The client may awaken abruptly after being given flumazenil, causing dysphoria, agitation, and seizures. Flumazenil does not reverse the respiratory depression.
66. Lorazepam (Ativan) is the prototype benzodiazepine, GABA receptor agonist.
67. Drugs similar to lorazepam that are used for anxiety are alprazolam (Xanax), chlordiazepoxide, clorazepate, diazepam (Valium), and oxazepam.
68. Drugs similar to lorazepam that are used for insomnia are flurazepam (Dalmane), temazepam and triazolam (Halcion).
69. Nonbenzodiazepine anxiolytics are used for treating anxiety and sleep disorders.
70. Zopiclone (Imovane) is the prototype nonbenzodiazepine anxiolytic, miscellaneous CNS depressant used as a sedative–hypnotic.
71. Drugs similar to zolpidem are buspirone.
72. Antidepressants are widely prescribed for anxiety disorders.
73. Antidepressants act by altering the levels of norepinephrine and serotonin in the brain.
74. Anxiety and panic attacks often occur in two stages: anticipatory anxiety and the stage of physical symptoms.
75. SSRIs and atypical antidepressants are often used to reduce symptoms of panic and anxiety.
76. Barbiturates are effective sedative–hypnotics but have potentially serious adverse effects that limit their use. Risk of psychological and physical dependence is high. Overdose results in profound respiratory depression, hypotension, and shock.
77. Barbiturates act by binding to GABA receptor–chloride channel molecules.
78. Within 2 weeks, tolerance begins to develop to the sedative effects, but not the respiratory depression.
79. Phenobarbital is the prototype barbiturate, GABA receptor agonist used as a sedative–hypnotic and antiepileptic drug.
80. Drugs similar to phenobarbital are classified by duration of action. Short-acting barbiturates are secobarbital (Seconal), intermediate-acting barbiturates are and long-acting barbiturates are mephobarbital (Mebaral) and phenobarbital.
81. Nursing diagnoses that may be useful for clients receiving pharmacotherapy for anxiety or sleep disorders include *Anxiety, Disturbed Sleep Pattern, Fatigue, Ineffective Coping, Activity Intolerance, Deficient Knowledge, Risk for Injury,* and *Risk for Falls.*
82. Assist the client in developing healthy coping strategies.
83. Monitor ethnically diverse clients for excessive or less than optimal therapeutic effects.
84. Ensure client safety, because drug may cause excessive drowsiness. Teach client to ask for assistance when first getting out of bed and ambulating.
85. Teach the family to watch for nighttime behavioral activities, such a sleepwalking.
86. Teach client not to take with other medications or alcohol.
87. Teach to avoid abrupt discontinuation of therapy and stress importance of keeping follow-up visits to the health care provider.
88. Teach client that these drugs should not be kept at the bedside to avoid taking additional doses when drowsy.

**Chapter 17 Pharmacotherapy of emotional and mood disorders**

**Learning Outcomes**

1. Compare and contrast the major categories of mood disorders and their symptoms.

Suggested Classroom Activity: Have students work in groups to compare and contrast the criteria associated with major depression and bipolar disorder.

Suggested Clinical Activity: Have students compare and contrast the criteria associated with major depression and bipolar disorder with assigned clients.

2. Explain the pathophysiology of major depression and bipolar disorder.

Suggested Classroom Activity: Refer students to previous chapter information about the limbic system. Have the students construct a pathway that defines major depression and its causes and treatment.

Suggested Clinical Activity: Have students provide the historical background of assigned clients with major depression or bipolar disorder.

3. Identify drug classes used for treating emotional and mood disorders.

Suggested Classroom Activity: Provide case studies and have students divide into groups and discuss assessment of clients with mood disorders.

Suggested Clinical Activity: Have students care for assigned clients with major depression or bipolar disorder.

4. Explain the therapeutic action of antidepressant drugs in relation to physiological aspects of neurotransmission.

Suggested Classroom Activity: Have students divide into groups and discuss the relationship between suicide and depression.

Suggested Clinical Activity: Have students assess assigned clients for history of suicidal ideation or suicide attempt.

5. For each of the drug classes listed in Prototype Drugs, identify a representative drug and explain its mechanism of action, primary actions, and important adverse effects.

Suggested Classroom Activity: Ask students to create a list of the prototype drugs and discuss their mechanism of action and effects

Suggested Clinical Activity: Ask students to identify the lab values required for the medications found in the above prepared list

6. Discuss the nurse’s role in the pharmacological management of clients with depression or bipolar disorder.

Suggested Classroom Activity: Provide case studies and have students identify the major mood-appropriate history, laboratory values, and therapeutic levels in clients with mood disorders.

Suggested Clinical Activity: Have students identify appropriate history, laboratory values, and therapeutic levels in assigned clients with mood disorders.

7. Describe and explain, based on pharmacological principles, the rationale for nursing assessment, planning, and interventions for clients with mood disorders.

Suggested Classroom Activity: Provide a case study and have students categorize prototype, mechanism of action, primary indications, contraindications, significant drug interactions, pregnancy category, and important adverse effects.

Suggested Clinical Activity: Have students administer medications to an assigned client.

8. Use the nursing process to care for clients who are receiving drug therapy for emotional and mood disorders

Suggested Classroom Activity: Provide a case study and have students discuss ways in which they can establish the therapeutic nurse–client relationship.

Suggested Clinical Activity: Have students care for assigned clients receiving drug therapy for mood disorders.

**Key Concepts**

1. The two major categories of mood disorders are major depressive disorder and bipolar disorder.
2. Categories of mood disorder include major depressive disorder (also called depression or clinical depression), dysthymic disorder, bipolar disorder, manic and hypomanic episodes, and cyclothymic disorder.
3. Signs and symptoms of depression include lack of energy, sleep disturbance, abnormal eating patterns, and feelings of despair, guilt, and hopelessness.
4. Depression is the most common mental health disorder.
5. Major depressive disorder is diagnosed when an individual has a depressed mood that lasts a minimum of 2 weeks and which is present for most of the day, every day, or almost every day.
6. The use of “specifiers” gives mental health professionals additional information about the disorder and its treatment. Specifiers include the following: with or without psychotic features, single episode or recurrent, melancholic features, atypical features, catatonic features, postpartum onset, and seasonal onset.
7. Postpartum depression occurs during the first 2 weeks after the birth of a baby.
8. Seasonal affective disorder is associated with a reduced release of the hormone melatonin from the pineal gland.
9. Pathophysiology of major depression has biologic, genetic, and environmental components.
10. The etiology of depression is not well understood.
11. The pathogenesis of depression is influenced by multiple, complex variables with a focus on the levels and function of neurotransmitters in the limbic system of the brain. Major depressive disorder has been associated with abnormally low levels of norepinephrine, serotonin, and dopamine in the limbic systems.
12. Certain hormonal abnormalities are associated with depression, implicating the endocrine system.
13. Depression is 1.5 to 3 times more common in persons who have a first-degree relative with depression.
14. Environmental causes of depression also exist.
15. The recognition of depression must be a collaborative effort among health care providers.
16. The diagnosis of depression begins by ruling out other medical conditions.
17. Depression remains greatly underdiagnosed in the older adult.
18. The assessment of mood disorders must include suicide risk.
19. Some theories propose that antidepressant medications increase risk of suicide.
20. The nurse’s role in reducing potential for suicide includes careful monitoring of the client with frequent contact as antidepressant medications become effective.
21. Any talk of suicide should be taken seriously.
22. Nonpharmacologic therapies for depression are also used.
23. Cognitive–behavioral methods are used to help clients change negative styles of thought.
24. Light or phototherapy may be used for those with seasonal affective disorder.
25. Clients who have serious and life-threatening mood disorders may be treated with electroconvulsive therapy.
26. Transcranial magnetic stimulation is an emerging therapy for major depression.
27. Vagus nerve stimulation is a somatic therapy currently under investigation.
28. Antidepressants are drugs used to enhance, elevate, or stabilize mood. They act by restoring normal neurotransmitter balances in specific regions of the brain.
29. Once antidepressants take effect, clients may discontinue them to avoid cost or unpleasant adverse effects. About half of these clients relapse within 6 months.
30. All antidepressants have similar effectiveness but clients respond differently to different medications. Adverse effects also vary from individual to individual.
31. Tricyclic antidepressants (TCAs) were once the mainstay of treatment for depression but do have many adverse effects.
32. TCAs work by blocking the reuptake transport of norepinephrine and serotonin at synapses.
33. TCAs are inexpensive and effective but have many adverse effects such as dry mouth, blurred vision, constipation, urinary retention, and tachycardia. They also can cause sedation and have a relatively high incidence of sexual dysfunction.
34. Imipramine (Tofranil) is the prototype norepinephrine reuptake inhibitor used as a tricyclic inhibitor.
35. Drugs similar to imipramine include amitriptyline and clomipramine, doxepin, and trimipramine.
36. Selective serotonin reuptake inhibitors (SSRIs) are the drugs of choice for treating depression.
37. Lack of serotonin in the limbic regions of the central nervous system can lead to depression.
38. SSRIs selectively target serotonin, whereas TCAs inhibit the reuptake of both norepinephrine and serotonin.
39. SSRIs are as effective in treating depression as TCAs, but have fewer adverse effects. The most common adverse effects relate to sexual dysfunction.
40. Serotonin syndrome (SES) is a serious medical condition that can occur when a client is taking multiple medications that result in serotonin accumulating in the CNS. Symptoms include mental status changes, HTN, tremors or muscle rigidity, sweating, hyperpyrexia, and ataxia.
41. Fluoxetine (Prozac) is the prototype SSRI used as an antidepressant, antianxiety drug.
42. Drugs similar to fluoxetine include citalopram, fluvoxamine, paroxetine, and sertraline
43. A diverse group of atypical antidepressants is also used to treat depression. They act by preventing the reuptake of specific neurotransmitters or by blocking neurotransmitter receptors. The drugs are classified as serotonin-norepinephrine reuptake inhibitors (SNRIs), norepinephrine and dopamine reuptake inhibitors (NDRIs), norepinephrine reuptake inhibitors (NRIs), or combined reuptake inhibitor and receptor blockers.
44. Venlafaxine (Effexor) is the prototype serotonin-norepinephrine reuptake inhibitor used as an atypical antidepressant.
45. Drugs similar to venlafaxine include amoxapine (Asendin), bupropion (Wellbutrin), mirtazapine (Remeron), and trazodone .
46. Monoamine oxidase inhibitors (MAOIs) are effective antidepressants, but have potentially serious adverse effects.
47. The mechanism of action of MAOIs is primarily to block the action of monoamine oxidase. In adrenergic neurons, MAOIs slow destruction of norepinephrine, dopamine, and serotonin.
48. A serious adverse reaction with MAOIs is their ability to cause hypertensive crisis if combined with foods that contain tyramine.
49. Phenelzine (Nardil) is the prototype monoamine oxidase inhibitor used as an antidepressant.
50. Drugs similar to phenelzine include selegiline , and tranylcypromine .
51. Nursing diagnoses useful in caring for clients receiving pharmacotherapy with antidepressants include *Ineffective Coping, Powerlessness, Anxiety, Disturbed Sleep Patterns, Self-Care Deficit (Bathing, Feeding, Dressing), Imbalanced Nutrition: Less than Body Requirements, Complicated Grieving, Social Isolation, Impaired Social Interaction, Interrupted Family Processes, Urinary Retention, Noncompliance, Deficient Knowledge, Risk for Self-Directed Violence, Risk for Self-Mutilation, Risk for Suicide,* and *Risk for Injury.*
52. Client should be taught that full effects of the drugs may not occur for some time after beginning therapy.
53. Client will need to return for periodic laboratory work and should report any signs of liver failure. Client should carry medical identification stating type of drug being taken.
54. Client should report any neurologic changes, sensory changes, cardiovascular changes, or hematology changes.
55. Clients taking MAOIs should receive explicit written and verbal instructions regarding interactions with foods or beverages.
56. Clients should be taught not to switch brands of medication, to take medications with food, to not abruptly discontinue the medication, and to not add any OTC, herbal, grapefruit juice, or dietary supplements without discussing them with the prescriber.
57. Bipolar disorder was once known as manic-depressive disorder and is characterized by extreme mood swings from depression to euphoria.
58. To be diagnosed with bipolar disorder, the symptoms must be present for at least 1 week and evidence of impaired functioning must be present.
59. Suicide is a major risk in clients with bipolar disorder.
60. Mania and hypomania (similar symptoms that are not as severe and do not cause impaired functioning) are likely the result of abnormal function of neurotransmitters in the brain.
61. Lack of sleep, excessive stress, and poor nutrition are triggers for manic episodes.
62. Pharmacotherapy of bipolar disorder is highly individualized and dependent on the severity of symptoms.
63. Nonadherence with drug therapy is a serious problem in clients with bipolar disorder.
64. Drugs for bipolar disorder are called mood stabilizers because they prevent the extreme shifts in emotion and relieve symptoms of mania and depression.
65. Lithium is the prototype alkali metal salt ion used as an antimanic drug for bipolar disorder.
66. There are no drugs similar to lithium carbonate.
67. Antiseizure drugs such as valproic acid (Depakene) and divalproex are approved for mood stabilization and mania suppression.
68. Carbamazepine (Tegretol) reduces the symptoms of both manic and depressive phases of bipolar disorder and can reduce recurrence of the condition.
69. The antiepileptic drug lamotrigine (Lamictal) is indicated for long-term maintenance therapy to prevent or delay relapses.
70. Antidepressants such as the SSRIs, venlafaxine , and bupropion may be used to treat the depression stage of bipolar disorder.

**Chapter 18 Central nervous system stimulants and pharmacotherapy of attention deficit and hyperactive disorders**

**Learning Outcomes**

1. Describe the action and pharmacotherapeutic applications of central nervous system stimulants.

Suggested Classroom Activity: Have students look up amphetamine use and abuse, and report to the class the effects of amphetamines that cause it to be abused as a recreational drug.

Suggested Clinical Activity: Have students evaluate the medication history of assigned clients diagnosed with attention deficit/hyperactivity disorder. What CNS stimulants are prescribed and why?

2. Identify the signs and symptoms of attention deficit/hyperactivity disorder.

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Suggested Classroom Activity: Assign half the class to act out signs of ADHD and the other half of the class signs of narcolepsy.

Suggested Clinical Activity: Have students assess clients for signs and symptoms of ADHD.

3. Compare and contrast the central nervous system stimulants and non-stimulants in treating attention deficit/hyperactivity disorder.

Suggested Classroom Activity: Give students a quiz regarding CNS stimulants used to treat ADHD.

Suggested Clinical Activity: Have students evaluate the medication history of several clients diagnosed with ADHD. Which drugs are used? Have students divide these drugs into stimulants and nonstimulants.

4. Describe the nurse’s role in the pharmacological management of attention deficit/hyperactivity disorder.

Suggested Classroom Activity: Have students play a game involving the nurse’s role in the pharmacologic management of ADHD.

Suggested Clinical Activity: Have students interview a nurse who provides care for clients diagnosed with narcolepsy. Discuss any specific nursing implications of use of these drugs.

5. For each class of drugs listed in the Chapter Outline, identify the prototype and representative drugs and explain the mechanisms of drug action, primary indications, contraindications, significant drug interactions, pregnancy category, and important adverse effects.

Suggested Classroom Activity: Assign groups of students individual medications for the treatment of ADHD and have them report to the class the action, primary indications, contraindications/ precautions, drug interactions, pregnancy category, and important adverse effects.

Suggested Clinical Activity: Have a pharmacist come talk to the clinical group about medications used for ADHD.

6. Apply the nursing process to care for clients who are receiving pharmacotherapy with central nervous system stimulants.

Suggested Classroom Activity: Have students work together to plot out a concept map for clients with a diagnosis of ADHD.

Suggested Clinical Activity: Have students attend a clinical at local schools and interview the school nurse to find out her or his involvement with students taking medications for ADHD.

**Key Concepts**

1. Central nervous system (CNS) stimulants range from caffeine to schedule I controlled substances (ecstasy). All CNS stimulants raise the alertness level of the brain, and increase wakefulness and the ability to focus or concentrate.
2. Adverse effects include symptoms of excessive excitation such as nervousness, dizziness, and irritability, with possible convulsions at high doses. An increase in heart rate, dysrhythmias, and loss of appetite may also occur.
3. CNS stimulants are used for the following: attention deficit/hyperactivity disorder (ADHD), narcolepsy, weight management, respiratory stimulation, and migraine headaches.
4. Attention deficit/hyperactivity disorder (ADHD) is a neuropsychiatric condition that presents before age 7, usually extends to adulthood, and is characterized by symptoms of impulsive behavior, lack of attention, and hyperactivity.
5. Symptoms of ADHD lead to poor performance and lack of interest in school, difficulty with peer and family relationships, difficulty remembering details and placement of personal items, inability to complete a task, and sleep disturbances.
6. The etiology of ADHD is mostly genetic; however, head trauma and exposure to lead, alcohol, and cigarette smoking by the mother during pregnancy are other etiologies.
7. Children with ADHD are deficient in dopamine and norepinephrine, and brain volume is reduced in the frontal lobes, temporal gray matter, caudate nucleus, and cerebellum.
8. Amphetamines and amphetamine-like agents are used for ADHD to increase attention, alertness, and the ability to focus.
9. Amphetamine exists in two closely related but distinct chemical forms. When using the term *amphetamine* it is understood that the drug is a mixture of the d- and l-forms. This mixture is sometimes called racemic amphetamine.
10. Despite the name *psychostimulant*, these drugs do not act by stimulating the brain in a person with ADHD. When used appropriately they do not produce euphoria and dependence is not a serious problem.
11. Amphetamines diminish the appetite (i.e., anorexiants) by direct inhibition of the appetite center of the hypothalamus.
12. Long-term amphetamine abuse may lead to tolerance, dependence, and serious side effects.
13. Therapy is begun at a low dose, which is gradually increased if necessary. Therapy does not cure the disorder and medications may be necessary into adult life.
14. Amphetamine/dextroamphetamine (Adderall) is the prototype CNS stimulant, anorexiant, sympathomimetic used as a drug for ADHD.
15. Drugs similar to amphetamine/dextroamphetamine (Adderall) are lisdexamfetamine and methylphenidate.
16. Nonstimulants have been used off-label to manage ADHD since 2003.
17. Atomoxetine is the prototype nonstimulant, norepinephrine reuptake inhibitor used as a drug for ADHD.
18. Drugs similar to atomoxetine are clonidine and guanfacine .
19. Narcolepsy is a chronic neurologic disorder characterized by excessive daytime sleepiness. It is treated with CNS stimulants and antidepressants.
20. The four symptoms of narcolepsy are sleep attacks, cataplexy, sleep paralysis, and hypnagogic hallucinations.
21. Modafinil is the prototype CNS stimulant used as a drug for narcolepsy.
22. Methylxanthines are CNS stimulants used to increase alertness or for their effects on the respiratory system.
23. Caffeine is the prototype methylxanthine used as a CNS and respiratory stimulant.
24. The only drug similar to caffeine is theophylline.
25. Nursing diagnoses useful in the care of clients receiving pharmacotherapy with CNS stimulants include *Imbalanced Nutrition: Less than Body Requirements, Disturbed Sleep Pattern, Urinary Retention, Interrupted Family Processes, Deficient Knowledge, Risk for Delayed Growth and Development,* and *Risk for Social Isolation.*
26. Keeping a social/behavioral diary may be a helpful tool in assessing for therapeutic effects.
27. Cardiovascular effects may include tachycardia, increased blood pressure, and dysrhythmia.
28. Close attention should be paid to growth (height and weight) because some drugs diminish appetite.
29. The client should avoid all foods, beverages, or OTC medications that contain caffeine or other stimulants.
30. Sleep disruption may occur. Dosing time adjustments may be necessary. Extended release formulations may be necessary.
31. Agitation, aggression, tremors, or seizures may occur.
32. Urinary retention may occur.
33. Clients should wear sunscreen.
34. Explore use of drug holidays.
35. Work with families to ensure prescription renewal restrictions and school policy about drug administration are understood.
36. Increased depression, agitation, delusional thoughts, or expressions of suicide or self-harm may occur. Close assessment is essential.
37. Teach clients and caregivers that the medication should not be abruptly discontinued.

**Chapter 19 Pharmacotherapy of psychosis**

**Learning Outcomes**

1. Identify drug classes used for treating psychoses.

Suggested Classroom Activity: Divide students into groups and tell each group to prepare to demonstrate in front of the class symptoms of a psychosis.

Suggested Clinical Activity: Visit a mental health institution for observation of clients who are diagnosed with a psychosis. Report observations to the class at postconference and compare student findings.

2. Explain the therapeutic action of antipsychotic drugs in relation to physiological aspects of neurotransmission.

Suggested Classroom Activity: Have students search the media for reports characterizing individuals as “schizo” or “psychotic.” Contrast the symptoms the media characterizes against the medical model of symptoms.

Suggested Clinical Activity: Seek out an outclient mental health group for the students to observe. Allow students to speak to the group moderator beforehand to gain information regarding behaviors to observe.

3. For each of the drug classes listed in Prototype Drugs, identify a representative drug and explain its mechanism of action, primary actions, and important adverse effects.

Suggested Classroom Activity: Have a discussion regarding possible etiologies for schizophrenia.

Suggested Clinical Activity: Identify the possible etiology of a particular client’s schizophrenia.

4. Discuss the rationale for selecting a specific antipsychotic drug for the treatment of schizophrenia.

Suggested Classroom Activity: Draw a timeline on the chalkboard for 2 to 4 weeks, 6 to 8 weeks, and 8 to 12 weeks. Have the students fill in the expected outcomes for drug therapy at each of those intervals.

Suggested Clinical Activity: Make arrangements for a psychiatrist to meet with the students at the clinical site to describe the medications commonly used for initial and maintenance treatment of schizophrenia.

5. Explain the importance of client drug adherence in the pharmacotherapy of schizophrenia.

Suggested Classroom Activity: Have students come up with nursing interventions that might be useful if a client with schizophrenia refuses to comply with the medication regimen.

Suggested Clinical Activity: Have students interview a nurse who works in a mental health outclient clinic. Ask questions about encouraging clients to adhere to their medication regimen.

6. Describe the nurse’s role in the pharmacological management of schizophrenia.

Suggested Classroom Activity: List examples of antipsychotic medications and have the students work together to place each in the proper classification.

Suggested Clinical Activity: Have students evaluate the medication records of assigned clients for antipsychotic drugs. Have students place these drugs into the proper category.

7. Explain the symptoms associated with extrapyramidal side effects of antipsychotic drugs and the nurse’s role in preventing and managing these side effects.

Suggested Classroom Activity: Divide students into groups and assign them certain symptoms of extrapyramidal side effects to demonstrate before the class.

Suggested Clinical Activity: During psychiatric clinicals, have the students check their client’s chart for any documentation regarding symptoms of EPS.

Suggested Classroom Activity: Divide students into groups. Give out scenarios of clients with differing ages and medical conditions and have each group determine which medications would work best for each scenario using the given information.

Suggested Clinical Activity: Have nurses at a mental health institution speak to the students about different side effects that they have observed in clients taking antipsychotic medications.

8. Describe and explain, based on pharmacological principles, the rationale for nursing assessment, planning, and interventions for clients with psychoses.

Suggested Classroom Activity: Have students write out drug cards with the name of the antipsychotic medication, action, usual dose, frequency, route, primary indications, contraindications, significant interactions, pregnancy category, and important adverse effects.

Suggested Clinical Activity: At psychiatric clinicals, the student must be ready to present the above information regarding all antipsychotic medications prescribed to the assigned client.

9. Use the nursing process to care for clients who are receiving drug therapy for psychoses.

Suggested Classroom Activity: Give students a client scenario involving a psychotic disorder and have them collaborate to create a nursing care plan.

Suggested Clinical Activity: Ask the psychiatric unit for copies of the nursing care plans commonly used on the unit. Discuss the different care plans during postconference.

Suggested Classroom Activity: Have students role-play as the discharge nurse giving discharge instructions to a client recently started on antipsychotic medications, as well as the client’s family.

Suggested Clinical Activity: On the mental health unit, ask to see any routine protocols for clients who are taking antipsychotic medications.

**Key Concepts**

1. Psychosis is a general term used to describe a loss of contact with reality.
2. Delusions are false ideas and beliefs not founded in reality. Grandiose delusions are present when persons believe they are a great person. Paranoid delusions manifest as an extreme suspicion someone is following or trying to harm them.
3. Hallucinations involve seeing, hearing, or feeling something that is not really there.
4. Lack of insight and judgment is common and clients often think their delusions and hallucinations are real.
5. Mood and affect may vary widely and may be inappropriate, such as laughing at sad events.
6. Acute psychotic episodes occur over hours or days, while chronic psychoses develop over months or years.
7. Psychoses may be attributed to a secondary cause such as a brain tumor, but most have no identifiable cause.
8. Long-term pharmacotherapy is required for clients with chronic psychoses to function in society. If the client stops taking the medications, the symptoms will return.
9. Schizophrenia is characterized by abnormal thoughts and thought processes, disordered communication, withdrawal from people and the outside environment, an inability to perform activities of daily living, and a high risk for suicide.
10. Positive symptoms are associated with an excess or distortion of normal function (i.e., delusions).
11. Negative symptoms are associated with loss of normal functioning and are sometimes hard to distinguish from depression.
12. Positive symptoms respond more favorably to drug treatment.
13. A third category of symptoms is cognitive symptoms, which include difficulty thinking, inability to concentrate, and significant learning and memory problems.
14. Schizoaffective disorder is a condition in which the client exhibits symptoms of both schizophrenia and mood disorder.
15. The etiology of schizophrenia is unclear.
16. Schizophrenia may be inherited genetically, and environmental factors such as family dynamics can influence the onset.
17. It is theorized that schizophrenia is caused by overactivity of the dopamine type 2 receptors in the basal nuclei.
18. Most antipsychotic drugs block D2 receptors by competing with dopamine for the receptors.
19. Medical management of psychosis is challenging because clients think their behavior is normal, and because most of the medications produce such undesirable side effects.
20. The primary goal in treating psychoses is to manage symptoms such that the client can function independently and accomplish ADLs with minimal assistance.
21. The initial treatment of a psychotic episode may be with a higher than normal dose of an antipsychotic drug to sedate combative behavior.
22. If the client is combative or “cheeking”(hiding the medicine in the mouth), then the medication may be given IM.
23. Maintenance treatment is a long-term process as symptoms tend to resolve gradually.
24. Improvement in mood, socialization, and ability to provide self-care is usually seen within 2 to 4 weeks, and by 6 to 8 weeks there should be definite improvement.
25. If there is no substantial improvement within 8 to 12 weeks, the health care provider must explore reasons (i.e., client is not taking the medication, is taking the wrong dose, or a different drug may be needed).
26. Abrupt cessation can cause serious withdrawal symptoms, including nightmares, diaphoresis, and nervousness, so antipsychotic drugs should be tapered when discontinuing.
27. Clients with psychoses have very high noncompliance with their medication regimen.
28. Clients with psychoses tend to think their behavior is normal, so medication is not necessary; or they are paranoid that the medication is being given to poison them. Side effects of the medications often cause noncompliance.
29. Alcohol is not to be taken concomitantly with medications, because it worsens psychotic symptoms; however, clients desire to drink alcohol and, therefore, may not take their medications.
30. Psychotherapy and supportive therapies, such as vocational therapy, are essential to enable these clients to return to the workforce and perform ADLs.
31. There is no cure for schizophrenia but it can be successfully managed.
32. The older system of classifying antipsychotic drugs used a conventional group of phenothiazines and nonphenothiazines, versus an atypical distinction.
33. Antipsychotic drugs are now classified as low potency (drugs that require higher doses), moderate potency (drugs that require middle-range dosing), or high potency (drugs able to control symptoms of schizophrenia with low doses).
34. Selection of a specific drug is based on clinician experience, the occurrence of side effects, and the therapeutic response of the client.
35. Several long-acting IM depot preparations are available for use in clients who exhibit chronic noncompliance.
36. *Extrapyramidal* means located in the central nervous system, but outside of the cerebrospinal pyramidal tracts of the brain.
37. Acute dystonia is characterized by severe muscle spasms, particularly of the back, neck, tongue, and face. Severe dystonia may dislocate a jaw or cause laryngospasm and, therefore, respiratory distress.
38. Akathisia is an inability to rest. The client paces, cannot sit still, and has difficulty sleeping.
39. Parkinsonism may include tremor, loss of fine motor skills, muscle rigidity, stooped posture, and a shuffling gait.
40. Tardive dyskinesia is characterized by involuntary, unusual tongue and face movements such as lip smacking, rapid eye blinking, and wormlike motions of the tongue. Tardive dyskinesia generally does not occur except with long-term use and may persist for years. It may even worsen when the drug is discontinued.
41. Neuroleptic malignant syndrome (NMS) may be a fatal adverse reaction. Symptoms include high fever, diaphoresis, muscle rigidity, tachycardia, and blood pressure fluctuations.
42. Other adverse effects include sexual dysfunction, galactorrhea, and gynecomastia.
43. Antipsychotics do not cause physical or psychological dependence.
44. The first-generation antipsychotics include phenothiazines and nonphenothiazines.
45. At equivalent doses all phenothiazines have the same effectiveness in treating symptoms and produce a similar set of adverse effects. Drug choice is determined by the severity and extent of expected adverse effects.
46. Some phenothiazines have other indications such as nausea and vomiting, cold and allergy symptoms, Tourette’s syndrome, and organic brain syndrome.
47. Chlorpromazine is the prototype phenothiazine dopamine (D2) receptor antagonist and is classified as a first-generation antipsychotic.
48. Drugs similar to chlorpromazine include fluphenazine, perphenazine, thioridazine, and trifluoperazine.
49. The nonphenothiazine agents cause less sedation and fewer anticholinergic side effects but exhibit an equal or greater incidence of EPS.
50. Haloperidol (Haldol) is the prototype nonphenothiazine, dopamine (D2) antagonist and is classified as a first-generation antipsychotic.
51. Drugs similar to haloperidol (Haldol) include loxapine (Loxitane), Pimozide (Orap), and thiothixene (Navane).
52. Second-generation antipsychotics are the drugs of choice for the treatment of schizophrenia.
53. Second-generation antipsychotics are thought to target more specific dopamine receptors or inhibit different subtypes of dopamine receptors.
54. Risperidone (Risperdal) is the prototype dopamine (D2) receptor antagonist and is classified as a second-generation, atypical antipsychotic and antimanic drug.
55. Drugs similar to risperidone (Risperdal) include clozapine, olanzapine (Zyprexa), and quetiapine (Seroquel).
56. Dopamine system stabilizers (DSS) are a newer class of atypical antipsychotic that exhibit both antagonist and partial agonist activities on dopamine receptors.
57. Aripiprazole (Abilify) is the prototype DDS used as an atypical antipsychotic.
58. There are no drugs similar to aripiprazole (Abilify).
59. Nursing diagnoses useful in caring for clients receiving pharmacotherapy with antipsychotics include *Disturbed Personal Identity, Anxiety, Impaired Verbal Communication, Impaired Social Interaction, Ineffective Health Maintenance, Impaired Home Maintenance, Noncompliance, Deficient Knowledge, Caregiver Role Strain, Risk for Self-Directed Violence, Risk for Other-Directed Violence,* and *Risk for Self-Mutilation.*
60. Teach the client and family that full effects of therapy may not occur for several days or weeks and that supportive, inclient care may be necessary during early therapy.
61. Engage client, family, and caregivers in strategies to ensure client remains on regular medication therapy. Do not leave drugs at the bedside and monitor for nonadherence to therapy.
62. Teach client and caregivers about EPS symptoms and when to report.
63. Teach client and caregivers to immediately report changes in LOC, elevated temperature, excessive sweating, severe muscle rigidity, increased respirations, shortness of breath, or incontinence.
64. Instruct client and caregivers to report dizziness, palpitations, tachycardia, chest pain, cough, chest congestion, fever, or breathing difficulties.
65. Teach the client and caregivers to report abdominal pain, changes in stool color, jaundice, darkened urine, skin rashes, general malaise, or redness or swelling around sites of injury. Also teach assessment findings of diabetes that are important to report.
66. Encourage use of sips of water, ice chips, hard candy, or chewing gum to ease mouth dryness. Avoid alcohol-based mouth washes. Increase dietary fiber intake. Report urinary frequency, hesitancy, or retention.
67. Encourage a healthy diet. Teach clients and caregivers to weight client daily and to report weight gain of 2 kg per week.
68. Teach client or caregiver to immediately report any suspicion of pregnancy because most of these drugs are category C.
69. Teach client to avoid alcohol or illegal drug use.
70. Teach the client to avoid caffeine-containing beverages and foods and OTC medications.
71. Teach the client to decrease smoking.
72. Teach client and caregiver to take the medication as ordered and to avoid switching brands of medication. Do not abruptly discontinue the medication.

**Chapter 20 Pharmacotherapy of degenerative disorders of the central nervous system**

**Learning Outcomes**

1. Identify drug classes used for treating Parkinson’s disease.

Suggested Classroom Activity: Have students identify three websites that you could refer clients to for information on Parkinson’s disease.

Suggested Clinical Activity: Have students make arrangements to attend a support group in the community for clients with neurodegenerative diseases.

2. Explain the therapeutic action of antiparkinson drugs, focusing on the roles of dopamine and acetylcholine in the brain.

Suggested Classroom Activity: Have students teach a classmate the differences between primary and idiopathic Parkinson’s disease and secondary Parkinson’s disease.

Suggested Clinical Activity: Have students evaluate clients with Parkinson’s disease to determine if the source is likely primary or secondary.

3. For each of the drug classes listed in Prototype Drugs, identify a representative drug and explain its mechanism of action, primary actions, and important adverse effects.

Suggested Classroom Activity: Have students list the primary symptoms of Parkinson’s disease.

Suggested Clinical Activity: Have students assess clients with Parkinson’s disease for classic symptoms.

4. Explain the therapeutic action of drugs used for treating Alzheimer’s disease and the efficacy of existing medications.

Suggested Classroom Activity: Have students develop a teaching poster describing the neurochemical basis for Parkinson’s disease and illustrating the roles of dopamine and acetylcholine in the brain.

Suggested Clinical Activity: Have students assess a client with Parkinson’s disease and determine the symptoms caused by disturbance in dopamine and acetylcholine levels.

5. Discuss the nurse’s role in the pharmacological management of clients with Parkinson’s disease and Alzheimer’s disease.

Suggested Classroom Activity: Have students prepare a client teaching handout describing the pharmacologic management of Parkinson’s disease.

Suggested Clinical Activity: Have students care for a client with a neurodegenerative disease. This should include listing medications that are currently being taken to treat the symptoms, interviewing the client to determine compliance and effectiveness of prescribed medications, identifying if any alternative therapies are being utilized, and determining the effectiveness of alternative therapies.

Suggested Classroom Activity: Have students prepare a teaching plan for a client newly diagnosed with Alzheimer’s disease, then have them share their teaching plan with a classmate.

Suggested Clinical Activity: Have students implement their teaching plan with a client newly diagnosed with Alzheimer’s and the caregivers.

6. Describe and explain, based on pharmacological principles, the rationale for nursing assessment, planning, and interventions for clients receiving drug therapy for degenerative diseases of the central nervous system (CNS).

Suggested Classroom Activity: Have students list the prototype drugs given for Parkinson’s disease, Alzheimer’s disease, and other neurodegenerative disorders.

Suggested Clinical Activity: Have students provide care for clients with neurodegenerative diseases, including administering medications.

Suggested Classroom Activity: Have students list the nursing interventions necessary when providing pharmacotherapy for Parkinson’s disease and Alzheimer’s disease.

Suggested Clinical Activity: Have students evaluate the medication record of clients with Parkinson’s disease or Alzheimer’s disease. Have the students differentiate the medications given specifically for those diseases and the medications given for other unrelated disorders.

7. Use the nursing process to care for clients who are receiving drug therapy for degenerative diseases of the CNS.

Suggested Classroom Activity: Have students identify available support that can be found in your community for clients and their families who are experiencing neurodegenerative diseases. Read newspapers and hospital newsletters, and contact mental health professionals or neurologists in your area to determine what resources are available. Compile a list of these resources to share with health care professionals who treat these populations.

Suggested Clinical Activity: Have students provide discharge teaching to the caregivers of clients newly diagnosed with a neurodegenerative disorder.

**Key Concepts**

1. Degenerative diseases of the central nervous system are characterized by irreversible and progressive loss of neuronal function.
2. Alzheimer’s disease and Parkinson’s disease are the most common of these disorders. Others are Huntington’s disease, multiple sclerosis, and amyotrophic lateral sclerosis.
3. The etiology of these disorders is mostly unknown.
4. Currently medications are unable to cure or significantly alter the clinical course of these disorders.
5. Parkinson’s disease (PD) is a progressive neurodegenerative disorder characterized by abnormal, involuntary motor movement. It may occur at any age, but usual age of onset is 40 to 70.
6. Idiopathic PD is the most common. It has no known cause, but may have a genetic link
7. Secondary PD occurs following a medical condition such as head trauma, brain infection, brain tumor, or exposure to neurotoxins.
8. Initially, subtle symptoms include fatigue, slow movement, and then slight tremor. Characteristic symptoms include tremor, muscle rigidity, bradykinesia, and postural instability.
9. Common comorbidities include depression, anxiety, sleep disturbances, dementia, difficulty urinating, and sexual dysfunction.
10. Parkinson’s disease is caused by inadequate secretion of dopamine-producing neurons in the substantia nigra, which results in low levels of dopamine in the striatum.
11. Dopamine release in the striatum leads to smooth, coordinated, unconscious muscle movement. Symptoms of PD are noticed when 60% to80% of neurons stop producing dopamine.
12. Acetylcholine (Ach) has an excitatory function and normally the effects of dopamine and Ach balance one another.
13. With Parkinson’s disease, pharmacology with dopamine agonists and anticholinergic drugs is aimed at alleviating symptoms through balancing dopamine and acetylcholine, but it does not cure the disease.
14. The goal of therapy for PD is to increase the ability of the client to perform normal activities of daily living.
15. A wearing-off of effects may appear gradually near the end of a dosing interval. This results in a worsening of symptoms and may require dose adjustment.
16. The on**–**off syndrome occurs when the client alternates between symptom-free periods (on) and times when the drugs stop working and symptoms abruptly appear (off).
17. The dyskinesias associated with adverse effects of pharmacotherapy for Parkinson’s disease are called extrapyramidal symptoms (EPS).
18. The most common treatment for Parkinson’s is dopamine replacement therapy with levodopa as it crosses the blood–brain barrier and is then converted to dopamine to compensate for dopamine deficiency. Pharmacotherapy may combine levodopa with carbidopa. Dystonia is a serious adverse effect, however. The goal is to treat with the lowest effective dose.
19. Levodopa/carbidopa (Sinemet) is the prototype dopamine replacement agent used as an antiparkinson drug.
20. Pharmacotherapy with dopamine agonists is early monotherapy or as an adjunct to levodopa. They are less effective than levodopa. The two classifications are ergot or nonergot alkaloid.
21. Advantages of dopamine agonists is that they are less likely to cause dyskinesias, they are effective even if not fully metabolized, they have no dietary restrictions, and they do not produce toxic metabolites.
22. Nursing considerations are that these drugs may cause dizziness, drowsiness, orthostatic hypotension, and dyskinesias.
23. Pramipexole (Mirapex) is the prototype dopamine receptor agonist, nonergot used as an antiparkinson drug.
24. Drugs similar to levodopa and pramipexole (Mirapex) are bromocriptine and ropinirole (Requip).
25. Miscellaneous dopaminergic agent used as adjuncts to levodopa therapy is amantadine (Symmetrel)
26. Anticholinergics are the oldest form of therapy for Parkinson’s. They are most effective at treating tremor, but are ineffective for treating bradykinesia. They are generally well tolerated, but are not as effective as levodopa/carbidopa.
27. Benztropine is the prototype cholinergic antagonist used as an antiparkinson drug.
28. The only other anticholinergic widely used for PD is trihexyphenidyl.
29. Dementia is a chronic, degenerative disorder characterized by progressive memory loss, confusion, and inability to think or communicate effectively.
30. Alzheimer’s disease is the most common form of dementia. It is not a normal part of aging, but an increased risk is associated with increasing age. Nearly 50% of people who are over the age of 85 have some changes in brain tissue associated with Alzheimer’s disease.
31. Amyloid protein and neurofibrillary tangles are found in brain biopsies of clients with Alzheimer’s disease.
32. In addition to structural changes, there are abnormalities in the balance of neurotransmitters.
33. With Alzheimer’s disease, pharmacotherapy does not stop the progression of the disorder. It provides only modest results, and is associated with delaying the worsening of symptoms.
34. Common medications to treat Alzheimer’s disease include cholinesterase inhibitors such as donepezil (Aricept), galantamine , and rivastigmine.
35. With cholinesterase inhibitors, the goal is to improve function in ADLs, behavior, and cognition. All drugs in this classification have equal efficacy. Side effects are primarily GI related, as the GI system is the most adversely affected. Side effects include nausea, vomiting, and diarrhea.
36. A newer drug, memantine acts to reduce glutamate. It is effective with cholinesterase inhibitors, and is used in combination.
37. Donepezil is the prototype reversible cholinesterase inhibitor used as an anti-Alzheimer’s drug.
38. Drugs similar to donepezil include galantamine and rivastigmine .
39. Multiple sclerosis (MS) is a chronic, neurodegenerative disease that is treated with immunomodulator drugs. It is characterized by the destruction or removal of the myelin sheath from a nerve or nerve fiber (demyelination).
40. The etiology of MS is unknown. It is most common in the 20- to 40-year-old age group. It is thought to involve an abnormal autoimmune response.
41. There are no drugs available that can cure multiple sclerosis (MS) or reverse the progressive demyelination of nerves. Existing drugs for MS are only partially effective and some have serious adverse effects. In general, pharmacotherapy has three goals: to modify the disease process, to treat exacerbations, and to manage symptoms.
42. The immunomodulators are used to prevent exacerbations. They can decrease the number of new plaques being formed within the CNS, delay future disability, and help clients maintain their present quality of life. Immunomodulators should be initiated as soon as the diagnosis of MS is confirmed. The earlier treatment is begun, the better chance the client has of avoiding or delaying permanent neurologic deficits. Treatment should continue indefinitely and only be stopped if toxicity develops or there is no apparent benefit.
43. Interferon beta-1b is the prototype immunomodulator used to treat relapsing forms of MS.
44. Acute exacerbations of MS may be treated with high-dose corticosteroid therapy with prednisone or methylprednisolone.
45. Antianxiety drugs, antidepressants antipsychotics, or sedative–hypnotics may be used to manage symptoms of MS.
46. Amyotrophic lateral sclerosis (ALS), or Lou Gehrig’s disease, is the most common degenerative disease of the motor neurons. Sensory and cognitive functions are not affected.
47. The pharmacotherapy of ALS is limited to a single drug.
48. Nursing diagnoses useful in the care of clients receiving pharmacotherapy for neurodegenerative disorders include *Impaired Physical Mobility, Impaired Swallowing, Impaired Verbal Communication, Constipation, Self-Care Deficit Bathing, Dressing, Feeding, Toileting, Disturbed Sleep Pattern, Ineffective Health Maintenance, Ineffective Family Health Maintenance, Caregiver Role Strain, Deficient Knowledge, Risk for Injury,* and *Risk for Falls.*
49. Teach client and caregivers that symptoms of PD do not improve rapidly but that increased symptoms or failure of symptoms to improve over time should be reported.
50. Teach the client and caregivers that medications given for AD do not halt the disease, but only delay progression of symptoms.
51. Assess clients for safety needs and teach activity modifications as indicated.
52. Teach clients and caregivers to report any changes in mood or behavior and any newly occurring neuromuscular findings.
53. Teach clients that medications for PD should be taken on an empty stomach or to avoid taking with a high-protein meal. Foods such as bananas, wheat germ, fortified cereals, green vegetables, and legumes should be avoided, as should multivitamins containing vitamin B6.
54. Encourage caregivers of those with AD and PD to attend closely to their own physical, emotional, and mental health.
55. Clients taking injectable drugs for the treatment of MS should report increasing redness, pain, or blackening of the injection site as tissue necrosis may occur.

**Chapter 21 Pharmacotherapy of seizures**

**Learning Outcomes**

1. Understand the causes of epilepsy.

Suggested Classroom Activity: Have students refer to the chapter table to review characteristics of epilepsy.

Suggested Clinical Activity: Have students provide a historical background of assigned clients with epilepsy.

2. Differentiate among the following terms: epilepsy, seizures, and convulsions.

Suggested Classroom Activity: Have students work in groups to compare and contrast the criteria associated with epilepsy, seizures, and convulsions.

Suggested Clinical Activity: Have students compare and contrast the criteria associated with epilepsy, seizures, and convulsions in assigned clients.

3. Identify drug classes used for treating epilepsy and seizures.

Suggested Classroom Activity: Provide case studies and have students divide into groups to discuss how epilepsy presents throughout the life span.

Suggested Clinical Activity: Have students choose an assigned client to identify how that person’s epilepsy has changed since diagnosis.

4. For each of the drug classes listed in Prototype Drugs, identify a representative drug and explain its mechanism of action, primary actions, and important adverse effects.

Suggested Classroom Activity: Have students select an AED and identify indications for use, contraindications, adverse effects, and client education for that medication.

Suggested Clinical Activity: Have students review the medication history of clients who have seizures to identify drugs administered as antiseizure medications.

Suggested Classroom Activity: Have students divide into groups and differentiate types of seizures, signs and symptoms, and pharmacotherapy.

Suggested Clinical Activity: Have students assess assigned clients with a history of different types of seizures.

5. Describe the nurse’s role in the pharmacological management of clients with epilepsy.

Suggested Classroom Activity: Provide case studies and have students divide into groups and compare and contrast pharmacotherapy for generalized and partial seizures.

Suggested Clinical Activity: Have students present drug profiles for assigned clients with seizures.

6. Describe and explain, based on pharmacological principles, the rationale for nursing assessment, planning, and interventions for clients with epilepsy.

Suggested Classroom Activity: Have students investigate the indications and contraindications for different antiseizure drugs.

Suggested Clinical Activity: Have students interview a prescriber about the decision tree used when selecting an antiseizure drug.

7. Explain the importance of client adherence in the pharmacotherapy of epilepsy.

Suggested Classroom Activity: Provide students with a case study. Then have students present drugs of choice for partial and generalized seizures, and specific nursing responsibilities for each type of seizure.

Suggested Clinical Activity: Have students identify appropriate history, laboratory values, and therapeutic levels in assigned clients.

1. Use the nursing process to care for clients who are receiving drug therapy for epilepsy.

Suggested Classroom Activity: Provide students with a case study. Then have students divide into groups and discuss the nursing care of a client on an AED.

Suggested Clinical Activity: Have students administer medications to an assigned client.

**Key Concepts**

1. Epilepsy is a disruption of the neuronal activity of the brain characterized by two or more seizures.
2. Seizures are a disturbance of the brain’s electrical activity that may result in loss of consciousness and sensation and alteration in motor activity.
3. Epileptic seizures often are symptoms of an underlying disorder.
4. Convulsions are involuntary violent spasms of the large skeletal muscles of the face, neck, arms, and legs. They are a characteristic sign of tonic–clonic seizures.
5. All convulsions are seizures but not all seizures are convulsions.
6. Of those who experience seizures, over half will experience their first seizure before age 10.
7. The pharmacology of epilepsy in women with childbearing potential is complicated because some AEDs interact with oral contraceptives and some have potential to produce teratogenic effects.
8. In women of childbearing age with epilepsy, fertility level is low and libido is decreased. Forty percent of women with epilepsy have polycystic ovaries.
9. Gestational epilepsy is rare. One presentation could be preeclampsia or eclampsia.
10. The amount of AEDs secreted in breast milk is low so breast-feeding may be allowed.
11. Childhood epilepsy is either idiopathic or acquired. Idiopathic seizures are associated with a family history of epilepsy or a serious neurologic abnormally (e.g., mental retardation). Febrile seizures occur in children under the age of 2. Seizure represents the most common serious neurologic problem affecting children.
12. Acquired seizures in children result from injury to the brain during prenatal, antenatal, or postpartum periods. Some causes may be cytomegalovirus (CMV), head trauma, metabolic imbalances, exposure to toxins, and infection.
13. For infants and children, the drug of choice is phenobarbital, valproic acid, phenytoin, carbamazepine, felbamate, lamotrigine, and topiramate.
14. Nonpharmacologic treatment can include a ketogenic diet, surgical intervention, and a vagus nerve stimulator.
15. Seizure activity in older adults can be associated with comorbidities such as cerebrovascular disease (especially CVA), progressive Alzheimer’s disease, subdural hematoma, CNS infection, and brain tumors.
16. Polypharmacy can cause seizures in older adults.
17. Most seizures are classified as generalized or partial.
18. Generalized seizures are multiple foci that spread abnormal neuronal discharges across both hemispheres of the brain.
19. Tonic–clonic seizures (grand mal) are the most common type in every age group. The tonic phase is characterized by an aura (considered part of the actual seizure), loss of consciousness, and intense muscle contractions. There may be a loud, hoarse cry. There may be temporary loss of bowel and bladder control. Dyspnea and or apnea may occur. The clonic phase is characterized by alternating contraction and relaxation of muscle, characteristic of convulsions. Seizure lasts 1 to 2 minutes. Clients may become drowsy or disoriented after the seizure. The period following the seizure is called the postictal phase.
20. Absence seizures (formally petite mal) are most common in children, and last a few seconds. This type of seizure is characterized by staring, transient loss of response, and slight motor activity (e.g., eyelid fluttering or muscular jerking movements). Episodes are subtle, and are often mistaken for daydreaming or inattention. They may lead to accidents and poor academic performance.
21. Atonic seizures (also referred to as drop attacks) may lead to stumbling or falling without cause. Episodes are short and are characterized by a loss of muscle control function throughout the body. During the episode, the client’s head will droop forward or trunk muscles may be nonsupportive—thus, the “drop” attack. Risk of injury is due to falls.
22. Myoclonic seizures are characterized by jerking body movements that involve the neck, shoulders, and upper arms. Major muscle groups contract for a few seconds, and the client appears unsteady and clumsy. There is no loss of consciousness. This type of seizure occurs most frequently in the morning, upon awakening, and worsens with sleep deprivation.
23. Partial seizures involve a limited portion of the brain. Abnormal neuronal discharges begin on one side of the body and travel a short distance before they stop. This type does not involve loss of consciousness or convulsions. Simple partial seizures have an onset usually beginning as a small regional focus. Symptoms are varied, and are dependent on the specific region of brain affected.
24. Complex partial seizures (formally known as psychomotor or temporal lobe seizures) originate from a single focus, usually the temporal lobe. Sensory motor or autonomic symptoms are exhibited with some degree of altered or impaired consciousness. Complex seizures are usually proceeded by an aura.
25. Febrile seizures usually occur in the 3-month to 5-year age group. Five percent of children may experience this type of seizure. They are associated with fever and are characterized by tonic–clonic motor activity lasting 1 to 2 minutes.
26. Status epilepticus is a medical emergency. Seizures last greater than 30 minutes or two or more sequential seizures occur without full recovery of consciousness between seizures. It is classified as a generalized form of epilepsy because tonic–clonic symptoms usually are exhibited.
27. Infantile spasm, which is also known as West syndrome, occurs the first year of life. It is characterized by a sudden bending forward, body stiffening, or aching of torso. Infants often have some degree of mental and developmental delays.
28. Lennox-Gastaut syndrome is considered a mixed seizure characterized by tonic–clonic, atonic, and atypical absence seizures. Cause is unknown with onset at 26 to 28 months, often associated with mental retardation and mood instability.
29. The choice of AED is dependent on seizure type and characteristics. It is highly individualized and dependent on many factors.
30. AED treatment begins at the lowest effective dose, and is increased as necessary to prevent adverse drug effects.
31. Effective management may be obtained by a single AED; however, if seizure activity continues, the initial drug is incrementally discontinued and replaced by a drug from a different class. Multiple AEDs may be required.
32. AEDs are never discontinued without the guidance of health care providers. Discontinuance can occur in, for example, clients who are symptom free or believe they have “outgrown” seizures.
33. All antiepileptic medications suppress neuron discharges, thus preventing the abnormal focus from forming or spreading across the cerebrum.
34. One mechanism of action for AEDs is control of electrolyte (sodium and calcium) movement. Sodium is the primary target.
35. Another mechanism of action for AEDs involves neurotransmitter balance. The neurotransmitter most affected by AEDs is gamma aminobutyric acid (GABA).
36. Barbiturates are traditional drugs for tonic–clonic seizure. They are being replaced by newer and safer drugs. Examples of barbiturates include mephobarbital , phenobarbital, and primidone.
37. The prototype for benzodiazepines and for antianxiety and skeletal muscle relaxants is diazepam (Valium). Its mechanism of action is as a major GABA receptor agonist, and it enhances GABA action.
38. Drugs similar to diazepam (Valium), clonazepam , clorazepate , and lorazepam (Ativan).
39. Hydantoins are effective in the management of most types of seizures but have many adverse effects.
40. Phenytoin is the prototype hydantoin, neuronal sodium channel modulator used as an antiepileptic drug.
41. A drug similar to phenytoin is fosphenytoin (Cerebyx).
42. Carbamazepine (Tegretol) is a neuronal sodium channel modulator used as an antiepileptic drug.
43. Drugs similar to carbamazepine ( Tegretol) is oxcarbazepine ( Trileptal).
44. Succinimides form a small groups of AEDs that suppress the influx of calcium into neurons during neuronal transmission.
45. Ethosuximide is the prototype succinimide, neuronal calcium channel modulator used as an antiepileptic drug.
46. The only drug similar to ethosuximide is methsuximide (Celontin).
47. Gabapentin (Neurontin) is the prototype GABA analog used in seizure management.
48. Valproic acid (Depakene) is the prototype GABA agonist used as an antiepileptic and antimanic drug.
49. Other miscellaneous drugs used in the management of seizures include felbamate , lamotrigine , and topiramate (Topamax).
50. Nursing diagnoses useful in the care of clients receiving pharmacotherapy for seizures include *Situational or Chronic Low Self-Esteem, Impaired Social Interaction, Deficient Knowledge,* and *Risk for Injury.*
51. Teach the client, family, or caregiver to keep a seizure diary.
52. Teach the client to carry a wallet identification card or wear medical information jewelry.
53. Teach the client to report signs of liver damage, neurologic changes, visual changes or eye pain, or increased bleeding or bruising.
54. Teach the client to wear sunscreen.
55. Teach the client to avoid alcohol and other CNS depressants, and to decrease intake of or avoid caffeine and nicotine.
56. Teach client to increase intake of foods that are rich in vitamins K, D, and B and folic acid.
57. Teach the client about support groups.
58. If medication is given IV, teach the client to report pain or burning at the site immediately as extravasation can be dangerous.
59. Teach the client to avoid changing brands of medication and to take medication as ordered.

**Chapter 22 Pharmacotherapy of muscle spasms and spasticity**

**Learning Outcomes**

1. 1. Discuss non-pharmacological therapies used to treat muscle spasms and spasticity.

Suggested Classroom Activity: Have students look up examples of muscle spasm and examples of muscle spasticity and report on those to the class.

Suggested Clinical Activity: Assign students to an orthopedic unit and a neurologic unit. Have them list symptoms of muscle spasm and/or spasticity experienced by clients with musculoskeletal injury in comparison to those caused by neurologic dysfunction.

2. Explain the therapeutic actions of centrally acting skeletal muscle relaxants and direct-acting antispasmodics in relation to the pathophysiology of muscle spasms and spasticity.

Suggested Classroom Activity: Divide the class into two groups. Have one group present pharmacologic interventions for muscle spasm or spasticity and have the other group present nonpharmacologic interventions.

Suggested Clinical Activity: Have the students ask the nurses and nurse aides at their clinical site what nonpharmacologic interventions they perform for muscle spasms.

3. Discuss the nurse’s role in the pharmacological and non-pharmacological treatment of clients with muscle spasms and spasticity.

Suggested Classroom Activity: Go around the room and see if each individual student can come up with a nursing function for a client on a muscle relaxant.

Suggested Clinical Activity: Have students look up the nursing implications and discharge instructions for clients on muscle relaxants at their individual clinical agency

Suggested Classroom Activity: Perform a brief quiz on the different classes of muscle relaxants or provide a game to quiz students on the classes of muscle relaxants.

Suggested Clinical Activity: Assign students to administer medications on a clinical unit where use of muscle relaxants is common.

4. For each of the drug classes listed in Prototype Drugs, identify a representative drug and explain its mechanism of action, therapeutic effects, and important adverse effects.

Suggested Classroom Activity: Ask a pharmacist to come speak to the class about medications used for muscle spasms and spasticity.

Suggested Clinical Activity: Visit the pharmacy at the clinical site to find out which medications are most commonly prescribed for muscle spasms at that facility.

Suggested Classroom Activity: Have students construct a chart listing the centrally and direct-acting skeletal muscle relaxants.

Suggested Clinical Activity: Have students review the medication records of assigned clients looking for these drugs. Have them report to the class on which drugs were more commonly used.

5. Describe and explain, based on pharmacological principles, the rationale for nursing assessment, planning, and interventions for clients with muscle spasms and spasticity.

Suggested Classroom Activity: Have students research the use of a specific skeletal muscle relaxant as surgical adjuncts. Have them report indications and considerations to the class as a whole.

Suggested Clinical Activity: Rotate students through the operating room and have them observe for use of the skeletal muscle relaxant drugs. Have them write what was given, why it was given, and how the client had to be monitored after administration of the agent.

6. Use the nursing process to care for clients who are receiving therapy for muscle spasms.

Suggested Classroom Activity: Provide a list of nursing interventions for several different nursing diagnoses and have the students determine which ones are specific interventions for clients with muscle spasms or spasticity.

Suggested Clinical Activity: Assign each student a client with a diagnosis likely to be associated with muscle spasms or spasticity and have them turn in a nursing care plan specific for muscle spasms or spasticity.

**Key Concepts**

1. Muscle spasms are involuntary contractions most commonly caused by injury or overuse of skeletal muscles.
2. Spasms cause sudden, intense pain, which diminishes after a few minutes.
3. The most common etiology of muscle spasm is injury to a skeletal muscle, either through muscle overuse or trauma.
4. Electrolyte imbalances, hypocalcemia, dehydration, and some medications can cause muscle spasm.
5. Muscle spasticity occurs when a certain muscle group remains in a continuous state of contraction caused by CNS damage.
6. Spasticity, also called hypertonia, creates more pain than a muscle spasm and results in greater impairment of movement and inability to relax the limbs.
7. Conditions most commonly associated with muscular spasticity include severe head or spinal cord trauma, multiple sclerosis, stroke, cerebral palsy, trauma, and amyotrophic lateral sclerosis.
8. Spasticity from a spinal cord injury results from the inability of inhibitory neurons to send messages for the muscle to relax; therefore, facilitory neurons that send messages for muscle to contract dominate.
9. Dystonia is a chronic neurologic disorder characterized by involuntary muscle contraction that forces body parts into abnormal, painful movements or postures. This affects the arms, legs, trunk, neck, eyelids, face, or vocal cords and can be localized or generalized.
10. Nonpharmacologic interventions are limited and include application of heat or cold, hydrotherapy, therapeutic ultrasound, assisted exercise, massage, traction, and manipulation.
11. Herbal remedies such as black cohosh, castor oil packs, and capsaicin may be used.
12. Nonsteroidal anti-inflammatory drugs and skeletal muscle relaxants are used to treat muscle spasms.
13. Reducing inflammation can take pressure off surrounding nerves, thus promoting increased mobility.
14. Muscle relaxants can relax tight, contracted muscles.
15. Greater pain relief is obtained when NSAIDs and muscle relaxants are used in combination.
16. Centrally acting skeletal muscle relaxants act on the central nervous system to produce sedation, which is beneficial to help clients with muscle spasms obtain sleep.
17. When combined with alcohol or other CNS depressants, significant drowsiness may occur.
18. Cyclobenzaprine is the prototype centrally acting antispasmodic used as a skeletal muscle relaxant.
19. Drugs similar to cyclobenzaprine include baclofen , methocarbamol, orphenadrine , and tizanidine .
20. Direct-acting skeletal muscle relaxants are often used to relieve muscle spasticity.
21. Dantrolene is the prototype calcium release blocker (skeletal muscle cells) used as a direct-acting skeletal muscle relaxant, antispasticity agent.
22. A drug similar to Dantrolene is botulinum toxin .
23. All botulinum therapy agents carry a black box warning that the drug may spread to distant muscles.
24. Skeletal muscle relaxants are administered during surgery in combination with anesthetic agents to facilitate intubation, endoscopy, and to manage mechanical ventilation.
25. Succinylcholine (Anectine) and tubocurarine are skeletal muscle relaxants given in surgery and require continuous monitoring.
26. These drugs have the ability to produce complete muscle paralysis, thus mechanical ventilation may be necessary.
27. Nursing diagnoses useful in caring for clients receiving pharmacotherapy for muscle spasms and spasticity include *Pain: Acute, Chronic; Impaired Physical Mobility; Self-Care Deficit: Bathing, Feeding, Dressing, Toileting; Disturbed Body Image; Fatigue; Deficient Knowledge;* and *Risk for Injury.*
28. Teach client that gradual improvement may take several days up to a week or longer.
29. Emphasize safety in ambulating and arising from lying or sitting down.
30. Mild ROM exercises only to the point of pain may be useful.
31. Provide nonpharmacologic pain relief measures such as heat or ice packs, massage, and positioning.
32. These medications may be constipating so the client should increase fluid to 2 L each day and increase dietary fiber. Laxatives may be necessary.
33. Report swelling of the tongue, face, or throat immediately as this may be a rare reaction to cyclobenzaprine.
34. The client should avoid all other CNS suppressants.
35. Urinary retention may occur.
36. It may be necessary to stop breast-feeding while taking these medications.

**Chapter 23 Pharmacotherapy of pain and migraines**

**Learning Outcomes**

1. Identify key principles of pain management.

Suggested Classroom Activity: Have students share their personal cultural and ethnic backgrounds in regard to perception and treatment of pain.

Suggested Clinical Activity: If possible, have students interview a client who is receiving pain management in the clinical setting. Have students explore any cultural or ethnic perceptions that the client is willing to share about pain management.

2. Describe the assessment and classifications of pain.

Suggested Classroom Activity: Have students make a list of the different types of pain, then next to each type list a specific injury, insult, or disease state that may manifest its pain response in that type.

Suggested Clinical Activity: Assign each student to a client receiving opioid pain management. Have students assess the pain before and during therapy. Students should include pain as part of the vital signs and discuss the effectiveness of the tool chosen.

3. Explain the phases of pain physiology: transduction, transmission, perception, and modulation

Suggested Classroom Activity: Have students interview each other regarding their perceptions of pain and pain management. Then share with the class, exploring how many myths they believed before studying the material.

Suggested Clinical Activity: If appropriate, have students interview health care professionals regarding their beliefs about pain and pain management.

4. Identify drug classes used for treating pain.

Suggested Classroom Activity: Have students diagram the phases of pain and the pain pathway.

Suggested Clinical Activity: Have students choose one medication their assigned client is receiving for pain and classify that medication by the phase in which it interrupts pain.

5. Explain the therapeutic action of analgesics in relation to physiological mechanisms of pain.

Suggested Classroom Activity: Have students make a list of nonpharmacologic therapies that they may practice in the clinical setting. Have them practice these therapies as part of a nursing laboratory activity.

Suggested Clinical Activity: Assign each student to a client who is receiving pharmacologic therapy for pain management. Have students develop a care plan for the client’s pain management that includes nonpharmacologic therapies and implement the plan.

6. For each of the drug classes listed in Prototype Drugs, identify a representative drug and explain its mechanism of action, primary actions, and important adverse effects.

Suggested Classroom Activity: Have students diagram the actions of the three different opioid drugs on the pain pathway.

Suggested Clinical Activity: Have students assess a client who is receiving an opioid receptor for pain management.

7. Relate the importance of pain assessment to effective pharmacotherapy.

Suggested Classroom Activity: Have students list different levels of pain and the drugs commonly used for treatment.

Suggested Clinical Activity: Have students review the medical record of their assigned client looking for episodes of pain and how it was managed. Compare the management to the guidelines established in the classroom activity for this learning objective.

8. Discuss the nurse’s role in using pharmacological and non-pharmacological therapies for clients who are experiencing pain.

Suggested Classroom Activity: Call out the names of medications commonly used in pain management. Have students respond with one of the three classes given.

Suggested Clinical Activity: Have students review the medications records of assigned clients. Being cognizant of HIPAA regulations, compare the list of drugs to see which class is most commonly used.

9. Compare and contrast the types of opioid receptors and their importance to pharmacology.

Suggested Classroom Activity: Have students explain why nonopioid and adjuvant medications are used in pain management.

Suggested Clinical Activity: Have students review the medication record of their assigned client. Are any nonopioid or adjuvant medications used? If so what are they?

10. Explain the role of opioid antagonists in the diagnosis and treatment of acute opioid toxicity.

Suggested Classroom Activity: Have students make a chart comparing and contrasting the actions and adverse effects of the opioids and nonopioids.

Suggested Clinical Activity: Have students assess a client who is receiving medications for pain. Are any adverse effects present? If so, how are they being managed?

11. Describe the long-term treatment of opioid dependence.

Suggested Classroom Activity: Assign each student one of the prototype drugs for the chapter. Have them create a list of possible nursing diagnoses related to each drug.

Suggested Clinical Activity: Have students administer medications on a clinical unit.

12. Compare the pharmacotherapeutic approaches of preventing migraines to those of aborting migraines.

Suggested Classroom Activity: Have students list the appropriate nursing interventions for a client receiving naloxone.

Suggested Clinical Activity: If possible, have students shadow a nurse who is administering naloxone to a client in an emergent situation. Have students observe how the nurse prioritized the nursing actions.

13. Describe and explain, based on pharmacological principles, the rationale for nursing assessment, planning, and interventions for clients who are experiencing pain.

Suggested Classroom Activity: Using the text, have students compare and contrast the drugs used for migraine prevention and migraine termination.

Suggested Clinical Activity: If possible, assign the student to a client receiving sumatriptan. Have students create a list of nursing diagnoses for the client.

14. Use the nursing process to care for clients who are receiving analgesics and antimigraine drugs.

Suggested Classroom Activity: Have students create a nursing care plan for a client receiving pain management treatment.

Suggested Clinical Activity: Assign the student to a client receiving pain management therapy. Have students develop a nursing care plan for this client to address pain management.

**Key Concepts**

1. Health professionals realize that accurate pain assessment and treatment are essential for quality client care.
2. The perception of pain is influenced by comorbid conditions.
3. The immediate goal of pain management is to reduce pain to a level that allows the client to perform reasonable activities of daily living.
4. The client is the expert on his or her own pain.
5. Pain management is a client’s right.
6. The effectiveness of pain management is enhanced by combination therapy.
7. Dosing should be individualized.
8. Adverse effects of medications should be managed.
9. Around-the-clock dosing for moderate to severe pain is most effective.
10. Pain assessment includes the location, intensity, quality, and precipitating or relieving factors.
11. Acute pain is of brief duration, and is usually from injury, surgery, labor and delivery, or myocardial infarction.
12. Chronic pain persists longer than 6 months and can interfere with activities of daily living.
13. Chronic nonmalignant pain is not life threatening, while chronic malignant pain can be life threatening, such as cancer.
14. Nociceptor pain is either somatic (localized sensations usually in muscles or joints) or visceral (usually located in internal organs).
15. Neuropathic pain is caused by injury to nerves.
16. Untrue beliefs about pain by both the health care profession and clients interfere with effective pain management.
17. Health care professionals cannot recognize pain independent of the client’s reports.
18. Not all clients who are in pain look like they are in pain and clients are able to sleep, even when they are experiencing pain.
19. Use of potent analgesics for pain will not lead to addiction. Clients do not overreport their pain because they are addicted to opioid medications.
20. Unrelieved pain can cause anxiety and fatigue, which can affect the emotions of pain perception.
21. Pain transduction begins when the nociceptor nerve endings in the peripheral nervous system are stimulated.
22. Pain transmission occurs when the nerve impulse signal travels from the nociceptors to the spinal cord along the sensory nerve fibers.
23. The gate control theory proposes a gating mechanism for the transmission of pain in the spinal cord.
24. Pain perception occurs in the brain as a conscious experience of pain. When the pain impulse reaches the brain, it may respond to the sensation with a variety of possible actions.
25. Pain modulation involves the descending nervous impulses traveling down the spinal cord that inhibit afferent pain transmission by means of a feedback mechanism. Various neurotransmitters can inhibit pain transmission.
26. Nonpharmacologic interventions are used to reduce and augment analgesic drugs and can be used to attain adequate pain relief without the use of drugs. They may allow for lower doses of drugs.
27. Nonpharmacologic interventions include acupressure and acupuncture; application of cold or heat; biofeedback therapy; distraction such as music, art, or laughter; electrical nerve stimulation; hypnosis; massage; meditation; physical therapy; and yoga.
28. The two broad categories of analgesics are the opioids and nonopioids. A third category is the adjuvant analgesics.
29. The most effective drug class for relieving severe pain is the opioids. Mild to moderate pain is treated with nonopioid drugs such as NSAIDs, central-acting agents, or acetaminophen.
30. Combining these two analgesics allows them to synergistically relieve pain, and the dose of the opioid can be kept small to avoid dependency and side effects.
31. Management of cancer pain may require radiation therapy, surgery, injection of alcohol or other neurotoxic substances, nerve blocks, and injection of local anesthetics or steroid hormones.
32. Client-controlled analgesia allows the client to self-administer pain medication at a controlled level.
33. The term *opioid* refers to either natural or synthetic drugs with morphine-like activity. These drugs may also be called *narcotic analgesics*.
34. Opioid agonists work by activating both the mu and kappa receptors. This action causes relief of moderate to severe pain.
35. Mixed opioid agonist-antagonists work by occupying one receptor while blocking or having no effect on the other receptor.
36. Opioid antagonist drugs block both the mu and kappa receptors.
37. Adjuvant analgesics can be used for neuropathic pain or to enhance analgesia of clients receiving opioids.
38. Opioids produce analgesia, suppress the cough reflex, slow motility of the GI tract, are powerful CNS depressants, and can cause sedation.
39. Opioids have the potential to produce many serious adverse effects, including respiratory depression, sedation, nausea, vomiting, and constipation.
40. Respirations should be monitored before initiating therapy and regularly throughout therapy. If respiratory rate falls below 12 breaths per minute, therapy should be withheld.
41. Orthostatic hypotension with resultant dizziness and fainting is possible.
42. Increased intracranial pressure may occur as an indirect result of respiratory depression.
43. Urinary retention may occur.
44. Constipation, nausea, and vomiting may occur.
45. Prolonged use of opioids can result in tolerance.
46. All of the narcotic analgesics have the potential to cause physical and psychological dependence.
47. Opioids are frequently abused for nonmedical reasons.
48. Clients who experience adverse effects of opioids may erroneously report that they are allergic to the drug.
49. If it is necessary to change either the pain medication or the route of administration, the use of equianalgesic tables is recommended.
50. Morphine sulfate is the prototype drug for the narcotic analgesics. It is an opioid agonist.
51. Drugs similar to morphine sulphate include codeine, fentanyl, hydrocodone, hydromorphone, meperidine, methadone and oxycodone
52. The mixed agonist-antagonists opioids are narcotic analgesics that were developed with the intention of producing drugs with strong analgesia that have fewer adverse effects than morphine and other pure opioid agonists.
53. Examples of mixed agonist-antagonist opioids are buprenorphine, butorphanol, nalbuphine and pentazocine.
54. Nonopioid analgesics such as NSAIDs, acetaminophen, and a few centrally acting agents are the medications of choice for mild to moderate pain.
55. NSAIDS act at peripheral sites by inhibiting pain mediators at the nociceptor level.
56. Because NSAIDs act by a different mechanism than opioids, they do not produce the severe adverse effects seen with narcotic analgesics.
57. A few miscellaneous analgesics reduce pain by acting on the CNS.
58. Tramadol is the prototype mixed opioid-nonopioid analgesic.
59. Nursing diagnoses useful in caring for clients receiving pharmacotherapy for pain include *Acute Pain, Chronic Pain, Ineffective Breathing Pattern, Constipation: Deficient Knowledge, Risk for Injury,* and *Risk for Falls.*
60. The goal of therapy is pain relief rather than mere control.
61. Respiratory rate and pulse oximetry are often monitored during therapy, depending on cause of pain.
62. Monitor client for mobility safety.
63. Constipation is common. Client should increase fluids and fiber. Medications such as MiraLAX or Colace may be necessary.
64. Itching may occur as an annoying, expected side effect or as a symptom of anaphylaxis.
65. Assess for changes in LOC.
66. Assess for urinary retention
67. Antiemetics administered 30 to 60 minutes before opioid dose may minimize nausea. Small amounts of dry crackers or sips of carbonated beverages may also be of benefit.
68. Teach the client and caregiver about prescription restrictions to prevent interruptions in therapy.
69. Drugs similar to tramadol is clonidine (Catapres).
70. Adjuvant analgesics are used to enhance analgesia for pain that is refractory to opioids and for neuropathic pain.
71. Adjuvant analgesics can be added at any step in the pain management ladder and are usually dosed on a regular schedule rather than prn.
72. Adjuvant analgesics include drugs from the following classes: antidepressants, antiseizure drugs, corticosteroids, local anesthetics, muscle relaxants, bone-specific agents, and some miscellaneous agents such as capsaicin.
73. The primary indication for an opioid antagonist is opioid-induced respiratory depression.
74. Infusion with naloxone (Narcan) may be used to reverse respiratory depression and other acute symptoms. The client must be constantly monitored because IV doses of naloxone only last 1 hour. Maintenance of a patent airway is essential.
75. If an opioid antagonist fails to quickly reverse acute symptoms, the overdose was likely due to a nonopioid substance.
76. Following therapy with an opioid antagonist the client who abuses opioids becomes much more sensitive to opioid effects. If the pretreatment dose of opioids is taken, death may result.
77. Migraines are a severe type of headache related to specific triggers. They are often preceded by an aura.
78. The neurotransmitter serotonin (5-hydroxytryptamine or 5-HT) appears to be a key factor in the pathogenesis and treatment of migraine.
79. NSAIDS offer the safest and least expensive therapy for mild migraine.
80. Oral, intranasal, or subcutaneous serotonin (5-HT) agonists are the drugs of choice for moderate migraine.
81. Subcutaneous, IM, or IV serotonin agonists are often required for severe migraine.
82. The two major drug classes used to terminate migraines are triptans and ergot alkaloids.
83. Triptans are selective for the 5-HT1 receptor subtype and are thought to work by constricting certain intracranial vessels.
84. Ergot alkaloids may be used to abort migraines in those who are unresponsive to triptans. Their use should be separated from triptan use by at least 24 hours.
85. Sumatriptan is the prototype serotonin (5-HT1) receptor agonist used as an antimigraine agent.
86. Drugs similar to sumatriptan include almotriptan (Axert), eletriptan (Relpax), naratriptan (Amerge), rizatriptan (Maxalt), and zolmitriptan (Zomig).
87. Lifestyle changes and nonpharmacologic therapies to reduce frequency of migraine include identification and avoidance of triggers.
88. Beta-adrenergic blockers, calcium channel blockers, antidepressants, and antiseizure drugs are also used to treat migraines.
89. Nursing diagnoses useful in the care of clients receiving pharmacotherapy for migraines include *Acute Pain, Ineffective Health Maintenance, Ineffective Coping,* and *Deficient Knowledge.*
90. Teach the client that pain relief, rather than merely control, is the goal of therapy.
91. Triptans and ergot alkaloids can cause vasoconstriction so the client should report any chest pain or tightness or severe throat pain.
92. The client should report any changes in the character or duration of headache, dizziness, light-headedness, or blurred vision.
93. Foods or beverages may be migraine triggers. A food diary may help correlate food intake and onset of pain.
94. Alternative treatment should be used if pregnant or breast feeding.

**Chapter 24 Pharmacology of local and general anesthetic agents and adjuncts**

**Learning Outcomes**

1. 1. Identify drug classes used for local and general anesthesia.

Suggested Classroom Activity: Have students identify the most likely form of anesthetic used for each of the following:

* A 14-year-old girl with bulimia and a GI bleed
* A 28-year-old with a retained placenta who is breast-feeding
* A mother of five who is having an outclient tubal ligation
* A male with Alzheimer’s disease who is having an inclient urologic procedure
* A client with cancer who is having a peripherally inserted central line placed
* A psychiatric client with major depressive disorder for whom pharmacotherapy has not been successful who will be receiving electroconvulsive shock therapy

Suggested Clinical Activity: Have students review the operative plan for their assigned client. How is the type of anesthesia listed? Why is this type of anesthesia appropriate for this client?

2. Compare and contrast the five major clinical techniques for administering local anesthetics.

Suggested Classroom Activity: Have students explain the five general purposes of balanced anesthesia. Ask the students how they would change their approach if the client were very young or very old.

Suggested Clinical Activity: Have students observe the teaching provided by the anesthesiologist prior to surgery.

3. Describe differences in therapeutic action between the two major chemical classes of local anesthetics.

Suggested Classroom Activity: Have students develop a spreadsheet of the changes associated with anesthesia induction and the stages of anesthesia. Have them identify the nurse’s role associated with the administration of anesthesia.

Suggested Clinical Activity: Have students observe anesthesia induction and view the physiological responses to anesthesia as the client progresses from stage 1 to stage 3.

4. Explain why epinephrine and sodium hydroxide are sometimes included in local anesthetic cartridges.

Suggested Classroom Activity: Have students quiz one another on these drugs.

Suggested Clinical Activity: Have students observe the use of regional anesthesia during a procedure in the emergency department.

5. Explain the therapeutic action of drugs used for general anesthesia with reference to effects on the central nervous system (CNS).

Suggested Classroom Activity: For each of the classes shown in the chapter outline, identify the prototype and representative drugs and explain the mechanism(s) of drug action, primary indications, contraindications, significant drug interactions, pregnancy category, and important adverse effects. Have students construct a chart listing this information.

Suggested Clinical Activity: Have students monitor a client who has received anesthesia for any adverse effects.

6. Compare and contrast the two primary ways that general anesthesia may be induced.

Suggested Classroom Activity: Divide the students into two groups. Have one group write a care plan for a client who is receiving regional anesthesia and the other group write a care plan for a client receiving general anesthesia. Compare the two documents.

Suggested Clinical Activity: Ask a nurse in the operating room to share with the students the treatment plan for malignant hyperthermia. Review the information on how to prepare and administer pharmacotherapy associated with malignant hyperthermia.

7. For each of the drug classes listed in Prototype Drugs, identify a representative drug and explain its mechanism of action, primary actions, and important adverse effects.

Suggested Classroom Activity: Have students compare and contrast adjunct agents used in providing surgical anesthesia for four different clients.

Suggested Clinical Activity: Have an anesthesiologist or CRNA address the clinical group regarding their use of adjunct agents during general anesthesia.

8. Discuss the nurse’s role in the pharmacological management of clients who are receiving anesthetics.

Suggested Classroom Activity: Have students provide a list of information required prior to transporting a client to the operating room for general anesthesia.

Suggested Clinical Activity: Have students spend a clinical day in the recovery room caring for clients who have been administered inhalation anesthetics and observing their recovery. What is similar? What differs?

1. Describe and explain, based on pharmacological principles, the rationale for nursing assessment, planning, and interventions for clients who are receiving anesthetics.

Suggested Classroom Activity: Ask students to prepare a comprehensive nursing care plan for a client undergoing general anesthesia

Suggested Clinical Activity: Ask students to apply the care plan they prepared in the above activity on a client in the OR undergoing general anesthesia

1. Use the nursing process to care for clients who are receiving anesthetics.

Suggested Classroom Activity: Ask students to skit the use the nursing process on an imaginary client in the nursing lab

Suggested Clinical Activity: Ask students to apply all the steps of the nursing process on a client in the operating room.

**Key Concepts**

1. The four types of anesthesia differ as to the degree of unconsciousness produced, the region of the body that is affected, and the amount of sedation produced. The types include general, local, regional, and monitored anesthesia care.
2. Subtypes of monitored anesthesia care include minimal sedation (anxiolysis), moderate (conscious) sedation, and deep sedation/analgesia.
3. The purposes of general anesthesia include analgesia, muscle relaxation, hypnosis (induction of unconsciousness), amnesia, and loss of reflexes.
4. Balanced anesthesia uses multiple drugs such as neuromuscular blockers, short-acting benzodiazepines, opioids, and general anesthetics to achieve a safe induction and maintenance of general anesthesia. It reduces the need for large amounts of inhaled anesthetics (which increases client safety).
5. Balanced anesthesia results in general anesthesia. This process occurs in four stages: analgesia, excitement and hyperactivity, surgical anesthesia, and paralysis of the medulla.
6. In stage 1 the client loses general sensation but may remain awake. This stage terminates when the client loses consciousness.
7. The client may become delirious and attempt to resist treatment in stage 2. IV agents are administered to calm the client.
8. Surgical anesthesia (stage 3) is when skeletal muscles relax, delirium stabilizes, cardiopulmonary effects stabilize, and the client becomes still. This is the stage in which major surgical procedures are done.
9. Stage 4 is avoided as the breathing and cardiac function may cease and death could occur.
10. Intravenous anesthetics include opioids, benzodiazepine, and several other miscellaneous agents.
11. When used as intravenous anesthetics, opioids provide analgesia and accomplish neurolept anesthesia. Neurolept anesthesia produces feelings of interference to the client’s surroundings; the client appears to be asleep but does not lose consciousness.
12. Fentanyl is the prototype opioid agonist used as an analgesic, anesthetic.
13. Drugs similar to fentanyl are alfentanil , remifentanil, and sufentanil.
14. Benzodiazepines are used to produce relaxation, sedation, and amnesia.
15. They may be administered PO as a premedication to relax the client.
16. Midazolam is the prototype benzodiazepine, GABA receptor agonist used as an IV anesthetic.
17. The only other drug similar to midazolam (Versed) is diazepam (Valium).
18. Ketamine and propofol are intravenous general anesthetics used to induce and maintain anesthesia.
19. Propofol is the prototype NMDA receptor agonist used as an IV anesthetic, sedative–hypnotic drug.
20. Drugs similar to propofol is ketamine. Ketamine produces a trance-like feeling called *dissociative anesthesia*.
21. Inhalation anesthetics (supplied as gases or volatile liquids) produce their effects on the CNS by inhibiting the flow of sodium into neurons. This delays the nerve impulses and dramatically reduces the activity of the neurons. Inhibitory GABA receptors in the brain become active and are thought to be responsible for the anesthetic action.
22. The potency of inhalation anesthetics is described by the minimum alveolar concentration: the concentration of drug vapor in the alveoli that prevents a motor response in 50% of subjects when exposed to a painful stimulus. The minimum alveolar concentrations changes with the age of the client.
23. The anesthesiologist controls length and depth of anesthesia by delivering the exact concentration of drug needed to maintain the degree of immobility desired.
24. Anesthetics are lipid soluble and are stored in fat so clients who are obese may take longer to recover from anesthesia.
25. Nitrous oxide is the prototype GABA-receptor agonist, opioid agonist used as a gaseous general anesthetic.
26. Nitrous oxide is the sole gaseous general anesthetic.
27. Volatile liquid general anesthetics are used to induce and maintain deep anesthesia. They have a low vapor pressure that allows them to form a gas at low temperatures and pressures.
28. The minimum alveolar concentrations of the volatile liquid anesthetics are very low, making them very potent. They rapidly produce unconsciousness at low doses.
29. Some volatile liquid anesthetics increase risk for dysrhythmia, laryngospasm, or respiratory arrest.
30. Isoflurane is the prototype GABA and glutamate receptor agonist used as an inhaled general anesthetic.
31. Drugs similar to isoflurane are desflurane, enflurane, and sevoflurane
32. Local anesthetic agents are used to produce loss of sensation to a small, limited area. The primary advantage is that they do not produce generalized CNS effects and do not affect the respiratory system.
33. Local anesthetic methods include topical (surface), infiltration, nerve block, epidural, and spinal anesthesia.
34. Onset and duration of drug action are dependent on diffusion from the application site.
35. Duration of anesthesia may be extended by injecting a vasoconstrictor such as epinephrine in combination with the local anesthetic.
36. Nursing diagnoses useful in the care of clients receiving general anesthesia include *Anxiety, Impaired Gas Exchange, Ineffective Breathing Pattern, Decreased Cardiac Output, Disturbed Sensory Perception, Nausea, Deficient Knowledge, Risk for Injury,* and *Risk for Infection.*
37. The client should be in a quiet environment postoperatively where frequent reorientation can occur.
38. Shivering is a common response to anesthesia. The client should be kept warm and reassured that shivering is normal.
39. Monitoring involves frequent vital signs, including temperature. Report jaw muscle rigidity, increased temperature, or cola-colored urine immediately.
40. Maintain adequate pain relief and encourage deep breathing and moving of lower extremities.
41. Old fentanyl patches should be disposed of safely.
42. Esters act by decreasing the amount of sodium that enters the neuron, thereby depressing depolarization and preventing conduction of the pain impulse.
43. Amide-type anesthetics have less effect on the myocardium than ester types and the risk for allergy is lower. They reduce the conduction of nerve impulses associated with pain.
44. Lidocaine (Xylocaine) is the prototype amide, sodium channel blocker, used as a local anesthetic.
45. Drugs similar to lidocaine (Xylocaine) include articaine (Septocaine) , bupivacaine (Exparel, Marcaine, dibucaine (Nupercainal), mepivacaine (Carbocaine), prilocaine (Citanest), and ropivacaine (Naropin).
46. Anesthesia adjuncts are used to enhance anesthetic effects or to treat or prevent potential adverse reactions.
47. Preoperative medications are given to reduce anxiety and to reduce the potential for aspiration pneumonia.
48. Pain management drugs may be given both in preanesthesia and postanesthesia care.
49. Neuromuscular blockers are necessary because general anesthetics to not have the ability to produce the amount of muscle relaxation necessary for surgery. They do not enter the CNS and the client is still able to feel pain. They do paralyze the diaphragm and intercostal muscles, so breathing requires a mechanical ventilator.
50. Nursing diagnoses useful in the care of the client receiving local anesthesia include *Acute Pain, Deficient Knowledge, Risk for Aspiration, Risk for Infection,* and *Risk for Injury.*
51. Local anesthesia may result in the area being numb for several hours after the procedure is complete, pressure sensation may be retained throughout the procedure, and the ability to move the limbs after epidural may return before the ability to feel the movement.
52. Monitor for and have the client report any increasing nausea, drowsiness, dizziness, light-headedness, confusion, or anxiety.
53. If oral or throat anesthesia is present, the client should not eat or drink for 1 hour or more after anesthesia or until sensation has completely returned.
54. Ensure client mobility safety.
55. Monitor for signs of infection and for pain relief post-regional blocks.
56. If client is prescribed an oral medication for swishing and spitting or gargling, warn against swallowing the medication.
57. Postoperative medications include antiemetic drugs.

**Chapter 25 Pharmacotherapy of substances of abuse and addictions**

**Learning Outcomes**

1. Describe underlying causes of addiction

Suggested Classroom Activity: Divide students into groups and have each group identify factors found in clients with addictions: user factors and environmental factors. Have each group discuss and report to the class regarding how these factors are involved in the risk of addiction to both the therapeutic use of scheduled drugs as well as to the use of illegal or illegitimate drugs.

Suggested Clinical Activity: Have the clinical group assigned to a drug rehabilitation unit, where possible. Have each student identify a client who was being prescribed legitimate prescriptive medications. What factors in this client’s history may make addiction more likely?

Suggested Classroom Activity: Have students discuss the most frequently abused legal prescription drugs. They should be able to present the economic, social, and public health issues related to each of the prescribed medications.

Suggested Clinical Activity: During the clinical rotation, have each student identify a client who may be subject to prescription drug abuse. The student is to identify clients who have been on long-term use of oxycodone (OxyContin) or alprazolam (Xanax). The student is to maintain strict confidentiality and is to discuss the client with the instructor only; this is not intended to be a group or public discussion.

2. Differentiate psychological and physical dependence.

Suggested Classroom Activity: Divide students into five groups. Assign each group a category of scheduled drugs. Each group is to report on the classification, the abuse potential, and the physiological and psychological dependence potential.

Suggested Clinical Activity: Have students interview a nurse who works in a drug dependency unit. Ask which drug schedule has the most commonly abused drugs in this nurse’s experience.

3. Compare withdrawal syndromes for the various addictive substance classes.

Suggested Classroom Activity: Have students discuss the different classes of substance abuse. They should discuss the withdrawal syndrome (with signs and symptoms) for each classification.

Suggested Clinical Activity: Have students provide care for clients hospitalized in a dependency unit. Have students review medical history for findings associated with withdrawal syndromes and the methods used to treat these symptoms. Report in postconference.

Suggested Classroom Activity: Have students search the Internet for recent legislation regulating controlled substances. Combine findings and identify a few major trends. Divide students into groups and assign each group a topic to research and report on to the entire group.

Suggested Clinical Activity: While in the clinical environment, have students identify where controlled substances are stored and under what conditions. Have students identify how the hospital “controls” these medications on a per-shift basis and on a daily basis. Have students discuss the procedure for reporting variances in controlled substances amounts or counts.

4. Describe signs of drug tolerance, drug dependence, and withdrawal.

Suggested Classroom Activity: Have students present examples of tolerance, cross-tolerance, and tachyphylaxis. Students must present drug classifications and examples of symptoms for each area listed.

Suggested Clinical Activity: Have students identify symptoms of tolerance, cross-tolerance, or tachyphylaxis in assigned clients. Discuss these findings in postconference.

5. Describe the major characteristics of addiction, dependence, and tolerance resulting from the following substances: alcohol, nicotine, marijuana, hallucinogens, central nervous system (CNS) stimulants, sedatives, and opioids.

Suggested Classroom Activity: Have students create a chart listing the characteristics of abuse, dependence, and tolerance resulting from a specific drug in each of the classes given in the learning objective.

Suggested Clinical Activity: Have students provide care for a client who has experienced abuse of one of the substances given in the learning objective. What were the symptoms of abuse and why did the client seek therapy?

Suggested Classroom Activity: Divide students into two groups. Assign one group the topic “physiological dependence” of substance abuse and the other “psychological dependence” of substance abuse. Have each group discuss the definitions, the signs and symptoms, and the treatment of each dependent area. Each group should select a spokesperson to discuss the findings with the entire class.

Suggested Clinical Activity: Have the clinical group assigned to a drug rehabilitation unit, where possible. Divide the clinical group into two groups; assign one group to identify clients who have become physiologically dependent on a substance; the other group should be assigned to identify clients who have become psychologically dependent on a substance. Each group is to discuss their findings in clinical postconference.

6. Describe the role of the nurse in delivering care to individuals with drug addictions.

Suggested Classroom Activity: Divide students into four groups. Have each group discuss one of the following nursing roles in the prevention and management of substance abuse: assessment of client, educator, pharmacologic intervention, and community service. Each group is to identify a spokesperson who will state the group’s findings to the class.

Suggested Clinical Activity: Have students in the clinical setting identify community resources that would be available for assisting clients with treatment programs in their living area. Have students report back to the class with the identified resources and other findings.

**Key Concepts**

1. Substance abuse is the self-administration of drugs that are used in a manner that does not conform to the norms of the individual’s given culture in society.
2. Characteristics of abuse include a craving for a specific substance despite understanding its effects; failure to maintain normal work or home relationships; development of tolerance to the drug; repeated, unsuccessful attempts to discontinue using the substance; development of withdrawal symptoms if substance is not used; and an increased amount of time devoted to obtaining or using the substance.
3. Abused substances belong to a variety of chemical classes. While they may have few structural similarities, they all have one thing in common: the ability to affect the brain.
4. Most substance abuse is associated with *illegal* drugs. However, that is not necessarily valid. Alcohol and nicotine, which are both legal substances, are the two most abused substances.
5. Drugs with a potential for abuse are restricted by the Controlled Substances Act. These drugs are categorized into schedules.
6. Five categories (I through V), or schedules, for drugs of abuse were formulated. Schedule I drugs have the highest potential for abuse and have limited or no therapeutic value.
7. Addiction is an overwhelming compulsion to continue repeated use of drugs.
8. This drug experience is highly personal for each abuser; the drug experience brings some degree of pleasure or satisfaction to the individual. The experiences are difficult to generalize, but typically bring feelings of euphoria, sedation, well-being, or excitement. Others may experience hallucinations, but each user finds the drug experience reinforcing and worth repeating.
9. Addiction depends on multiple variables including agent factors such as cost, availability, speed of onset; user factors such as prior experiences with drugs, pathologic state, and willingness to take risks; and environmental factors such as social and community norms.
10. Addiction may begin with a legitimate need for pharmacotherapy. Narcotics may be indicated for pain relief or sedatives for a sleep disorder. Because these legitimate reasons provide a positive experience (relief of pain or sleep), the clients will want to repeat the use of the drugs.
11. Even among health care providers, there is a common misconception that the therapeutic use of scheduled drugs creates larger numbers of addicted clients; in fact, prescription drugs rarely cause addiction when used according to accepted medical protocols.
12. Physical and psychological dependence result in continued drug-seeking behavior despite the health and social consequences.
13. Physical dependence occurs when the body adapts to repeated use of the substance by altering normal physiology. It is not the same as addiction.
14. Physical dependence may occur during the normal course of therapy, such as in clients receiving high doses of narcotic analgesic during cancer treatment. Addiction implies destructive, compulsive substance use.
15. Psychological dependence produces no signs of physical discomfort after the agent is discontinued. There is, however, an intense desire to continue the substance despite clearly negative economic, physical, or social consequences.
16. Withdrawal syndromes are sets of characteristic symptoms that occur once a substance on which the client has become physically dependent is discontinued.
17. Symptoms of withdrawal are typically opposite to those of the drug’s effects.
18. Rebound effects (the intense symptoms that are produced as the drug is discontinued) often lead the individual to take additional doses of the abused substance because that may cause the withdrawal symptoms to disappear.
19. Tolerance is a biologic condition that occurs when the body adapts to a substance after repeated administration. Larger doses of the substance are required over time to achieve the same initial effect. The development of tolerance is not evidence that addiction to the substance has occurred.
20. Tolerance may lead to serious consequences for those who abuse hazardous substances. In an attempt to produce the desired effect (such as euphoria), the client may self-administer higher and higher doses of the drug, elevating the risk of overdose. The abuser may reach a daily dose that would be lethal for a nonaddicted individual.
21. Tolerance fades after the client discontinues the drug, usually after 10 to 14 days. Should the client return to the same high dose, death may occur.
22. Tachyphylaxis, the rapid development of tolerance, occurs with drugs such as cocaine, LSD, and amphetamines, but is not unique to abused substances. Some clients with cardiovascular disease will exhibit tachyphylaxis to the therapeutic effects of nitrates, such as nitroglycerin.
23. Cross-tolerance occurs between closely related drugs. When two or more drugs are similar chemically, the possibility of cross-tolerance is greater.
24. Resistance is often confused with tolerance, but this term more correctly refers to the immune system and infections and should not be used interchangeably with tolerance.
25. Central nervous system (CNS) depressants, including sedatives, opioids, and alcohol, decrease the activity within the system. These drugs are strictly controlled because of their abuse potential.
26. Sedatives are also known as sedative–hypnotics and tranquilizers. They are primarily prescribed for clients who have sleep disorders and certain forms of epilepsy. Two primary classes of sedatives are the barbiturates and nonbarbiturate sedative–hypnotics. Both groups have similar actions, indications, safety profiles, and addictive potentials.
27. Overdoses of sedatives are extremely dangerous because the drugs suppress the respiratory centers in the brain.
28. High doses of benzodiazepines cause clients to appear detached, sleepy, or disoriented. Many clients appear carefree.
29. Gamma-hydroxybutyric acid (GHB), another CNS depressant, occurs naturally within the body. It is also used to treat clients with narcolepsy who experience excessive daytime sleepiness or cataplexy (weak or paralyzed muscles). It is now abused by recreational users for its ability to produce euphoria at low doses.
30. Opioids, also known as opiates or narcotic analgesics, are prescribed for severe pain, anesthesia, persistent cough, and life-threatening diarrhea.
31. Effects of opioids begin within 30 minutes and may last over a day. Injecting or smoking opium produces immediate effects, including the brief, intense rush of euphoria sought by heroin addicts.
32. Tolerance to opioids develops rapidly; the client may require up to 10 times the initial dose to achieve their desired effects.
33. Opioid dependence can occur rapidly and withdrawal can produce very intense and unpleasant symptoms. These withdrawal symptoms may occur within a few hours of discontinuation of parenteral agents, and within 3 to 5 days for those dependent on the oral agents.
34. Oxycodone abuse has escalated in the past decade. Reformulation of the medication has decreased the practice of crushing, dissolving, and injecting the drug.
35. Methadone has been the conventional treatment of choice for opioid addiction. Although methadone has addictive properties of its own, it does not produce the same degree of euphoria as other opioids.
36. If methadone use is discontinued, gradual dose reduction occurs over a period of about 6 months. Withdrawal from methadone is more prolonged than with heroin and morphine, but the withdrawal symptoms are less intense.
37. The drug similar to buprenorphine with naloxone is naltrexone.
38. Alcohol (ethanol) is one of the most commonly abused drugs.
39. The drug crosses the blood–brain barrier easily; its effects on the brain are observed immediately, within 5 to 30 minutes after consumption.
40. Depending on the activity of two hepatic enzymes (alcohol dehydrogenase and aldehyde dehydrogenase), alcohol is metabolized at a constant rate.
41. Elimination of alcohol from the tissues occurs at a constant rate that is independent of the concentration of alcohol in the blood. Blood alcohol levels decline at about 15 mg/h. There is no food or drug that can be given to speed up the rate of excretion once it has reached the blood.
42. Acute overdoses of alcohol produce vomiting, severe hypotension, respiratory failure, and coma. Death is not uncommon.
43. Chronic alcohol consumption produces both psychological and physiological dependence.
44. The organ most affected by the chronic user is the liver. The liver is responsible for metabolizing and detoxifying alcohol. Hepatitis occurs in up to 90% of heavy users.
45. For clients with chronic alcoholism, drug doses should be reduced in order to avoid drug toxicity.
46. One of the major adverse effects of alcohol consumption occurs within the fetus of a pregnant alcohol user. There is no “safe” dose for consumption of alcohol during pregnancy.
47. Alcohol withdrawal is severe and may be life threatening. Five to ten percent of the cases of withdrawal proceed to delirium tremens, a syndrome of intense agitation, confusion, terrifying hallucinations, uncontrollable tremors, panic attacks, and paranoia. Thirty-five percent of the clients with delirium tremens die.
48. Disulfiram (Antabuse) is the prototype alcohol antagonist, acetaldehyde dehydrogenase inhibitor, used for treating alcohol abuse.
49. A drug similar to disulfiram (Antabuse) is naltrexone.
50. Marijuana is the most frequently abused illicit substance. Tetrahydrocannabinol (THC) is the active ingredient responsible for most of the psychoactive properties.
51. When inhaled, marijuana produces effects that occur within minutes and last 1 to 3 hours.
52. Chronic use is associated with apathy and a lack of motivation in achieving or pursuing life goals, and very high doses may cause hallucinations
53. THC appears to reduce the pressure in the eyeball, reduce severe nausea and vomiting, and reduce muscle spasticity so medical uses may exist and several states have approved the use of medical marijuana.
54. Hallucinogens are club drugs that cause an altered state of thought and perception.
55. LSD is a hallucinogen derived from a fungus that grows on rye and other grains. It is extremely potent and is administered orally.
56. Effects of LSD occur within an hour and may last 6 to 12 hours. It affects both the central and the autonomic nervous systems.
57. “Bad trips” are unpleasant experiences with LSD and may include acute anxiety, panic attacks, confusion, severe depression, and paranoia.
58. Drugs similar to LSD include psilocybin (mushrooms), mescaline (peyote cactus), and dimethyltryptamine (DMT).
59. Club drugs and miscellaneous hallucinogens are a diverse group of abused substances that includes ecstasy, GHB, methamphetamine, Rohypnol, ketamine, and other agents, usually ingested with alcohol. Others include MDMA, MDA, DOM, PCP, and DXM.
60. Central nervous stimulants such as amphetamines and cocaine are used to increase the activity of the CNS.
61. Amphetamines produce effects by increasing activity of the endogenous neurotransmitters norepinephrine, serotonin (5-HT), and dopamine.
62. Short-term use of amphetamines induces pleasurable feelings, but long-term use causes restlessness, anxiety, defensiveness, and fits of rage.
63. Methamphetamine, a drug used to induce euphoria, can be easily synthesized from pseudoephedrine.
64. Methylphenidate (Ritalin) is a CNS stimulant prescribed to treat ADHD. It is sometimes abused by those seeking euphoria, increased alertness, or appetite suppression.
65. Cocaine is a schedule II drug that produces psychoactive and physiological actions similar to amphetamines.
66. The half-life of cocaine is short and tolerance rapidly develops to the pleasurable effects of the drug.
67. Cocaine readily crosses to the placenta and produces marked effects on the fetus. These drug effects are prolonged because the fetus lacks the hepatic enzymes necessary to metabolize cocaine.
68. After the feelings of euphoria diminish, cocaine users may be left with a sense of irritability, exhaustion, insomnia, depression, and extreme distrust.
69. Caffeine is a natural substance that is rapidly distributed to almost all parts of the body after ingestion. It produces mental alertness, restlessness, nervousness, irritability, and insomnia.
70. Nicotine is a powerful and highly addictive cardiovascular and CNS stimulant.
71. Nicotine affects many body systems, including the nervous, cardiovascular, and endocrine systems.
72. Both psychological and physical dependence occur relatively quickly with nicotine.
73. Discontinuation of tobacco produces withdrawal symptoms that include agitation, impaired concentration, weight gain, anxiety, headache, and an extreme craving for the drug.
74. Nicotine replacement therapy (NRT) is based on the assumption that the blood level of nicotine is what drives people to continue smoking.
75. Varenicline (Chantix) is the nicotinic receptor agonist used as a drug for smoking cessation.
76. There are no drugs similar to varenicline (Chantix).
77. Inhalant abuse occurs when clients breathe the fumes of vaporized substances. These substances differ greatly in their chemical structures and include nearly any chemical that can be vaporized.
78. The inhalation route produces almost instantaneous effects and the substances quickly enter the brain.
79. Chronic use can cause serious and permanent adverse effects on the nervous system.
80. Nursing diagnoses useful in providing care for clients receiving pharmacotherapy for substance abuse disorders include *Anxiety, Ineffective Coping, Compromised Family Coping, Diarrhea, Imbalanced Nutrition: Less than Body Requirements, Impaired Memory, Insomnia, Social Isolation, Deficient Knowledge,* and *Risk for Injury.*
81. Consistency of treatment is essential.
82. The nurse should monitor use of pharmacotherapy and teach clients not to alter doses.
83. If client is receiving disulfiram, all forms of alcohol must be avoided.
84. Monitor clients for an increase or changes in psychological symptoms.
85. If client is using varenicline (Chantix), no other form of NRT should be used.
86. Use of support groups should be encouraged.
87. Anabolic steroids are abused for their ability to increase muscle strength and are banned by most sports organizations.
88. Abusers may “stack” drugs or “pyramid” doses.
89. These drugs can cause infertility, impotence, testicular atrophy, and gynecomastia. They also may cause hepatic cysts, elevated cholesterol, myocardial infarction, stroke, and personality changes such as aggression, violent behavior, depression, insomnia, anorexia, and decreased libido.
90. The nurse has a pivotal role in recognizing and treating substance abuse and must be knowledgeable about the signs and symptoms of substance abuse.
91. The nurse must be firm in disapproving substance abuse, yet compassionate in trying to help the client receive treatment.

**Chapter 26 Brief review of the endocrine system**

**Learning Outcomes**

1. Describe the general structure and functions of the endocrine system.

Suggested Classroom Activity: Review a video that explains the anatomy and physiology of the endocrine system.

Suggested Clinical Activity: Have students consider a 75-year-old male recovering from routine knee surgery. Think about his potential for endocrine system problems during recovery. Speculate as to whether he would be at high or low risk for signs and symptoms associated with these endocrine organs. Ask students to explain their reasoning.

2. Compare and contrast the nervous and endocrine systems in the control of homeostasis.

Suggested Classroom Activity: Divide students into two groups and assign the nervous system to one group and the endocrine system to the other. Have students create a chart listing the actions of their assigned system in the control of homeostasis. Compare these charts.

Suggested Clinical Activity: Present the following case study: A client is seen in the emergency department after a negative reaction to a bee sting. He is short of breath and has hives. The staff begins treatment to prevent shock. It is clear that the client is unstable and struggling to regain homeostasis. Ask students whether the client’s initial response to the challenge of the bee sting was neuronal or hormonal. What endogenous hormone levels would students expect to see elevated in the client’s bloodstream? Which hormone level is most likely to have increased first?

3. Explain circumstances in which hormone receptors may be up-regulated or down-regulated.

Suggested Classroom Activity: A client is receiving supplemental cortisone therapy to treat the bronchial inflammation associated with an acute exacerbation of chronic bronchitis. The intent of this therapy is to decrease the severe response in the bronchial tubes. Have students draw a concept map that notes the locations of the various other receptors throughout the body that will bind cortisol.

Suggested Clinical Activity: Assign students the following critical thinking exercise in preconference: You are caring for a client who has been receiving steroid therapy to decrease an inflammatory response. The dose is being decreased gradually and the time between doses is being increased gradually. Is this an up-regulation or a down-regulation scenario? Defend your answer.

4. Through the use of a specific example, explain the concept of negative feedback in the endocrine system.

Suggested Classroom Activity: Review the concept of negative feedback systems.

Suggested Clinical Activity: Have students recall a clinical client who was receiving medications affecting the endocrine system. Have students identify how a negative feedback system was at work.

5. Explain the three primary types of stimuli that regulate hormone secretion.

Suggested Classroom Activity: On the board, list these four headings: Neuronal, Humoral, Hormonal, and Mixed. Have students complete the chart by listing medications that affect each type of negative feedback.

Suggested Clinical Activity: Have students compare the medications being taken by assigned clinical clients. Which feedback mechanism is involved and what client findings indicate this is occurring?

6. Identify indications for hormone pharmacotherapy.

Suggested Classroom Activity: List commonly prescribed hormone replacements and have students identify which conditions are present when this pharmacotherapy is indicated.

Suggested Clinical Activity: Have students review the medical history of an assigned client who is taking a drug that affects the endocrine system. Compare assessment before and after therapy was initiated.

**Key Concepts**

1. The endocrine system is a major source of control in the body’s homeostasis. The nervous system has a very rapid impact on homeostasis, but the endocrine system forces generally are much slower.
2. Hormones travel throughout the body via the bloodstream seeking receptor sites. Endocrine hormones bind to specific receptors in the walls of their target cells. These targets are protein based. Once binding occurs, a change inside the cell occurs.
3. The action inside the target cell is specific to the hormone.
4. Up-regulation refers to an increase in the number of receptors that can capture the desired hormone on the surface of the cell wall, while down-regulation refers to a decrease in the number of hormone receptors. Down-regulation occurs when there is a decreased need to capture all hormone molecules.
5. Down-regulation has strong implications in pharmacotherapy. When a drug is discontinued, the target cells need time to make more receptors; this process takes several days.
6. Negative feedback is the most potent means by which hormone secretion and release are regulated in the body.
7. The negative feedback mechanism may be comprised of two or three types of stimuli, including neuronal, humoral, and/or hormonal.
8. Neuronal stimuli are supplied by the nervous system.
9. Humoral stimuli are driven by sensors in the endocrine glands.
10. Hormonal stimuli are common in the endocrine system, with one hormone triggering the release of the second hormone, which in turn causes the release of a third hormone. The last hormone in the sequence provides negative feedback that shuts off production of the first hormone in the sequence.
11. The goals of drug therapy with hormones vary widely. The goals include:
    1. The provision of hormones to clients who were never able to make their own
    2. Supplementation in situations where previously adequate levels dropped
    3. Shrinkage of hormone-sensitive cancers
    4. Provision of an exaggerated response to a normal hormone function, such as suppression of inflammation or ovulation
12. Antihormones are drugs that block the receptors to which endogenous hormones normally bind. Examples include:
    1. PTU (propylthiouracil) blocks the effects of an overactive thyroid.
    2. Tamoxifen blocks estrogen-receptors in estrogen-dependent breast cancer.

**Chapter 27 Pharmacotherapy of hypothalamic and pituitary disorders**

**Learning Outcomes**

1. Explain the principal actions of the hormones secreted by the hypothalamus and the pituitary gland.

Suggested Classroom Activity: Review the anatomy of the endocrine system by card sort. Produce and laminate cards with the following labels: Hypothalamic Hormones, Pituitary Hormones, Other Target Organs, Adrenocorticotropic hormone (ACTH), Antidiuretic hormone (ADH), Calcitonin, Corticotropin-releasing hormone, Corticosteroids, Estrogen, Follicle-stimulating hormone (FSH), Gonadotropin-releasing hormone, Growth hormone–inhibiting Hormone, Growth hormone, Growth hormone– releasing hormone, Luteinizing hormone (LH), Oxytocin, Progesterone, Prolactin, Prolactin-inhibiting hormone, Prolactin-releasing hormone, Testosterone, Thyroid-stimulating hormone (TSH), Thyrotropin-releasing hormone, Thyroxine. Have students sort the various hormones into the correct category.

Suggested Clinical Activity: Have students identify which hormones are most commonly administered in their clinical setting.

2. Identify indications for hypothalamic hormone therapy.

Suggested Classroom Activity: Have students discuss the following statement: “There are very few indications for the administration of hypothalamic hormones.”

Suggested Clinical Activity: Have students identify assessment findings that indicate a hypothalamic hormone imbalance exists.

3. Explain the pharmacotherapy of growth hormone disorders in children and adults.

Suggested Classroom Activity: Discuss with students the potential use of GH to treat cardiomyopathy and Crohn’s disease, with emphasis on the risk–benefit ratio for each condition.

Suggested Clinical Activity: Contact the social service department in an acute care setting. Ask a social worker to explain what he or she would do to facilitate growth hormone therapy for a child with lack of insurance coverage.

4. Explain the pharmacotherapy of antidiuretic hormone disorders.

Suggested Classroom Activity: Have students identify the actions and importance of antidiuretic hormone balance.

Suggested Clinical Activity: Have students interview a nurse who works in the neurointensive care unit. What impact does this nurse see in clients in regard to imbalance of antidiuretic hormone?

5. For each of the classes shown in the chapter outline, identify the prototypes and representative drugs and explain the mechanism of action, primary indications, contraindications, significant drug interactions, pregnancy category, and important adverse effects.

Suggested Classroom Activity: Have students create drug cards with this pertinent information.

Suggested Clinical Activity: Quiz students in clinical as they administer these drugs.

6. Apply the nursing process to care for clients receiving pharmacotherapy for disorders of the hypothalamus and pituitary gland.

Suggested Classroom Activity: Discuss why clients who have an antidiuretic hormone imbalance might benefit from the use of both of these nursing diagnoses: *Deficient Fluid Volume* and *Excess Fluid Volume.*

Suggested Clinical Activity: Have students develop a care plan for a client with a disorder of the hypothalamus or pituitary gland.

**Key Concepts**

1. The hypothalamus and the pituitary gland have a complex relationship. They collaborate to secrete hormones that control the functions of numerous organs. The hypothalamus and the pituitary work together to integrate the nervous system with the endocrine system.
2. The hypothalamus is an almond-sized structure located in the center of the diencephalon of the brain and just above the brainstem. The hypothalamus’ core purpose is to maintain homeostasis of all body functions. It receives messages from many parts of the nervous system, examines those messages for imbalances, and makes adjustments that regain homeostasis.
3. All of the hormones produced by the hypothalamus seek receptors on target cells in the pituitary. After traveling to the pituitary by the bloodstream, the hypothalamic hormones either increase or decrease the rate of discharge of the pituitary hormones.
4. The hypothalamic hormones that do have clinical applications are analogs or antagonists of gonadotropin-releasing hormone (GnRH).
5. The anterior pituitary produces and secretes several hormones, four of which are tropic hormones. Tropic hormones regulate other hormones.
6. The posterior pituitary hormones are antidiuretic hormone and oxytocin. These hormones are made in the hypothalamus and stored in the posterior pituitary until they are released.
7. Regulation of hormone levels is an essential function because too little or too much of any of these endocrine secretions can cause profound symptoms.
8. In general the pathologies of the endocrine glands can be categorized as causing either hypo- or hyperfunction of the gland.
9. Growth hormone (somatotropin or somatropin) is produced and secreted by the anterior pituitary. It is now recognized that adults produce nearly as much GH as children.
10. Many of the effects of GH are dependent on insulin-like growth factor (IGF).
11. GH deficiency in children produces dwarfism. Body size is normal at birth, but growth proceeds slower than normal, with short stature.
12. Adult GH deficiency is characterized by a loss of muscle mass, increased visceral fat, insulin resistance, and blood lipid abnormalities. The risk for cardiovascular disease is increased.
13. Human growth hormone is a drug of abuse. Athletes use it inappropriately to increase muscle mass. Older individuals misuse it as an antiaging remedy that is purported to improve memory and skin tone.
14. Somatropin (Humatrope) is the prototype pituitary hormone used as human growth hormone.
15. Overproduction of growth hormone can occur in childhood or in adulthood. If it occurs prior to puberty, the condition is termed gigantism.
16. In adulthood, overproduction of GH causes the condition acromegaly.
17. Octreotide (Sandostatin) is the prototype somatostatin used as a growth hormone antagonist, antidiarrheal.
18. Nursing diagnoses useful in the care of clients receiving pharmacotherapy with growth hormone include *Acute or Chronic Pain, Disturbed Body Image, Imbalanced Nutrition: Less than Body Requirements, Deficient Knowledge, Risk for Disproportionate Growth, Risk for Situational Low Self-Esteem, Risk for Impaired Social Interaction, Risk for Loneliness,* and *Risk for Unstable Blood Glucose Level.*
19. Baseline assessment and reassessment throughout growth hormone treatment will help to guide therapy and to identify adverse effects.
20. Monitor for reports of muscle, joint, or bone pain.
21. GH may increase glucose level and should be monitored.
22. Fluid retention may occur initially but should resolve over time. Findings of fluid volume overload should be reported.
23. If parenteral therapy is used, reconstitute the drug exactly as indicated and do not shake the vial. Unused solution should be refrigerated.
24. GH should be administered in the evening.
25. ADH deficit causes problems with fluid homeostasis.
26. A lack of ADH or an inability to utilize ADH is termed diabetes insipidus (DI). Individuals with DI produce huge amounts of very dilute urine and are very thirsty.
27. An excess of ADH is labeled SIADH (syndrome of inappropriate antidiuretic hormone). Individuals with SIADH have fluid retention, scant urine output, and very low serum osmolality.
28. Desmopressin (DDAVP) is the prototype pituitary hormone used as antidiuretic hormone replacement.
29. The only drug similar to desmopressin (DDAVP) is vasopressin.
30. Nursing diagnoses useful in the care of clients receiving pharmacotherapy with antidiuretic hormone include *Deficient Fluid Volume, Impaired Urinary Elimination, Deficient Knowledge, Excess Fluid Volume,* and *Risk for Bleeding.*
31. Baseline assessment and continued assessment are essential to client’s health.
32. If given for nocturnal enuresis, have family keep a diary of sleep patterns.
33. Fluid retention secondary to antidiuretic therapy may lead to increased intravascular volume, HTN, and water intoxication. Findings associated with these conditions should be reported.
34. Peripheral ischemia, HTN, or angina is possible and signs should be reported.
35. If nasal administration is used, monitor nasal passages for excoriation or bleeding.

**Chapter 28 Pharmacotherapy of Diabetes Mellitus**

**Learning Outcomes**

1. Describe the endocrine and exocrine functions of the pancreas.

Suggested Classroom Activity: It is important for students to understand glucose/insulin balance. A scale is a good picture of the balance: As glucose rises, to balance the scale, insulin must be secreted.

Suggested Clinical Activity: Have a glucometer and let students check their own finger-stick blood sugar. It might be fun to do a spreadsheet of the various numbers. Be prepared: Someone actually might be undiagnosed as having DM.

2. Compare and contrast type 1 and type 2 diabetes mellitus in relation to their pathophysiology and treatment.

Suggested Classroom Activity: Have students create a chart comparing and contrasting the three types of diabetes.

Suggested Clinical Activity: Have students take all of the finger-stick blood glucose measurements on the floor for one required time period.

3. Compare and contrast types of insulin, including onset, peak, and duration of action

Suggested Classroom Activity: Have students develop their own list of the types of insulin they see most often in the clinical setting and identify the onset, peak, and durations of each of those.

Suggested Clinical Activity: During campus lab, give students physicians’ orders for insulin and have them draw up the appropriate amounts.

4. Describe the signs and symptoms of insulin overdose and underdose.

Suggested Classroom Activity: Divide students into two groups. Assign one group the topic DKA and the other the topic HHS. Have each group devise a unique method to explain their topic to the class.

Suggested Clinical Activity: Interview a nurse who works in a diabetes management clinic. What acute complications are most common and what signs and symptoms indicate they are imminent?

5. Compare and contrast the pharmacology of the different types of diabetes.

Suggested Classroom Activity: Have students review the pathophysiology of diabetes and describe why oral hypoglycemics will not be effective in type 1 diabetes.

Suggested Clinical Activity: Administer medications used for type 2 diabetes.

Suggested Classroom Activity: Use the example of an arm that has “gone to sleep” while sleeping. As the limb begins to “wake up,” the tingling almost “hurts” while it is waking up. This is paresthesia. Use covered lens or glasses that do not “fit” the person’s eyesight to describe retinopathy.

Suggested Clinical Activity: Have an ophthalmologist who specializes in care of clients with diabetes discuss visual changes in this population.

6. Describe the nurse’s role in the pharmacological management of diabetes mellitus.

Suggested Classroom Activity: Use this analogy to understand the inability of the body to get to the glucose in the bloodstream and the symptom of polyphagia. Have students think about the biggest meal they have experienced. There is a huge piece of glass between them and the food. They get hungrier and hungrier. The “body” brings more and more food to the feast, but they (“the cell”) cannot access the feast.

Suggested Clinical Activity: Have students assess their clients for any symptoms of hyperglycemia.

7. For each of the drug classes listed in Prototype Drugs, identify a representative drug and explain its mechanism of action, therapeutic effects, and important adverse effects.

Suggested Classroom Activity: Divide students into pairs, and have one act as the nurse and teach the “client” about insulin, its storage, its administration, and its side effects. Then, switch roles and have the new “nurse” teach the client about two of the oral hypoglycemics and their side effects, etc.

Suggested Clinical Activity: With each student who is administering any oral hypoglycemia agent or insulin, during postconference, have the student present the client, age of onset of diabetes, what the client knew about diabetes and its management, and how the treatment is working. Is the client performing self-monitoring at home? Does the client know the most recent HbA1C?

8. Use the nursing process to care for clients who are receiving drug therapy for diabetes mellitus

Suggested Classroom Activity: Use the scenario in the chapter and have students develop a care plan including assessment, analysis, planning, implementation, and evaluation.

Suggested Clinical Activity: Have a client with diabetes come and talk to the class about the complications that can occur and the client’s perspective.

**Key Concepts**

1. Glucose is the body’s primary energy source. The brain relies almost exclusively on glucose for its energy needs.
2. Normal serum glucose is 60 to 100 mg/dL. The body maintains a tighter control at 80 to 90 mg/dL.
3. Insulin and glucagon work together to maintain this control. Insulin decreases blood glucose levels, and glucagon increases blood glucose levels.
4. After a meal, glucose is absorbed from the bowel, some goes to cells immediately for energy, and some is stored as glycogen. When needed, glycogenolysis is initiated and glucose is released back into the bloodstream. Insulin is the “garage door opener” that allows glucose to enter the cells.
5. Actions of insulin:
   1. It promotes entry of glucose into cells.
   2. It stores excess glucose as glycogen.
   3. It inhibits the breakdown of fat and glycogen.
   4. It inhibits glucogenesis.
6. Insulin is produced by beta cells in the pancreas.
7. Blood glucose levels are decreased by fasting, exercise, and alcohol. They are increased by stress, overconsumption of carbohydrates, growth hormone, and corticosteroids.
8. The types of diabetes are type 1, type 2, and gestational.
9. Type 1 diabetes is true insulin absence. Although it may be the most recognized, type 1 diabetes occurs the least frequently.
10. Type 2 diabetes is decreased secretion and lack of cell sensitivity to the insulin that is produced. This lack of sensitivity is called insulin resistance.
11. Obesity has a direct link to the development of type 2 diabetes, especially in children. People with upper-body obesity (central obesity) are at increased risk.
12. Other risk factors include family history, race, ethnicity, age (older than 45 years), hypertension, low levels of HDL cholesterol, and delivery of a baby over 9 pounds.
13. Most people with type 2 diabetes do not require insulin administration, at least initially; their condition can be managed with oral antidiabetes medications.
14. Type 2 diabetes was once called adult-onset diabetes and non–insulin-dependent diabetes but these are not accurate descriptions because the disorder occurs in children and some clients require insulin.
15. Gestational diabetes results from glucose intolerance with an onset, or first recognition, during pregnancy.
16. The risks of gestational diabetes to the mother and fetus include hypo- or hyperglycemia at birth and large-for-gestational-age babies. The incidence and complications of pregnancy, such as DVT, increase with gestational diabetes, as does the possibility of a required cesarean section.

1. The classic triad of diabetes include polyuria, polydipsia, and polyphagia.
2. The pathophysiology of polyuria is due to increased thirst as well as the hypertonic state of the extracellular fluid due to increased glucose load. Polydipsia is due to increased pull of fluid from the intracellular space into the extracellular space. Polyphagia occurs when nutrient stores are too depleted to meet the body’s energy needs.
3. The two primary blood tests used to diagnose diabetes are the fasting plasma glucose (FPG) test and the oral glucose tolerance test (OGTT).
4. The hemoglobin A1C is used to evaluate glucose control over time. The HbA1C should be 7.0% or less.
5. Home monitoring of blood glucose is essential to tight glucose control.
6. Prediabetes is a period of impaired glucose tolerance that often leads to the development of type 2 diabetes. Metabolic syndrome is a group of abnormalities that tend to occur together; it increases the risk of developing diabetes and vascular complications.
7. Diabetic ketoacidosis (DKA) occurs most commonly in those with type 1 diabetes. Metabolic disturbances are hyperglycemia, metabolic acidosis, and osmotic diuresis. Symptoms are polyuria, polydipsia, nausea, vomiting, fatigue, a fruity odor to the breath, and abdominal pain. These may progress to stupor and eventual coma.
8. Hyperosmolar hyperglycemic state (HHS): a serious, extreme state that occurs in type 2 diabetes with a mortality rate of 20% to 40%. It is characterized by extreme hyperglycemia, hyperosmolarity, dehydration, absence of ketoacidosis, and CNS dysfunction.
9. Hypoglycemia: abnormally low serum glucose. The client experiences confusion, sweating, and tachycardia, often with a very rapid onset. The following factors contribute to hypoglycemia: errors in insulin dosage, failure to eat correctly, increased exercise, and changes in injection sites.
10. Glucagon is the prototype pancreatic hormone used as an antihypoglycemic drug.
11. There are no drugs similar to glucagon.
12. Diabetic neuropathies affect both the somatic and autonomic nervous systems.
13. Diabetic nephropathy is the leading cause of end-stage renal disease.
14. Diabetic retinopathy is the leading cause of acquired blindness in the United States.
15. Diabetes is a major risk factor in the development of vascular disease, such as premature atherosclerosis, which leads to coronary artery disease, cerebrovascular disease, and peripheral vascular disease.
16. Foot ulcers are the result of peripheral neuropathies and poor circulation. Vascular insufficiency and elevated glucose levels inhibit healing of the ulcer.
17. Insulin replacement therapy is the cornerstone of therapy for clients with type 1 and gestational diabetes. The fundamental principle of therapy is that the right amount of insulin must be available to cells when glucose is present in the blood.
18. Almost all insulin today is human insulin obtained through recombinant DNA technology.
19. All insulin products used clinically are U-100.
20. Rapid or regular insulin can be administered by insulin pump.
21. Hypoglycemia is typically defined as a blood glucose less than 50 mg/dL.
22. Other adverse effects of insulin administration are injection site reactions, such as urticaria and Somogyi phenomenon.
23. The benefit of pramlintide as an analog to accompany insulin is its ability to reduce postprandial levels of glucose, primarily by delaying gastric emptying and suppressing glucagon secretion.
24. Human regular insulin (Humulin R) is the prototype short-acting hypoglycemic drug used as an antidiabetic drug, pancreatic enzyme.
25. Drugs similar to human regular insulin (Humulin R) are insulin aspart , insulin detemir (Levemir), insulin glargine (Lantus), insulin (Apidra), insulin lispro (Humalog), and isophane insulin (NPH, Humulin N).
26. When oral hypoglycemics are used, the client must secrete some insulin.
27. Treatment usually begins with one agent and then a second agent. Failure to achieve glycemic control with two agents indicates a need for insulin to be added to the regimen.
28. Nursing diagnoses useful in the care of clients receiving pharmacotherapy with insulin include *Imbalanced Nutrition: Less than Body Requirements, Obesity, Ineffective Health Maintenance, Deficient Knowledge, Risk for Unstable Blood Glucose Level, Risk for Deficient Fluid Volume, Risk for Injury,* and *Risk for Infection.*
29. Client should be check capillary blood glucose regularly and report any signs of hypoglycemia or hyperglycemia.
30. Proper administration techniques should be emphasized.
31. Dietary consultation may be required.
32. Client should always carry a quick-acting carbohydrate source.
33. If client is unsure whether symptoms are related to hypoglycemia or hyperglycemia, treatment for hypoglycemia should be instituted.
34. If unable to eat regular meals due to illness, consultation with provider may be necessary.
35. Injection sites should be rotated.
36. Injection technique includes rolling the vial instead of shaking and drawing up the quickest acting insulin first.
37. Insulin glargine or insulin detemir should not be mixed with any other type of insulin.
38. Glyburide (DiaBeta, Glynase, Micronase) is the prototype sulfonylurea antidiabetic drug.
39. Drugs similar to glyburide (DiaBeta, Micronase) are the first-generation sulfonylureas chlorpropamide (Diabinese), tolazamide (Tolinase), and tolbutamide (Orinase), and the second-generation sulfonylureas glimepiride (Amaryl) and glipizide (Glucotrol).
40. Metformin (Glucophage) is the prototype biguanide antidiabetic drug.
41. Repaglinide (Prandin) is the prototype meglitinide antidiabetic drug.
42. The only other meglitinide is nateglinide (Starlix).
43. Rosiglitazone (Avandia) is the prototype thiazolidinedione antidiabetic drug.
44. The drug similar to rosiglitazone (Avandia) is pioglitazone (Actos).
45. Acarbose (Precose) is the prototype alpha-glucosidase inhibitor antidiabetic drug.
46. The drug similar to acarbose (Precose) is miglitol (Glyset).
47. Sitagliptin (Januvia) is the prototype DPP-4 inhibitor, incretin enhancer used as an antidiabetic drug.
48. Drugs similar to sitagliptin (Januvia) are albiglutide (Tanzeum), alogliptin (Nesina), dulaglutide (Trulicity), exenatide (Byetta), linagliptin (Tradjenta), liraglutide (Victoza), and saxagliptin (Onglyza).
49. Canagliflozin (Invokana) is the first in a new class of drugs called sodium-glucose transporter inhibitors. Two other drugs in this class are dapagliflozin (Farxiga) and empagliflozin.
50. Nursing diagnoses useful in the care of clients receiving pharmacotherapy for type 2 diabetes include *Obesity, Ineffective Health Management, Deficient Knowledge, Risk for Unstable Blood Glucose Level, Risk for Injury,* and *Risk for Infection.*
51. Client should be check capillary blood glucose regularly and should report any signs of hypoglycemia or hyperglycemia.
52. Dietary consultation may be required.
53. Monitor clients on sulfonylureas for hepatic toxicity.
54. Biguanides may cause lactic acidosis.
55. Client should always carry a quick-acting carbohydrate source. If client is unsure whether symptoms are related to hypoglycemia or hyperglycemia treatment for hypoglycemia should be instituted.
56. Exercise is generally beneficial to clients. Glucose levels should be monitored.
57. Thiazolidinedione may cause edema and worsening of heart failure.
58. Beta blockers antagonize the action of some oral antidiabetic drugs and may mask the symptoms of a hypoglycemic episode.

**Chapter 29 Pharmacotherapy of thyroid and parathyroid disorders**

**Learning Outcomes**

1. Explain the functions of thyroid hormone.

Suggested Classroom Activity: Have students discuss what the body’s response would be to an increase in basal metabolic rate of 60% to 100%. Compare this to adding logs on an already raging fire.

Suggested Clinical Activity: Have students review lab results for T3 and T4.

2. Explain the negative feedback control of thyroid function.

Suggested Classroom Activity: Compare the negative feedback mechanism to a thermostat.

Suggested Clinical Activity: Have students write a teaching plan for a client undergoing thyroid testing.

3. Explain how thyroid disorders are diagnosed.

Suggested Classroom Activity: Have students practice palpation of the thyroid gland on a partner.

Suggested Clinical Activity: Have students review thyroid results and any scans, if available.

4. Describe the pathophysiology of thyroid disorders.

Suggested Classroom Activity: Have a student lie on a long piece of butcher-like paper and have other students draw around the body. Then, using the drawing, have students identify the effects of hypothyroidism by body system.

Suggested Clinical Activity: Assign students to the care of a client with hyperthyroidism, especially following thyroidectomy.

5. Describe the pharmacotherapy of thyroid disorders.

Suggested Classroom Activity: Invite someone taking thyroid replacement therapy to visit with the class.

Suggested Clinical Activity: Provide opportunities for client teaching in the clinical setting.

6. For each of the classes shown in the chapter outline, identify the prototype and representative drugs and explain the mechanism (s) of drug action, primary indications, contraindications, significant drug interactions, pregnancy category, and important adverse effects.

Suggested Classroom Activity: Assign half of the class hypothyroid drugs and the other half hyperthyroid drugs. Have each group develop a TV commercial or advertisement (much like the ads seen now) that includes the purpose of the drug, its side effects, and any monitoring needed.

Suggested Clinical Activity: Have a pharmacist come to postconference and discuss the differences in preparation between the thyroid drugs.

7. Apply the nursing process to care of clients receiving pharmacotherapy for thyroid disorders.

Suggested Classroom Activity: Review assessment of the client who is improving following 3 months of thyroid hormone therapy.

Suggested Clinical Activity: Assign students to clients receiving thyroid or thyroid-inhibiting medications.

**Key Concepts**

1. The thyroid gland contains two kinds of endocrine cells: follicular, which produce, store, and secrete thyroid hormone, and parafollicular, which produce calcitonin.
2. The thyroid hormones are tri-iodothyronine (T3) and thyroxine (T4). These hormones are highly protein bound (thyroxine-binding globulin or TBG), which requires caution with clients with low protein or liver impairment.
3. Thyroid hormone stimulates the basal metabolic rate of all tissues except the brain, anterior pituitary, spleen, lymph nodes, testes, and lungs.
4. One of the strongest stimuli for increased thyroid hormone production is exposure to cold. Negative feedback works similarly to a thermostat, which rises and falls based on temperatures going up and down. Levels of thyroid hormones rise and fall based on a feedback loop associated with the anterior pituitary and TRH and TSH.
5. Disorders of the thyroid result from hypofunction or hyperfunction of the gland.
6. Thyroid disorders can be congenital in origin.
7. When the gland is enlarged, it is referred to as goiter. This increase in size can place pressure on surrounding tissues, even the superior vena cava, and can cause facial edema.
8. The thyroid gland is easily accessible and can be easily palpated.
9. Elevated levels of TSH are considered primary in the diagnostic process. T3 and T4 are also useful.
10. The diagnostic tool of choice for detecting malignancy is needle biopsy. Ultrasound, CT, and MRI can aid in the diagnosis.
11. Antithyroid antibody titer and radioactive uptake can also be used.
12. Hypothyroidism may occur as a congenital or acquired disorder.
13. If it occurs at infancy, the child appears normal at birth due to the mother’s hormones.
14. If left untreated, cretinism develops and the child is at risk for mental retardation and impaired growth.
15. Thyroid hormone replacement should begin in the first 6 weeks of life.
16. Hypothyroidism in older children and adults results in myxedema.
17. There are three types: primary, secondary, and tertiary.
18. The most common cause of hypothyroidism is an autoimmune disorder, Hashimoto’s thyroiditis.
19. Hypothyroidism symptoms include weakness, fatigue, weight gain, cold intolerance, hypotension, bradycardia, skin changes, brittle hair, and constipation.
20. Myxedema coma is a life-threatening complication of end-stage hypothyroidism that causes fluid accumulation in tissues, including pericardial and pleural tissues. It occurs most often in elderly women. It carries a 30% mortality rate.
21. Treatment for hypothyroidism includes thyroid replacement with either synthetic or endogenous forms of hormones.
22. Levothyroxine (Levothroid, Levoxyl, Synthroid, Unithroid) is the prototype thyroid replacement hormone.
23. Drugs similar to levothyroxine (Levothroid, Levoxyl, Synthroid, Unithroid) include liothyronine (Cytomel), and desiccated thyroid.
24. The most common cause of hyperthyroidism is Graves’ disease, characterized by excessive secretion of thyroid hormone.
25. The most visible signs are goiter and exophthalmos, with one third of clients having severe eye problems such as damage to the optic nerve and corneal ulceration.
26. Nursing diagnoses useful in the care of clients receiving pharmacotherapy with thyroid hormone replacements include *Activity Intolerance, Fatigue, Constipation, Deficient Knowledge, Risk for Infection,* and *Risk for Imbalanced Body Temperature.*
27. Educate client that thyroid hormone levels will stabilize quickly but that full effects of the therapy may take a week or longer. Dosing should remain constant.
28. Clients taking thyroid replacement should avoid changes in normal intake of foods that contain iodine.
29. Client should report significant changes in pulse rate, weight, nervousness or fatigue, intolerance to heat or cold, and changes in bowel habits.
30. Thyroid replacement may cause changes in glucose levels.
31. Consistency of dosing time is important and brands of medication should not be changed.
32. Graves’ disease is considered an autoimmune disorder and can be familial in origin.
33. Manifestations are caused by the hypermetabolic effect.
34. Very high levels of thyroid hormone can lead to thyrotoxicosis or thyroid storm. These carry a mortality rate of 80% to 90%. It is manifested by high fever, tachycardia, heart failure, and CNS effects that lead to coma.
35. In less serious cases of hyperthyroidism, pharmacotherapy can be used to diminish the secretion of thyroid hormone.
36. Radioactive iodine can be used to destroy part of the gland (ablation). The goal of ablation is to use the ionizing radiation from the drug to destroy just enough of the thyroid gland to return the client to a normal thyroid state.
37. Antithyroid drugs, such as propylthiouracil (PTU) and methimazole (Tapazole), may be administered to manage hyperthyroidism. They prevent the incorporation of iodine into the thyroid hormone molecule, and block the conversion of T4 to T3 in peripheral tissues.
38. A thyroid storm is a medical emergency. Methimazole is preferred by some health care providers because it can be given by either the oral or IV route and risk for adverse effects is lower than with propylthiouracil.
39. Potassium iodide solution can be given to immediately block the release of thyroid hormone.
40. During acute hyperthyroid states the following drugs may be used: propranolol (Inderal), esmolol (Brevibloc), metoprolol (Toprol), hydrocortisone (Solu-Cortef), and dexamethasone (Decadron).
41. Propylthiouracil (PTU) is the prototype thyroid hormone inhibitor used as an antithyroid drug.
42. Drugs similar to propylthiouracil (PTU) include Lugol’s solution (5% elemental iodine and 10% potassium iodide), methimazole (Tapazole), potassium iodide (Thyro-Block), and radioactive iodide (131I).
43. Nursing diagnoses useful in the care of clients receiving pharmacotherapy with antithyroid drugs include *Activity Intolerance, Fatigue, Constipation, Deficient Knowledge, Risk for Infection,* and *Risk for Imbalanced Body Temperature.*
44. Advise client that additional treatment such as surgery or radioactive iodine may be necessary.
45. Clients taking antithyroid drugs should avoid changes in normal intake of foods that contain iodine.
46. Client should report significant changes in pulse rate, weight, nervousness or fatigue, intolerance to heat or cold, and changes in bowel habits.
47. Antithyroid drugs may cause agranulocytosis, may interact with cardiac drugs, and may cause changes in blood glucose. Appropriate monitoring is indicated.
48. Clients receiving radioactive iodine treatments should limit personal contact to 1 hour per day per person, avoiding contact with young children and pregnant women. Coughs should be covered and client should not expectorate.

**Chapter 30 Pharmacotherapy of adrenal disorders and corticosteroids**

**Learning Outcomes**

1. Identify the functions of the three classes of hormones secreted by the adrenal gland.

Suggested Classroom Activity: Discuss the catabolic nature of the glucocorticoids and the effect mineralocorticoids have on blood pressure measurement.

Suggested Clinical Activity: Discuss how inclients are often in stress states. Discuss the effects of circulating corticosteroids and catecholamines on homeostasis at postconference. Review the method for checking bedside blood glucose. Review the use of unit glucometers.

2. Diagram the negative feedback regulation of corticosteroid secretion.

Suggested Classroom Activity: Have students draw a diagram of the negative feedback regulation of corticosteroid secretion.

Suggested Clinical Activity: Have students assess clients for the effects of glucocorticoids on blood sugar, immunity, and inflammation.

3. Identify common properties of the corticosteroid medications.

Suggested Classroom Activity: Discuss the pharmacodynamics of the corticosteroids.

Suggested Clinical Activity: Ask the charge nurse to assign students to clients receiving steroid therapy. Have students monitor their clients for adverse effects.

4. Describe the potential adverse effects of long-term corticosteroid therapy.

Suggested Classroom Activity: Show students a picture of a client with Cushing’s disease who manifests the signs and symptoms of glucocorticoid excess.

Suggested Clinical Activity: Have students investigate alternative dosing schedules for corticosteroids.

5. Compare and contrast the pharmacotherapy of acute and chronic adrenocortical insufficiency.

Suggested Classroom Activity: Compare and contrast primary versus secondary adrenocortical insufficiency. Emphasize the importance of adrenal crisis and its emergency management.

Suggested Clinical Activity: Have students explain the rationale for never abruptly discontinuing corticosteroid therapy.

6. Explain how corticosteroids affect the inflammatory and immune processes.

Suggested Classroom Activity: Have students list inflammatory or immune disorders that may occur when clients are on long-term corticosteroid therapy.

Suggested Clinical Activity: Ask students to research their client’s medical administration records for corticosteroid therapy. Review the complete blood counts of clients on corticosteroid therapy. Discuss opportunistic infections.

7. Recognize nonendocrine disorders that respond to corticosteroid therapy.

Suggested Classroom Activity: Divide students into eight groups and assign each group one of the nonendocrine disorders listed in the chapter. Have each group discuss the benefit of corticosteroid use, the mechanism of action, and the typical drugs and dosages used.

Suggested Clinical Activity: Assign students to provide care to a client receiving corticosteroid drugs for a nonendocrine disorder.

8. Describe indications for pharmacotherapy with mineralocorticoids.

Suggested Classroom Activity: Discuss clinical manifestations of hypoaldosteronism. Discuss the diagnostic tools used in identify problems of endocrine origin.

Suggested Clinical Activity: Have students write a care plan for a client with Conn’s syndrome.

9. Explain the pharmacotherapy of Cushing’s syndrome.

Suggested Classroom Activity: Discuss the rationale for administering an antifungal agent to a client with Cushing’s syndrome.

Suggested Clinical Activity: Have students identify assessment findings associated with Cushing’s syndrome.

10. Describe the nurse’s role in the pharmacologic management of adrenal disorders.

Suggested Classroom Activity: Discuss why the client on long-term therapy with corticosteroid drugs should carry a wallet card identifying the drugs being taken.

Suggested Clinical Activity: Have students discuss the emergency treatment of a client in adrenal crisis.

11. For each of the classes shown in the chapter outline, identify the prototype and representative drugs and explain the mechanism(s) of drug action, primary indications, contraindications, significant drug interactions, pregnancy category, and important adverse effects.

Suggested Classroom Activity: Have students create drug cards with pertinent information.

Suggested Clinical Activity: Have students identify corticosteroid drugs being administered on the clinical unit. Quiz students on the pertinent information about these drugs.

12. Apply the nursing process to the care of clients who are receiving pharmacotherapy with corticosteroids and mineralocorticoids.

Suggested Classroom Activity: Have students write a care plan for the client receiving pharmacotherapy with corticosteroids or mineralocorticoids.

Suggested Clinical Activity: Assign students to provide care for the client receiving pharmacotherapy with corticosteroids or mineralocorticoids.

**Key Concepts**

1. The adrenal medulla secretes epinephrine and norepinephrine.
2. The adrenal cortex secretes three essential classes of steroid hormones: the mineralocorticoids, glucocorticoids, and gonadocorticoids. Collectively, the mineralocorticoids and glucocorticoids are called corticosteroids.
3. Aldosterone accounts for more than 95% of the mineralocorticoids secreted by the adrenal glands. The primary function of aldosterone is to conserve sodium and water and promote the excretion of potassium.
4. More than 30 different glucocorticoids are secreted from the adrenal cortex. Cortisol, also called hydrocortisone, is secreted in the highest amount, and is the most important.
5. The effects of glucocorticoids include increasing the level of blood glucose, increasing the breakdown of proteins to amino acids, increasing the breakdown of lipids (lipolysis), suppressing the inflammatory and immune responses, modifying smooth muscle tone, affecting mood and maintaining normal nerve excitability, increasing bone demineralization, promoting bronchodilation, and stabilizing mast cells.
6. Gonadocorticoids that are secreted by the adrenal cortex are mostly androgens, though small amounts of estrogens are also produced. The amounts of adrenal sex hormones are far less than the levels secreted by the testes or ovaries.
7. General statements about corticosteroid medications: All act by the same mechanism and have the same basic adverse effects; well absorbed, some systemic absorption from topicals; highly bound to plasma proteins; metabolized by the liver and excreted by the kidneys; and may cross to the placenta and breast milk.
8. Long-term therapy with corticosteroids has the potential to cause serious adverse effects in multiple body systems.
9. The following are the most significant adverse effects of corticosteroids: suppressed immunity and inflammation, peptic ulcers, osteoporosis, behavioral changes, eye changes, metabolic changes, and myopathy.
10. Strategies to prevent adverse effects are keeping doses as low as possible, alternate-day dosing, tapering doses, and avoiding systemic use if possible.
11. Lack of adequate corticosteroid secretion by the adrenal gland is called adrenocortical insufficiency. When pathology of the adrenal glands is the cause of the hyposecretion, it is called primary adrenocortical insufficiency, or Addison’s disease.
12. Secondary adrenocortical insufficiency occurs due to inadequate secretion of ACTH from the pituitary.
13. Symptoms of adrenocortical insufficiency include hypoglycemia, fatigue, muscle weakness, hypotension, increased skin pigmentation, and GI disturbances.
14. The goal of replacement therapy is to achieve the same physiological level of hormones in the blood that would be present if the adrenal glands were functioning properly. Replacement therapy is usually lifelong and concurrent use of a mineralocorticoid is usually necessary.
15. Adrenal crisis can occur due to rapid withdrawal of corticosteroid therapy. Symptoms include GI disturbances, myalgia, seizures, coma, and renal failure. Treatment is immediate administration of IV hydrocortisone. Adrenal crisis can be prevented by tapering corticosteroids.
16. Hydrocortisone is the prototype corticosteroid adrenal hormone.
17. Drugs similar to hydrocortisone are dexamethasone and prednisone.
18. Nonendocrine disorders respond to corticosteroid therapy.
19. Corticosteroids used for nonendocrine conditions act by decreasing inflammatory mediators, inhibiting macrophages and leukocytes, and decreasing prostaglandin formation.
20. Doses necessary to treat nonendocrine diseases are much higher than those used to treat adrenocorticoid insufficiency.
21. Corticosteroids are administered to control the inflammation associated with arthritis, but do not cure arthritis.
22. Exacerbations of inflammatory bowel disease may be treated with corticosteroids.
23. Both oral and inhaled corticosteroids are used in the treatment of asthma.
24. Corticosteroids have largely replaced antihistamines as drugs of choice for allergic rhinitis.
25. Corticosteroids are part of most therapeutic regimens to prevent transplant rejection.
26. Topical corticosteroids are the most effective therapy for treating the inflammation and itching of dermatitis.
27. Corticosteroids may be used as adjunctive therapy in clients with certain neoplasms.
28. Corticosteroids are occasionally used to treat disorders characterized by edema.
29. Nursing diagnoses useful in the care of clients receiving pharmacotherapy with systemic corticosteroids include *Deficient Knowledge, Risk for Imbalanced Fluid Volume, Risk for Electrolyte Imbalance, Risk for Unstable Blood Glucose Level, Risk for Injury, Risk for Infection,* and *Risk for Impaired Skin Integrity.*
30. Advise the client to carry a wallet identification card and medical identification jewelry.
31. Monitor and report findings associated with GI bleeding, infection, osteoporosis, changes in mood or affect, fluid retention, or visual changes.
32. Do not stop drugs abruptly. Drug dosages should be tapered.
33. Clients taking corticosteroids for adrenal insufficiency should carry PO and injectable medication forms for emergency use.
34. Lack of adequate aldosterone secretion, or hypoaldosteronism, may be caused by a number of disorders. The three broad categories of hypoaldosteronism are as follows: defects in the stimulation of aldosterone secretion, defects in the secretion of aldosterone, and defects in aldosterone sensitivity.
35. Whenever possible, the cause of the hypoaldosteronism should be identified and treated.
36. Fludrocortisone (Florinef) is the prototype mineralocorticoid drug used for hypoaldosteronism.
37. Antiadrenal drugs may be administered to lower serum corticosteroid levels in clients with Cushing’s syndrome.
38. Cushing’s syndrome occurs when high levels of corticosteroids are present in the body over a prolonged time period.
39. Cushing’s syndrome may be iatrogenic, or caused by pituitary or adrenal tumors; however, the most common cause of Cushing’s syndrome is long-term therapy with high doses of corticosteroids.
40. Signs and symptoms of Cushing’s syndrome include adrenal atrophy, osteoporosis, hypertension, increased risk of infections, delayed wound healing, acne, peptic ulcers, general obesity, and a redistribution of fat around the face, shoulders, and neck.
41. The antifungal drug ketoconazole (Nizoral) has become a drug of choice for clients with Cushing’s disease who need long-term therapy. The drug rapidly blocks the synthesis of glucocorticoids, lowering serum levels.
42. Metyrapone (Metopirone) is an antiadrenal drug used for diagnostic purposes. A single dose is administered orally at midnight, and blood samples are taken 8 hours later. Levels of ACTH, glucocorticoids, and their metabolites are measured to see whether or not the adrenal glands responded to the inhibiting action of metyrapone.

**Chapter 31 Pharmacotherapy of disorders of the female reproductive system**

**Learning Outcomes**

1. Describe the roles of the hypothalamus, pituitary, and ovaries in maintaining female reproductive function.

Suggested Classroom Activity: Ask students to draw the organs, routes, and hormones involved in hormonal regulation of the female reproductive system.

Suggested Clinical Activity: In postconference, have students discuss the laboratory tests used in the diagnosis and treatment of female reproductive disorders.

2. Explain the mechanisms by which estrogens and progestins prevent conception.

Suggested Classroom Activity: Discuss the effects of lowered levels of estrogen and the psychological effect this may have on a client experiencing menopause.

Suggested Clinical Activity: In preconference, ask students to note the specific effects of estrogen seen in their female clients and then discuss those effects in postconference.

3. Describe the nurse’s role in the pharmacological management of clients who are taking oral contraceptives.

Suggested Classroom Activity: Discuss the effects (physical and psychological) seen in clients who are given progestins for treatment of metastatic cancer.

Suggested Clinical Activity: In postconference, have students discuss the nonpharmacologic treatments of dysfunctional uterine bleeding.

4. Compare and contrast the options available for long-term contraception.

Suggested Classroom Activity: Ask students to debate the idea of using HRT to delay the aging process and the effect of aging on sexuality.

Suggested Clinical Activity: In postconference, have students discuss how a client would decide if menopausal symptoms are severe enough to need medications.

5. Explain how drugs may be used to provide emergency contraception and to terminate early pregnancy.

Suggested Classroom Activity: Discuss the reasons clients may request elective labor induction and the reasons it may or may not be done.

Suggested Clinical Activity: In preconference, ask students to discuss the signs of water intoxication that may be seen in clients who are given oxytocin for induction of labor.

6. Describe the role of drug therapy in the treatment of menopausal and postmenopausal symptoms

Suggested Classroom Activity: Identify the assessment findings indicating need for a uterine relaxant.

Suggested Clinical Activity: Have students discuss the nursing responsibilities in administering a drug to suppress labor.

7. Discuss the uses of progestins in the therapy of dysfunctional uterine bleeding.

Suggested Classroom Activity: Have a classroom discussion about the emotional implications of infertility.

Suggested Clinical Activity: Have students tour a facility that provides in vitro fertilization (IVF). Discuss the medications necessary for successful IVF.

8. Compare and contrast the use of uterine stimulants and relaxants in the treatment of antepartum and postpartum clients.

Suggested Classroom Activity: Have students list the nursing assessment required by each of the prototype medications in this chapter.

Suggested Clinical Activity: Assign students to administer medications to clients receiving pharmacotherapy for a condition of the female reproductive system.

9. Explain how drug therapy may be used to treat female infertility.

Suggested Classroom Activity: Ask students to develop a client education booklet for one of the prototype drugs in this chapter.

Suggested Clinical Activity: Ask the health care facility pharmacist to discuss the use of these prototype medications with students.

10. For each of the drug classes listed in Prototype Drugs, identify a representative drug and explain its mechanism of action, therapeutic effects, and important adverse effects.

Suggested Classroom Activity: ask students to develop a list of the most common medications used for reproductive disorders and to discuss the respective mechanisms of actions and adverse effects

Suggested Clinical Activity: Ask student to identify the common reproductive disorders in the hospital settings and the associated medications used to treat these disorders.

1. Describe and explain, based on pharmacological principles, the rationale for nursing assessment, planning, and interventions for clients with conditions of the female reproductive system.

Suggested Classroom Activity: Provide the students with a case study and ask them to develop a comprehensive care plan addressing assessment, planning, interventions and evaluation

Suggested Clinical Activity: Ask students to utilize the care plan developed in the above activity

In their care for a client with the same disorder in the hospital setting. Inquire about the degree of applicability of the care plan.

12. Use the nursing process to care for clients who are receiving drug therapy for disorders and conditions of the female reproductive system

Suggested Classroom Activity: Divide students into four groups (assessment, planning, implementation, evaluation). Ask each group to determine the most appropriate nursing actions related to their assigned group for any client with reproductive dysfunctions.

Suggested Clinical Activity: In preconference, ask students to name the priority nursing intervention needed by their client that day, and then in postconference ask the students to report if this really became the top priority of the day.

**Key Concepts**

1. Estrogen and progesterone are the two primary hormones of the female reproductive system.
2. The hypothalamus secretes gonadotropin-releasing hormone (GnRH). GnRH travels to the pituitary to stimulate secretion of gonadotropins, which are follicle-stimulating hormone (FSH) and luteinizing hormone (LH).
3. FSH and LH stimulate the maturation of ovarian follicles.
4. Maturing ovarian follicles secrete increasing amounts of estrogen.
5. On day 14 of the ovarian cycle, a surge of LH causes one follicle to expel an egg.
6. The ruptured follicle remains in the ovary and is transformed into the corpus luteum, which steadily secretes increasing amounts of progesterone.
7. Progesterone thickens the uterine mucosa, which readies the uterus for implantation and possible pregnancy.
8. High progesterone and estrogen levels cause GnRH, FSH, and LH secretion to be shut off.
9. When the hormone stimulation ends, estrogen and progesterone levels fall sharply, causing the endometrium to be shed and menstruation to begin.
10. The reproductive functions of estrogen include maturation of the reproductive organs and the appearance of the secondary sex characteristics in women during puberty.
11. The nonreproductive functions of estrogen include decreased level of low-density lipoprotein (LDL), increased level of high-density lipoprotein (HDL), lowered heart attack risk, and increased bone length and strength in younger women due to blocked resorption of the bony matrix
12. High doses of estrogen may be used to treat prostate and breast cancer.
13. Conjugated estrogens (Premarin) are the prototype estrogen used as a hormone.
14. Drugs similar to conjugated estrogens (Premarin) include estradiol , estradiol valerate (Delestrogen), and estropipate (Ogen).
15. In combination with estrogen, progesterone promotes breast development and regulates the monthly changes of the uterine cycle.
16. The primary noncontraception indication for progestins is dysfunctional uterine bleeding, which is usually due to an imbalance between estrogen and progesterone.
17. Types of dysfunctional uterine bleeding include amenorrhea, endometriosis, oligomenorrhea, menorrhagia, breakthrough bleeding, premenstrual syndrome, postmenopausal bleeding, and endometrial carcinoma.
18. Medroxyprogesterone (Provera) is the prototype progestin used as a hormone for dysfunctional uterine bleeding.
19. Nursing diagnoses useful in the care of clients receiving pharmacotherapy with estrogen include *Decisional Conflict, Disturbed Body Image, Deficient Knowledge, Risk for Imbalanced Fluid Volume, Risk for Ineffective Tissue Perfusion,* and *Risk for Decreased Cardiac Tissue Perfusion.*
20. Monitor for symptoms of cardiopulmonary, cerebrovascular, and peripheral vascular thromboembolism and teach clients signs to report.
21. Encourage smoking cessation.
22. Monitor Pap tests, HPV screening, and breast exams.
23. Small amounts of breakthrough bleeding may occur midcycle, but if bleeding continues or is heavier than normal, contact health care provider.
24. Educate client to inform all new health care providers about use of estrogen prior to beginning any new prescription.
25. A drug similar to medroxyprogesterone (Provera) is progesterone (Prometrium).
26. Hormone replacement therapy (HRT) is used to treat the most distressing symptoms of menopause. HRT began in the 1960s with the use of estrogen alone. In the 1970s, it was discovered that the use of estrogen alone greatly increased the risk of uterine cancer. Progestins were added to lower this risk.
27. Two studies investigated HRT: the Women’s Health Initiative (WHI) and the Heart and Estrogen/Progestin Replacement Study (HERS). Both studies showed few benefits of HRT for postmenopausal women.
28. Hormone replacement has been shown to increase the risk of myocardial infarction (MI), stroke, breast cancer, dementia, and venous thromboembolism. However, studies found that in estrogen-only HRT, there was no significant increase in the risk of breast cancer.
29. Hormone replacement therapy may help to prevent osteoporosis-related fractures and also may offer some degree of protection from colorectal cancer.
30. A class of drugs called selective estrogen receptor modifiers (SERMs) have been approved to treat some symptoms of menopause.
31. Nursing diagnoses useful in the care of clients receiving pharmacotherapy with progestin include *Decisional Conflict, Disturbed Body Image, Deficient Knowledge, Risk for Nausea,* and *Risk for Injury.*
32. Monitor for symptoms of cardiopulmonary, cerebrovascular, and peripheral vascular thromboembolism and teach clients signs to report.
33. Encourage smoking cessation.
34. Monitor for presence of bone or MS pain because progestins are associated with increased loss of bone density.
35. Educate client to inform all new health care providers about use of progestins prior to beginning any new prescription.
36. Monitor Pap tests, HPV screening, and breast exams.
37. Small amounts of breakthrough bleeding may occur midcycle, but if bleeding continues or is heavier than normal, contact health care provider.
38. Oxytocics are drugs that stimulate uterine contractions and promote the induction of labor. Oxytocin is secreted by the posterior pituitary and targets the uterus and the breast.
39. Oxytocin causes the smooth muscle of the uterus to contract, initiating labor.
40. Parenteral oxytocin (Pitocin) may be given to induce labor if a continuation of pregnancy constitutes a significant risk to the mother or the fetus.
41. Parenteral oxytocin (Pitocin) may also be given after delivery to assist in stimulating the uterus to contract, which prevents hemorrhage.
42. Oxytocin is released by the posterior pituitary in response to suckling at the breast by the neonate.
43. Prostaglandins may also be used to stimulate the uterus to contract and are used to promote cervical ripening or to control postpartum hemorrhage.
44. Oxytocin is the prototype oxytocic hormone used to induce labor and as a uterine stimulant.
45. Drugs similar to oxytocin are carboprost (Hemabate), dinoprostone (Cervidil), and methylergonovine (Methergine).
46. Tocolytics, or uterine relaxants, are used to suppress preterm uterine labor contractions. They are usually used short term to give the fetus a chance to mature. All tocolytics have risks for the mother and fetus.
47. There are no prototype drugs for uterine tocolytics.
48. The most common drugs used as tocolytics are magnesium sulfate, nifedipine, and terbutaline. Magnesium sulfate must be administered IV. The client must be monitored continuously while receiving the medication, because it may cause toxicity.
49. Nursing diagnoses useful in the care of clients receiving pharmacotherapy with oxytocin (Pitocin) include *Acute Pain, Deficient Knowledge, Risk for Injury,* and *Risk for Excess Fluid Volume.*
50. Teach client that labor contractions will increase in strength and duration. Client should report any sustained contractions or severe abdominal pain.
51. Have client report any headache, dizziness, disorientation, confusion, palpitations, chest pressure, or pain.
52. Monitor fundal firmness and location for postpartum bleeding. Report if more than two pads are saturated after 2 hours.
53. The three main causes of female infertility are pelvic infections, uterine tube obstruction, and lack of ovulation.
54. Drugs may be used to treat infertility caused by ovulatory dysfunction.
55. The most common cause of ovulatory dysfunction is polycystic ovary syndrome.
56. The goal of drug therapy is to restore a regular, monthly ovulatory cycle.
57. Drugs may be used to stimulate maturation of ovarian follicles.
58. Drugs may be used to trigger ovulation at the end of follicular maturation.
59. Drugs may be used to promote regular ovulation at the midpoint of the menstrual cycle.
60. Clomiphene (Clomid) is the prototype drug for the treatment of infertility caused by ovarian dysfunction.
61. Drugs similar to clomiphene (Clomid) include bromocriptine (Parlodel), gonadotropin-HCG (Pregnyl), danazol (Danocrine), goserelin (Zoladex), leuprolide (Lupron), menotropins, and nafarelin (Synarel).

**Learning Outcomes**

1. Identify the choices available for birth control.

Suggested Classroom Activity: Ask a nurse from the local health department to discuss the most common forms of birth control requested and prescribed.

Suggested Clinical Activity: During the clinical day, have students interview women of childbearing age to determine the forms of birth control used (if any). During postconference, have students discuss their findings.

2. Delineate advantages and disadvantages of the different contraceptive options.

Suggested Classroom Activity: Divide students into groups and assign them each a different type of birth control. Have them develop an “ad campaign” for their assigned type of birth control and then present it to the class. The group should include both the benefits and risks for the assigned form of birth control.

Suggested Clinical Activity: During postconference, have students discuss the use of birth control and what motivates someone to use it regularly.

3. Explain the mechanism by which estrogens and progestins prevent conception.

Suggested Classroom Activity: Ask students to draw a concept map that shows the action of estrogen and progesterone on the functions of the ovary and the uterus.

Suggested Clinical Activity: In postconference, have students discuss the possible implications for the viability of a pregnancy if a woman’s progesterone level is low.

4. Compare the safety and effectiveness of different birth control methods.

Suggested Classroom Activity: Divide students into three groups and ask them to discuss one major type of contraception and develop strategies to ensure that the client knows how to use that method safely.

Suggested Clinical Activity: During postconference, have students discuss the effectiveness of each major type of contraception and what may alter that effectiveness.

5. Explain how drugs may be used to provide emergency contraception and to terminate pregnancy.

Suggested Classroom Activity: Discuss the OTC nature of Plan B. Ask students to discuss whether this will keep this medication from being used by young women under the age of 17.

Suggested Clinical Activity: During postconference, have students discuss strategies that may be used to encourage women to use contraception regularly.

6. Describe the nurse’s role in the pharmacologic management of clients taking oral contraceptives.

Suggested Classroom Activity: Discuss the type of antibiotics most likely to alter the effectiveness of OCs and ask the students to problem solve why these medications would be prescribed and come up with alternate medications.

Suggested Clinical Activity: In postconference, have students discuss the modifications that should be made by a client with diabetes who is using oral contraceptives.

7. Compare and contrast the options available for long-term contraception.

Suggested Classroom Activity: Discuss which type of client would be most motivated to use long-term contraception.

Suggested Clinical Activity: During postconference, have students discuss why a client would use long-term contraception as opposed to sterilization.

8. Explain the use of drugs for emergency contraception and inducing pharmacologic abortion.

Suggested Classroom Activity: Discuss the monitoring necessary when a client has taken a drug for emergency contraception or to induce a pharmacologic abortion.

Suggested Clinical Activity: Ask a community health nurse from the city or county health department to discuss with students the use of these drugs.

9. For each of the classes shown in the chapter outline, identify the prototype and representative drugs and explain the mechanism(s) of drug action, primary indications, contraindications, significant drug interactions, pregnancy category, and important adverse effects.

Suggested Classroom Activity: Discuss the other uses of the prototype besides contraception or pregnancy termination.

Suggested Clinical Activity: During postconference, ask students if the female client they cared for during the day would have any contraindications to the use of these prototype drugs.

10. Apply the nursing process to the care of clients who are receiving pharmacotherapy for contraception.

Suggested Classroom Activity: Using the three prototype drugs from this chapter, divide students into 12 groups. Then ask three of the groups to be the assessment groups; they will plan the nursing assessment for a client on one of the prototype drugs. Three of the groups will do planning, three will do implementation, and three will do evaluation. This exercise should only take approximately 15 minutes and another 15 minutes to present. It will give the students a good chance to see how other groups complete the nursing process.

Suggested Clinical Activity: Prior to a clinical experience that focuses on women’s health, ask students to prepare a care plan for a client desiring a form of contraception. In postconference, ask the students to compare the care they gave to the plan they had prepared.

**Key Concepts**

1. The selection of a contraceptive is based on effectiveness, safety, the client’s age, ease of use, preexisting medical conditions, frequency of intercourse, and cultural beliefs/practices.
2. The final decision should be based on advantages, disadvantages, effectiveness, adverse effects, contraindications, and long-term risks of the selected type of birth control.
3. Thirty percent of women choose oral contraceptives (OCs) for birth control. OCs are readily available, inexpensive, and nearly 100% reliable if used correctly.
4. The amount of estrogen contained in OCs has steadily declined over the years.
5. Failure to take pills correctly is the most common reason for pregnancy to occur while on OCs.
6. Estrogen-progestin combination OCs act by preventing ovulation.
7. The four types of OCs are monophasic, biphasic, triphasic, and a four-phase version.
8. It may take several months for fertility to be restored after OCs are discontinued.
9. OCs may also decrease cramping during menstruation, cause fewer skin breakouts, and create a decrease in the incidence of PID; ovarian, colorectal, and endometrial cancer; anemia; and benign breast disease.
10. Seasonale, and Seasonique are “extended regimen” OCs.
11. Estradiol and norethindrone (Ortho-Novum) comprise the prototype estrogen-progestin combination oral contraceptive.
12. Dozens of different estrogen-progestin combinations are available for use as OCs.
13. Progestin-only OCs are less effective than combination OCs and they are usually reserved for clients who are at high risk for estrogen-related adverse effects or who are lactating.
14. Adverse effects to OCs are uncommon but can be serious.
15. Absolute contraindications as established by WHO for use of hormonal contraceptives include current breast cancer, severe hepatic cirrhosis, major surgery with prolonged immobilization, migraines with aura, impaired cardiac function, complicated valvular heart disease, HTN, smoking, history of stroke, SLE, and high risk for thromboembolic disease.
16. Adverse effects of OCs include HTN, symptoms of pregnancy, growth of some types of cancers, abnormal uterine bleeding, benign hepatic adenoma, multiple births, retinal disorders, and melanoderma. OCs may accelerate growth of gallstones and increase glucose levels.
17. The patch, vaginal ring, and Depo-Provera injection provide contraception by different methods but have similar side effects as OCs.
18. Some studies indicate that clients using the patch have an increased risk of venous thromboembolism.
19. Local effects of the NuvaRing include vaginal irritation, sensation of foreign body, and vaginitis.
20. Once injected the actions of depot methods of birth control cannot be reversed and fertility may not be restored for up to 12 months.
21. Subdermal implant delivery results in release of progestin for up to 3 years.
22. Intrauterine devices are safe, inexpensive, and reliable. However, they may cause cramping and bleeding after insertion. IUDs provide long-term contraception and may be effective for 1 to 10 years.
23. Spermicides are inexpensive, easy to use, and do not require a prescription, but they must be applied and/or reapplied immediately prior to sexual intercourse.
24. Spermicides have few side effects but must be paired with a barrier device to provide effective birth control.
25. Nonoxynol-9 is the prototype spermicide used as an intravaginal contraceptive.
26. The emergency contraception medication Plan B or Plan B One Step are available OTC for women over age 17.
27. Plan B is most effective when taken within 72 hours of unprotected intercourse. Plan B One Step should be taken within 120 hours.
28. The side effects of Plan B are nausea and vomiting and they rarely cause serious problems.
29. Nursing diagnoses useful in the care of clients receiving hormonal contraceptives include *Decisional Conflict, Disturbed Body Image, Deficient Knowledge, Risk of Excess Fluid Volume, Risk for Ineffective Peripheral Tissue Perfusion, Risk for Ineffective Cerebral Tissue Perfusion,* and *Risk for Decreased Cardiac Tissue Perfusion.*
30. Taking the pill at the same time every day helps with remembering to take it.
31. Monitor for and teach client to report signs of cardiopulmonary, cerebrovascular, and peripheral vascular thromboembolism.
32. Encourage smoking cessation.
33. Monitor Pap tests, HPV screening, and breast exams.
34. Spotting may occur midcycle with some OCs.
35. Teach client techniques of administration for the specific form of contraceptive prescribed.
36. Certain drugs may be used to terminate pregnancy and are known as abortifacients.
37. Mifepristone and misoprostol (Cytotec) are given together to terminate a pregnancy under 49 days. It requires three office visits.
38. Side effects are common with these medications. Vaginal bleeding may continue for several weeks. Most experience minor side effects.
39. Prostaglandins are used for pregnancy termination for second-trimester pregnancies. They cause nausea, vomiting, cramping, and fever.
40. Mifepristone (Mifeprex) is the prototype abortifacient, progesterone antagonist used for abortion.

**Chapter 32 Pharmacotherapy of disorders of the male reproductive system**

**Learning Outcomes**

1. Identify drug classes used for treating disorders of the male reproductive system.

Suggested Classroom Activity: Have students prepare a concept map explaining the physiological effects of androgens.

Suggested Clinical Activity: Have students assess for virilization in a female client receiving androgens.

2. Explain the therapeutic action of each class of drug in relation to the pathophysiology of the disorder being treated.

Suggested Classroom Activity: Have students diagram the roles of the hypothalamus, pituitary, and testes in regulating male reproductive function.

Suggested Clinical Activity: Have students assess the sexual development of a client being treated for a pituitary disorder.

3. Explain the role of androgens in the treatment of male hypogonadism.

Suggested Classroom Activity: Divide students into three groups and assign each group one of these topics to investigate. Have students report their findings to the class.

Suggested Clinical Activity: Have students prepare a teaching plan for a female client with breast cancer who will be treated with androgens.

4. Describe the misuse and dangers associated with the use of anabolic steroids to enhance athletic performance.

Suggested Classroom Activity: Have students research the implications of using anabolic steroids to enhance athletic performance.

Suggested Clinical Activity: Have students prepare a teaching presentation to share with local high school athletes on the dangers of anabolic steroid use.

5. Discuss the use of androgens as antineoplastic agents.

Suggested Classroom Activity: Have students diagram the types of male sexual dysfunction and their potential cause as an overlay on an anatomic chart.

Suggested Clinical Activity: Have students interview a practitioner who specializes in treating sexual dysfunction disorders.

6. Explain the limited role of drugs in the therapy of male infertility.

Suggested Classroom Activity: Have students list the primary causes of male infertility and treatment.

Suggested Clinical Activity: Have students discuss the use of these drugs with a nurse who works in a fertility clinic.

7. Describe the role of drug therapy in the treatment of erectile dysfunction.

Suggested Classroom Activity: Have students role-play with a classmate a situation involving a client seeking treatment for erectile dysfunction. Ask students to identify strengths and weaknesses in their interactions. Ask them what they can do to become more comfortable in interviewing and caring effectively for these clients.

Suggested Clinical Activity: Identify clients at risk for erectile dysfunction in the clinical setting based on comorbid medical conditions. Ask students to consider how they would assess these clients who may be experiencing an alteration in sexual activity.

8. Describe the role of drug therapy in the treatment of benign prostatic hyperplasia (BPH).

Suggested Classroom Activity: Have students identify the mechanisms responsible for the signs and symptoms of BPH.

Suggested Clinical Activity: Have students compare and contrast five clients admitted for surgical resection of the prostate. What known risk factors are present? How many of these clients were treated medically prior to surgical intervention? What medications were used? What was the client’s compliance and assessment of effectiveness of the medications? What is the expected postoperative course of these clients?

9. For each of the drug classes listed in Prototype Drugs, identify a representative drug and explain its mechanism of action, therapeutic effects, and important adverse effects.

Suggested Classroom Activity: Have students create a chart listing the nonpharmacologic and pharmacologic management for common disorders and conditions of the male reproductive system.

Suggested Clinical Activity: Have students care for a client who has had surgical resection of the prostate. Review the history and physical. Was the client treated with pharmacotherapy prior to surgical intervention?

10. Describe and explain, based on pharmacological principles, the rationale for nursing assessment, planning, and interventions for clients who are receiving pharmacological therapy for disorders and conditions of the male reproductive system.

Suggested Classroom Activity: Have students create a game to quiz one another on this pertinent information.

Suggested Clinical Activity: Assign students to administer or assist with administering the prototype medications in the clinical setting.

11. Use the nursing process to care for clients who are receiving drug therapy for disorders and conditions of the male reproductive system

Suggested Classroom Activity: Have students identify and discuss the nurse’s role in assisting a couple in managing infertility.

Suggested Clinical Activity: Assign students to provide care for a client with a disorder or condition of the male reproductive system.

**Key Concepts**

1. The Leydig cells in the testes are responsible for androgen secretion.
2. Androgens are responsible for the development of the urogenital system in the fetus. After birth, the Leydig cells remain quiet until puberty.
3. The increased testosterone levels associated with puberty are responsible for virilization and the development of male sexual characteristics.
4. Testosterone has an ability to enhance skeletal muscle mass, stimulate the growth of bone, and promote synthesis of erythropoietin.
5. Adrenal androgens have a role in the growth of pubic hair and the skeletal growth spurts of adolescence.
6. Insufficient testosterone is called hypogonadism and may be congenital or acquired.
7. Insufficient testosterone may delay the onset of puberty.
8. Pharmacotherapy of hypogonadism includes replacement therapy with testosterone or other androgens.
9. Nonreproductive uses of androgens include treatment of anemias, muscle wasting, and palliation for breast cancer.
10. Replacement testosterone therapy, or other androgens, are administered in a variety of forms including intramuscular injection (testosterone cypionate [Depo-Testosterone], testosterone enanthate [Delatestryl]), implantation, topical patch, buccal, or in a form appropriate for The route of choice is usually based on health care provider experience, ease of use, and the client’s personal preference.
11. Testosterone is the prototype androgen, anabolic steroid, antineoplastic, used as a male sex hormone.
12. Two drugs similar to testosterone are fluoxymesterone (Halotestin) and methyltestosterone (Android, Testred).
13. Anabolic steroids are testosterone-like substances that promote the growth of skeletal muscle mass and stimulate the synthesis of erythropoietin, which contribute to a competitive athlete’s temptation to use and abuse anabolic steroids. They are rarely prescribed.
14. All major athletic organizations prohibit the use of anabolic steroids by their participants.
15. Nursing diagnoses useful in the care of clients receiving pharmacotherapy with androgens include *Disturbed Body Image, Sexual Dysfunction, Excess Fluid Volume,* and *Deficient Knowledge.*
16. Androgens can cause sodium and water retention, increases in cholesterol and calcium, increases in blood glucose levels, and premature closure of epiphyseal bone endings. Monitoring for effects of these conditions is essential.
17. Drug abuse may occur among adolescent clients.
18. Educate client about administration methods for specific type of androgen prescribed.
19. Anabolic steroids may produce serious adverse effects including hypertension, hepatotoxicity, permanent liver damage, hepatic carcinoma, elevated cholesterol levels, aggressive behavior, severe acne, and a risk for developing an intra-abdominal hemorrhage from peliosis hepatitis.
20. Male sexual dysfunction may include diminished libido, erectile dysfunction, ejaculation disorder, and infertility.
21. The two most common drugs classes that cause sexual dysfunction are antihypertensives and antidepressants.
22. Diabetes and HTN are the two chronic medical conditions most frequently associated with male sexual dysfunction.
23. Factors associated with ED include smoking and obesity.
24. The most common cause of congenital infertility is Klinefelter syndrome.
25. Acquired infertility is due to testicular trauma, pituitary or hypothalamic disorders, infections, or sexually transmitted infections (STIs).
26. The most obvious cause of male infertility is lack of sufficient sperm production.
27. Sperm production can be enhanced through administration of testosterone, human chorionic gonadotropins, menotropins, and antiestrogens.
28. Erectile dysfunction (ED) affects 15 to 30 million men in the United States. Incidence increases with age but can occur at any age.
29. Organic causes are related to damage to nerves or blood vessels involved in the penile erection reflex. These causes can include atherosclerosis, arteriosclerosis, diabetes, CVA, hypertension, and kidney disease.
30. Psychogenic causes may include depression, fatigue, stress, or fear of sexual failure.
31. Other causes may include medication side effects or hypogonadism.
32. Diagnosis of ED includes health history and physical examination, laboratory tests to check for possible metabolic or hormonal causes: serum testosterone, prostate-specific antigen (PSA), blood chemistry, prolactin, thyroxin levels, nocturnal penile tumescence and rigidity test, and penile blood flow test.
33. Treatment of ED may be a combination of psychotherapy and pharmacotherapy.
34. The PDE-5 inhibitors do not cause an erection, but do enhance the erection.
35. Sildenafil (Viagra) is the prototype phosphodiesterase-5 inhibitor used to treat impotence.
36. Drugs similar to sildenafil (Viagra) include avanafil (Stendra), vardenafil (Levitra, Staxyn), and tadalafil (Cialis).
37. Benign prostatic hypertrophy (BPH), an abnormal enlargement of the prostate, leads to a chronic obstruction of the neck of the urinary bladder with resultant urinary retention.
38. The two mechanisms of this disease, static and dynamic, have led to two different classes of drugs for treating symptoms.
39. Some drugs worsen the symptoms of BPH.
40. If left untreated, recurrent infections and development of chronic renal failure are potentially serious complications.
41. Drug therapy can only treat symptoms; it is not a cure for BPH.
42. BPH is treated with either 5-alpha reductase inhibitors or alpha1-adrenergic blockers. The former work by reducing levels of 5-alpha dihydrotestosterone (DHT), whereas the latter work by relaxing the smooth muscle of the prostate and around the bladder neck.
43. Finasteride (Proscar) is the prototype antiandrogen, 5-alpha reductase inhibitor used as a drug for BPH.
44. Nursing diagnoses useful in the care of clients receiving pharmacotherapy for benign prostatic hypertrophy include *Sexual Dysfunction, Deficient Knowledge,* and *Risk for Falls.*
45. These drugs may take several months to achieve full effects.
46. Monitor hepatic function, blood pressure, and urinary output and teach client findings to report.
47. Alpha-adrenergic blockers may induce a first-dose response, so the first dose should be administered at bedtime.
48. Client should be educated to not abruptly stop alpha-adrenergic therapy for BPH.
49. Protect women of childbearing age and children from accidental exposure to 5-alpha reductase.